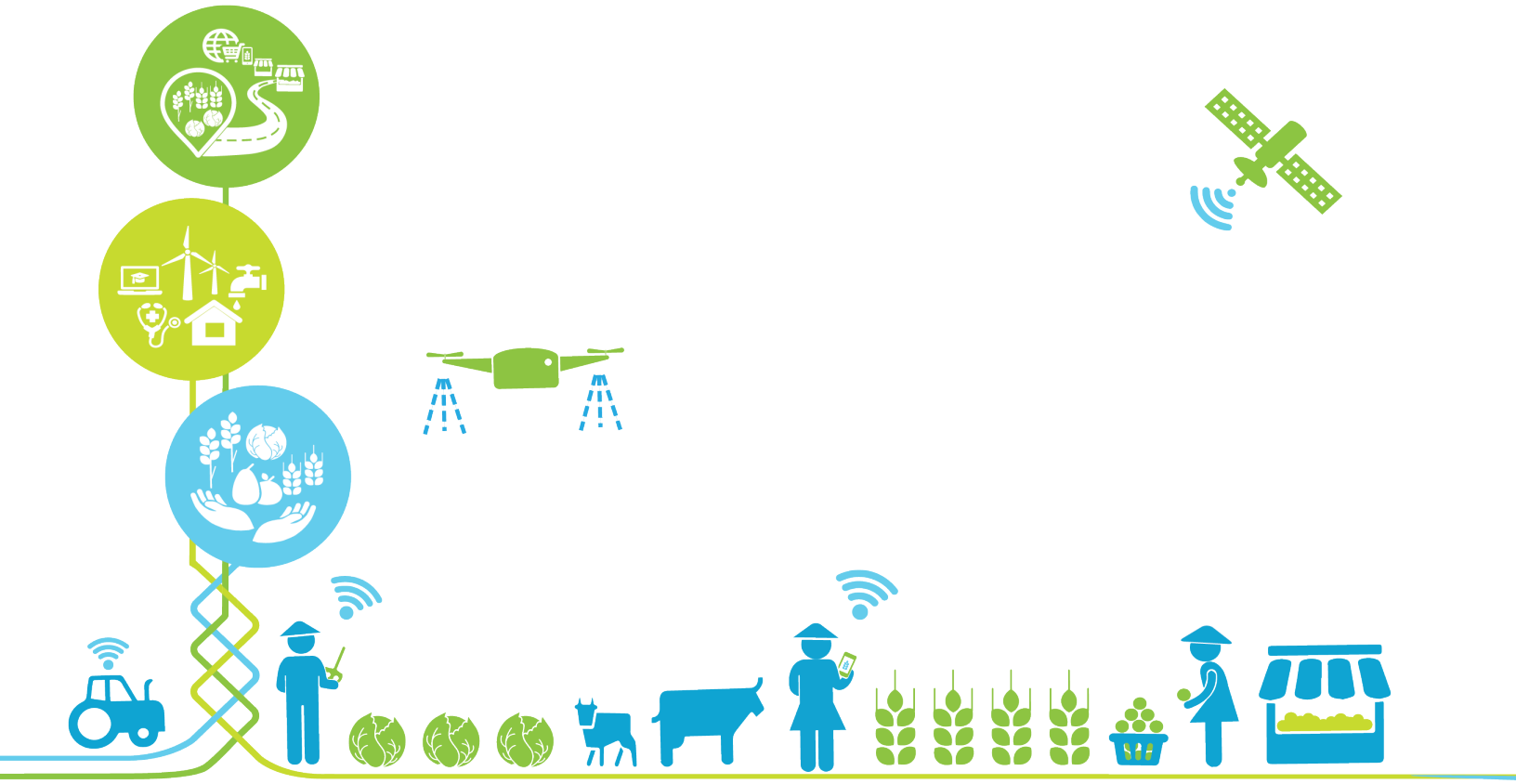

RURAL DEVELOPMENT AND FOOD SECURITY FORUM 2019 PROCEEDINGS

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.
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Contents

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

Sharing best practices. The Rural Development and Food Security Forum served as venue to discuss how to address the farming crisis and malnutrition, and learn about transformative technologies for rural prosperity.

Introduction

The Asian Development Bank (ADB), partnering with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute, hosted the 2019 Rural Development and Food Security (RDFS) Forum,[1] with the theme "Transformative Changes for Rural Prosperity and Nutritious Food" on 28–30 October 2020 at the ADB headquarters in Manila, Philippines. More than 350 participants, including officials from ADB's developing member countries (DMCs), multilateral organizations, academics, farmers, and youth attended the forum. The RDFS Forum 2019 was a call to action for DMC governments to provide leadership to generate rural prosperity and effective stewardship of land and water (fresh and marine) resources to provide sufficient, safe, nutritious, and affordable food.

ADB's new corporate Strategy 2030 promotes rural development and food security as one of its seven operational priorities. ADB will incorporate climate-smart technologies and enabling policies into its operations; catalyze public and private sector investments for rural development; and promote transformative changes to make farming profitable, gender-responsive, highly productive, and attractive to youth. ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. In 2019, ADB committed $21.64 billion in loans and grants to support our DMCs. ADB's Strategy 2030, which is aligned with the global Sustainable Development Goals (SDGs), calls for urgent attention to meeting the challenges of poverty, food insecurity, and rural prosperity in Asia and the Pacific region.

The RDFS Forum 2019 aimed to:

(i) share and learn best practices, recent trends, and innovations;
(ii) strategize on how to scale up innovations; and
(iii) identify ways to strengthen cross-institutional and cross-sector synergies, networks, and partnerships.

[1] The discussions presented in this report took place on 28–30 October 2019. This summary reflects the key issues of the pre-coronavirus disease (COVID-19) food system and has limited coverage on the pandemic impacts on the system and pathways to achieve the Sustainable Development Goals (SDGs).

With the theme "Transformative Changes for Rural Prosperity and Nutritious Food," the discussions focused on three issues:

(i) farming crisis, with emphasis on transforming unprofitable farming to profitable farming with livable incomes by strengthening agricultural supply and value chains;

(ii) malnutrition that still significantly impacts Asia and the Pacific, with emphasis on meeting the malnutrition and food safety challenges to achieve ADB's Strategy 2030 and commitments to SDGs, particularly SDG 2: Zero Hunger;[2] and

(iii) transformative policies and technologies for rural prosperity that help overcome structural constraints. These include small farm size and holdings and poor physical and market infrastructure. Policies and technologies that focus on rural prosperity enable rural areas to become spaces of economic development, give impetus to growth, modernized agriculture, and nonfarm goods and services.

The forum outcome and outputs will inform the implementation of ADB's Strategy 2030 OP5: Operational Plan for Rural Development and Food Security, 2019–2024. ADB's Strategy 2030 calls for renewed focus of ADB operations in three areas:

- **accelerated rural development** to focus on improved rural services, increased private sector investments, and more jobs in the rural areas;
- **efficient agricultural value chains** to produce and distribute food efficiently from farms to consumers, reduce postharvest losses, improve farmers' profitability, and provide sufficient, safe, nutritious, and affordable food; and
- **resilient food systems** to ensure food security by sustainably producing more with less resources while addressing malnutrition, and nature-based green recovery effectively combined with climate-smart practices.

The forum had eight plenary sessions. There were no breakout sessions because all the topics are important for all participants to attend, reflect on, and propose the way forward. Information and communication technology (ICT) in the form of the Event App was used to engage participants in real time. Participants used it to ask questions and share insights and recommendations. This Highlights and Takeaways report documents key messages from the RDFS Forum 2019.

The COVID-19 pandemic in early 2020 will have profound impacts on the development and investment planning priorities and approaches. Not all implications of the COVID-19 pandemic on agriculture, food security, and rural development

[2] Nearly 392.3 million people were severely food insecure in Asia during 2017–2019, while 303.5 million alone were from South Asia. Women aged 15–49 years that met the Minimum Dietary Diversity for Women – MDD-W during the same period were 50% in Nepal and 80% Tajikistan. Globally, less than one in three children aged 6–23 months (29%) met the minimum dietary diversity; the same share in South Asia accounts for 20%. Also see Food and Agriculture Organization of the United Nations (FAO), The International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), United Nations World Food Programme (WFP), and World Health Organization (WHO). 2020. The State of Food Security and Nutrition in the World 2020: *Transforming Food Systems for Affordable Healthy Diets*. Rome, FAO.

are yet fully understood and further studies are needed. However, a few points of significance in a post-COVID-19 era include:

- Food security of the urban poor, and daily laborers in particular, is suffering a severe blow due to the pandemic. This needs urgent attention as urban poor, migrant labor, and self-reliant microentrepreneurs (hawkers, petty traders, street vendors) need a minimum intake of nutritious food to survive. They now face disruptions in production supply and distribution chains. These are the most vulnerable groups of the population that need targeted and efficient measures to enhance food security. This has to be independent of what they may earn as daily wages have been wiped out under lockdown situations. There is great uncertainty about these sources of livelihoods reemerging sufficiently in a post-2020 period. ADB has provided unconditional cash transfers and in-kind support to the poor and vulnerable. Emergency assistance during the pandemic included strengthening public health preparedness, procurement of medical equipment, and supplies and medicine.
- Smallholders are the other major vulnerable group, who in the pre-COVID-19 period were already facing existential problems due to high production costs, price volatilities, and climate change-exacerbated droughts and floods. During the pandemic, and in the post-2020 period, smallholders will continue to have limited access to credit, markets, and assured buying prices of the intermediaries or wholesale brokers. It is important to revisit the suggestion of a minimum farmer income for small and marginal farmers to survive in times of crises and enable them to continue to produce for their own consumption and the markets. It is important to note that pre-COVID-19, remittances (domestic and foreign) provided a major safety net for the rural poor in times of crises. The COVID-19 pandemic, however, led to a sharp drop in remittances. Global remittances are projected to decline sharply by about 20% in 2020 due to the economic crisis induced by the COVID-19 pandemic and shutdown. Flows are expected to fall across all regions, most notably in Europe and Central Asia (27.5%), South Asia (22.1%), and East Asia and the Pacific (13%).[3]
- The COVID-19 pandemic has brought into sharp focus the issues of inefficient markets. The needs of smallholders for basic market infrastructure (hard and soft), including storage facilities to secure short-, medium-, and long term supply and value chains that can self-isolate and/or self-sustain in times of major disruptions—natural and/or human induced—should be addressed. Many food value chains in DMCs remain informal and lengthy with many handling agents involved, limiting marketable trading volumes, crop quality, and profitability of smallholder farmers. Farmer organizations can play an important role in addressing this structural issue by improving input/output aggregation and empowering smallholders vis-à-vis the supply and value chain transactional actors. Digitization can play an enabling role in facilitating these changes at scale and in a cost-effective manner. Farmer associations and organizations should be provided assistance so that they can establish

[3] World Bank. 2020. *World Bank Predicts Sharpest Decline of Remittances in Recent History* (No: 2020/175/SPJ). Press Release. April 22.

and manage local market infrastructure such as storage and cold storage facilities. Complementary advisory services on marketing and price volatility management will be critical for smallholders to move toward sustainable livelihoods in the post-2020 era.

- Production and supply of safe and nutritious food are of great importance as avoidance of epidemics and pandemics are intrinsically connected with sale and consumption of safe, nutritious, and quality food. Food safety has become a basic public health and livelihoods issue in both rural and urban areas. Moreover, as the COVID-19 pandemic has disproportionately affected the rural and urban poor, food and nutritional security must be increased, and investments in food safety are a must. This pandemic redefined the food safety challenge. Apart from the safety of food at the point of consumption, other critical factors for maintaining food supply chains are packaging and no-contact delivery, essential food production, and availability of distribution workers. Under the One Health approach, food cold chains and logistics system can in the near future potentially play an important role in the effective distribution of COVID-19 vaccines.
- The COVID-19 pandemic has further exacerbated the pre-existing policy, structural, and market inefficiencies. It is imperative digital technologies are brought to bear to overcome these chronic and persistent constraints. Opportunities for using digital technologies in agriculture, telemedicine, and education (both in terms of working from home as well as remote consultation and teaching via internet) have underlined a post-COVID-19 change in how people in the corporate world and in the health and education sectors may work in the future.
- Post COVID-19, pressure on the rural sector to supply adequate food and nutrition will persist. Despite economy-wide income losses, it is still possible for food demand to remain relatively high due to shifting consumption preference for food (especially nutritious food) compared to non-food items. Hence, policies and strategies should support agricultural finance, technology (including rapid digitalization of value chain), logistics, infrastructure, and transport for a two-way movement of inputs and services and outputs. Investment in data infrastructure may play an important role in improving access to key social services for rural populations. Hence, digital connectivity between urban and rural areas and investments in peri-urban and rural areas are a way forward to reduce the rural–urban divide and distress.

Proactive assistance. President Nakao stressed ADB's commitment to assist DMCs to increase agricultural productivity and profitability, enhance food safety, and improve climate resilience.

Welcome Remarks

Excellencies, Distinguished Guests, Participants, Ladies and Gentlemen:

I am honored to welcome you all to the Rural Development and Food Security Forum 2019. I am encouraged to see strong participation of our member governments, partner agencies, academic and research institutions, the private sector, and civil society. I am particularly pleased to see farmers, especially female farmers and youth from India, Indonesia, Nepal, and the Philippines.

The last time we organized a food security forum was in June 2016. Now with Rural Development and Food Security as one of the seven operational priorities of ADB's Strategy 2030, we need to deepen and accelerate our knowledge-sharing efforts with key stakeholders around the world.

In the last 40 years, the Asia and Pacific region has made tremendous progress in reducing poverty and achieving food security. When ADB opened for business in 1966, agriculture was among its top priorities, since many parts of the region were facing food shortages and even the risk of starvation.

On the poverty front, in 2010, Asia and the Pacific achieved Millennium Development Goal 1 - Eradication of Extreme Poverty and Hunger—5 years ahead of schedule. Extreme poverty, defined as $1.90 per day threshold, has declined in developing Asia from 69% in 1980 to about 7% in 2015. The agriculture sector has played a pivotal role in delivering these developmental outcomes.

Similarly, the food security situation in the region has shown remarkable improvement in the last 4 decades. Most countries in Asia including Bangladesh and India are self-sufficient in food. This progress was largely driven by the green revolution technologies that put high-yielding seed varieties in the hands of our farmers, accompanied by investments in rural roads and irrigation, and agricultural extension. The region's share in global food production, crops, and livestock has increased.

Despite this great progress, there are still more than 300 million people living below the poverty line. An additional 900 million people who live on less than $3.20 per day are

constantly at risk of being pushed back into extreme poverty of below $1.90 per day. Moreover, poverty incidence continues to be higher in rural areas than in urban areas.

In many parts of the region, farmers are unable to make a livable income. Agriculture endures many risks, including weather, diseases, and financial risks. But market risk is the most devastating to farmers' income. Prices of most farming products vary widely within a year, as well as year-on-year. Market infrastructure and related policies and regulatory frameworks in most DMCs require significant improvements.

Cold chain infrastructure is practically nonexistent in most DMCs. This results in postharvest losses of 30%–40%, lowering the quality of produce, and generating worm and bacteria contamination. This issue is especially serious for perishables, such as fruits and vegetables.

The continued inability of farmers to generate a livable income risks rolling back many of the poverty reduction gains we have made in the last 4 decades. Further, extreme weather conditions caused by climate change, and degraded farmland and water resources are making our task of finding sustainable solutions even more difficult.

For its part, ADB will proactively assist its DMCs to increase agricultural productivity and profitability, enhance food safety, and improve climate resilience and sustainability. We are committed to supporting our member countries to supply sufficient, nutritious, safe, and affordable food. People also want higher quality food as their incomes increase. Let me share three innovative examples.

In Uzbekistan, ADB's $280 million project aims at modernizing the country's horticulture wholesale markets by reducing distribution and marketing costs and increasing agribusiness profitability and farmer incomes.

In Cambodia, the Lao People's Democratic Republic, and Myanmar, ADB's Climate-Friendly Agribusiness Value Chain projects are targeting to boost net incomes of rural households by increasing climate resilience of rural roads and irrigation systems, developing cold chains, and promoting bioenergy and solar energy access for agri-processing.

In the People's Republic of China, the Gansu Internet-Plus Agriculture Development Project is supporting farmers' access to high-value e-commerce markets by developing smartphone applications. The project is also introducing sensors to monitor in real-time temperature, moisture, and soil nutrients for smart farming and to support food traceability.

At this forum, in the coming 3 days, I invite you all to share your expertise and wisdom with us, and of course among yourselves to respond to rural development and food security challenges. I am also looking forward to your views on how ADB can make a better contribution to the needs of farmers and rural communities.

Thank you.

Takehiko Nakao
President, Asian Development Bank
28 October 2019, ADB headquarters, Manila, Philippines

Information and communication technology as an opportunity. Smallholders and rural stakeholders can benefit from using ICT but they will need advisory and user support.

Farming Crisis

This session described the current key challenges of farming and proposed transformative changes in policies and approaches for making farming profitable and gender-friendly, highly productive, and attractive to the youth in the region.

Keynote Address

Mekhala Krishnamurthy, Associate Professor of Sociology & Social Anthropology, Ashoka University, India

In 2009, 10 years ago, during the soya bean harvest in Madhya Pradesh I was sitting in the field with a young farmer named Vijay Tale. That day, Vijay's primary concern was getting the harvest in because it had been raining a few days before and he was focused on bringing in the harvest that morning. He had spent a week organizing, traveling all the way from rural Punjab to come to Madhya Pradesh and get to his fields in time as clouds were gathering, and there is a small window of time within which farmers must harvest the crop. In the middle of all of this, I noticed his T-shirt and I asked him if he knew what his T-shirt said. He laughed and said it is his favorite T-shirt and I should not say anything to ruin it for him. But he said he did not know what the T-shirt displayed. I told him, it read "Make your own destiny." Vijay laughed loudly and said what a ridiculous T-shirt for a farmer to be wearing! He asked what kind of farmer thinks they can make their own destiny. As if on cue, the harvester started bellowing smoke and Vijay ran to find out what he could do. Afterwards Vijay said that is just one example of the type of everyday risk that farmers face.

Vijay's humor is typical of many farmers across the world. There is a philosophical approach to every day risks faced by farmers and the ability to laugh even under extraordinary stress and to share a joke in the middle of what clearly is a daily crisis for Vijay and millions of others. It also reveals something about the helplessness that many farmers across the region face. When they think about what it means to bring in the harvest, that particular moment, a vulnerable moment in which weather, market risks, postharvest storage conditions—all are playing on his mind, not least the small matter of how Vijay would have

Agrarian destiny as a collective public effort. Mekhala Krishnamurthy, Associate Professor of Sociology & Social Anthropology, Ashoka University, stressed that farm income support is not a substitute for public investment in agriculture and rural development or for other vital forms of social protection.

the cash to pay the harvester driver, who had come from a long distance and was to leave shortly after.

This small example tells you a great deal about the kinds of risks that farmers face every day. ***Farming has always historically been a very risky business***. But what farmers like Vijay Tale are facing today are both the intensification of old risks and the extensification and expansion of risks that encompass new aspects that are affecting farming. It begins of course with questions of land—access to land, land insecurity, ownership, lack of recognition of title, timely access to high-quality inputs; seeds, water, fertilizer; access to labor, which is complicated in all of these economies; access to credit at the right time and at serviceable cost; weather and climate, and volatility and risks brought about by the market.

Risks in Agriculture

We must keep in mind when we think about agriculture today that the scale, frequency, complexity, and context-specificity of risks are all coming together. This means we have risks at a larger scale than ever before but that they are also highly context specific. The challenges that Vijay Tale (a 10-hectare [ha] farmer) was facing in his field were both quite unique as well as general. Right next to his plot was a small farmer owning only 2 acres (0.80 ha) of land and who took on an additional 10 acres (4 ha) on lease. His risks were quite different than the ones that Vijay was facing, but they both shared common risks as well. This is where scale and context-specificity come together. Moreover, the frequency of risks has escalated and equally their complexity. This makes it extraordinarily challenging for farmers, who must manage scale, frequency, complexity, and context. It also makes it exceedingly challenging for those who are seeking solutions to these kinds of risks.

Let's take an example from land—insecurity of ownership of and access to land across many countries of the Asia and Pacific region. Farmers still often do not have clean title or access to their land. Those who have ownership rights often struggle to ensure that the title remains updated, struggle with mutation, passing on that land to other members of their families. Tenants and sharecroppers—a very large proportion of our farmers—are also landless. Tenants and sharecroppers struggle to get basic recognition. This affects their ability to access inputs, to access guaranteed minimum support prices, and to access credit, which is often in the agricultural context tied to land and the ability to furnish clean title to land and property. Farmers are coping with land fragmentation. Land fragmentation is happening both as a result of family sizes and generational and intergenerational transfers. But there is also the dynamics of land acquisition at work.

Across the region, farmers are dealing with the challenge of quality and declining productivity of their land. This is a problem related to access to water but also soil quality. Land is vulnerable to humans and nonhuman actors. Vijay Tale and many other farmers across our region spend their nights close to the harvest, sleeping on their land to protect themselves from both human and nonhuman intervention. This is just one example of risks related to land. Similarly, we could see similar kinds of

complexity related to inputs, labor, credit, weather and climate, and markets. Each aspect of agriculture is dealing with challenges at multiple levels.

The importance of understanding these risks and their interlinkages must be highlighted. If we look at land, we could find solutions to each one of the problems. For example: how do we improve ownership and titling; how can we give recognition to tenants and sharecroppers; how do we combat the question of fragmentation and think about land pooling; how does one address the enormous challenges of land quality and productivity? However, what makes agriculture so complicated is how these risks are interlinked and interconnected with the whole range of other risks, beginning with the fact that we are centrally concerned with farmers who work both on and off the farm.

Farmers as Consumers

A great amount of our attention is focused on the farm as a unit. But these risks happen on-and-off the farm. We also spend a large amount of time thinking of farmers as producers. But we pay very little attention to the fact that all farmers are also consumers. They are not only consumers of the very produce they grow—as they both buy and sell agricultural produce and food—they are also consumers of inputs. As the journalist Harish Damodaran puts it often, farmers buy in retail but sell in wholesale. The terms of their engagement in both input and output markets tend to be poor. But many farmers, especially small and marginal farmers, are also laborers. They work as paid laborers on other people's farms, off-farm labor, and of course also work as unpaid laborers, contributing to household labor in a range of activities as part of the production system. A number of farmers are also aggregators or petty commodity traders. These are multiple roles that the same farmer plays. Income is both augmented and depleted in multiple ways for a single farming household. This makes the analysis of farm income extremely complicated because we are not dealing with a single, linear kind of analysis—e.g., how much did you get from this particular crop? Farmers usually grow multiple crops on the same farm, and provide labor for multiple kinds of livelihood options at the same time.

Agriculture needs to be seen as an agro-ecological, agro-commercial, and socioeconomic system. If we do not understand the ways in which these linkages are combined, we are unable to address the challenges. This multiplication of risks also presents the multiplication of opportunities for engagement but we need to understand the whole complex—if vicious—cycle, where farmers are inundated with accelerating and intensifying risks is to be turned into a different, more virtuous cycle. This kind of coordination can only be done with public, government-led transformation.

In many ways we are at a crossroad, where benefits of the green revolution and its costs have reached a critical point. In terms of the many achievements of food security over the last several decades, we are finding a plateauing. The focus on cereals and cereal-centricity of that intervention is now being widely questioned. It has had—and we have seen this across the region—very large and serious agro-ecological consequences. In some ways, we are now better able and equipped to

Turning crisis into opportunity. William Dar, Secretary, Department of Agriculture, Philippines, pointed out that the rice sector crisis is a chance to develop the Philippines' agricultural economy.

think about solutions or mitigation strategies for these consequences—to think about scale-neutral technologies, socioeconomic interventions, leveraging a whole range of scientific and technical developments. However, what we have not learned from the green revolution is the fact that it was a massive, coordinated public sector intervention. In 2019, we need to go back to those lessons; to take the right lessons from that effort, not to replicate the "package" but the public investment. We need new frameworks of public investment. We need to rebuild and strengthen agricultural systems and institutions, whether they are institutions of science, agricultural extension, agro-commercial context, or farmer organizations. We must rebuild state capacity for agriculture and think of new frameworks by which technology can be adapted and adopted. This calls for extraordinary coordination and this is where ADB and organizations of this kind are so vital as you can coordinate at different scales and across different kinds of entities and region. Just to take the few examples that I mentioned—land rights and consolidation, agricultural extension and knowledge ecosystems, farmer producer organizations, where the massive questions of capital, working capital constraints, and institutional capacities, market design and regulation—all of these require coordination and are areas where women and youth are critical.

I will end with two brief points: firstly, farm income support, which is one of the key elements that governments are turning to as a way to address the crisis in agriculture, is not a substitute for public investment in agriculture and rural development or for other, vital forms of social protection. We must think of farm income support as an important complement, not as a band-aid to public investment. Secondly, our region and subregions have benefited from an understanding of agriculture as a multiplier and driver for wider economic growth and development. We need to move from the current scenario of distress-driven diversification to a cycle of surplus-sustained diversification. To come back to Vijay Tale, in many ways making an agrarian destiny must be a collective public effort.

Thank you very much.

Address

William Dar, Secretary, Department of Agriculture, Philippines

On behalf of President Rodrigo Roa Duterte and the Filipino People, we would like to thank again ADB, led by its President Takehiko Nakao, for inviting us to the Rural Development and Food Security Forum 2019. Indeed, this event provides the Department of Agriculture an opportunity to share our thoughts on the relevant topic of addressing various challenges and crises. When one mentions crisis, the challenge of global climate change often comes to mind, particularly when if it applies to agriculture and rural development.

I would like to focus on the challenge that springs from fragmentation of farmlands. Such fragmentation results in the dominance of smallholder farmers, who are

fast aging because of the uninviting appeal of farming on the youth. It also limits the application of modern farming technologies and tools leading to low farm productivity. This comes at a time when population notably in urban areas is growing and the demand for healthy and safe food is on the rise.

The Philippines is not spared from the so-called farming crises. Due to the implementation of an agrarian reform for more than 30 years now, the country's farmlands have been divided into miniscule sizes, currently averaging less than 1.7 ha. One major factor is increasing population, which grows at an average of 1.8 % annually, one of the highest in Asia. Furthermore, there are competing demands for the use of farmlands exacerbated by urbanization and industrialization. Thus, there is an urgency to elevate the efficiency of our farmers, especially on how they adopt modern farm technologies. This requires farm consolidation.

Take the case of the rice sector. Rice is considered a political commodity. The performance of the Department of Agriculture and the Agriculture Secretary depends on how rice is produced in the country. With the recent policy change in the rice economy from quantitative restrictions to the Rice Tariffication Law (RTL), there is now a so-called farming crisis in the agriculture sector. As farmers continued planting of palay, rice was exempted from liberalization for more than 2 decades despite our country's official participation in the World Trade Organization since 1994. Traditionally, we experienced fully farmgate prices of palay during peak season, from October to December. With smallholders' inadequate knowledge of modern farm technologies, there has been difficulty in increasing productivity. This proves that rice farms can no longer compete with imported rice.

Through the years, attaining rice self-sufficiency has been consistently set as the cornerstone of our agricultural policy. However, this proved to be unfavorable, as other agricultural crops have been deprived of much needed support. Hence with the RTL in place, ensuring food security now is the country's goal. A reason to level up Philippine agriculture is encapsulated in the eight paradigms of our new thinking, a new development framework for agriculture.

i. Modernization must continue.
ii. Industrialization of agriculture is key.
iii. Promotion of exports is necessary.
iv. Consolidation of small and medium-sized farms is needed with an inclusive agri-business approach as the anchor.
v. Infrastructure development would be critical.
vi. Higher budget and investment for Philippine agriculture is a must.
vii. Legislative support is needed.
viii. Road map development is paramount.

We need to turn this crisis into an opportunity. We see the crisis in the rice sector as an opportunity to further develop and modernize our agricultural economy. The rice industrialization road map, which will serve as a blueprint for the modernization of the rice industry, is in its finalization process. This will promote consolidation of production without necessarily consolidating ownership and enable efficient use of

farm technologies and machineries. To promote farm mechanization, increase the use of better seeds, provide low interest production credit, and offer training programs to palay farmers, a PHP10 billion World Competitive Prize Fund was established for every year. The registry system for basic sectors in agriculture serves as a basis for providing assistance to farmers who are affected by the falling palay prices. The updated farmers' registry is the basis for identifying beneficiaries. We are optimistic that the unconditional transfer the government has decided will be rolled out by the end of the year in time for our affected farmers and their families to celebrate Christmas season on a happy note.

In closing, we recognize the big and small contributions in improving the agricultural sector and in achieving a more bountiful harvest for our farmers and fishers. It has been barely 3 months since I have assumed leadership in the Department of Agriculture, and we have a long way to go. But I know that with your knowledge, expertise, resources, and support, we will increase the productivity and profitability of the farming and fishing sector. We see ADB as one of our important allies and supporters in this noble undertaking. I look forward to a fruitful discussion with you.

Panel Discussion

Shenggen Fan, Director General, IFPRI: In IFPRI's 2019 *Global Food Policy Report*,[4] we highlighted several crises facing rural areas. Foremost is hunger and malnutrition. We know that we still have 800 million people globally who suffer from hunger and 2 billion people lack micronutrients, which we call hidden hunger. Majority of the hungry are in rural areas despite rapid urbanization. Many of these malnourished people are in our region—Bangladesh, India, Pakistan, and the PRC, or even in Southeast Asia.

Secondly, the environmental crisis threatens rural areas. My colleagues at CGIAR and I am proud of the green revolution without which many millions would have suffered from hunger. But we also have to recognize that because of the overuse of inputs and water, we are facing an environmental crisis today. Land has been degraded, water has been polluted, and particularly the air has been polluted (such as burning of straw in India).

The third crisis is unemployment. We know that between 20%–50% rural youth are either unemployed or underemployed. The average rural income is one-third, and in some places only 20% of average urban income, which is a great disparity evidencing poverty. I would call that a crisis.

But that does not mean we do not have opportunities. There is rapid urbanization, and by 2030, two-thirds of the middle-income population will be residing in Southeast Asia and Asia in general. Many will also be in rural areas, and this will be an opportunity as these people will demand better and more food. Another opportunity is the rapid development of ICT. Access of smallholders to that technology can help

[4] IFPRI. 2019. *Global Food Policy Report*.

More productive and less resource intensive agriculture. Results from and the ADB-IFPRI research showed that climate-smart practices could increase profits from rice production and make it less material intensive with lower water use, less greenhouse gas emissions, improved labor productivity, increased carbon sinks, and improved soil quality.

improve their productivity and employment opportunities. IFPRI's Global Food Policy Report 2019 (footnote 2) highlights several solutions:

1. **Rubonomics** (term coined with Achim Steiner of the United Nations Development Programme). This means considering rural and urban areas as one economic entity with no need to segregate them in consideration of employment, resource, or mobility. There should be no artificial boundaries, so that rural and urban areas are in one economy. It is easier said than done. First, there is a need to improve infrastructure such as urban-to-rural roads. Second is policy—there has to be coordination of food policy between rural and urban areas.

2. **Restore the environment.** In restoring the environment, rural areas get a great opportunity. If degraded land can be improved or restored, we can increase productivity without much inputs. We can help to mitigate negative effects of climate change. If smallholders use conservation agriculture, they must be compensated because they will contribute to the social and environmental goals.

3. **ICT as a technology opportunity.** We hear that villages in the PRC, for instance, are connected to the internet and use apps and e-commerce. Smallholders and shops in villages can sell not just agriculture products and food items but also traditional crafts to urban consumers and even export to foreign countries.

4. **Empowerment of women.** We know that in rural areas women do almost 50%–60% of the work in agriculture. If they are not empowered, we cannot revitalize rural areas. Empowering women in South Asia and Southeast Asia is the way to go. IFPRI has worked with Oxford and with the United States

Agency for International Development (USAID) to develop an Empowerment Index to ensure that women have access to land, water, technologies, extension services, etc. How can we ensure that women farmers are well-represented in political decision-making process at village, county, state levels? I do see great opportunities to do this.

5. **Finally, accountability.** Accountability is key to ensuring that governments respond to citizens, especially the poor and those in rural areas. Some policies and services for rural revitalization need to be implemented at the local level, for which strengthening subnational capabilities will be important. With such decentralization, citizens may feel more empowered to participate in decision-making and communicate their demands. At the same time, harnessing the information revolution to enhance information available to the rural poor can further empower them to demand accountability to keep policy makers accountable and responsive.

6. **Successful country cases.** There are three cases where we have seen successes: (i) European Union: in the 1970s and 1980s, the European Union spent €40 billion to subsidize agriculture—fertilizer, water, land, etc. Today, those reforms have succeeded. They used the funds to support rural infrastructure investment, direct income support, and nutrition and health thus improving the whole rural landscape; (ii) Republic of Korea: the new village movement in the 1980s used government funds to support agriculture technologies, rural infrastructure, improving living conditions of rural communities. After 30 years you do not see much difference between rural and urban areas. Rural residents enjoy high living standards as those in urban areas; and (iii) rural revitalization in the PRC. I applaud ADB that has signed an agreement to revitalize rural areas in the PRC. Again, it deals with improving rural infrastructure, ICT, linking rural areas to urban areas.

7. **Reform of subsidies** is an important issue. We currently spend $600 billion to subsidize agriculture production—water, fertilizer, and pesticides. These subsidies do not produce healthy and nutritious food and are usually linked to grain production. These subsidies are not sustainable as they use more water and land and do not benefit farmers. When you subsidize, food prices go down and governments restrict food export. Farmers in India suffered tremendously because trade bans kept food prices artificially low. The funds used for subsidies could go toward supporting smallholders to produce healthy, nutritious, high value crops, and protect the environment and transform the food system and rural areas to be sustainable, healthy, and with good living conditions. I am confident that with these strategies, rural areas will become in 5–10 years a new attraction. I am retiring soon, and my dream is that one day I will return to my village where the environment, infrastructure, and health services have improved. I wish this to happen in every part of Asia.

Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, ADB: This crisis is not limited to one part of the region or one country. In just about all countries—as Dr. Fan mentioned, the PRC—there are major

issues in this sector. Within every country, there are bright spots from which lessons can be derived—which policies work and what kind of actions can we take to improve the situation. ADB has set its Operational Priority 5 under Strategy 2030 and will try to strive to provide the necessary policy and regulatory framework ideas to the governments. ADB provides financing to go with these initiatives. I would like to share my perspective on what ails the agriculture sector:

i. Governments have significantly underinvested in agriculture. There are no two opinions about this issue. Gaps are different in different countries, but the underinvestment is very clear.
ii. Agriculture in just about every country I have visited is considered to be unsophisticated, less desirable, and not a very fancy sector to work in. For ADB work, we interact with so many governments and, frankly, the weakest ministry I see in terms of capacity and resources is the ministry of agriculture. This makes me wonder ... we all eat three times a day and we desire to have nutritious and safe food. I can assure you even in my own country Pakistan, I feel very apprehensive eating every day because I know for a fact where the food is coming from. It is not safe. It is not nutritious, but people have no choices.
iii. If you look at developed country agriculture, they have food systems that are relatively safe and affordable. The food is mostly nutritious. There is one common denominator in all developed countries—the governments lead from the front, provide public goods, research and development, infrastructure, and most importantly policies and regulatory frameworks where producers, processors, wholesale markets, and retail markets have to comply with quality standards. Without enforcement of those standards, you cannot ensure safe food even in developed countries.

In Egypt, there is a common adage where mothers tell their daughters to behave or else, she would be married off to a farmer. This shows you how cultural and official biases have ignored the support that agriculture requires. I also like to pose a million dollar question to people. If I gave them a million dollars to invest in any country or their own and then asked after a year where they have invested the million dollars, chances are they would not have invested even a dollar in farming.

As we have heard, the return on farming is minimal. Rather, in many countries when we examine the farm enterprise budgets, the returns are often negative for many operations. We must make agriculture profitable and desirable. As Dr. Fan has said, the youth are not interested in farming because it is a back-breaking drudgery and they do not see making reasonable livelihood by farming.

What ADB would like to do under its Strategy 2030 is to try to convince its member governments that there is a need to change policies and set out the regulatory frameworks that enable agriculture to become more profitable. We have heard that subsidies do not work. Most subsidies are perverse—they make the situation go from bad to worse. What we would like to see are smart policies, and good enterprise models. As Dr. Krishnamurthy said, fragmentation of land in agriculture is not helpful.

Modern geographic information system technology is now available at affordable cost which can make land ownership and land use rights transparent and safe for farmers to pool their lands from a fragmented farm to a larger landholding to become financially viable enterprise. These are some of the creative ideas under ADB assistance that we would like to try out in a few countries.

Hopefully, we will be able to set some models that show that fragmentedand subsistence farming can be turned into profitable, modern, commercial farming. May be then we will see a lot of private investment come into farming and youth will be interested in taking up farming. Otherwise, we are facing a difficult situation in ensuring food security and especially safe and affordable food.

Mekhala Krishnamurthy, Ashoka University, India: One of the exciting things about this framework is not to look for a quick-fix solution to the farming crisis but to look for a comprehensive public approach. The example given by Secretary Dar on paddies from the Philippines shows all the different levels of coordination that are possible. It also allows us to think about diversification.

Under the green revolution, one of the biggest challenges was the cereal-centricity. How do we think about paddy-rice and wheat today? We should think about diversification in this context and supporting both. Dr. Fan mentioned thinking about the urban and rural economy as a whole. This is powerful because one of the key things in South Asia historically is that the urban emerged from within the rural. We always make a separation between the urban, the rural, and agrarian. What we thereby forget is that the rural has always been more than agriculture, but the agrarian has always been urban. Anywhere where you eat food is part of the food system. It is part of a common system. Therefore, connecting the urban, the rural, and the agrarian in a common framework is vital to reimagining how we think about growth engines and agriculture as a multiplier.

Rural demand is an important and salient factor. In many countries across Asia, rural demand spurs economic growth. What we are seeing in India and the PRC is that as we have lower rural wages—we start seeing rural demand play less of a role. Economic crises are also driven to a large extent by a lack of rural demand. This is where agricultural incomes become important. Moving beyond just thinking of urban as the trigger of demand but realizing that rural communities are huge consumers is critical. And they are a large part both in terms of employment as well as in terms of agricultural surplus. We are beginning to see rural demand and rural incomes slow down across the region, which is in some ways an indication of the crisis. Before it becomes an even greater problem, we need to address it with these efforts.

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William Dar, Department of Agriculture, Philippines: I saw the new RTL, which was made effective in March 2019, as an opportunity to put a new development framework with which we can develop and grow Philippine agriculture. There was a critique earlier on before I became secretary of the Department of Agriculture relating to where agriculture is going. Once given the opportunity, we started ensuring food security for the country as a priority with prosperous farmers and fisherfolk.

There are two dimensions in the vision, where for the first time in the history of the country, we had a vision to have prosperous farmers and fisherfolk. When we came down to the goals, we needed to increase productivity. All these years Philippine agriculture has had low productivity. The second major goal will be increasing income, with a target of doubling the income of farmers in 5 years.

I have enumerated early on what the eight paradigms or areas we can holistically develop for agriculture: modernization, industrialization, export, farm consolidation, increasing budget. All these big items that we need to bring together in a systematic way for development and growth of agriculture. I have been saying all along—the country has been rice-centric—we really need to build a program on crop diversification. This is also part of the new RTL law, under which some of the farmers will now venture into crop diversification and high value agriculture. We have an existing program on that, and we will now broaden this so that aspects like safe food, nutritious food, resiliency, and sustainability will be considered. We are targeting a 2% growth of the sector to be achieved within 1 year from the time I have assumed office as secretary of the Department of Agriculture. We will mainstream

a new development framework that will focus on rice agriculture but with crop diversification and high value agriculture plantation crops.

Shenggen Fan, IFPRI: On the question of why the private sector is not investing in agriculture, there are two reasons why private sector investments are not coming to agriculture: agriculture subsidy policy and the risks of private sector investment.

On the first point, if the government is responsible for procurement, buying and selling, and public distribution, then there is no role for the private sector. The private sector engagement has been crowded out in trade, investment, and from the whole system. That is one of the biggest problems why the private sector is not coming in to invest in agriculture.

The second problem is risk. We have heard about common risks as well as smallholder risks. Again, how we use the public investment or reform public policy to ensure that we de-risk the private sector agriculture investment through a bundle of measures such as insurance and financing will help the private sector to come in to invest providing higher returns with lower risks. We must think innovatively. For example, we must think of green funds, or orange funds (for nutrition) that can attract private sector to invest that also helps solve the social and environmental problems.

William Dar, Department of Agriculture, Philippines: In terms of export, modernization, and industrialization, we are ready to welcome a "big brother–small brother" partnership. I just came back from the province of Leyte, where a couple from France (Renucci family) came after the big typhoon. They sold their properties and invested in processing facilities ranging from silos to drying and milling and marketing. They are working with 1,000 smallholder rice farmers with an additional 3,000 in the vicinity.

We believe private sector investment can happen in a nurturing environment with a win-win for big business as well as small farmers. What is the role of government in this regard? We will be involved in training the farmers, enhancing partnership between big and small farmers, and we will see to it that this is replicated in other areas. In the last 50 years we have been developing farmer organizations but with few success stories. This has to change. We must bring in other components of that process for it to be accelerated. In terms of collective and individual growth, it is the private sector that can bring about a difference with a nurturing policy environment support.

Mekhala Krishnamurthy, Ashoka University, India: We do have to take into account the market failures in the past in agriculture. This is why the role of the public sector becomes important. From a multiplier perspective, public investments lead to private investments. It is important to get to the point where we see those multipliers. We have an organized private sector but also a large, unorganized private sector, farmers, traders, and consumers.

There is a productive relationship between public and private investments in the context of agriculture. Creating a large, integrated market exchange is a critical

role that should be taken up by the public system because getting market design, structure, and regulation right—as markets do not regulate themselves—is a role that governments should play. In India where we are trying to establish a common market, this is a key role of regulatory capacity by the public sector.

William Dar, Department of Agriculture, Philippines: On the question of an integrated market and trading exchange, when a country has competitive edge with certain commodities and value addition, one can see a trade exchange of various products in the Association of Southeast Asian Nations (ASEAN), e.g., coconut between the Philippines and Indonesia. While currently coconut oil is the number one product of the Philippines, we can diversify our value-added products, which can also compete with Indonesia and others. That possibility is always there within the framework of a trading arrangement like the ASEAN.

Shenggen Fan, IFPRI: On trade issues, the current anti-trade movement or sentiment affects global food and nutrition security. The food price crisis of 2008–2009 left millions hungry. More importantly, the nutrition status of many has suffered. In the current anti-trade climate, countries become isolated, which will further hurt our global food and nutrition security. We know that free trade can help, as vegetables from the Philippines can be exported to the PRC, Japan, and the Republic of Korea. Using trade as a weapon, particularly trade in food and agriculture, means the poor and hungry will suffer most.

Here in this region I am not sure whether it is possible to form a trading block. But we can start with some of the subregional trade agreements. South Asia is working on its own trade agreement. East Asia is also working on a free trade agreement. ASEAN + 3[5] and ASEAN + 6[6] are also working out trade deals. Growing trade relations in the subregions could gradually form a whole Asian trading block and this would enable Asian agriculture and food products to move freely. That would help enhance food and nutrition security. It will also help to mitigate climate change because different products have different carbon footprints. We from IFPRI with 45 years of experience would argue not to use trade as a weapon and particularly in agriculture and food.

[5] ASEAN countries plus the PRC, Japan, and the Republic of Korea.

[6] ASEAN countries plus Australia, the PRC, India, Japan, the Republic of Korea and New Zealand.

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. Geora by Bridie Ohlsson, CEO

Geora 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.

Role of the private sector. Government investment in market infrastructure development may be between 25% and 30% and the bulk of the investment will come from the private sector.

Dysfunctional Agricultural Markets and Malnutrition

This session discussed the impacts of dysfunctional agricultural markets on farmer profits, low farm productivity, bad food quality, high prices for consumers, and the devastating impact on malnutrition. Recommendations to improve policies and regulatory frameworks and to make key investments in market infrastructure and nutrition programs were made by panelists and participants.

Keynote Address

Irakli Loladze, Associate Professor, Bryan College of Health Sciences and Adjunct Faculty, Arizona State University, United States

Malnutrition is a top global challenge. As far as hunger is concerned, we have about 800 million people that do not have enough food. But when it comes to malnutrition—just on mineral undernutrition—we have over 1 billion people at risk of zinc deficiency and over 1 billion people at risk of iron deficiency. The latest estimates say that about 3.5 billion people, almost every other person on earth, is at risk of dietary calcium deficiency. Malnutrition not only means undernutrition but also overnutrition—overconsumption of calories. Over 2 billion people are estimated to be overweight and over 600 million are obese. What is particularly worrisome is that both overnutrition and undernutrition can coexist in the same family or even in the same individual.

Malnutrition particularly heavily affects the Asia and Pacific region. When we look at the rates of people being overweight, the fastest rise is seen in Southeast Asia and the Pacific. Nearly half of the world's population is experiencing the double burden of stunting among children under 5, and overweight adult females in Southeast Asia and the Pacific.

The prevalence of the double burden (% stunting, % overweight) is as follows: the Philippines (32%, 29%); Indonesia (36%, 26%); and Papua New Guinea (43%, 50%). Overconsumption has been linked to junk food: "high availability and promotion of processed, low-cost (cheap), energy-dense foodstuffs." Haddad et al (2015).

Nutrition and Carbon Dioxide Levels

Nutrition is an extremely complicated subject but here I take a very simple and unusual perspective on junk food, which originated in the western world and is culturally alien to many countries. It is heavily promoted by the "Big Food" industry because it is highly profitable. It is so profitable because it is created by injections of fats and sugars, which are among the cheapest calories available, and, it tastes good. There is a lot of debate about fats versus sugars but from an elemental perspective, both fats and sugars are made out of three elements: carbon (C), hydrogen (H), and oxygen (O). By injecting fats and sugars, the "Big Food" industry dilutes essential minerals and micronutrients with these three elements: C, H, and O. Junk food is processed food. What about unprocessed food, vegetables, and fruits and staple crops? Can we be assured that the quality of these foods is not declining? I will be making the case today that with every passing year, the quality of all crops is declining as well. In other words, nutrient density in these crops is declining too.

Let's take a simple—elemental or stoichiometric—perspective on photosynthesis under rising carbon dioxide (CO_2) levels. Plants take CO_2 from the air and water from the soil, which they split into hydrogen and oxygen to make sugars and starches. CO_2 concentrations have been steadily increasing over the last few decades and are projected to double within this century, possibly within our lifetimes. When there is more CO_2 in the air, most plants make more sugars and starches. Some of those can be stored within plant cells, in special compartments: vacuoles and plastids. These extra sugars and starches do not really hurt plants but let us conjecture what will happen to plant eaters, including humans. Just as in the junk food example, those extra C, H and O would end up diluting essential minerals with every bite of plant-based foods.

Seventeen years ago, I made the argument that rising levels of CO_2 will affect human nutrition by decreasing nutrient density of crops and wild plants globally. At that time, there were only 24 studies that reported mineral densities in plants grown at elevated CO_2 conditions. Zinc, iron, magnesium, and calcium are declining in wheat and the mineral density in leaves is declining as well. Back in 2002, millions of people were already deficient in iron, zinc, or iodine. It was logical to conclude that high levels of CO_2 should intensify the problem of micronutrient malnutrition. While this argument is logical, it involves several disciplines—plant physiology, agriculture, human nutrition, human health.

Specialists within these disciplines looked at it and did not buy into the whole argument. There was a lot of skepticism toward the concept. To prove that rising CO_2 decreases nutrient densities, we would need to measure plant samples from CO_2 experiments. For example, in rice, CO_2 was maintained at a high level within a ring in the field, and rice grown within this ring could be compared with rice grown at

Incentives to improve crop quality. Irakli Loladze proposed that one way to mitigate the negative effect of rising CO_2 on plant quality and human nutrition is to change farmers' incentives so they will be motivated to improve crop quality.

identical conditions but at ambient CO_2 levels in the same field. Plant physiologists do these experiments for various reasons: to measure yield and plant parameters. Occasionally, they do measure mineral content. These experiments could also be run in open-top chambers, greenhouses, etc. I compiled data that researchers published worldwide. Relatively more data has been published on protein levels in crops grown in elevated CO_2 conditions.

Results

In 2008, Daniel Taub and collaborators analyzed the available data and showed that protein level significantly declined in the grains of staple crops and potato. It took 12 years to compile enough data to show that rising CO_2 levels decreased mineral density in crops and wild plants. Thanks to all those researchers running experiments in Asia, Europe, the United States, and Australia, I was able to compile data on 25 minerals in 130 plant varieties. To this day it remains the largest study on the issue.

These are the results for plants grown at elevated CO_2 conditions. The carbon content appears to increase in plant tissues but nearly all the essential minerals including zinc, iron, magnesium, calcium, and potassium decline, including protein, which is represented by nitrogen (N). Ionome is collectively all the minerals and trace elements in an organism and rising CO_2 levels appear to downshift the plant ionome by 8%. What is important to bear in mind that this is not an isolated effect only occurring in one region of the world or in one specific plant species. This is a systemic and pervasive global effect.

This decline in the ionome or nutrient density is found in major staple crops such as rice, wheat, barley, and potato. This effect of rising CO_2 levels on nutrient density of plants is found in temperate areas, in subtropics, and every country for which we have sufficient data. Elevated CO_2 levels also decrease nutrient density in wild plants, trees,

and herbaceous plants, etc. It is a systemic and pervasive effect on nearly all plants globally. As CO_2 concentrations rise and plants accumulate more sugars and starches, these dilute not only minerals but other nutrients. Last year, we published a study analyzing grains of 18 rice cultivars grown at elevated and ambient CO_2 conditions in the PRC and Japan. As expected, we found that zinc, iron, and protein decline in most of these rice cultivars. But interestingly, we also found that B-vitamins, such as B1, B2, B5, and B9, declined in essentially all rice cultivars for which data are available. In 2019, we published a study about the effects of elevated CO_2 on carotenoids plants. In both plant and human tissues, carotenoids protect against oxidative stress. Recent trials showed that when diet is supplemented with certain xanthophyll, which is a class of carotenoids, not only several parameters of vision improve but also memory improves in human subjects.

What is worrisome is that when we analyze the data from elevated CO_2 experiments reporting carotenoid levels, we find a significant decline in carotenoid density. It appears that this happens not only because of dilution by extra starches and sugars but also because the genes responsible for carotenoid biosynthesis become down regulated. In other words, plants appear to have less need for carotenoids at elevated CO_2 conditions. That does not hurt plants, but it can hurt the nutrition of plant consumers, including humans.

We have several methods of improving crop quality, from biofortification via conventional breeding, to engineering, and to various ways of enriching soil with minerals. We know they will improve the nutrient density of crops. However, the problem lies with incentives in agriculture, which are essentially based on yield. The green revolution, synthetic fertilizers, etc. are all about increasing food quantity while food quality is disregarded. Now we know that rising levels of CO_2 work against us. The nutrient density of most crops and wild plants globally will keep declining with every passing year as CO_2 concentrations keep rising. I feel that we need to fundamentally change incentives so that farmers are paid for improved crop quality—then they will have financial incentives to use the available tools to boost nutrient intensity in crops. This will help us mitigate the negative effect of rising CO_2 on plant quality and human nutrition.

Panel Discussion

Diwakar Gupta, ADB: The postharvest cycle is equally or more vulnerable. And that is where we come to realize that farming is probably the riskiest business in the world. The reason is that you are exposed to the vagaries of nature and pest attacks, but also exposed to a lot of problems caused by humans. In a year with a crop failure, the farmer is obviously in trouble. Paradoxically, in a year with a bumper harvest, the farmer is equally in trouble. Why does this happen? It happens because the postharvest value chain is either broken, is in the hands of vested interests, or there is no coordination.

Typically, the three large crops—potato, onion, and tomato—go through three- to four-year cycles of boom and bust. Typically, in the fourth year, the production is so

good, but the farmer has nowhere to sell it. Often, farmers leave the crop in the field as what they receive by selling is less than what they will spend to take it out. And in the same year, this crop will sell at 10 times the price in the consumer market. Why does this happen? There is not enough cold chain capacity. Even in countries where cold chain capacity is adequate, it is in the hands of middlemen.

I know about the situation in India but the same is happening in Bangladesh or other subregions. Last year, Bangladesh lost $500 million worth of potatoes left in the ground because there was not enough capacity to keep it, and not enough middlemen were willing to buy it. In other words, the farmer has no pricing power. How can we change this? The private sector obviously will not bring it up as a holistic solution to a country's or region's problems. The private sector is tuned to being efficient and productive and to being profit-generating. It will not invest in something that has a 10-year payback and no line of sight. At the same time, the other big problem that agriculture suffers from is the fact that it is a state subject (under the mandate of the state). In a federal set up, central governments cannot do very much (e.g., India). Centralization of government policies is only partly effective in most countries. Therefore, a coordinated approach is needed.

ADB's effort has been to educate governments that they need a holistic postharvest value chain, where produce can be quickly handled. The other statistic that is important is the loss of 30%–45% of perishable produce before it can be processed. Forget about reaching the food plate. It perishes at the farmgate or somewhere in-between. Governments need to be sensitized. ADB has been doing this, and its Agricultural and Natural Resources divisions already have four pilots in three or four countries. The idea is to sensitize the governments that (i) they are losing 1%–2% of gross domestic product (GDP) by not handling the problem; (ii) capacity needs to be handled in such a way that the farmer has somewhere to go immediately, such as within 6 hours, to a "cooling center" for assaying, sorting, grading, storing. Then he or she has pricing power and is not left to the vagaries of nature or to cartels, which will then determine what he or she does with the produce.

For this to work, the initial investment must come from the government. Governments have certain strengths about enabling policy frameworks, regulation, and land issues. The private sector's role is execution. It must be a partnership in which both have to come together. If that happens the world could be adding 2%–3% of GDP by just crops saved, apart from the fact that the distribution will be better, and the farming and farmers' own lives and livelihoods would be better. We can imagine what the effect on population will be in the long term. Today, malnutrition affects 84 million children of this region, of which about 30 million are starving or wasting.

Martien van Nieuwkoop, The World Bank: I will reflect on dysfunctional markets—the size of the problem, the governments' role, and the nature of the solution to get to outcomes when it comes to nutrition. We have done some analysis on the hidden costs of the global food system. Around 2 billion people are undernourished or malnourished. About 2 billion people are overweight and obese, and about one-third of agricultural production is lost and wasted. About 25% of land is degraded due to poor management practices. Agriculture and land use take up about 25% of

greenhouse gas emissions. Agriculture is the biggest driver of biodiversity loss. One can go on and on.

The aggregate hidden cost is estimated at about $6 trillion a year. Out of this $6 trillion, $4 trillion relate to the 2 billion people that are malnourished, overweight, and obese. Six trillion dollars is a big number. The question is—what is a good comparable reference? The value added of the global food system is about $8 trillion annually. This is huge. You have $6 trillion of hidden costs on a value added of $8 trillion. Numbers given out by the FAO estimate gross return of primary agriculture at $5 trillion a year. The hidden cost of agriculture exceeds the turnover value. It may be comparing apples and oranges, but it shows the huge numbers. Now what do governments have to do with this?

If you look at the public support programs that governments around the world have in place for agriculture and the global food system, whereby we have data from 53 countries representing about 80% of the global agriculture production, our estimate is that the public support programs are about $600 billion a year. If we compare this with the $6 trillion hidden cost, it looks very low. Of the total public support, only 15% is for true public goods—such as agricultural research, extension, infrastructure, payment for environmental services. The rest of it is production subsidies, input subsidies, and direct and indirect price support. Such programs generate allocated inefficiencies, technical inefficiencies, and negative environmental externalities, etc. Moreover, in terms of composition of the public support by crop, there is a huge bias against high-value agriculture like fruit and vegetables. Most of it go to grains—starch and sugar. That is also one of the reasons why those products are cheap as they are used by companies to produce all kinds of cheap junk food as mentioned in the presentation. Last but not the least, many public support programs currently do not really benefit the farmers. Fertilizer subsidies go to the manufacturers. What is the value of fertilizer subsidy if a farmer has nothing to sell? The farmer has nothing to harvest because of the drought.

The bottom line is that governments have a lot to do with dysfunctional markets. If we project to 2050 when we will have 9.8 billion people on the planet, the global food system needs to produce 56% more food. With business-as-usual, it will require an additional 600 million ha of land—the size of India—and greenhouse gas emissions will go through the roof. Governments will need to change the way they support the agriculture sector. The public support programs need to be repurposed. Many countries are underinvesting in agriculture innovation systems, extension, and market infrastructure, as mentioned, and probably also recognize that farmers are also providers of ecosystem services, and therefore, need the right incentives. The size of the problem of dysfunctional markets is enormous. Governments have a huge part to play in this.

Marco Wopereis, World Vegetable Center: We have enormous malnutrition problems. Ten percent of people are still hungry. We have micronutrient deficiencies—26% of Asia's children are stunted, and one-third of Asia's adults have a problem with being overweight. In the next 25–30 years, Asia will add 1 billion people to its cities. We will have to feed and nourish 1 billion additional urban Asians. Right

Fixing the value chain. Session panelists said that we need to fix the value chain inefficiencies to minimize postharvest losses and create attractive profit for producers.

now, we are not doing a good job of it. What can we do with vegetables? There is the nutritional power of vegetables and the economic power of vegetables. Vegetables are rich sources of micronutrients, fiber, vitamins, and all kinds of phytochemicals. You can also earn good money with vegetables. Our data show that farmers can earn between 3–14 times more profit with vegetables than with cereals.

Climate change is already causing erratic weather, pest, and diseases, and affects micronutrients in plants as the keynote speaker mentioned. It is a complex situation. But we can turn challenges into opportunities. Somebody this morning mentioned planetary diet. Yes, if you have read the EAT Lancet report[8], this calls for a radical overhaul of our food system in terms of better environmental stewardship but also a radical change of diet, doubling consumption of vegetables, legumes, and nuts.

The World Health Organization minimum requirement for vegetables is 200 grams (g) per capita per day. The PRC, Japan, the Republic of Korea, and Viet Nam are doing well as they consume more than 200 g per capita per day. In the Philippines, it is 130 g per capita per day. A country like Bangladesh consumes 57 g of vegetables per person per day—hence, a huge diversity. However, the optimum intake is said to be 360g per capita per day. The main concern with perishables is microbial contamination. Such problems can occur during the production stage, during storage, and even during food preparation. That is a major health issue. The other one is pesticide use. Our study shows that 70% of vegetable growers in Cambodia overuse pesticides, and that is not going to be different in other countries. In Bangladesh or the Philippines, farmers growing eggplants may spray every other day against fruit and shoot borer. There are no studies that show a clear relationship between maximum pesticide residue limits in vegetables and health. It will be difficult to do such studies. In countries where pesticides are not well-regulated, where farmers lack knowledge of how to apply

[8] Willett, Walter et al. (2019, January 2016). Food in the Anthropocene: the EAT–*Lancet* Commission on healthy diets from sustainable food systems. The Lancet, 393 (10170), 447–492.

pesticides properly, and in situations where pesticides are used that are not meant for vegetables—for example, using insecticides meant for cotton or rice—this is a clear concern.

How can we bring more vegetables to the table in Asia? We must work on supply and demand, as consumption of vegetables is not automatic. In countries with increasing wealth, the tendency may even be to eat fewer vegetables. We must work on demand creation, awareness about eating nutritious food, perhaps through soft policy measures, knowledge management campaigns, TV shows, social media. Hard measures could also be undertaken like banning unhealthy food. On the supply side, providing greater access to quality vegetable seeds will be important.

The World Vegetable Center[9] is well placed to work on this. We have the largest collection of vegetable germplasm in the world with seeds that are for example disease-resistant, insect-resistant, and heat-tolerant. We get these improved traits to farmers through various pathways including through a vegetable-breeding consortium that we have established with the Asia & Pacific Seed Association that includes 43 seed companies. This knowledge is being spread to the farmers, at least in Asia. In food systems pilots, we work on protected cultivation, aiming to facilitate year-round production, improving the availability and affordability of vegetables. The PRC, Japan, and the Republic of Korea are ahead today because they used protected cultivation. In countries like the Philippines, less than 1,000 ha of vegetables is under protected cultivation.

Anthea Webb, World Food Programme: I congratulate ADB for bringing together two topics that are not often seen in a session, and that is markets and malnutrition. These topics are intrinsically linked. The World Food Programme[10] has a portfolio of about $3 billion in Asia and the Pacific region and we look at reaching about 30 million people. As part of that, we look at how much it costs a person in Asia and the Pacific region to be able to afford not just enough food but a sufficiently nutritious diet. What we found was quite surprising. While generally speaking most people in the region can now afford enough food, there is a shocking number or percentage of people who cannot afford the right kind of diet they need to meet their basic human growth requirements.

We looked at six countries across the region and found that in terms of affordability, a nutritious diet was out of reach for about 20% of people in Cambodia to up to 68% in Pakistan. That gives you a big indication of just how dysfunctional some of our markets are when it comes to price and affordability. Often, it was in rural areas that food was most out of reach. The ability to afford the right kind of diet was much more difficult for the people who in fact grow a lot of the food that you and I purchase in the cities. The person in a household who most needs a highly nutritious diet—an adolescent girl or a woman who has just had a baby, is nursing, or is still pregnant—has the most expensive diet of all and at the same time, has the hardest diet to come by. It gives you a sense of the opportunity lost because so many of our women and girls are

[9] https://avrdc.org/

[10] https://www.wfp.org/

not simply getting the kind of nutrients they need. Interestingly enough, they do not go to bed hungry. But the calories they have do not produce the kind of physical and mental growth that is required to compete on the global marketplace for labor and productivity.

If we can address this, there will be a huge step up possible if those gains are matched in terms of quality of education, health care, and sanitation. The focus needs to shift toward those highly valuable nutritious foods that are also highly profitable: fruits and vegetables, animal protein, fisheries, livestock, dairy. But these are the kind of foods that have traditionally not received support from governments and the private sector. Even though they hold the most promise both in terms of their nutritional impact and bottom-line profit.

I will finish with a story that comes out of Bangladesh, and a very new collaboration between the World Food Programme and ADB in Cox's Bazaar. There was a movement of several hundred thousand people from the Rakhine State in Myanmar into Bangladesh at the end of 2017, of whom 80% rely on external help. They are not allowed to have jobs. Children are not allowed to go to school. They rely heavily on aid. With support from ADB and the Government of Bangladesh, we are helping to build a new set of stores where refugees can come and cash in their electronic food voucher. The beauty of that is that they were no longer just giving the people bags of rice, a can of oil, or a couple of lentils but they were able to purchase the food that is most nutritious and most suited to their diet. A good portion of the money that they spend is for purchasing locally grown food by the host community, which has suffered by the arrival of so many new people and for whom food prices have also gone up. With this very helpful partnership, those refugees who arrive with horrific malnutrition problems can address their own nutritional needs while supporting the local community.

Jane Gerardo-Abaya, International Atomic Energy Agency: We heard about technologies that the Philippine Nuclear Research Institute, which is collaborating with the IAEA, presented as part of the exhibitor information. It is important to look at the daunting problems in light of technologies that we have and can use to alleviate the situation.

Some questions have arisen. What is the IAEA and what is it doing? We are known as a nuclear watchdog, but the IAEA supports member countries in Asia and the Pacific region on the SDGs. In fact, 9 of the 17 SDGs are relevant to our technical cooperation program. Nearly 25% of our technical cooperation program is on health and nutrition according to the request of our member states. This includes cancer treatment diagnosis and therapy, and nutrition of children and mothers. Another major part of the technical cooperation programs is on food and agriculture. Through projects we support, we build the capacity of member states to acquire nuclear science and technology to address SDGs. We also provide networking between member states, including least developed and developed countries to share knowledge, acquire technologies, to address development problems where nuclear techniques are relevant.

In Indonesia, we supported the production of 13 soya bean varieties with the biggest success being a yield of 4 tons per ha. The other example is from Bangladesh where we helped produce shorter growing time and productive varieties of rice. Bangladesh has now produced about 3–4 tons per ha of the new variety that was harvested within 115 days instead of the usual 130 days. In Malaysia, we have supported production of a rice variety that has survived periods of drought as well as floods for 8 days. Malaysia has now started multiplying seeds of this variety and partnered with the private sector, which has mainstreamed the seeds, propagated it and delivered to the farmers—a good example of public–private partnership (PPP). In the Philippines, Dr. Abad has presented to us today the use of carrageenan to boost rice production by 30% with only half the dose of fertilizer. In Myanmar, mutation breeding has enhanced higher yields and shorter maturation periods. In Viet Nam, irrigation helps in increasing quality and shelf-life of food suitable for export. A triangular cooperation with Cambodia and the Lao People's Democratic Republic (Lao PDR) has been signed to cooperate in capacity building for the use of nuclear technology. In the context of exporting fruits, sterile insect techniques have been used. Additionally, on undernutrition of children, nuclear techniques can measure the effectiveness of fortification interventions and others.

Irakli Loladze, Arizona State University, United States: Malnutrition is a multifaceted problem and the solution to it also requires several dimensions to be simultaneously resolved. While rising CO_2 levels decrease micronutrient levels in plants, fruits and vegetables are still more nutritious than staple crops and junk food. We still need to eat fruits and vegetables. We just need to be aware that as CO_2 concentrations keep rising, the nutrient content worldwide of nearly all plants is declining.

From my perspective, as a mathematical biologist, I often hear about potential or theoretical solutions, for example fortification or supplementation. If the nutrient density of crops declines, why cannot we just fortify foods or give everybody a pill? However, if you look at fortification, for example iodine, which is one of the most successful, we still see the logistical hurdles, where hundreds of millions of people do not get enough iodine. Fortification works for some foods, and only for some nutrients. There is also the question of just adding minerals to the soil. Adding minerals to the soil produces better quality crops, but farmers do not have financial incentives to do so, unless it also increases yields. Farmers do not see the benefits for the additional work and costs of adding minerals. Expecting farmers to care about the nutritional value of crops in the face of unpredictable weather, unpredictable markets, and exploitation by middlemen is unrealistic. Governments can work together to provide incentives, where producing more nutritious crops can change the food supply system for the better. On the one hand, the "Big Food" industry dilutes our food with cheap calories. On the other hand, we have rising levels of CO_2 that do the same.

Jonathan Hellin, IRRI: We were left with a critical question—the emphasis has been on yield. How do we shift things so that we get a greater emphasis on quality? There are incentives for increasing crop quality. I am a cynical optimist. I believe we can bring about change. It is just going to be difficult.

[11] EAT. Healthy Diets from Sustainable Food Systems: Food Planet Health.

The solutions are there. Implementing them is a much more difficult challenge. What was insinuated but not really talked about a lot on the panel was the fact that we are continuously grappling with trade-offs and contradictions. Income increases, nutrition goes down. Demand for high-value crops can lead farmers to using tons of insecticides to produce vegetables without any blemishes on them. Nutrition could come from greater meat and dairy consumption. And yet if you read the EAT Lancet report[11], it points out that to stay within planetary boundaries, we should be reducing meat and dairy consumption. There are always trade-offs between the agriculture sustainability, health and nutrition, and prosperity.

There is nothing wrong with trade-offs. We need to recognize them. We need all that coordination along the value chain, and that is where the incentives are going to come from, and not just for farmers. Intermediaries may be bad, but they play an important role. If it is not an incentive for the intermediaries, farmers are not going to sell their product. If you talk about health and biofortification, these are often invisible traits. How do you as consumer know that what you are consuming is what you think are consuming?

We do have digital tools, knowledge, and incentives around. Governments can use the carrot-and-stick approach. The answers are there. The issue is how you stitch things together so that you minimize the trade-offs and enhance the synergies. This is only going to work when there is enough consumer demand. That we must be very careful about because mention was made about willingness-to-pay. I seldom see that play out in reality. Willingness-to-pay needs to be backed up.

Biofortification, crop diversification, cropping systems—the money is there. You can do it through smart subsidies, for example. It is getting the political will, and the panel today has shown that there is considerable political will and ways forward. But we must never lose sight of having to minimize those trade-offs.

Howarth Bouis, HarvestPlus: I want to make four points. Firstly, what is the primary objective of agricultural policy makers? What agricultural policy makers decide has an important impact on the nutrition and health of the nation. How do we get policy makers to put nutrition and health as a higher priority in their decision-making?

Secondly, what has happened to food prices over the last 40–50 years? We had the green revolution, where rice and wheat prices came down. Cereal prices are now lower than they were 40 or 50 years ago. Vegetable, fruit, and meat prices have doubled and tripled over the same time period. If the rice price tripled, the agriculture minister in the country would not be able to sleep. The government would not stay in power. But when vegetable or fruit prices triple, nobody pays attention.

Thirdly, the cognitive abilities of the nation are compromised when non-staple prices go up. This is the underlying cause why dietary quality is so poor. The prices of foods that are rich in minerals and vitamins have been going up so much.

Fourthly, how do we take action? We must take specific action in each of the broad food groups. Food staples are what the poor eat in large amounts of. We have an

intervention, referred to as biofortification (developing mineral and vitamin dense staple food crops), on which I have worked. One can substitute the non-biofortified crop with the bio-fortified crop at no extra cost. High zinc rice costs exactly the same as non-biofortified rice. You do not have to spend any more money and you get more zinc in your diet.

In Africa we have orange maize. Forty-five percent of preschool children in Africa suffer from vitamin A deficiency. You just have to substitute one-for-one, orange maize for the white maize at the same price and thereby do a lot to reduce vitamin A deficiency. What about vegetables and fruits? In this case, it is necessary to bring the price down. If you can lower the price, then people can eat more. You must invest in the value chains infrastructures and agricultural research to get the productivity up. And it is exactly the same for animal and fish products. Milk is a very important food item in India. A government program improved production of milk rapidly and milk prices came down by 50%. If you are poor and the price comes down by 50%, you can consume twice as much milk for the same amount of money. That is exactly what we need to do. For example, improve productivity of eggs, which are generally not traded internationally. Find a few key foods, focus on the productivity, and get it up. But we must get the agriculture ministers to focus their actions on nutrition of the nation.

Lee Pai-Po, International Cooperation and Development Fund, PRC: Climate change is a serious threat due to the increase of uncertainty factors in agricultural investment. Total agricultural production and unit productivity are reduced, resulting in market failure and malnutrition. Secondly, rural migration and increasing urbanization—whereby rural areas have shortage of labor and women do most of the work and production—suffers. Thirdly, agriculture investment in the 1960s was 33% and is now less than 4% of national GDP annually. Multilateral and bilateral development agencies' financing in agriculture have also declined. Therefore, encouraging agricultural investment is still very important. As far as markets are concerned, middlemen will have to be prohibited. Reduce the exploitation of middlemen and establish a sound auction system for agricultural products so that farmers' products can be sold directly to the market to protect farmers' livelihoods. Fourthly, poverty issues and malnutrition caused by food insecurity, including undernutrition (underweight, stunting, and wasting), overweight and obesity, and micronutrient deficiency (vitamin A, zinc, and iron). In Asia, 84 million people have malnutrition, and the proportion is quite high. Appropriate measures must be taken to overcome this phenomenon.

On solutions—firstly, based on the concept of agricultural value chain, increase agricultural investment (including land, seeds, fertilizer, and irrigation) to increase agricultural production. Establish climate resilience (such as the use of new varieties, anti-drought, resistance of disease and pest); new agricultural knowledge (precise agriculture, wisdom); new agricultural knowledge (precise agriculture, climate-smart agriculture, digital agriculture); and apply new agricultural technologies (such as ICT, GIS, drones) to solve the problem of insufficient market supply. Secondly, reduce food waste and loss. Every year about 1.3 billion tons of food is lost and wasted. If we can reduce the food loss and waste, it will be of great help to global food security. Thirdly, food security and nutrition for all should concentrate on food availability, food

access, food stability, and food utilization. Fourthly, in agriculture financial support, including microcredit and microinsurance for small farmers are useful mechanisms, allowing small farmers to obtain funds for agricultural production will greatly help increase farmers' income. Lastly, in recent years, the World Health Organization (WHO) has attached great importance to universal health coverage and primary healthcare coverage. The prevention and control of noncommunicable diseases, including malnutrition caused by undernutrition, obesity, diabetes, and cardiovascular diseases is the focus.

Hean Vanhan, Secretary of State, Ministry of Agriculture, Forestry and Fisheries, Royal Government of Cambodia: A solution to the challenges is to increase income. Malnutrition is mainly a problem of the poor. When farmers have increased income, they can have access to many kinds of food. The use of insecticides is dangerous and should be avoided. It is important to increase productivity of varieties. Farmers need to increase productivity and not yields. Many countries focus on the yield but not productivity. In Cambodia, farmers report on their tonnage per ha. after harvesting. While some claim they get 5 tons per ha; others say 4.5 tons per ha. However, sometimes the farmer that gets 4.5 tons per ha gets more benefit and more profit because of higher productivity.

Diwakar Gupta, ADB: Development of a market can always happen. I was addressing the postharvest losses that happen. More importantly, the producer or farmer has absolutely no power on pricing or holding on to his or her stock. It is not so much about developing segments of the postharvest value chain as it is about having an integrated value chain.

This will require several things. For example, an adequate cold storage capacity could use a digital backbone to understand in real-time how much is available or how much is pledged. This could be linked to a banking channel, where the farmer can pledge produce against a warehousing receipt and get 20% or 30% of the value of the crop. This would also eventually give information at national level about the cropping for a particular crop, which could be helpful in forecasting for the next year and avoid boom and bust cycles every 3–4 years for certain crops. Eventually, this might even lead to the government using a buffer to ensure against volatility. If warehouses are full and you have access, one can do a one-time export. On the other hand, if there is insufficient supply, cropping could be influenced for the next season.

There are a lot of options but these need to be integrated. Otherwise specific segments will develop, and specific people will benefit. Eventually they will become vested interests, as what is happening today.

Martien van Nieuwkoop, The World Bank: Despite many public support programs, there was a steep rise in food staple price in developing countries in 2007. This led to a doubling of public support programs in developing countries, while such programs were maintained at the same levels in developed countries. In countries of the Organisation for Economic Co-operation and Development (OECD), as mentioned earlier by the director general of IFPRI, public support programs, particularly in the European Union, are decoupling from influencing production decisions by farmers

and moving toward income support. One would, therefore, argue that public support programs in OECD countries over the last decade or so have become less distortionary than they used to be. If you look at global value chains, you see increasing concentration in the downstream segment of value chains that may give rise to questions about farmer's proportion in the retail price of the produce. You see this reflected in the discussion about livable wages in agriculture and the rural sector.

We are not saying that the volume of $600 billion in public support programs in agriculture, should be reduced. We are saying that public support programs should be repurposed and put to better use and generate outcomes by investing in innovation, market infrastructure, and resilience. By doing that, health and nutrition outcomes will be achieved, and there will be huge economic dividends in terms of better income to farmers. This will provide better incentives to farmers to grow high value crops with better income opportunities. Finally, at the fiscal side—the linking of expenditures under public support programs to public goods—the sector becomes more effective from a fiscal point of view. Ultimately it boils down to the political will in individual countries. The opening speaker this morning also said that in the end, the solutions are very context specific. There are no global solutions and there is no silver bullet. In the end, each country will have to make that shift and that is why national leadership is very important.

Marco Wopereis, World Food Programme: In reaction to the gentleman from the Philippines, there is a clear need to change food habits and eat more nutritious food—in particular fruits and vegetables. Development of the vegetable sector is a complex business. It is highly capital-intensive and knowledge intensive. There must be political will. We need policies that foster health and nutrition and lay the groundwork for the future. We need investments in production, storage, marketing, and research. A tiny fraction of public funds is allocated to research and capacity strengthening for nutritious food like fruits and vegetables. Why would the Philippines aim to export vegetables when there are more than 110 million people that need to eat more vegetables?

Diwakar Gupta, ADB: On the role of the "Big Food" processing industry, in the developing world, barely 2% or 3% of the food is processed. As far as the weighted average importance of processors is concerned, not more than 5% of what we are producing get processed. What we need to look at is the 95% of perishable crops. The point raised about the role of "Big Food" processors and how to incentivize them to produce nutritious food is relevant. It has to do with the free market. The government needs to start with policy at the grassroots and eventually the free market will take over.

Martien van Nieuwkoop, The World Bank: After the food price crisis in 2007, the private sector became interested in investing in agriculture. This led to discussion about land grabbing, among others. In response to that, work was done on the principles of responsible agriculture investments. There was discussion on ensuring that private investors comply with local laws on social and environmental legislation and for investments to be inclusive. Right now, principles are focused on the production side of the supply chain. To what extent we can bring in the private sector

to produce more nutritious food. Why can't we extend those principles to agricultural marketing? What is the role of multinational corporations and agribusiness to educate their consumers in making healthy choices? That is a discussion we are starting with the World Business Council and we are in the early stages but that is an avenue the World Bank would like to explore.

Connectivity matters. Using digital technologies in connecting rural ecosystem services value chains and human capital with peri-urban and urban growth centers and economies gives opportunities to speed up post-COVID-19 recovery and economic renewal.

Rural Distress

This session highlighted the imbalance in rural–urban development and its significant negative impacts on national economic growth, rural employment, food security and nutrition, and urbanization. Good examples of rural revitalization will show that well-developed rural areas can play a vital role in wider economic development and generating good jobs for the youth. Specific recommendations regarding green and blue investments were discussed.

Keynote Address

Mihir Shah, Distinguished Professor, Shiv Nadar University and Former Member, Planning Commission, Government of India

Rural distress is one of the most important issues of today. We cannot continue with business-as-usual. We have been following a certain paradigm, which has been dictating policies and actions we have taken in the rural and farming sphere. I am here to urge that we need to make an urgent change.

Since the 1950s, when the economies of Asia, Africa, and Latin America emerged from colonial rule, the primary strategy of development that has been followed is to try and move people away from the farm—to try and move them into industry and urban areas because agriculture was essentially seen as a no-hoper. That has been the strategy we have consistently followed. Even after following those policies for the last 70 years, the demographic realities are:

i. The global rural population today, which is 3.4 billion, will remain over 3 billion in 2050.
ii. An overwhelming proportion of people in developing countries will continue living in rural areas well beyond 2050.
iii. The very possibility of absorbing an increasing number of rural migrants in the urban centers of these countries is severely limited already even as we speak.

iv. The kind of crisis that urban areas face in these countries is even more grave than the one that faces us in the rural areas.

While this is no doubt a crisis, it is also a crisis full of opportunity because we have the possibility of making these rural areas leapfrog into the 21st century on the back of certain major and exciting technological, social, and ecological innovations.

Economic Development

We need to change the way we look at economic development itself. The paradigm of economic development has not recognized that the economy is only a small subset of the larger ecosystem. Here we have many examples from across the world. We have the People's Republic of China's (PRC) commitment to become an ecological civilization in the 21st century. It has already embarked on a model of ecosystem compensation; whereby upstream communities are compensated for maintaining downstream water quantity and quality. The Chinese have a concept termed "ecological space," which needs to find its place along with rural space and urban space. The city of New York negotiated with farmers living in the catchment areas to pay for ecosystem services that farmers provided to the city assuring a safe and secure supply of drinking water. Over many years, the water catchment areas were protected, farming was of a certain kind and the farmers were paid by the residents of New York city to be able to do this. This is a win-win scenario where you preserve the ecology, which sustains development.

We need to learn the right lessons from the green revolution. I quote from FAO's review[12] in 2017:

> High-input, resource-intensive farming systems, which have caused massive deforestation, water scarcities, soil depletion and high levels of greenhouse gas emissions, cannot deliver sustainable food and agricultural production. Needed are innovative systems that protect and enhance the natural resource base, while increasing productivity. Needed is a transformative process toward 'holistic' approaches, such as agro-ecology and conservation agriculture, which also build upon indigenous and traditional knowledge." What we require is a new agriculture. Chemical agriculture across the world is now reaching its limits. Farmers have to apply more and more fertilizers and pesticides to get the same level of output. The costs of these inputs are rising by the day. This has led to a dramatic rise in the cost of production, resulting in negative incomes in some cases. In countries like India, hundreds and thousands of farmers have committed suicide over the last 30 years. This is unprecedented in Indian history. You have had rural distress, but you have never had a situation where farmers are compelled to commit suicide.

We need to think out of the box. If we continue with the old paradigm of giving higher minimum support prices, giving subsidies for chemical inputs, that gets us deeper and deeper into the same vicious cycle.

[12] FAO. 2017. *The future of food and agriculture – Trends and challenges*. Rome.

Alternatives

What are the alternatives? There are major efforts on the ground. For example, in the Southern Indian State of Andhra Pradesh in India, the state government has committed that by 2027, 8 million ha, its entire cultivated area, will shift to natural farming. This is a political call taken also because the largest number of suicides has taken place in that state. With the recent change of government in Andhra Pradesh, the new chief minister has also committed to following this path of natural farming. If you follow this path, you get multiple win-wins. There are higher farmer incomes because costs of cultivation come down. There is better soil health, the foundation of agricultural productivity. There is water security, and we can move toward ensuring consumer health.

The Lancet Commission Report that came out in 2019 is called the *Global Syndemic of Obesity, Undernutrition, and Climate Change*.[13] Diabetes in a country like India has become an epidemic. In 1990, there were 26 million diabetics. After 26 years, this number increased by 150% to 65 million. The number of diabetics is expected to double by 2030 due to the massive consumption of ultra-processed food products. A major contributor to this epidemic is the displacement of wholefoods from our diet by energy-dense, nutrient poor and ultra-processed food products. How do we, therefore, address this crisis of nutrition? The fundamental change we need to make is to diversify our cropping pattern.

The green revolution no doubt made a huge contribution to food security. But today after 50 years, the green revolution has run out of steam. We need to look for alternatives, particularly in the area of crop diversification. We should move away from the "traditional crops" of the green revolution. Millets, pulses, and oil seeds have high nutrient value. Along with that we need to have fruits and vegetables. We need to develop cold chain infrastructure, which will move the farmers up the value chain while addressing the nutrition crisis. Tomorrow, you will hear from a farmer from Maharashtra, who is growing strawberries, which are an extraordinary option for that farmer. The farmer will explain to you that moving to organic strawberry cultivation dramatically reduces the cost of cultivation with yields being stabilized within two years when production moves to organic.

Water

I also want to focus attention on the question of water. When the Honorable Prime Minister of India invited me to join the Planning Commission, my major task was to suggest a paradigm shift in water. The new government has asked me to continue this work in recent years. We need to shift the emphasis from endless supply to sustaining supply by reducing the demand for water and moving away from water-intensive crops.

Invisible infrastructure. Mihir Shah, Distinguished Professor, Shiv Nadar University, stressed that invisible infrastructure, specifically participatory approaches to development and women's leadership, must be part of the battle against rural distress.

[13] The Lancet. 2019. *The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report*.

We also need to have a new vision for infrastructure. The 21st century now offers us the possibility of what we call blue-green infrastructure. This is infrastructure, which builds with nature, allowing room for the river, is energy- and resource-sensitive, and, therefore, enables us to create jobs in the infrastructure sector, which leads to sustainable development.

We also need to carefully pay attention to innovations in waste management. Biological and nature-friendly technologies are now available for us to leapfrog the capital and energy intensive technologies of the 20th century.

What we have seen so far is that farmers have interacted with markets and the isolated farmer has had an unfair deal. Innovations in farmer producer organizations and collectives have turned adversity faced by farmers in markets to empowerment and bargaining power. Institutions of the poor, in our battle against poverty, and institutions led by women are key to overcoming farming and rural distress across the globe. We need major investments and facilitative action that enable farmers and others in rural areas to come together to benefit from the power of collective action.

Invisible Infrastructure

Finally, I emphasize the importance of what has been called "invisible infrastructure"—participatory approaches to development. All development experience across the world in health, education, sanitation, nutrition, or water shows that when people are centrally involved in making decisions about the kind of development that should happen and in overseeing the very process of implementation of development programs, that is when these programs are successful. The leadership of women has proven to be a critical factor in ensuring success for these development programs. Invisible infrastructures are the social and human systems that enable capacity building among primary stakeholders, and this must form an integral part of our battle against farm and rural distress.

To summarize: (i) harnessing the power of ecology, and ecosystem services; (ii) Evergreen Revolution; (iii) harnessing the power of blue-green infrastructure; (iv) building institutions of the poor led by women at the grassroots.

Panel Discussion

Montserrat López Jerez, University of St. Andrews, Scotland: I am a trained economic historian. The discipline's almost exclusive focus on industrialization and rise of the west is illustrative of the neglect of the role of agriculture. No country has undergone structural change without transforming agriculture. It is thus an important aspect to study and research. Many historians would be researching situations faced by European farmers and assume no valid comparisons can be drawn, but conditions affecting small-scale holders and labor intensity in Europe and Asia were relatively similar albeit at different periods in time.

I look at comparative examples in Asia. First, I highlight the importance of farmers as agents of structural change, which is not the way we normally think of farmers. I stress the point brought up by the keynote speaker in Session 1, Dr. Krishnamurthy, that farmers are both producers and consumers. However, in relation to the urban bias, as the keynote speaker in session 3, Dr. Shah, has pointed out, an urban–industrial, labor-absorbing versus a traditional rural economy hypothesis does not hold true today.

In the developing world, people might move to cities, but then the urban bias takes up another dimension, which is that people coming from a poverty-stricken background in rural areas risk end up in urban poor groups adding to urban poverty. This mobility is no longer a proxy for improving incomes. The growing pressure of urban poverty forces urban administrations to keep food prices low as many people migrating into urban areas nowadays have delinked themselves from the rural economy, which they cannot return to for livelihoods during crises. Urban administrations cannot afford then to allow food prices to rise in the cities in order to maintain social and political order. There is a consequent trade-off. The urban authorities try to keep food prices down, which then proves a disincentive to farmers. That becomes a vicious cycle.

Second, one of the problems seen today in Asia is that agriculture as percentage of GDP is going down, while employment in sector remains high—significantly above the world average. That indicates that structural adjustment is not taking place. Hence, the important but complex relationship between on-farm and off-farm incomes in Asia needs to be addressed. In the initial stages of transformation, we see that both in Japan and Taipei, China, and to a lesser extent in the Republic of Korea, the relation between on and off-farm was much greater than what the literature usually acknowledges. It is seldom that we come across farmers fully employed in a business. There is an intermediate stage of transformation that most literature on the subject ignores, and that is rural industrialization. The combination of on-and-off-farm incomes allows resilience build up against shocks, seasonality, and the labor-intensive production. It is a relatively small stage and if one gets stuck there, it becomes a vicious cycle. That is when public policy steps in. State interventions might lead to a different type of dynamics.

Finally, I emphasize the importance of resilience build up for smallholders. When we look at the data, especially the East Asian cases, which are good examples from which lessons can be learned, we understand about avoiding urban bias. How to help farmers cope with the distress they are exposed to, or the risks they have to take. Farmers are exposed to many risks both as producers and consumers. One of the fundamental aspects is that the most inclusive processes of transformation are those that keep the imbalances between rural and urban at bay by leveling out incomes. The provision of public goods is fundamental but labels of rural and urban cannot solely define the inequalities. We can see inequality within rural economies as well. For instance, in the Red River Delta, rural income inequalities are driven by off-farm rather than on-farm activities due to the small size of farmland holdings. Thinking along the lines of big categories, rural and urban, is important but we must also look at each specific rural economy to be context-specific within the same country. Otherwise, we will miss the importance of the local rural economy and policies

may not reach the intended beneficiaries or result in not achieving targets they are supposed to foster.

Thierry Giordano, French Center for Research and Agricultural Development (CIRAD): First, we should think beyond agriculture, food security, and sectoral approaches and get to systems. This also goes in the direction of recognizing diversity of income sources we have in rural areas today. CIRAD has just released a report together with FAO and the European Commission during the Committee meeting on Food Security in Rome, Food Systems at Risk. The main message is that risks combine and become complex as we go down to lower levels, as these are context specific. The question is how to address these local specificities and find the right solution for the right places.

Second is the urban–rural dichotomy that has to disappear, and instead, the rural–urban linkages need to be strengthened. But building roads is not enough. We need to close the development gap between rural and urban areas and that goes beyond just connectivity. We have to ensure urban policies that benefit both rural and urban drivers and this must bring about a major change in the way we work and stop working in silos.

How do we move to something more specific? UN-Habitat has developed guidelines for strengthening rural–urban linkages and they are now trying to apply in some countries. In the PRC, the first forum on urban–rural linkages will be held in 2 weeks' time. At CIRAD, we are developing an integrated territorial approach, whereby we have developed an advocacy paper in collaboration with many international agencies and partners, such as FAO, the European Commission, United Nations Capital Development Fund, African Union Development Agency-NEPAD, German Development Cooperation, and French Development Agency.

It is about ensuring solutions at local level at the right scale, at the right time, in the right manner. Some basic principles are firstly, to be forward looking, identifying what will be the future of the territory we are working on. For example, we are talking about how to make farming attractive. Apart from ensuring livable incomes, we must ensure that farming has a future. In Senegal, when I talk to farmers who are making a decent living, they do not wish their children to go into farming as they do not see a future in the rural areas and no future in farming. Thus, we need to work on developing a future for rural areas. Secondly, if governments have a role to play, local governments need space to act. Decentralization and devolved governance are key in this process. Thirdly, when we are implementing integrated territorial development approach, we need to be participatory. This what Dr. Shah was mentioning in his keynote address. We aim to include all stakeholders—the farmers, civil society, churches, local and national government, and make sure that we all agree on what the future could be. This forms the basis for working together. Finally, it is important to be impact oriented. It is just not about ticking the box. We need to look at outcomes and impact. We need to analyze all the interconnections with other sectors, initiatives, and actors—all these must come together. This approach is about multisectoral, participatory, multi-stakeholder, multi-governance levels. We have applied this approach in several

Mobile internet to help reduce poverty. The improvement of internet and mobile phone services, once further upgraded to high speeds and accommodating bandwidths, can easily bring high-quality services from urban areas to rural areas.

African countries but unfortunately studies are in French language. We are now working in Botswana and soon will have results documented in English.

David Dawe, Food and Agriculture Organization of the United Nations: The key question we need to ask ourselves is how to convince the people who are not in this room. We need to think about how to convince others. We must think of hooks to augment our arguments. One is that inequality in society is now becoming a major issue such as the rural–urban divide, especially in Asia. Howarth Bouis talked yesterday about a competitiveness angle, which is another hook we can use. If we do not get our diets right so that our children are eating more nutritious foods from a very young age, which are rich in protein, micronutrients, and fibers. For example, it may become an issue of national competitiveness. People's brains will not develop fully. In today's age, it is not physical strength or human labor that really matters, it is the mental capacity that is the human capital that determines national competitiveness.

We need to think of these angles and use them to sell the importance of rural development and food security to outsiders. We need to go beyond agriculture in rural areas. Once we secure funding for rural development what is it spent on? Martien van Nieuwkoop (World Bank) mentioned that the money is spent not well. One issue I would like to raise that Prof. Shah mentioned earlier is the use of inputs in farming. It is well-known that use of fertilizer, pesticides, water—all have negative externalities and impacts on things that are outside the food they produce. In economics, the standard policy prescription is to tax the use of that input. Instead, we subsidize them. This is a complete reversal of what we should be doing.

We need to ensure that any extra funding coming in for rural development and food security is not spent on input subsidies. Fifty-sixty years ago, it may have been a good idea to teach farmers about an input (fertilizer) that they were unfamiliar with. I do not think zero fertilizer is the solution. There is some optimal level of fertilizer that should be used. Nowadays, farmers are well past that stage. They know very well how

to use fertilizers and we do not need to encourage increased use of fertilizers, which results in more negative environmental impact.

These are difficult issues politically and we need to [use] political economy. In Indonesia, they raised fuel prices and ended up giving cash transfers to poor people to compensate for price increases. We need to learn from experience. It is not easy to remove these subsidies, but it is possible. Education, healthcare, water, and sanitation costs more per person of investment in rural areas than in urban areas. There may be a case to prioritize use of scarce financial resources. We should spend on nutrition. We need more funding on basic agricultural research, on fruits and vegetables, on aquaculture, and other animal protein source products. This research will help farmers to become productive. As consumers are also looking for products that are affordable, research will help identify ways to increase productivity, and hopefully not at the expense of the environment. We need increased spending on agricultural research and development on food that provide better nutrition. Staple cereals remain important but those are not enough. Diets are moving in other directions. In many countries, prices of fruits and vegetables have risen more rapidly than the prices of cereals. This makes it harder for poor people to afford these foods. There are also implications for value chains. A lot of these nutritious foods are perishable, and we need cold chains so as not to lose the nutritional content in the process of getting it from farms to consumers. We also need to impart better business skills to farmers, which will help them to create more value added to have good returns. Business skills will also be valuable for farmers pursuing off-farm occupations or income generation options. This is inevitable. It has happened in every country that has ever become wealthy in the history of mankind.

Saulye Janimkhan, Vice-Minister of Food, Agriculture, and Light Industry, Mongolia: The Government of Mongolia is paying keen attention to this forum. This forum is essential as it promotes rural development in developing countries and effective implementation of food security policy.

The population of Mongolia is approximately 3 million. Its land area of 1.5 million square kilometers (km^2) is one of the least densely populated countries of the world. Mongolia is administratively divided into 21 provinces containing 330 administrative sub-units known as soums. Sustainable rural development has been one of the priority focus areas of Mongolian government policy. The following are the main challenges and constraints that the Government of Mongolia faces in the context of rural development:

i. The economy of around 85% of the old sub-provinces is vulnerable as people only depend on livestock and farming.
ii. Due to lack of infrastructure in rural areas, agricultural commodities are not easily available in the market.
iii. Mongolia has harsh weather conditions and its impact on the agriculture sector is enormous. The extreme weather conditions affect the competitiveness of the agricultural sector in the country.

In 2018, Mongolia had around 110 million ha of rangeland according to the national statistics, with 66 million heads of livestock. In recent years, the number of livestock have been increasing and about 25 million heads of livestock exceed the pastoral carrying capacity. There are about 170,000 households and average age has increased. Productivity needs to increase and breeds need to be improved to increase the number of animals for herders, as herder income increases. Some of the polices the Government of Mongolia is implementing focus on developing the rural areas.

The agriculture sector plays an important role in rural areas by minimizing the density of population living in cities. The Government of Mongolia is implementing the National Industrialization Program 2100 as well as the Meat and Dairy Campaign in order to develop local production, create jobs, increase the income of herders and farmers and ensure a local and sustainable development. The Government of Mongolia pays key attention to food security. In 2017, the Ministry of Health, together with the Center for Public Health conducted the 5th National Nutrition Survey of Mongolia. According to the survey, 90% of children under the age of 5 years, 95% of pregnant women, and 82% of men have vitamin D deficiency. Overweight and obesity of the population have been increasing risks to public health. Hence, the public should be aware of a healthy diet, including vitamins and minerals. More healthy food should be produced. Therefore, the Government of Mongolia is aiming to ensure food security and improved public health. The parliament has adopted the Food Fortification Law in 2018, which mandates iodization of salt and enrichment of flour and food items that are mostly consumed in Mongolia. Mongolia will gratefully cooperate with regional countries as well as international organizations to implement rural development and food security policies in the country.

Cesar Jose da Cruz, Secretary General, Ministry of Agriculture and Fisheries, Timor-Leste: I will focus on climate change, under which droughts can occur in both high and low rainfall areas. Asia has been increasingly affected by unpredictable weather and drought has decreased availability of water. Prolonged dry seasons as well as floods impact heavily on food security. Drought is by far the more devastating, frequently caused by El Niño.

Consequently, the impacts of climate change and extreme weather events are likely to increase in frequency and intensity, which will impose a major threat to nutrition and food security and hamper gains made already. Seventy per cent of the population depends for their livelihoods and food security on farming and rural activities and these will be greatly affected. The adverse impacts seriously harm the country's development by impacting on infrastructure, ecosystems, and communities. The topographic and socioeconomic conditions have led to classification of large parts at risk to natural hazards, disasters, and social vulnerability.

The agriculture and forestry sectors have suffered disproportionately from droughts. At the same time, the sectors provide ample opportunity to promote resilience and sustainability and socioeconomic development of communities. The strategy of agriculture and food and nutrition security provides a framework for an integrated and action-oriented approach to reduce negative impacts of drought in the agriculture sector and increase resilience of rural communities toward proactive disaster risk

management. The goal of sustainable development is to strengthen communities to better cope with drought by installing early warning and response systems. Priority interventions have to be identified to institutionalize a systematic approach to drought risk monitoring; early warning and early action; and to enhance capacities at national, municipality, and local levels for timely and needs-based response and to ensure that drought risk reduction is a part of recovery, reconstruction, and rehabilitation efforts.

The objectives are reduced vulnerability and increased capacity of farmers to implement drought risk reduction good practices and strengthening of mechanisms to manage and reduce drought risk; and increase productivity as well as production intervention in priority activities and working mechanisms for enhanced risk reduction in agriculture, livestock, forestry, and fisheries at all levels—national, municipality, local, and development partners including private sector.

The Strategy for Agriculture and Food Nutrition and Security outlines key priorities, national policies, and regulatory framework and builds on good practices. There is an imbalance of urban–rural development. This negatively impacts national economic growth. We need to reduce the gender gap in rural and urban areas. Without positive interventions there will be no farmers, no food, and no future.

Duc Chien Dang, Institute of Policy and Strategy for Agriculture and Rural Development, Viet Nam: I will focus on three things: mobile internet, rural–urban migration, and rural development program in Viet Nam. The mobile internet will help reduce poverty. Muhammad Yunus, founder of Grameen Bank once mentioned "The quickest way to get out of poverty right now is to have one mobile telephone."

Currently, 47% of world population uses mobile phones to access internet. In low- and middle-income countries, 57% people exclusively use mobile phones to connect to the internet. Mobile internet is growing and this could be one option that helps rural development. In low- and middle-income countries, mobile internet access in rural areas can provide services in the agriculture, health, and finance sectors, which can be support by the public and private sectors. However, there are some barriers preventing rural populations from using mobile internet—affordability, literacy, and digital skills of the farmer. These barriers could be overcome by enabling government policies so that mobile services can reach their full potential. Governments can also encourage developers of apps to provide farmers with useful apps that provide agriculture, market information, tele-education, and financial services. In Viet Nam a lot of mobile apps allow people to conduct financial transactions easily and speedily, which facilitates remittances from urban to rural areas.

The second issue is migration. One-third of international migrants are aged between 15-34 years. Around 40% of remittances are sent to rural areas. This underscores the fact that a major portion of migrants are from rural areas. Migrants not only remit funds back to their homeland. They also bring along knowledge and skills. But migration has both pros and cons. Because of out-migration, rural areas face challenges. Farm labor in rural areas is aging and younger people (aged 15–34) are migrating out to urban areas. Yet the young are the motivation, the engine of

development in rural areas. In Viet Nam, a study based on census results shows that between 2008–2014, labor movement out of primary production to downstream or nonfarm activities improved their livelihoods and wealth significantly

The recommendation could be that policies target rural smallholder business and start-up entrepreneurs to facilitate and accelerate establishment of their businesses and activities. Policy should also focus on diversification of off-farm activities. Investments in rural services and value chain must be accompanied by education, vocational training, and skills transfer. These policies are critical for rural development. Questions include: (i) is out-migration the root cause of decline of agriculture and development in rural areas, or is migration the motivating force accelerating rural development? (ii) Should we put in place policies to stop out-migration from rural areas or maintain the status quo (migrating to urban areas) that brings back remittances and investment to rural areas?

My last point is Viet Nam's National Targeted Programs for New Rural Development. Making rural areas livable and worth living for rural residents will reduce rural distress. This not only encompasses physical conditions but also cultural, social, and mental conditions. We need to create conditions that make people in rural areas feel proud about their place of residence. Viet Nam's New Rural Development Program deals with socioeconomic infrastructure like transportation, irrigation, electricity, school, cultural infrastructure, rural market, and post office. We also look at economic and production organizations like housing, income, poor households, labor structure, form of production organizations, education, health care, cultural organizations, environment, and sustainable production systems. The program (i) mobilizes participation at local levels; (ii) supports development of off-farm activities and diversification of income sources; and (iii) sustainable vision of development including economic, social, and environmental dimensions. The Government of Viet Nam is implementing a holistic and comprehensive rural development program.

Forum Participant: I come from a rural community in northern Philippines where my father was a smallholder farmer. I moved to the United Kingdom (UK) and studied in London courtesy of my mother. I know what it is like to be left behind in a rural community with no opportunities. The only opportunity my mother could offer was to leave. In the UK, I became an investment banker, a management consultant advising corporate firms on capital markets and hotel investment. Through my work I learned how the hospitality business and agriculture could have an impact on rural communities if their investments are utilized effectively and channeled properly. Two years ago, I returned and started working with social entrepreneurs and farmers to aggregate their produce and help them with access to markets and compete with big producers funded by multinational corporations. How do we support smallholder producers to access funds, market, and compete against bigger players? How do we channel funds to such rural institutions? Where are the multinational food producers in this discussion?

Mihir Shah, Shiv Nadar University, India: We need farmer-producer organizations so that farmers can benefit from participation in the market, which they have not achieved as much as they should. You raised the question of where the investment

will come from. In India we have a small farmer agribusiness consortium set up initially with capital by the Government of India, where equity was provided for these corporations to be set up. Without that initial support it is not going to fly. Private capital will not come in. It is too risky a venture but with this kind of public sector backing we, in India, are getting a number of success stories moving forward. Farmers must come together to benefit from participation in the market with value addition, moving up the value chain, and double-farmer incomes, which is now a national objective in India.

Forum Participant: My grandparents are also farmers. Sometimes, they are not paid well because of commercialization and pressure from buyers (intermediaries) to sell at low prices. It is not about increased competitiveness. We need to work in harmony. My question is, how can we benefit the farmers in rural areas?

Mihir Shah, Shiv Nadar University, India: Let me tell you my story. Thirty years ago, after completing my PhD I went and lived in a tribal village in central India where I worked with farmers, became a farmer myself, and that is where I learned how we could address the question that you are posing today. The first thing is to make farming sustainable. The costs of farming are too high. We realize we need to change the technology of agriculture. We also need to work in harmony with nature. There is ecological destruction of the catchment areas from we get our ecosystem services, unless we create a win-win for the farmers wherein they can receive payment for ecosystem services they are providing.

I was talking yesterday to some Filipino farmers like yourself and they were telling me that the indigenous peoples themselves are cutting down the forests. This is because they do not see value in the trees. Yet millions of dollars of value is hidden in the natural resources. The market does not put a value to them. We need to unlock that value and create that potential for livelihoods to be generated on the basis of what exists by sustaining what exists and not by destroying it—not by logging and burning. This is a planetary issue. We need to recognize in this time of climate change that we need to move toward more sustainable approaches. Otherwise neither the farmers nor the urban inhabitants will benefit.

David Dawe, FAO: There are many opportunities and we are only limited by our imagination. This is not to deny that there is distress in rural areas, but sometimes we are so caught up in the moment that we do not step back. Rural poverty rates in this part of the world have been declining almost everywhere. More people have been brought out of poverty in the last 40 years than at any time in human history. There is no denying that many people suffer but there is hope. A lot of people are doing better and have better lives than they have had before. This should not stop us from working hard to improve the plight of the people who are suffering now, but a lot of people are succeeding.

Thierry Giordano, CIRAD: We need to be optimistic and we will need food anyway. We have no choice but to produce. The question is how. In Europe, we are now discussing reform of the Common Agriculture Policy and a report released from a think tank in the French Prime Minister's Cabinet Office suggests taxing antibiotics,

inputs, fertilizers, and livestock and using the funds to cross-subsidize farms based on the numbers of jobs they create. I am not sure what sort of impact such a proposal can have but it is real change. I agree that we need to imagine new solutions. The market economy is here to stay but is dysfunctional. We need new regulations, but we need to be guided by a collective approach to new solutions and we have the capacity for that.

Forum Participant: I am contemplating on how we can deal with the plight of farmers and how it impacts migration to urban areas. It is a combination of everything. Governments must intervene. Farmers must help themselves. We as researchers in international institutions also must do our best, but there are some concrete solutions we can take. Policies could make farming attractive to farmers as migration is triggered when young farmers do not see a value in farming. Younger generations see more value in the cities than in the villages. The farmgate prices is a number one problem. We should give salaries to farmers during the days they are involved with farming, increase the efficiency of farming and make it ecologically sustainable. We also must ensure that farmers have access to universal health care and education.

Forum Participant: How will the integrated approach proposed by CIRAD be different in theory and practice from the poor performance of the Integrated Rural Development Program (IRDP) of the 1980s and 1990s?

Thierry Giordano, CIRAD: The CIRAD approach is based on a completely different mindset. It has nothing to do with what we used to do. The IRDP of the 1980s and 1990s was very top-down and it was expert-led. The CIRAD approach is bottom-up and people-centered. However, it has multilevel governance as well. We need to accompany the strategy of the farmers. We cannot get rid of what they are doing. Farmers have a strategy. They are trying to survive. We can help them. This is what we are trying to do. It is not about telling them what they should be doing. It is about helping them to do what they are doing better. That is a big difference from IRDP—it is bottom-up, multi-stakeholder, and multisectoral. We need to create jobs in the transforming agriculture and all the other spaces in the food system. If we can create local markets for local products of local people, we will then make a big difference.

Montserrat López Jerez, University of St. Andrews, Scotland: To follow up on what Thierry and Prof. Shah have mentioned, farmers live in a social and ecological environment, which is part of a national policy as well. Farmers are not a homogenous group and there are so many variations in growing even rice or coffee, or diversified crops that farmers will have different types of needs and solutions. What will be the most appropriate in the local context will certainly have to fit into the global economy (prices, shocks, and externalities). There is a trade-off and national policies usually do try and protect farmers. There is a difficult balance between letting the markets function yet protecting farmers from the worst type of externalities. Farmers will always have difficulties to compete.

This balance is a challenge for policy makers that has to be acknowledged. Evidence in history shows that protective policies will have to be part of the priorities of the countries otherwise nothing much will happen. Although we have seen a substantial

reduction in poverty, in Asia there is still a structural problem, especially in middle-income countries and emerging economies. Rural economies are not catching up as quickly as we have seen in other cases. Something needs to be addressed but as David Dawe pointed out, how do we get people outside this room to listen to us. The importance of identifying what the problem is should not be understated. Then solutions can come.

Akmal Siddiq, ADB: Our first expectation from this discussion is to determine whether the governments have rural development policies. To my knowledge, no government in our region has a comprehensive policy. Of course, many governments will say they have a rural development policy. We build roads, schools, and provide social services. We heard from Prof. Shah that we need to value natural resources. There are a few policies here and there but nothing comprehensive. The Government of the PRC is at the forefront with such policies. Farmers are paid for ecosystem services and there is a complex web of subsidies. We have created a complex economic ecosystem for farmers. There may be 10 different policies that affect farming but we only attention to one or two policies. That does not really help farmers' or private investment going into farming.

The second point is that farming is seasonal. Farmers are busy in the sowing season and at harvesting. If we estimate their level of employment, they usually have up to 50% of slack time. What we are telling governments is that rather than giving incentives to nonfarm investments around peri-urban areas, they should create opportunities—infrastructure, water supply, sanitation, roads, and telecommunication in the hinterland—so that some industries can move there where the labor is available, instead of trying to attract them closer to urban areas.

This is a new paradigm we want to put on the table. A comprehensive rural–urban policy that connects all these dots. In the last decade, the emergence of high-speed internet and telecoms have provided opportunity of tele-health and tele-education, which can easily bring high-quality services from urban areas to rural areas. A doctor does not have to go to the rural areas. He can be on the screen from his hospital in the city and talking to the paramedic in the village.

These are some of the policies we want to encourage. Rural areas have to become centers of economic activities, which has not been the case so far. The classic western model of development is to get everybody out of rural areas and take them to the cities. Now there are opportunities to slow down that process and maybe even reverse that process. That is our vision. I just want to put a framework on the table.

Timely contributions to analyzing challenges. The knowledge products prepared in partnership with IFPRI, IRRI, and Mercasa will help stakeholders understand the issues facing the rural development and food security sector.

Publications Launch

Introduction

Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB

We would like to launch our knowledge products. We have had the privilege to work with two partners, IRRI in the Philippines, and IFPRI in Washington, DC.

Over the last year and half, we have worked with both institutions to carry out this research. With IRRI, we undertook field experiments to test their technologies for climate-smart agriculture in three countries—Bangladesh, Cambodia, and Nepal. With IFPRI we worked on long term policy for food security for the region as well as one particular study focusing on Indonesia. We also worked with them on a study to assess the potential of e-commerce in the PRC.

We are pleased to launch these four studies today. ADB also undertook studies in four countries to analyze agriculture value chains. We have discussed how agriculture markets have not performed well. These four policy briefs will also be launched, and we will share the results with you. The four countries we worked in were Bangladesh, Nepal, Pakistan, and Viet Nam.

I acknowledge the presence of our Vice-President Knowledge Management Bambang Susantono. After we hear from our Director General, Woochong Um about some of the salient features and lessons we have learned, we will request our vice-president to launch the studies.

I invite Director General Um to deliver the keynote address.

Holistic and cross-cutting approach for agriculture projects. Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB, invited partners and stakeholders to work together in financing operations that adopt integrated approaches including gender equity, climate adaptation and mitigation, water resources management, natural resources management, and use of ICT and high-level technologies in agriculture.

Keynote Address

Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB

Good morning everybody. I hope you had a good chance to enjoy some networking opportunity just before this session. Welcome to this launch event.

Mr. Oliver Frith representing Dr. Mathew Morrel, Director General of IRRI; Vice-President Bambang Susantono. Thank you very much for making it here because I know you arrived at 6.00 in the morning. Ladies and gentlemen, welcome.

I am honored to deliver this message at the launch of these four technical reports and four country briefs today during the Rural Development and Food Security Forum. These are:

i. *Climate-Smart Practices for Intensive Rice-Based Systems in Bangladesh, Cambodia, and Nepal;*
ii. *Ending Hunger in Asia and the Pacific by 2030: An Assessment of Investment Requirements in Agriculture;*
iii. *Policies to Support Investment Requirements of Indonesia's Food and Agriculture Development during 2020-2045;*
iv. *Application of Information and Communication Technology for Agriculture in the People's Republic of China; and*
v. *Country Briefs on Dysfunctional Horticultural Value Chains and the Need for Modern Marketing Infrastructure in Bangladesh, Nepal, Pakistan, and Viet Nam: Dysfunctional Horticultural Value Chains and the Need for Modern Marketing Infrastructure.*

These publications are the outputs from the joint research with our long-standing partners, IRRI and IFPRI for over 2 years. We also have a new partner, Mercasa, a public company based in Spain that specializes in horticulture value chain development and modern wholesale markets. The joint research was also done in close collaboration with national research organizations and think tanks in Bangladesh, Cambodia, the PRC, Indonesia, Nepal, Pakistan, and Viet Nam.

The launch of these publications and the forum itself are timely contributions to understanding and analyzing the challenges facing the rural development and food security sector.

Despite this great progress, there are still 822 million people who are still food insecure, 517 million of which are in Asia and the Pacific region. Basic services are limited especially in terms of access to sanitation and safe drinking water.

In the PRC, Philippines, and Thailand, for example, the average age range of farmers is 56–58 years old. At the same time, the youth, even the children of farming families,

are lured to urban areas for better opportunities resulting in the aging of farmers. This is a critical problem for sustainability of the sector.

The inefficient and ineffective markets and agricultural value chains, which result in high postharvest losses, are another area of concern. According to a United Nations study, around 42% of fruits and vegetables, and 30% of grains, are lost before reaching the consumers.

Based on a 2009 ADB-IFPRI study, climate change impacts the yields of primary commodities. Examples are the yields of irrigated rice, wheat, and soybeans, which could fall by 9% to 44% in 2050, thereby lifting commodity prices by up to 50%. Because of high prices, micronutrient intake of children decreases, which leads to 20% more malnourished children by 2050.

The publications are also timely because the ADB Board endorsed the action plan of the seven operational priorities for our corporate strategy, Strategy 2030, in October 2019. Rural development and food security are one of the seven priorities of Strategy 2030 that paves the way for ADB's efforts to eradicate extreme poverty while expanding its vision of a prosperous, inclusive, resilient, and sustainable Asia and the Pacific.

With Strategy 2030, ADB has committed to call for renewed focus of ADB operations in three areas:

i. **accelerated rural development** to focus on improving rural services, attracting private sector investments, and generating jobs in the rural areas;
ii. **efficient agricultural value chains** to distribute food efficiently from farmers to consumers, reduce postharvest losses, improve farmer profitability, and provide sufficient, safe, nutritious and affordable food; and
iii. **food security for all** to focus on building food systems to sustainably produce more with less resources while addressing malnutrition.

The findings of publications we are launching today will also help strengthen our operations in promoting rural development, improving agricultural value chains, and achieving food security.

I highlight three key insights based on the joint work with IFPRI, IRRI, and Mercasa:

First, there are investment opportunities that can address the challenges in agriculture. The publication on ***Ending Hunger in Asia and the Pacific by 2030: An Assessment of Investment Requirements in Agriculture***, quantifies the amount of investments needed by countries to reduce the number of food-insecure people below 5% of the total population by 2030. To achieve this goal, we must increase annual investments in agricultural research and development, water resource management, and infrastructure to reduce postharvest loss from the current level of $41 billion to $78 billion.

The report also identifies the priority areas for investments within the agriculture and natural resources sector. Additional annual investments in agricultural research and development can reduce the number of food-insecure people in ADB's developing members countries by 84 million by 2030. Although return on investments in irrigation will not be equally impressive, they will reduce the agricultural use of water by 7%, making more water available for alternative uses. Higher annual investments in rural infrastructure, such as rural roads, railways, and rural electricity by $16 billion can reduce the number of food insecure people by 67 million.

Second, agriculture can be made more productive and less resource intensive. Our agricultural resources are shrinking. The results of the joint research with IRRI in Bangladesh, Cambodia, and Nepal showed that climate-smart practices can increase profits from rice production and make it less resource intensive. These practices can result to lower water use, less greenhouse gas emissions, improved labor productivity, increased carbon sinks, and improved soil quality to enhance and sustain production. Depending on the country, climate-smart agriculture can reduce agricultural water use by 32%, labor by 79%, and emission of greenhouse gases by 41% without affecting rice yields.

However, to realize these benefits, we need supporting policies and an enabling environment for technology adoption, and affordable financing for farmers. The farmers' lack of access to knowledge and technology could create roadblocks in the successful promotion and adoption of climate-smart agriculture. ADB and key partners, including IRRI, will continue to work on developing the appropriate approach, mechanism, and institutions to deliver the knowledge and technology to farmers.

Third, we need to fix the value chain to minimize postharvest losses. The agricultural value chains, especially of fruits and vegetables, are most often dysfunctional and inefficient. These inefficiencies result in high postharvest losses and fail to generate fair profit for producers.

The conclusions of the four country briefs show that by reducing fruit and vegetable postharvest losses, countries like Bangladesh and Viet Nam can save up to almost $2 billion every year. This amount is far more than the cost of building modern wholesale market infrastructure, which can help preserve produce longer and reduce the losses.

The country briefs also tell us that market price fluctuations of fruits and vegetables in these countries are very high, which reflects inefficient value chains. For instance, in 2017, the price of tomatoes in Lahore, Pakistan, fluctuated by more than 800%. In the same year, the price fluctuation of fresh potatoes was about 177%. If these countries can regulate these fluctuations by reducing prices by 10%, the annual savings will be $815 million for Bangladesh, $145 million for Nepal, $825 million for Pakistan, and $581 million for Viet Nam, based on 2018 data.

We hope the joint finds of ADB, IFPRI, IRRI, and Mercasa will motivate us all to reflect and rethink our engagement in agriculture and food security. For example, how should we design our projects to achieve on-the-ground impact with optimal use of

resources? How can we effectively partner with other institutions to avoid duplication of effort and instead supplement and complement each other's efforts?

Moving forward, agriculture projects need to follow a holistic and cross-cutting approach. ADB is already financing operations that adopt integrated approaches encompassing gender equity, climate adaptation and mitigation, water resources management, natural resources management, and use of ICT and high-level technologies. The horticulture value chain projects in Pakistan and Uzbekistan; the use of Internet of Things to promote food safety and traceability in the PRC; the climate-friendly agribusiness value chains sector projects in Cambodia, Myanmar, and the Lao PDR; and the agriculture and rural development project in Mongolia that assists agro-processing enterprises, are a few good examples. You will hear more in Session 4 on ADB Knowledge Sharing and Experience on Climate Change, Gender Equity, High-Level Technology, and Natural Resources Management.

Under Strategy 2030, one of the cross-cutting themes is enhancing our partnership with everyone we work with because the task at hand is so vast and bigger than what we can do ourselves. Maximizing synergy from partnerships is also critical. We can only make a difference if we join forces with partners and relevant stakeholders to improve the lives of people in Asia and the Pacific region, and I am particularly grateful to our three knowledge partners.

Finally, let me, once again, express our appreciation for the cooperation and hard work of all our partners for the successful completion of this important knowledge sharing initiative.

The digital copies of the four reports and four country briefs, as well as the Strategy 2030 and the operational plan for Rural Development and Food Security, are available for download from ADB's website. We also invite you to read the ADB Blogs and feature articles in Development Asia on these publications.

Thank you very much.

Promoting more sustainable rice agri-food systems and practices. Oliver Frith, Head of Business Development, IRRI, shared that their field experimentation showed that alternate wetting and drying direct-seeded rice, when combined with climate-smart varieties, crop diversification, and mechanization practices can make rice production more profitable, sustainable, and resilient to climate change.

Messages

Oliver Frith, Head of Business Development, IRRI

Firstly, we would like to thank Director General Um and Vice-President Susantono for being here today for the launch and we also want to commend Dr. Akmal Siddiq and his team for the great work that they are doing in partnership with our national partners and IRRI over the last few years on the projects.

I am honored to speak on behalf of our Director General Morrell with the goal of sharing the joint progress and accomplishments that we have done with ADB to address the challenges of poverty, food security, and rural prosperity in Asia and the Pacific region.

IRRI's current research collaboration with ADB centers on fostering resilient agri-food systems in the face of a formidable challenge—climate change. Rice brings nutrition and income to millions of rice farmers in many Asian countries. It is also becoming a strategic crop for most of Africa. However, demographic and economic transformations, deteriorating soil, diminishing water resources, and climate change pose formidable challenges to the accomplishment of ending hunger and malnutrition by 2030 in line with SDG. Our deadline to meet this SDG 2 goal is fast approaching.

The reports we are launching today on climate-smart agricultural practices for intensive rice-based systems in Bangladesh, Cambodia, and Nepal offers some hope. There are consolidated efforts going into research for development supported by ADB and our partners in the region. This project was developed based on an ADB technical assistance project called *Investment Assessment and Application of High-Level Technology for Food Security in Asia and the Pacific*[14] The project uses participatory approaches and piloting of climate-smart agricultural practices for rice-based systems in Bangladesh, Cambodia, and Nepal.

The project aimed to do several things. Firstly, it aimed to identify strengths, policy and institutional support, and logistics needed to promote widespread adoption of research proven climate-smart practices and rice varieties. The project also aimed to demonstrate the use of alternate wetting and drying (AWD); direct seeded rice; on-farm mechanization; and climate-smart rice varieties in the rice-based systems in Nepal, Cambodia, and Bangladesh. The document shows findings and results of the field experimentation and policy recommendations that came out of the project. The results and initial outcome of the pilot project showed that AWD and direct-seeded rice, when combined with climate-smart varieties, crop diversification, and mechanization practices can make rice production more profitable and sustainable as well as more resilient to climate change. In the case of Nepal for example, we were able to see farmers having a significant decrease in the amount of inputs they required in their farming system, which heavily improved the sustainability of those systems. In Cambodia, we also saw very promising results with the application of drought tolerant varieties. In Bangladesh, we were able to show a good and strong adaptation and adoption among farmers for AWD technology.

I would like to thank and acknowledge our national partners that worked with us on this project. This includes the Bangladesh Rice Research Institute, the Cambodian Agriculture and Development Research Institute, and the Nepal Agricultural Research Council for their respective collaborations and the vital contributions they made to deliver the results we are representing here today.

Beyond the technologies and practices highlighted in the pilots, I urge you to learn more about the work that we are doing with our partners on promoting more sustainable rice agri-food systems and practices by speaking to the IRRI team that is here in the forum and also visiting our booth.

[14] ADB. 2016. Investment Assessment and Application of HighLevel Technology for Food Security in Asia and the Pacific.

We have been working with ADB for over 40 years. ADB has been a strong partner, working to address challenges to rural development, delivering prosperity and increased agricultural productivity in Asia. IRRI firmly believes in rural prosperity in Asia. IRRI supports the vision behind ADB's Strategy 2030 of increasing agricultural profitability and productivity, enhancing food safety, and improving climate and environmental resilience of smallholders in Asia. This aligns very closely with the IRRI mission of improving the health and welfare of rice farmers and consumers, promoting environmental sustainability in a world challenged by climate change, and supporting the empowerment of women and youth in the rice industry. IRRI is committed to continuing its partnership with ADB and we look forward and stand ready to build on results we have presented today. This will include helping ADB member countries prepare for climate change, competing uses of land due to increasing urbanization, shortage of labor, diminishing natural resources, and population and demographic changes.

In the future, our work will focus on supporting some of the key pillars of ADB in terms of farm mechanization and postharvest technologies as well as the application of ICT tools to support extension agents and farmers. We look forward to working with everyone here, mobilizing more resources to support revitalization of rural areas across Asia. In closing, I wish to laud all ADB partners whose projects have featured in this publication and other publications today.

Trends in ICT applications in rural PRC. Mark Rosengrant, Research Fellow Emeritus, IFPRI, said IFPRI's study showed that rural e-commerce and drone application in agriculture are growing fast.

Mark Rosegrant, IFPRI

Both the studies in Asia and the Pacific and Indonesia shared the objectives and methodology, which was to assess the investments and polices required in the agriculture and rural sector to meet food demand and end hunger in Asia and the Pacific region and Indonesia by 2030. In Indonesia, we took the analysis up to 2045 as requested by Bappenas in Indonesia. We used integrated agricultural and economy-wide modeling of the costs and impact of agricultural investments and policies on food security under climate change. In the PRC, we examined trends in applications of ICTs in rural PRC, the enabling factors and constraints to adopting ICTs, assess impacts, and generate policy implications for further development. For the PRC ICT, rural surveys and review of evidence to assess trends, constraints, and policies for development of rural e-commerce were conducted. We relied on our colleagues in the China Certification Center for Automotive Parts for this work. In Asia and the Pacific region and Indonesia studies, we looked at three types of investments:

i. agriculture research and development investments,
ii. irrigation investments (infrastructure and water use efficiency), and
iii. rural infrastructure investments.

Each of these scenarios has specific pathways to generate food security. Under agriculture research and development (R&D) investments, the primary pathway was through agricultural productivity growth, which tends to reduce food prices to consumers and increase food consumption. Higher agricultural productivity also boosts economy-wide growth in GDP and household income. Impacts in

agriculture have broad implications for the general economy. Under irrigation, pathways start with increase in crop area and yield through expansion of area or savings of water. This reduces food prices and increases food consumption, thus inducing economy-wide growth in GDP and household income. Under the rural infrastructure investments, the initial impact is to reduce marketing margins and postharvest losses. That in turn increases farm-level productivity and profitability, reducing prices to consumers, and increasing food consumption. The combined impacts drive economy-wide growth in GDP and household income. We have already heard some of the key results here—in Asia and the Pacific region, average annual public investments projected to 2030 of about $42 billion; incremental investments required for the combined, comprehensive scenario are about $37 billion. Some of the key impacts of the combined scenario of the three types of investments:

i. Ends hunger in Asia and the Pacific region by 2030 (reduces hunger share below 5% of population, the prudential threshold established by FAO/WHO for effectively achieving zero hunger);
ii. Generates GDP benefits of $1.1 trillion in Asia and the Pacific region in 2030 compared to baseline investments; and
iii. Agricultural R&D has highest rate of economic returns and hunger reduction, followed by rural infrastructure and irrigation.

In Indonesia we did a similar approach with specific models for Indonesia. We have three scenarios that focus on comprehensive investment impacts on agricultural production in 2045. In scenario III increases of about 19% are expected by 2045 compared to baseline for staple crops and livestock and over 7% for other crops and fisheries. Investment impacts on economy-wide welfare in 2045, based on a concept called absorption, the comprehensive investment scenario III projects the benefits compare to the Indonesia baseline are Rp1,834 trillion annually by 2045, which about $129 billion annually.

Based on the study, a number of policy recommendations were made. The most important ones are significant increases in investments in\

i. **Agricultural R&D** (crop and livestock breeding) both from government and private sector;
ii. **Infrastructure** (rural roads, electricity, cell phone towers, markets, cold chains, processing facilities) in partnership with private sector;
iii. **Irrigation** - expansion and improvement of existing systems with careful attention to cost-effectiveness;
iv. **Extension services and agricultural education** – need upgrading to support adoption of conventional and advanced agricultural technology (precision farming);
v. **Legal and regulatory reforms** – to reduce barriers to private investment and adoption of advanced agricultural technologies; and
vi. **Fertilizer subsidies** – should be phased-out; resources invested in increased agricultural R&D and targeted direct income support to small farmers.

Turning to ICT application in the PRC, the brief summary is drone application in agriculture is growing fast. The area of pesticide spraying by drones tripled in just 2 years up to now 2 million ha in 2017. It has important benefits. It improves speed and effectiveness of pest control—more responsive to pest outbreaks. Drones use less pesticides and a tenth of the water traditionally required by manual spraying, reducing ecological and economic costs. Rural e-commerce is also growing fast. It is still limited in remote areas but widespread in more advanced regions. Nearly 60% of surveyed rural households in Shandong and Zhejiang used e-commerce during 2016–2017. We also found that the use of rural e-commerce in the regions we studied increases farmer income. The prices obtained through online sales for apple and peach are significantly higher than what can be obtained through offline sales. There is substantial benefit for income increase to farmers. To boost e-commerce, we found that farmers' capacity should be built through training, investments provided in storage and transportation, scale of operational costs should be reduced cooperatives should be set up, financial and credit support to farmers provided, e-commerce market regulations strengthened, trust issues clarified, and development among regions and households should be inclusive.

New opportunities. Growing rice using the direct seeded rice system has opened more chances for farmers to use sound scientific data in rice propagation said Hans Bhardwaj, Rice Breeding Platform Lead, IRRI.

Hans Bhardwaj, IRRI

This project was titled *Climate-smart practices and varieties for intensive rice-based systems in Bangladesh, Cambodia, and Nepal*. The work was carried out from early 2016 to mid-2019. The principal investigator from IRRI was Arvind Kumar, who could not make it and sends his regrets; I am filling in for him.

I thank ADB for publishing the results of this study. This will be valuable information going forward for researchers and development experts in these countries. About 14 different partners were involved in this project in these three countries. I would also like to take this opportunity to thank all these partners who provided their support to the technologies that were researched, developed, demonstrated and deployed, depending on the need and country we are talking about. These include climate-smart varieties, water-saving mechanized cultivation such as alternate wet and drying system or directly seeded rice (DSR), mechanized direct seeding, and training and capacity building for distribution of quality seed of improved varieties. There was a total of nine sites in three different countries: two sites were in Bangladesh, two in Cambodia, and five in Nepal. Activities involved demonstration of AWD as well as DSR technologies, seed multiplication and distribution, and training of extension workers and farmers. Farmers also trained in mechanization and were linked to some of the service providers. To increase system productivity, the project introduced technologies to intensify and diversify rice-based agri-food system in these three countries. This included a combination of cropping—for example in Bangladesh it included cropping systems of rice-mustard-rice, rice-potato-rice, rice-pulses-rice; in Cambodia rice-mung bean, rice-vegetables, and even cassava in some cases. In Nepal it was primarily two seasons, so it was rice-wheat, rice-pulses, and rice-mustard as well as rice-maize were demonstrated.

The need for public sector action. ADB's study recommended the setting up of a production marketing architecture to reduce postharvest loss according to Md. Abul Basher, Natural Resources and Agricultural Specialist, ADB.

Some of the benefits of mechanized AWD and DSR are highlighted in the report. In some cases, yields increased up to 48% or stayed stable. The cost of seed used in some cases by 22% and up to 57%. The net profit to farmers following AWD or DSR practices increased from 30% to 47%. Similarly, labor cost was significantly reduced in almost all cases. Another important element, which we studied in this project, was greenhouse gas emissions (growing rice in flooded conditions leads to methane emissions). Methane emissions were reduced by over 40%. Some minor differences were observed from one variety to the other.

Both ADB and IRRI have tremendous new opportunities to work together and make an impact. The DSR is an emerging trend as increasingly, rice is being planted using the DSR system and that opens new opportunities for not only conducting research but also ensuring propagation of practices based on sound scientific data to rice farmers wherever possible. Even though the package of practices for DSR has been developed, there is no targeted effort to develop germplasm or breed varieties that adapt into the system. So far breeders, farmers, or researchers have been using varieties developed for conventional transplanting or flooded conditions and adapt them to DSR conditions. That is not the best use of those varieties as well as for that particular practice. IRRI has recently launched an initiative in developing and improving germplasm, which adapt to DSR conditions. I thank ADB again for providing this opportunity to IRRI to work together as well as inviting us to the forum to share our experience and learning.

Md. Abul Basher, ADB

We conducted four market studies in Bangladesh, Nepal, Pakistan, and Viet Nam. We used secondary data and information; visited wholesale markets in Dhaka (Bangladesh), Kathmandu and Pokhara (Nepal), Lahore (Pakistan), Ha Noi and Ho Cho Minh (Viet Nam); consulted with wholesalers, market management, and traders; and finally conducted consultative workshops in Dhaka, Kathmandu, Lahore, and Ha Noi. Some common facts about fruits and vegetables in the four countries are: (i) agriculture in these countries is still dominated by cereal production; (ii) the share of fruits and vegetable production on cultivated land is low, particularly in Bangladesh and Pakistan (estimated at less than 5%), while Nepal and Viet Nam have slightly higher shares; (iii) production is increasing but their yields are low compared to those of developed countries; and (iv) per capita consumption of fruits and vegetables is low, except for Viet Nam, where consumption is at par with the developed world.

There are four different transmission channels from producers to consumers, starting with Channel 1: Producers to Consumers (direct selling). The middlemen step in, then the supply chain gets longer.

i. Channel 1: Producers to Consumers (direct selling)
ii. Channel 2: Producers > Retailers > Consumers (middlemen introduced)
iii. Channel 3: Producers>Collectors > Local wholesaler > Retailers/Supermarket > Consumers
iv. Channel 4: Producers>Collectors>Local wholesalers>Regional wholesalers> Retailers / Supermarket > Consumers.

Channels 3 and 4 are significant. They account for the largest share of fruits and vegetable consumptions—for example, in Viet Nam the share is about 72% of fruits and vegetables consumed in that country. Channels 3 and 4 also require infrastructure and some logistics such as packaging facilities, cooling houses in the production areas, refrigerated transports, and cold storage in wholesale markets; these are either inadequate or missing in these four countries. The negative impacts of this inadequate or missing infrastructure are:

i. Postharvest loss is high: 30%–40% of fruits and vegetables lost in transition. Quality of produce is also affected for which retailers do not get expected price.
ii. Eventually the middlemen recover the economic costs of the postharvest loss of quantity and quality by paying less to the producers. The share of producer in retail price of fruits and vegetables is less than 30%. For perishables, this share is around 15%–20%.

One important point to note is that the cost of postharvest loss impacts the farmer. The profits of middlemen are not affected in the same manner as the losses of the farmer. The middlemen do not see an incentive for improving the transmission channel. There needs to be some public sector action. There are also high marketing costs as a result of long loading and unloading time, high transportation costs, and spoilage. Related to these factors is the price of produce, which fluctuates greatly in these four countries. The monthly price of tomatoes in 2017–2018 in Nepal varies from Rs30–Rs90 per kg within the same year. In addition, farmers suffer from the production cycle because of the nature of their production—every 4–5 years, there is crop failure. As shown in the Pakistan brief, potato farmers suffer both during crop failure and bumper harvests.

Based on these findings, we recommend the establishment of a production marketing architecture. Starting with production area, a collection center must be established with better agri-logistics, cooling houses, and packaging, grading, and sorting facilities so that products can be stored in the production area. Transmission from the production area to the local collection center must be improved as well as it is a source of postharvest loss. Transmission from the local collection center to the wholesale market (whether local or urban) must also be improved significantly. This is the poorest segment we have seen in these four countries. The wholesale markets need to be improved—those that we have visited in these countries are not in good shape. These wholesale markets are unable to deliver safe food and maintain supply. Transmission from wholesale markets to retailers to consumers require regulation in the form of food safety acts as well as monitoring, detecting, and preventing food contamination.

If we can improve the supply chain, postharvest loss will be reduced. Estimates done in these four countries show that cutting down postharvest loss by 10% from current highs of 40%–30% could result in savings of ranging between $1 billion–$2 billion depending on the size of the country. Similarly, if price fluctuations of produce could be reduced by 10% of the upper band, savings are estimated to be a $1 billion in countries like Bangladesh and Pakistan. The volume of savings alone provides us

A call to fix the markets. Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, ADB, recommended that governments come up with the overall architecture of the marketing framework and to spend seed money in developing the wholesale market infrastructure.

a reason to think hard and improve the supply chain, transmission, and marketing of fruits and vegetables in these countries. If we can manage to improve the wholesale market infrastructure of Kalimati in Nepal and manage to reduce trading costs by 2 cents per kg, there will be savings of $1.3 million per year. Since the volume of trading in a wholesale market like Lahore, Pakistan is big, similar improvements will result in savings of $5.5 million a year. I hope these numbers are good enough to convince all of us that we need to do something about the supply chain and improve them.

Synthesis
Akmal Siddiq, Chief of Rural Development and Food Security Thematic Group, ADB

These reflect financial costs. In fact, the results of our studies in these countries do not yet reflect economic costs. For example, partly decomposed vegetables and fruits and those in the process of being decomposed, are bought by a lot of consumers. Consuming these produce has a detrimental effect on human health. We have not yet calculated the cost of detrimental health effects by consuming unsafe food. The other impacts are high and fluctuating prices and varying degrees of availability. Fruits and vegetables are not always available to low-income consumers, who spend between 50% and 60% of their household income on food.

One of the reasons for malnutrition is that low-income households cannot afford fruits and vegetables. If those costs were incorporated in the equation in these countries, the cost of dysfunctional markets would amount to billions of dollars. Therefore, our recommendation to governments is to seriously consider fixing the markets. These investments are worth every penny. Most of these investments will not come from the government. The role of government is to come up with the overall architecture of the marketing network. Within that investment framework, the government will spend seed money in developing the wholesale market infrastructure and some key infrastructure in the hinterland. We think government investment may be between 25% and 30% while the bulk of the investment will come from the private sector. This is the key message. But as David Dawe (FAO) said, we are all converts to the idea and the challenge is to convey the message to those who are not in the room. Hopefully, these studies will catch their attention as well.

Pushing for more gender balance. More effort is needed to promote lead roles for women and women entrepreneurs in ADB-funded projects.

ADB Experience and Knowledge Sharing (Focus on Gender, Climate Change, and High-Level Technology)

ADB has stepped up its efforts to introduce innovative approaches and technologies under its policy-based and investment loans as well as technical assistance projects. This session was used to present some of these innovative projects and highlight lessons learned so that other DMCs may consider adopting similar approaches and designs for their projects..

Presentations

1. Efforts to Apply High-Level Technologies in Central and West Asian Countries by Natsuko Totsuka, Principal Portfolio Management Specialist, Environment, Natural Resources and Agriculture Division, Central and West Asia Department, ADB

In ADB, Central and West Asia starts from Pakistan, and includes Afghanistan, Uzbekistan, and other Central Asian countries. In our division, we have been making efforts to apply something new to each project. The Tajikistan–Pyanj River Water Resources Project is one of the first to introduce the satellite-based monitoring and evaluation for irrigation system. This project focuses on rehabilitation and modernization of an existing irrigation system (about 50,000 ha). The project was approved in September 2016 and project preparation took place between 2015 and 2016. During this time, we discussed the application of satellite remote sensing technology for monitoring and assessing irrigation performance. The model was developed during project preparation in 2016 with baseline data. We plan

to prepare updated maps during project implementation and conduct assessment of updated conditions at the end of the project in 2022 (and future) to compare before-and-after cases. Using satellite data of evapotranspiration, the team computed water use ratio (actual evapotranspiration/optimum evapotranspiration as well as dry and wet season cases) to monitor and evaluate system performance.

We have also been using satellite imagery data for irrigation projects in Pakistan and other countries. Thereby, we encountered some challenges. We tried to collect field data using satellite imagery. However, we found that we needed quality ground truthing to verify remote sensing data collected and get better estimates. We also needed a higher specification of computers as well as experienced local staff to ensure sustainability of the project. The application of high-level technologies like remote sensing data is quite challenging in developing countries. We are now trying to look into applying high level but simpler technologies like mobile applications, which can work even under conditions of less stable internet access in countries like Afghanistan and Tajikistan to collect from and provide agriculture and water resources information to individual farmer level.

The two projects, one in Afghanistan—Arghandab Integrated Water Resources Project (raising existing multipurpose dam and development and rehabilitation of irrigation systems) and one in Tajikistan, use technology, which is technically and skills-wise, appropriate for the rural areas of these two countries. The Pyanj River Water Resource project disseminates to and collects information from the level of small farmers in Afghanistan and Tajikistan. The information includes field flow discharge measurements in the irrigation system and discharge data transfer to the server; agricultural extension advisory and information sharing (e.g., farm development cost information, crop recommendations, market information, a "how-to" video, climate-resilience knowledge, etc.); and water allocation and availability information.

2. Mongolia's Agricultural and Rural Development and ADB's Assistance
by Qingfeng Zhang, Director, Environment, Natural Resources & Agriculture Division, East Asia Departments, ADB

I will present how ADB operations can effectively address climate change and thereby also empower women's participation.

Mongolia's economy depends heavily on the mining sector, which accounts for 21% of GDP and 85% of its exports—but employs 4% of the population. Agriculture accounts for 12% of the GDP but employs about 30% of Mongolia's population. In agriculture, the livestock subsector plays an important role. While the human population is estimated at over 3 million, the livestock headcount is estimated at 66 million. The per capita livestock count stands at about 22 per person. The supply of livestock offers a big potential for export. However, Mongolia exports raw material and imports finished products, thus losing opportunities.

Drought and harsh environmental conditions also affect the livestock. They are vulnerable to climate change—lack of water, hay storage, and livestock winter

shelter—which have led to heavy losses. There is poor livestock, pasture, and water management. Seventy percent of pasture is degraded. There is greenhouse gas emission from organic carbon in soils, and by 2050, there will be a reduction by 6.3%–9.5% in forest steppe and the steppe regions.[15] It is projected that animal losses caused by drought and *dzud* (severe winter conditions) will increase and are estimated to reach 8.2% in 2020 (footnote 7). Another constraint is lack of long term financing. The commercial loan terms in Mongolia are high, with interest rates at 30% and loan repayment period at 2 years.

From the ADB side, we have two examples to demonstrate how we effectively support agriculture, address climate change, and empower women. Since 2009, we have provided $4 million in technical assistance and $40 million from the Asian Development Fund grant. In 2015, we made $50 million available as additional lending. Through this financing package we generated five key results: We (i) supported 15 enterprises to process cashmere, dairy products, and wool products; (ii) supported the production capacity of the herders and farmers; (iii) introduced cashmere wool-testing facility for improving wool products; (iv) provided support for marketing and certification of products for international market bringing investors, buyers, processors and sellers together; and (v) helped 70% of women achieve employment in the wool processing industry (e.g., Gobi Cashmere Company). We can significantly increase women employment by supporting the agriculture sector.

We are supporting the agriculture value chain and businesses, but we must not forget natural resources and climate change. We introduced the climate-resilient livestock sector project and focused on four key elements: (i) strengthening pasture management and grassland protection, (ii) upgrading of water points and enhanced winter shelters, (iii) facilitating livestock supply contracts, and (iv) improving processing capacity. We linked natural resource protection to marketing and women participation to impact climate change.

3. ADB Operations in South Asia
by Mio Oka, Director, Environment, Natural Resources & Agriculture Division, South Asia Department, ADB

The South Asia region is growing. Compared to countries in Southeast Asia, India and Bangladesh enjoy robust growth. But water and food security are pressing issues in the region. By 2050, 100% more food must be produced with 30% less water in Asia. Despite economic growth, there are pockets of poverty. There is a large client demand for rural infrastructure (irrigation and rural roads). We estimate irrigation potential for modernizing to be around $500 billion in the region. Our clients also have an appetite for new technologies and climate resilience to be embedded in the design of projects. There is a growing private sector but public funds for operation and maintenance (O&M) are inadequate.

[15] According to the Mongolia Intended Nationally Determined Contribution to the 2015 Agreement under the United Nations Framework Convention on Climate Change.

In our team we have about 10 international and 10 national staff and we focus on three subsectors: (i) water - there are issues related to irrigation, flood management, and coastal management; (ii) rural roads – we have to connect pockets of poverty to urban areas so that they can enjoy economic growth; and (iii) agribusiness – farmers can grow enough food but they need to sell to generate additional income.

I will present two examples, one on irrigation and one on agribusiness. On irrigation, we do have issues and opportunities. Traditionally, ADB invests in open canals and drainage. Issues here include lack of efficient water use, need for more crop per drop, and lack of water for farmers at the end of the line. There has also been a multitude of small contracts with land acquisition. Hence, project implementation delays have occurred. Furthermore, funds for O&M are insufficient, or are set aside or committed elsewhere. Farmers did not pay for water; hence, sustainability was in question. Our response last year was the Madhya Pradesh Irrigation Efficiency Improvement Project in India, a large-scale project of $375 million approved last year.[16] It introduces a pressurized irrigation system, which will increase irrigated area from 58,000 ha to 125,000 ha using the same amount of water and with better irrigation service delivery. Secondly, we introduced design-build-operate contracts. Two contractors were appointed to design, build, operate, and maintain the system for 5 years. Water-user fee are to be collected by the service contractors.

The second example is from agribusiness. There were many trials and errors in India. Pilots were implemented, but the government did not have the confidence to scale up due to failures. As ADB was new to agribusiness, we had to demonstrate a workable solution.

Nowadays, technologies are available and private sector is entering the agriculture sector. New ideas are being tried in agribusiness. But farmers still rely on traditional ways to sell their products and hence, did not benefit from economic growth. Our response to the problems is the AgTech Application in Agriculture in Andhra Pradesh,[17] India, which has the highest growth in the horticulture sector (17%), is ranked first for the ease-of-doing- business index (2017) and is the leading state for AgTech-driven innovations. The project funding is $2.5 million grant, to be approved in 2020. It aims at successfully demonstrating doubling farmers' income through improving market information to farmers. A digital platform will be created where farmer-producer organizations can get access to data. We are engaging a farmer mobilization facilitator to help organize and collect data, disseminate information, build capacity, and provide advisory services.

4. Climate Friendly Agribusiness Value Chains in the Greater Mekong Subregion and Cross-Border Livestock Health and Value Chains in Southeast Asia by Ancha Srinivasan, Principal Climate Change Specialist, Environment, Natural Resources & Agriculture Division, Southeast Asia Department, ADB

[16] ADB. 2018. India: Madhya Pradesh Irrigation Efficiency Improvement Project.

[17] ADB. 2020. India: Farmer Group Market Access Development using Agricultural Technologies in Andhra Pradesh.

I will introduce two projects from Southeast Asia. The first one is the Greater Mekong Subregion (GMS) Climate Friendly Agribusiness Value Chains Sector Project being implemented in Cambodia, Lao PDR, and Myanmar with a funding of $250 million. Background to this project is Strategy for Promoting Safe and Environment Friendly Agro-Based Value Chains endorsed by the GMS ministers of agriculture in September 2017. This is the first project being implemented under the strategy. The expected project impact is the improvement of agricultural competitiveness in the project areas (reflected through enhanced productivity, climate resilience, quality and safety, value addition and rural household incomes). The expected outcome of the project is: Productive and resource-efficient agribusiness value chains developed in project areas. The project aims to (i) improve and make climate-resilient agribusiness value chain infrastructure, (ii) promote climate-smart agriculture and agribusiness, and (iii) enhance the enabling environment for climate friendly agribusiness.

We are undertaking actions on greenhouse gas mitigation mainly through bioenergy management, biodigesters, as well as promotion of solar energy. We are also enhancing the climate resilience of cropping systems as well as rural agribusiness infrastructure. We are also looking at opportunities for mitigation and adaptation synergies and promoting capacity for mobilizing green finance and ability to manage climate risks. In terms of high- level technologies, this project is looking at laser land leveling/solar drip irrigation for improving water use efficiency and reducing greenhouse gas emissions; drought, flood and salt-tolerant varieties developed through advanced breeding methods/tissue culture; ICT platform for agribusiness; and digital technology-based agriculture finance.

In terms of gender actions, we are trying to create employment for women along the value chain with preferential support to women-led enterprises, agriculture cooperatives, and agricultural production groups. In this context, we are looking at measures to address time poverty and upgrading of skills in value addition.

We are also preparing another project to be implemented in Cambodia, Lao PDR, and Myanmar called GMS Cross-border Livestock Health and Value Chains

Improvement Project with a funding of $250 million. The areas of livestock disease control that the project will focus on are the following: Myanmar–Thailand, Myanmar–PRC, Lao PDR–PRC, and Cambodia–Viet Nam. There are also some secondary priority areas. Selection of priority areas will be done before the start of implementation as the project is still in the conceptual stage. The vision is the same as that identified by the ministers, which is that GMS becomes a leading supplier of safe and environment-friendly agriculture products. The expected outcome is healthy value chains, and formal trade of livestock and livestock products improved in project areas. The project objectives include: (i) livestock health and value chain infrastructure expanded and upgraded in a climate-friendly manner; (ii) capacity for improved production and health of livestock and livestock products strengthened; and (iii) enabling policies for better supply, health, safety and trade in livestock and livestock products enhanced. In terms of climate actions, greenhouse gas mitigation through feed/pastureland management, breeds, biodigesters, waste management

facilities will be promoted. Climate-resilient breeds, livestock value chain infrastructure will be built, and adaptation-mitigation synergies will be promoted.

In terms of high-level technologies, ICT-enabled disease control zones will be established, wherein an ICT-enabled Livestock Epidemic Prevention Platform will be created to foster e-traceability of livestock and livestock products. In terms of gender actions, the project will create employment generation for women along value chain; provide preferential support to women-led livestock enterprises; undertake measures to address time poverty; and upgrade of skills in value addition

5. Private Sector Solutions to Women's Empowerment in Agriculture
by Martin Lemoine, Head, Agribusiness Investment Team,
Private Sector Operations Department, ADB

I am in charge of the Agribusiness Investment Team in the Private Sector Operations Department (PSOD) of ADB. While my colleagues are focused on working with governments, my team works directly with private sector companies in the food and agriculture sector. Why would ADB give money to private sector? There are three important visions in this sector: firstly, it is highly complementary to what we do on the sovereign side. While the work with governments is focused on the supply side, ensuring that factors of production are in place through irrigation, rural roads, market infrastructure, standards etc., we focus on the demand. Our clients need to know what consumers want to buy. These two approaches join in the middle, essentially at the farmer level. The second reason is that there are market gaps. Many companies in this sector lack access to financing both in the short term for working capital, and long term financing when it comes to investing in new processing plants and new infrastructure. Thirdly, we wish to promote innovative business models. Each time we pick an investment we want to tell a story to promote a business model that is sustainable, inclusive, and should be replicated as much as possible in Asia and the Pacific.

One of the models is on contract farming, which Mio Oka referred to earlier. There is a contractual relationship between the farmer and an agro-processor. It is a win-win situation because the company will provide technical assistance and training to the farmers and ensure off-take of the produce. In Bangladesh, we work with a company called Pran, which operates a potato chip factory. The company has entered into contractual relationship with 2,000 potato farmers to supply the right kind of potato. The farmers will make more money. Each time we try and promote investments, typically, farmers double their income. That has been consistent across countries we are working in. It is not because the farmers are getting a higher price. It is mainly through higher yield and better quality. In Bangladesh, we also supported cassava contract farmers, who also expanded their cultivated area. There are various ways in which contract farmers can increase their returns.

The other model is to work directly with modern farms, or enterprises or corporate farms. This example is about a company that produces cut flowers in Viet Nam [Dalat Hasfarm] using modern greenhouses. This is a good model to support and we wish to see more greenhouses like this in Asia because these technologies are

Out-of-the-box thinking. There needs to be more ADB-funded projects that are climate-resilient and innovative through the use of appropriate and culturally-sensitive technology.

highly climate-resilient, protected from climate risk, efficient in water use, and has reduced the use of pesticides. In addition, working with modern farms allows enterprises to invest more in the workforce. The employee is trained and receives social security and benefits. This is where agriculture is moving toward an industrial stage—where a middle class that receives more benefits can be built. Ramesh asked what is the future? What is my dream? This could be a good career, to work in a modern farm like this. Skilled employees could make enough money to invest in a home or in the education of their children. In the case of Dalat Hasfarm in Viet Nam, 65% of the workforce consists of women—including those at the management level. This is something we also negotiate with the client—i.e., to push for more women empowerment in those companies. So far, we have worked with 15 companies in 10 countries. We are open for business. If you are willing to bring us a proposal, we will look at it.

Panel Discussion

Ramesh Subramaniam, Director General, Southeast Asia Department, ADB: My name is Ramesh Subramaniam and I am the director general of the Southeast Asia Department for ADB, which covers the 10 ASEAN countries plus Timor-Leste, which is part of the Southeast Asia group of countries in ADB. I am pleased to welcome all of you to this session. In the past one and a half days, there were some excellent discussions. There was a range of speakers largely from outside ADB. Many experts from think tanks as well as Secretary Dar; IFPRI's director general, and a number of others who had given their perspectives. What we have heard in this session are ADB perspectives. Five of my colleagues from different parts of ADB have shared with you what we do in the respective regions. Yesterday, the keynote speaker Dr. Mekhala Krishnamurthy presented in her first slide Vijay Tale, a farmer wearing a T-shirt saying, "Make your own destiny." She used that to highlight what making your own destiny means for poor farmers. Just imagine instead of Vijay Tale, a woman farmer would have to struggle to make her destiny. I can bet that her destiny will be even more

difficult to make. We do have gender disparities across the region. In fact, Akmal mentioned a country where being married off to a farmer was what parents used to scare girls who were not behaving well. We can imagine what plight a female farmer would face in such circumstances.

My colleagues are: Natsuko Totsuka, principal portfolio management specialist from the Environment, Natural Resources and Agriculture Division, Central and West Asia Department; Qingfeng Zhang, director, Environment, Natural Resources and Agriculture Division, East Asia Department; Mio Oka, director, Environment, Natural Resources and Agriculture Division, South Asia Department; Ancha Srinivasan, principal climate change specialist, Environment, Natural Resources and Agriculture Division, Southeast Asia Department; Martin Lemoine, head, Agribusiness Investment Team, PSOD. My five colleagues have presented case studies of projects from respective countries that they deal with. I now open the floor for questions.

Forum Participant: I am from IRRI and work on rice. As you work in different parts of Asia and the Pacific, how do you ensure sampling of expertise of other international organizations and there is no repetition of some of the activities.

Qingfeng Zhang, ADB: We have an Agriculture and Food Security Thematic Group within ADB where we get together to exchange notes and share experiences. When we have a peer review process for projects, we invite external and internal peer reviewers to provide comments. If there are any important findings or lessons, we incorporate those in the project.

Ancha Srinivasan, ADB: For every project that we process we prepare a document called development coordination matrix. We assess what and how every development partner is helping the government in the related field, and wherever there are opportunities for collaboration—as the purpose of the document is to identify synergies and avoid overlaps—we discuss with potential development partners. For example, in the Climate Friendly Agribusiness Value Chain Sector Project that we are implementing in three countries, IRRI is one of the partners. In Cambodia, the International Institute for Tropical Agriculture is also supporting the project. I mentioned in the livestock project, the International Livestock Research Institute is interested in some form of collaboration. We try to look at competencies and match and avoid overlaps.

Martin Lemoine, ADB: From the private sector perspective, there is no risk of overlap or competition where the sector is underinvested. The more partners there are, the better. We also work with cofinancing partners on projects and that may include the International Finance Corporation, European Bank for Reconstruction and Development, Japan International Cooperation Agency, Korean Development Bank, and commercial cofinancing partners. In the new trending model of blended finance, we have countries that are willing to provide grants that can be blended with commercial financing. We can use this instrument in specific cases such as climate change mitigation or adaptation or in some specific countries. This is essentially subsidized but under very strict guidelines.

Forum Participant: My name is David Friedman and I work as ADB country economist for Timor-Leste. I have a question for Mio. You showed very clearly issues around water management such as needing to do more with less water and the move toward high-pressure irrigation systems. Presumably, O&M is more complex and challenging for the high-pressure systems. I was quite impressed with the idea of having the five-year O&M bundled into the packaging. My question is whether you considered long term O&M arrangements and whether you could also have a PPP-type model covering 25–30 years, whether that is something that you are looking at in the future?

Mio Oka, ADB: You are right. With this project, we started collecting water tariffs so that it can provide a basis for future O&M fees. Normally, ADB's involvement is to initiate one project. However, we will continue over a long term period, between 10–15 years. We have a PPP component in the second project, which is of a similar nature. With that we will continue to support building the capacity of the Department of Irrigation in the Madhya Pradesh State. Additionally, we are trying to change O&M financing system as well. So, it is a longer-term involvement, not only 5 years.

Forum Participant: I am from the information technology (IT) sector. In the past 3 weeks I have been doing roadshows in the north of the Philippines at local government levels. What I noticed is that there is a gap between what technology solutions we offer and what the local levels can utilize. My question is addressed to those who have successfully applied IT solutions in project. How did you address the technology adoption challenge, such as the lack or slow internet connection, lack of network coverage, smartphone usage, power-energy management, and gaps in education?

Qingfeng Zhang, ADB: As we discussed with the Government of Mongolia, we realized the importance of using high-level technology, which is lagging in agriculture than the mining sector. The government has recognized that the agriculture sector can help diversify the Mongolian economy. They have started discussing the comprehensive packaging of the big data, internet, and block chain technology in the agriculture sector. We discussed with the government about the ICT approach in agriculture. As livestock headcounts in Mongolia are estimated at over 66 million, the government has a strong buy-in into using technology for product certification and traceability, and website marketing on the internet. We currently have only one project in one of the core provinces of the PRC in Gansu—the Internet-Plus Agriculture recently approved by the board. We can also share with you how we can apply Internet-Plus in the agriculture sector.

Natsuko Totsuka, ADB: During the project design stage, it is important to assess infrastructure and existing capacity in terms of electricity and internet connectivity. There may be some changes during implementation, so we must include the potential improvement of infrastructure over several years. It is important to design projects for developing countries, which are not too ambitious. From my experience of more than 25 years, we should not be very ambitious. Project design must be simple. In terms of project implementation and sustainability, it may be better to be cautious. In terms of capacity building, the project can contribute to improving skills. In short, it is

important during design of the project to understand restrictions in each region and country.

Mio Oka, ADB: Rural infrastructure is important. Alongside those innovative projects, we do have general projects that support provision of national level infrastructure, not just rural but also highways, electrification, etc. That is important. I mentioned a lot of newcomers in the sector. Those are the IT people and venture people who have a lot of means. What we are trying to do is link them to working with traditional agricultural actors like agronomists. Newcomers may not be collecting the right kind of information to include in their apps. That is something that ADB can perhaps provide—acting as a bridge between the new and old, traditional actors in the sector.

Martin Lemoine, ADB: On technology adoption, there is one model, which I thought is quite effective that is being used in the cut flower sector in Dalat, Viet Nam. Initially, there were no modern greenhouses in Dalat. There were traditional greenhouses for strawberries. [Dalat Hasfarm] was the first to establish greenhouses to produce cut flowers. Now, the technology is widespread, and neighbors have been copying them. The best way to spread technology among farmers is to encourage an investor to take the lead. The widespread greenhouse technology is not the same but is low-cost. They have learned at least the basic techniques. The company has been able to buy back products and the farmers have become contract farmers.

Ancha Srinivasan, ADB: Unlike other high-end technologies, the penetration of IT-related technologies is much faster in developing countries. While there are many bottlenecks, IT has something called technology leapfrogging modus, which is the reason why our projects are focusing more on IT-enabled technologies in all sectors, not just agriculture. We should take advantage of that. These interventions are not like high-end, traditional technologies facing serious constraints; IT has some advantages.

Forum Participant: Will ADB fund community-based projects managed by peoples' organizations, particularly in the area of natural resources management? Why is ADB not doing enough in this area?

Natsuko Totsuka, ADB: We do finance community-based projects in different regions. For instance, in Afghanistan we finance community-based projects, mainly for minor irrigation structures, which have been working very well. Not many contractors want to work [in Afghanistan] due to security reasons. Irrigation structures are people's assets. Therefore, the local communities are motivated. Government and communities have developed good working relationships. This is just one example.

Mio Oka, ADB: In South Asia, we do work directly with farmer-producer organizations, water user associations, and so forth. However, it does depend on the project implementation period. We have a thousand communities and it takes a lot of time to do community-based work. It must be a blend between community participatory approach and a contractor-based implementation.

Ancha Srinivasan, ADB: In Southeast Asia also, we work with several communities, including agriculture production groups or cooperatives. The modality of working with communities is established. We also work with civil society organizations and pilot community-based adaptation and disaster risk reduction measures. ADB, together with other development partners, is launching a community resilience partnership program that will mobilize additional funds to support community-based activities.

Ramesh Subramaniam, ADB: To supplement, it is a balance that ADB needs to achieve. Across the regions, ADB has projects where we work with community-based organizations. In the Philippines' KALAHI CIDSS National Community-Driven Development Program, natural resource management encompasses 25%–30% of resources. The success of the program is lies in a well-established structure with rules and protocols laid out at the local community levels in terms of participation and eliciting views. As opportunities are provided to communities, they require capacities to be built and the capability to manage finances at the local level.

Forum Participant: We talked about technology—how do we make sure that the high-level technology solutions reach out to the end-user, particularly poor farmers, who may not have capacity? What are the insights we have gained in engaging with local farmers and using such technology? What is ADB doing?

Qingfeng Zhang, ADB: This question is linked to the previous question about how to engage with the community. For example, we have the Internet-Plus Agriculture Project in the Gansu province in the PRC where the key users are farmer cooperatives. The executing and implementing agencies will engage the farmer cooperatives. Also, the transition between ADB's 2020 and 2030 strategies is a period of adjustment. The 2030 strategy has more modalities to accommodate a community-based approach. Both in Mongolia and the PRC, the natural resources project and the agriculture project are very much community based.

Ancha Srinivasan, ADB: For every technology we cannot directly go to the last consumer. The role of intermediaries is important. Depending on the level of capacity, we need to engage end-users for a successful demonstration of the technology. We cannot avoid the role of intermediaries in technology diffusion.

Ramesh Subramaniam, ADB: From what you experienced in the GMS, have you done any pilot testing of specific technology solutions and what are the insights gained?

Ancha Srinivasan, ADB: In Cambodia, we did a pilot study with the support of the Sustainable Development and Climate Change Department on the feasibility of ICT application for agribusiness. There were challenges in terms of data availability, data transmission, and the ability of farmers to reliably understand the weather information and credit or market information. How do we overcome those challenges in a real project? The feasibility study has given us some understanding of the challenges we have to overcome in the main investment.

Martin Lemoine, ADB: Technology should be part of an ecosystem. If we take the contract farming model, it is effective to add technology into it because an agreement already exists between producer and buyer. For instance, in Bhutan, we are supporting a hazelnut processor, who has helped 15,000 farmers plant hazelnut trees on their land. The company has deployed about 200 extension workers and monitors, who traveled through Bhutan to help the farmers. They have developed their own app and have the technology. Bhutan has good connectivity, so it works very well. It is true that the farmers will not be able to figure out the use of technology on their own. They have learned how to use the technology because someone from the company comes every month to teach them and solve their problems. Technology tends to reinforce inequalities. We need to bundle technical assistance with technology through the private sector, through government, through nongovernment organizations (NGOs) and civil society organizations using various channels.

Mio Oka, ADB: In ADB operations we always think about value addition. We try to ask ourselves about what the government is involved in at the moment. If ADB gets involved, what is the value addition that we can bring to the development project. One of the things we can often undertake in our sector is targeting. In a rural infrastructure project, we can target a less fortunate area; or in provision of capacity building, we can stipulate based on baselines undertaken a percentage (e.g., 30%) coming from a scheduled tribe (minority) or indigenous people, or poorest of the poor. We do include this targeting mechanism in the project design.

Forum Participant: My question is addressed to the livestock project. What were the main criteria for selection of farmers for funding? After receiving funding what is the increase in yield of milk and meat?

Qingfeng Zhang, ADB: We have had two approaches related to farmers. One is contract farming. Most of the cases are with small and medium-sized enterprises (SMEs) that have pig farms or culture farms and have contract farming arrangements with individual farmers. In some cases, we have also directly engaged with individual farmers. One of the long term projects we are working with in the PRC is the Efficient Utilization of Agricultural Wastes Project with biogas digesters. At the individual farm household levels, we lend them $2,000. But this kind of modality is difficult to scale up. That is why we are encouraging the agricultural value chain and participation of agro-processing enterprises, financial intermediaries, and commercial banks.

Forum Participant: I am from Timor-Leste. My question is addressed to the panelist on private sector operations. You mentioned contract farming and it has a great impact in the community. It has increased incomes in the community. Is it possible for you give some elaboration on the socioenvironmental impacts of that? When the private sector comes into play, most of them focus on income (profitability), but those farmers are also looking at food security. When they produce for exports, most likely they will have to rely on food importation. Once cash crop producing-countries face problems, there will be problems for farmers. Could you give information on ensuring food security for those involved in contract farming.

The second question is on irrigation scheme. Ensuring water availability is very important and Timor-Leste is no exception to that. We are a small country with a big problem of water provision. I was impressed with the pressurized system of irrigation mentioned. ADB has done some study in Eraulo in Timor-Leste on water and was going to undertake some work but up to now the project has not been implemented. Since the initial considerations, 5 years have passed, and I do not know why nothing has happened. Water provision in Timor-Leste is very important. Without ensuring water availability, we cannot talk about productivity or food security. The introduction of technologies will remain without impact unless we ensure water is available. Is there any opportunity for ADB to apply experience from other countries to Timor-Leste in improving water provision, using PPP, or other mechanisms to help vulnerable people?

Martin Lemoine, ADB: Your point on the risk of the contract farming model is fair. We are quite selective in trying to pick business models that are sustainable for the farmers. There are two elements. Firstly, we do not support purely a trader who will come in-and-out. We pick agribusinesses that are investing for the long term in the countries. If we invest in a coffee processing plant, for example, this could be a 10–20-year investment and we cannot just abandon it after a few years. That is why foreign direct investment (FDI) is so important. An investment is a multiyear commitment as opposed to a trade, which could be for less than a year. That is why we support long term investments and FDIs. When the farmers see that, they understand the commitment. The farmers then are also ready to invest on their part. It is thus important to have long term commitment in agribusiness from the buyer. Secondly, our support and technical assistance promotes intercropping and discourages mono-cropping. For instance, hazelnut tree growing in Bhutan is being done on barren land intercropped with cassava. Farmers still retain their paddy fields for rice, and they have livestock on the side. In Timor-Leste, we have ensured that intercropping for coffee farmers is part of the technical assistance.

Ramesh Subramaniam, ADB: In the past few weeks we have been discussing a new business strategy and plan for Timor-Leste. I suggest is that my colleagues Jiangfeng Zhang and David Friedman discuss with you. In short, we will certainly be happy to look at it because until now our support has been focused on transport connectivity. Both the government and ADB are interested in looking at water supply as well as water resources, including efficiency improvements.

Forum Participant: What are the challenges faced by ADB in trying to bridge farmers and the private sector and how does it address those challenges?

Qingfeng Zhang, ADB: The agriculture and rural development project I just presented is an example how we can use private sector to reach out to farmers. I shared information about cashmere wool and dairy products in Mongolia. These products are difficult to package if there is no intermediary SME to reach out to the farmers. That is why we engage the five commercial banks and these banks lend funds

[18] ADB. 2018. Lao People's Democratic Republic: Climate-Friendly Agribusiness Value Chains Sector Project.

to 15 SMEs, most from the private sector, who work with farmers and herders to buy the raw material. Then they process and sell products to international and domestic markets. The modality is quite important: commercial bank as a finance intermediary, private sector, farmer-herder.

Ancha Srinivasan, ADB: It varies from country to country depending on the extent of the appropriate enabling environment for private sector participation in agriculture. For example, in Lao PDR under the Climate Friendly Agriculture Value Chain Project,[18] we plan to try a matching grant scheme. The intention is to provide up to 60% grant to a private sector entity that has prepared a business plan, which provides for working closely with smallholders and commits to help them with climate-smart agriculture practices while following good, climate friendly manufacturing practices. The intention is to build confidence between the private sector and farmers so that farmers can see that the private sector company is not only after profits but is there to help them. The variation of such interventions depends on the maturity of the private sector and farmers and the appropriate enabling environment (e.g., the contract farming law as regulation vary with each country). PPP frameworks are also of variable quality. The extent to which PPPs will work for the agriculture sector is more challenging than in sectors like tourism, textiles, and mining.

Martin Lemoine, ADB: A critical element to bridging the gap between companies and farmers is working capital. That is the main issue for many of our clients. Working capital is important in this sector because one may have to (i) advance cash to farmers to purchase seeds, equipment, or other inputs; (ii) carry inventory because buying is scheduled once or twice a year. Advances and inventory are elements of working capital, which are short term assets that have to be financed by short term loans from banks. That component of financing could become huge and become an issue because if at the same time the company wants to grow, this will eat into the operating cashflow. This is an area that needs attention and it would be good if governments could look into it. They could partially subsidize the costs or enact a law to allow banks (as in the Philippines) to allocate a certain percentage of their lending to the sector. Thus, working capital is very critical for the sector.

Forum Participant: I am from IFPRI and my question is addressed to Mio. It seems that your projects on irrigation in South Asia tend to focus on technical or irrigation side of interventions. To what extent is ADB looking into soft interventions, such as social learning, behavioral change, and community institutional development, particularly in managing ground water resources? With our partner in India, the Foundation for Ecological Security, a large NGO, we have been piloting experiential learning using group games relating to groundwater management issues, which also involve community-wide discussion and briefing sessions on what they learned. We found that these games help improve perceptions of individuals and the community relating to how one's actions will affect the resources for others and how important rules and enforcement are. Communities who underwent involvement in games were likely to adapt water security plans and these games tend to play a role in making communities more receptive to technology interventions. To what extent is ADB thinking about incorporating soft interventions in the programs what ADB sees as challenges and issues in doing that?

Mio Oka, ADB: You are right. We put the farmers in a position to pay for water, which they never paid for before. As the farmers plant grains, the project encourages farmers to also grow high-value crops as well for more income. The technical assistance that goes with the project will be implemented by the Department of Agriculture. As we go along, we will identify lessons from within India and from outside and will be happy to learn from experiences gained by other institutions.

Forum Participant: My first question is addressed to private sector operations. I am sure you have interacted with a lot of agribusiness groups. From your interaction, what are the policy constraints that could probably be addressed by the public sector operations to further development of agribusiness in this area.

For the regional departments, I have two questions. One is about ADB's promotion of PPP schemes—are there any success stories, which you could possibly share with us and inform? Secondly, we have been hearing in the past one and a half days that Asia has been quite successful in reducing poverty incidence but not the hidden hunger, which is malnutrition; on the one hand, we have stunting, which is becoming a persistent problem. On the other hand, we have obesity, which is emerging as a major issue. We all know that food and nutrition security are inextricably linked. What are the present and future investments that ADB is looking at in the context of addressing the linkage of food and nutrition?

Forum Participant: Could ADB private sector loans focus on more products to address nutritional needs?

Martin Lemoine, ADB: The FDIs usually express one constraint, which is the requirement of local ownership in some countries. This is typically not well understood and probably not needed, but there are historical reasons for that. Governments need to think carefully what they wish to pursue. The sector is underinvested, and countries need investments in the sector. The foreign investor should be responsible and should have a sustainable business. Such investors should then be allowed to own the FDI as a 100% entity. In the case of Viet Nam, the cut flower company is a 100% foreign-owned company and works very well. Secondly, trade barriers e.g., rules regarding import of packaging materials are heavily taxed; vitamins and minerals one can use for fortifying flowers or biscuits are heavily taxed. If we want to make food more nutritious, importation of such ingredients should be without trade barriers. Perhaps governments are not aware of this problem as there is no feedback loop. Thirdly, the tax system in some countries is very attractive (agriculture is not taxed at all), while in other countries the tax system could be quite disadvantageous to the sector. Nutrition is a core priority for ADB. In the past, we have supported investment in the dairy sector, which is important for nutrition. We have supported agribusinesses dealing with fresh fruits and vegetables, which is also important for nutrition. We support the coconut sector, which is considered a healthy ingredient for food and beverage. We could go into fortified food.

Qingfeng Zhang, ADB: For PPP I can use Mongolia as an example. In the livestock sector there is tremendous opportunity to use PPP. PSOD looked at a number of companies from the 15 SMEs. Gobi Cashmere may be sizable enough to be

considered by PSOD. But that is not enough. In terms of dairy production there is an opportunity for PSOD to examine downstream investment in the livestock project. The public sector is paying attention to providing an enabling framework while private sector is picking up investments on processing and value addition.

Natsuko Tosuka, ADB: In the Central and West Asia Department, we have several financial lending programs where ADB channeled its loans to private banks through the Ministry of Finance. Private banks provided subloans to the private sector like food processors, large farmers wishing to build cold storage, or anything related to value chain improvement (e.g., horticulture). We are now going to have lending in the livestock sector. The financial intermediary modality helps to link private sector to farmers to develop the value chain. The modality also helps develop the value chain in line with government policy. Instead of just providing the private sector with financial support, we involve the Ministry of Agriculture, for instance, to evaluate subloan proposals from private banks to ensure that these proposals are in line with government policy. The financial intermediary loans can only be applied in countries that have a robust financial system. For countries that have sufficient capacity in the financial sector, the financial intermediation modality is one option, where the private sector can contribute to agriculture investments, while the government enables a sound policy environment.

Ancha Srinivasan, ADB: In terms of PPP there are several models that have been tried out with each model having its own strengths and weaknesses, as well as particular circumstances of the country and the regulatory framework of the PPP law. Like environment or climate change, investments in nutrition are seen as soft investments. We do not have concrete numbers that can convince policy makers on how much additional investment is needed for nutrition. That is where we need to do more work and create a demand for nutrition-related investments.

Forum Participant: I have been hearing about the use of high tech to foster growth in agriculture in the last few days. Technology does not necessarily need to be high tech to be relevant. It can also be simple, affordable, safe, practical, scientific, and yet east-to-use, free or cheap, and relevant, especially in times of climate change. I agree with the gentleman from Timor-Leste that water availability would first have to be ensured for any irrigation system to be fully utilized. Otherwise, investment in agriculture may not be as relevant. In India, there are many groundwater recharging and traditional water harvesting systems available. I am sure there are many more in other countries, which may have become lost due to disuse but are more than ever relevant today because of climate change, as water availability can really become volatile. Similarly, many traditional varieties of crops are available, which are not only robust and resilient to climate change stresses—many are high yielding varieties. Many modern climate-resilient varieties that have been developed have been based on traditional genomes, which are again based on traditional knowledge of farmers. Is ADB doing anything to revive traditional infrastructure relating to knowledge, resources, varieties, as the economic value is huge?

Ancha Srinivasan, ADB: Definitely, there are many projects that are building on traditional knowledge, and it is important. However, we cannot only rely on traditional knowledge or traditional practices to cope with for example future impacts of climate change. Building on current technologies and then blending with modern technologies is the approach in ADB.

Ramesh Subramaniam, ADB: Our President talks about his visit to Sri Lanka, how 4-centuries old water management technology and system is still robust, in operation, and could go on operating for many more decades to come. Certainly, the point that you have made about traditional systems and knowledge and their value today is valid.

Qingfeng Zhang, ADB: There are old irrigation schemes in the PRC that are 2,000 years old and still working in Chengdu and Sichuan province. These are still relevant for adaptation to climate change. Nowadays, we do have hydrological maps and basin maps that provide us with a structure and forecasting has become relevant. But knowledge of traditional structures is still valid today.

Farmer Participant: My name is Samath and I am from Cambodia. I am from the Livelihood Improvement Association that has a membership of 30,000 farmer families. Women represent about 60% of our membership. I am happy to inform you that all our members are happy to receive ADB support. I would like request ADB to continue support and confirm that our women members have received a better understanding than in the past. I hope that ADB will introduce new farming and livestock-raising technologies and facilitate linkages with the market. Finally, I would like to request ADB not to abandon us as we have just been established for one and a half years. The association in the near future will increase its membership by another 15,000 farmer families. We need continued ADB support.

Ramesh Subramaniam, ADB: Thank you very much for that feedback. ADB colleagues working in Cambodia flank you on both sides in the room here. They have heard your feedback and we will certainly take this into account.

Forum Participant: My first question is, is there any facilitation like R&D for livestock, crops, and fisheries due to climate change? Do you have any framework or model for private sector research institutions, including the end-user approach? My second question is, how do we assess the impact of our projects implemented in the different DMCs? Do you have any data to show sustainable impact in the DMCs?

Qingfeng Zhang, ADB: We do have a research associate with livestock background and capacity building expertise. You can contact us.

Ramesh Subramaniam, ADB: I will also supplement your question on whether there is any framework in terms of engagement with such institutions. The answer is yes. We do have some models, for example in promoting South–South cooperation, learning between countries. There has been work done with PRC as well as between India and the Philippines. We can share these frameworks with you.

On the second question relating to impact of projects in DMCs—that is a major question. Evaluations are done from time to time. The usefulness of the evaluation also depends on how good the design is, particularly if you are looking at community-level interventions. The time and effort put into design and monitoring framework, the key performance indicators we have in place is important. Ground trothing and ground-level data is an issue.

Forum Participant: I am from the University of the Philippines, Los Baños. I am also a farmer and an entrepreneur. Most of the initiatives shared today are on the supply side, i.e., increasing farm productivity and income. But I have not heard anything on the demand side—good distribution and consumption, which in my opinion is lacking. It is also related to how rural–urban linkages can be facilitated. My family owns a food store. Our vision is that every corner of a settlement should have a 7/11 food store. We all know what 7/11 offers. Maybe less than 20% of that store content can be classified as food. Nevertheless, I think that every 300 households should have access to a food store. Activities of this nature can be put together by the private sector. But we want that the neighborhood store should be inclusive. I mean homeowners associations, tricycle drivers associations, for example, should have a place there. Putting up something like this will need logistics and organizing producers and consumers. Does ADB have a business model that can do this, and which can be replicated elsewhere?

Martin Lemoine, ADB: Retail distribution is important for the private sector. We know this from our partners like EBRD, which has had a huge success in this. It is highly important to develop and promote modern trade and retail outlets that include 7/11 or supermarkets. But they need to be inclusive. One model we are supporting in Kazakhstan and the Kyrgyz Republic is the model of a food and beverage company that is helping shopkeepers by providing coolers. It is similar to contract farming—only that this is contract retailers, creating a win-win situation. By putting in coolers with products of the company in the retail outlets, it opens multiple avenues for the sale of its products. The coolers are energy efficient, which is good. But we are telling them to go beyond that. We insist that 50% of coolers should be given to women-owned retail shops. We could try that in the Philippines.

Ancha Srinivasan, ADB: Consumer-driven interests have driven the design of projects even in the public sector. It may not be directly evident when we explain the project. For example, in the agribusiness project I am referring to, we look at the type of standards and quality and safety standards that are on demand by consumers, whether high-end consumers, tourists, or for the export market. Consumer demand of standards are guiding factors in the design of agribusiness projects.

Qingfeng Zhang, ADB: We need to have integration between rural and urban. Tomorrow my colleague will talk about rural vitalization in the PRC, which is a demand-driven project we are supporting. More importantly, it is necessary to attract investment from urban to rural areas.

Ramesh Subramaniam, ADB: Before I bring this panel discussion to a close, I would like to supplement on your last question, which is a very important point you have raised. If you just type "agriculture," "ADB," "demand side," you will find a series of things funded by the Japanese Fund for Poverty Reduction (e.g., support for establishing rural retail markets), thus bringing supply and demand side together, including examples from the Philippines, Myanmar, Cambodia, South Asia and many other parts of the Asia and Pacific region. I greatly appreciate your active participation and a round of applause for my ADB colleagues.

Thank you.

Key ally in rural development. The active participation of the private sector is essential to drive transformative changes in rural areas.

Knowledge Sharing Among ADB Member Countries

Some countries in the region have taken creative and out-of-the box initiatives through public policies, and public and private investments. Discussions focused on what has been done so far and adopted by the member countries of the ADB. The sector profiles and developments showcased knowledge sharing and learning by participants to reflect on the good models that they countries can adopt..

Presentations

1. Farmer Producer Organizations: Experience in Maharashtra, India
by Anoop Kumar, Principal Secretary for Marketing Department, Maharashtra, India

Maharashtra is one of the largest states in India. It is third largest in area and second in population with 120 million. Agriculture continues to be the backbone of the economy: 52.1% of its population depends on agriculture and contributes 15% to agriculture GDP. Over recent years, Maharashtra has significantly transformed its agriculture, which is no longer based on cereals and food crops. It has become a leading state producing high-value crops like cotton, soya bean, horticultural crops, and vegetables. Maharashtra is a top exporting state of India containing maximum infrastructure, including the Jawaharlal Nehru Port Trust, which handles 70% of India's exports and a maximum number of institutions dealing with exports. We also have the largest number of farmers who are global agricultural practices-compliant. However, the state has a diverse geography and some areas are not doing that well—distressed areas such as Vidarbha and Marathwada.

In Maharashtra, all out efforts have been made in last 2 decades to intensify and diversify crop production, improve crop quality and productivity, making it more market-led production with better postharvesting handling. Maharashtra has ranked number one

in India in Agricultural Marketing and Farmer Friendly Reforms Index prepared by Government of India.

The formation of farmer producer organizations (FPOs) and/or farmer producer companies (FPCs) is a process of collectivization of primary producers, especially small and marginal farmers, into a formal legal entity. It has emerged as one of the most effective pathways to address many challenges of agriculture—access to markets, quality inputs, technology applications, improved logistic and public investment. Hence, the government of Maharashtra's policy focus has been on farmers' collectives and FPOs for better aggregation, better logistics, and their integration with retail market value chains. The FPOs, registered as FPCs, under the special provisions of the Company Act 1956, have emerged as most appropriate institutional formats in Maharashtra to mobilize farmers, build their capacity, and collectively leverage their production and marketing strength.

The farmers' price realization in most agricultural produce is in the range of 35%–50% of the price paid by end consumers. Farmers have neither control over logistics nor control over the entire value chain process. Many may ask what is the difference between FPO and cooperatives? In Maharashtra, cooperative societies developed early but over the years they lost relevance because of political overplay by dominant political forces. Except for commodities like sugar cane and cotton, cooperatives started failing the farmers. FPCs emerged as a viable option, which have between 20–25 members. It started primarily with the input side by scaling up the procurement operation, bringing down the cost of inputs, especially seed and pesticides. Later, FPOs started covering the entire value chain. First it started at farmgate level, with drying primary processing and then making it market ready. Then they went into market logistics, transport operation bringing produce to retailers, wholesalers, or commodity exchangers, or even export markets. Currently 1,696 FPCs have been registered, of which 1,000 are reported to be active. The Maharashtra state government has given various facilities to FPCs. They have received 50% discount on storage charges agricultural produce in Maharashtra State Warehousing Corporation. Free direct market licenses have been given to FPCs by the directorate of marketing. Interstate 50% transportation subsidy has been given to FPCs for agricultural produce trade. This subsidy is given by the Maharashtra State Agricultural Marketing Board. Priority has been given to FPCs to trade market their produce in weekly market organized by the board. Under several agriculture schemes, priority or preference is given to FPCs—for example, crop production, seed production, and farm equipment. Preference has been given to FPCs under the Public–Private Partnership-Integrated Agriculture Development scheme for example, modern onion storage projects.

Majority of FPOs formed in India are in the nascent stage of their operations with shareholder membership ranging from 100 to over 1,000 farmers. Even though the central and state governments are taking measures to strengthen FPCs network and improve their current situation, majority of FPCs face some critical challenges, which are inadequate professional management, inadequate access to credit, inadequate access to market linkages, inadequate access to postharvest infrastructure, lack of technical skills and awareness, and lack of risk-mitigation mechanisms. Benefits of FPCs are (i) farmers' cost-savings on inputs, (ii) cost reduction on harvesting and

reduction in losses, (iii) increase in value of produce and encourages farmers to undertake risks, (iv) working capital, (v) seed production, (vi) training and capacity building, and (vii) market linkages. So far 180,000 farmers have been mobilized into 406 FPCs. There has been a 22% higher price realization of goods produced and 8% input cost reduction for FPCs.

2. Harvest More with Less: Water Smart Farm
by David Tan, CEO, Netatech Pte Ltd, Singapore

Singapore needs to establish food security due to increased uncertainties. It has limited land, high costs of water and energy, climate change, supply disruption, and population growth. As a small country, what options are open to Singapore? By the way, which country ranks first in the world in food security? Singapore. Yes, Google and find out. We do have farmland and agritech. How did we achieve that? We have three lines of defense: (i) make a lot of money and buy globally—we procure food from 95 countries, (ii) grow globally, and (iii.) grow locally. We have stockpiled 3–6 months of rice to feed our population if global supplies are disrupted.

Let us look at the third line of defense—growing locally. This has called for a Smart Farm for a Smart City. We do indoor farming and use any space found suitable to grow food. We envisage a 20-story farm to grow vegetables on the rooftop and below that we can grow fish. Further down there are apartments used by people to live in. This is our vision for the future. One of the realistic spaces we are exploring to use are walls of large housing complexes, whereby we have 1 million square meters of vertical wall space available. If we can farm 2–3 kg/square meter, we can produce 2–3 million kg of vegetables, which is enough for at least 30% of our monthly food supply. We need to break away from traditional farming methods changing from centralized to decentralized farming. Hereby we are talking of utilizing very small spaces like 200–300 square meters per housing block—and we have about 10,000 housing blocks. We can invent a whole supply chain: how to produce seedlings, how do we grow and market, and how the food is delivered to the doorstep. Grow the food, use an app, order the food, pay for it, and receive delivery. We want to farm cleanly and responsibly because the farms we are proposing are integrated in the places we reside. We do not want to have contamination in our residential buildings, in the water, and the environment.

Singapore has high humidity and high temperatures that are not suited for good farming as there can be outbreaks of pests and disease. That is why we need to look for technologies and a new way of farming. Therefore, climate control is important and so is biosecurity, which is crucial to be able to farm 100% free of pesticides. Most people in Singapore do not drive but catch a cab. The rooftops of car parks are empty, and we can set up rooftop farms. Underneath highways we have space where we can channel light into and farm under viaducts. There is the option of underground farms, indoor farming, and vertical farms and integrate aquaculture and hydroponics.

The possibilities are endless. At the newly refurbished Funan Mall in Singapore, we are showcasing a pilot farm on the sixth floor, which grows rice. We grow dragon fruit, mushrooms, and chili, and do aquaculture and microgreens (sprouts).

From the vertical to the horizontal—5 years ago, we established a capacity building academy that trained young people from the region. We focused on research and training, brought young people to Singapore and trained them. They went back to their respective countries to fuse rural with urban ideas. We are trying to build capabilities for the future among younger generation that can deal with technologies to grow vegetables. In Singapore we grow capsicum and strawberries. Our trainees are provided with skills and then sent back to their countries so they could use their skills and knowledge. Our trainees, who went back to Chiang Mai, Thailand, which is 1,400 meters above sea level, started producing food and exporting to Singapore. When our trainees go back, we support them in farm operation best practices, crop and soil agronomy, farm system and infrastructure optimization, pest and plant health management, automation, and farm to Internet of Things digital solution. We walk with them in the field, build together and finance them. Vegetables grown on the farm are exported every 2 days to Singapore. We have built 34 greenhouses in 4 months that produce 10,000 kg of vegetables every month for export to Singapore. This kind of project is highly scalable, and it has created employment for 30 families in 4 months. We connect the producers directly to demand for their products using our supply chain system and help them brand their products. These products are now being sold to cold storages, supermarkets, and online. Together we can make a better world.

3. Food Processing and Supply Chain Management
by Charoenchai (Charlie) Khompatraporn, Head of Sustainable Technology, Management and Design Research Cluster, King Mongkut's University of Technology Thonburi (KMUTT), Thailand

In 2018, Thailand produced over 39 million tons of food, of which 55% was consumed domestically, about 40% was exported, and 5% was kept as inventory. Some raw materials were exported for further processing abroad while other items were exported as processed goods such as canned tuna, cassava starch, canned pineapple, food flavors and sauces, as well as ready-to-eat meals. Most of the exports are to Japan, the PRC, US, and six countries in Southeast Asia as well as the UK. We are ranked twelfth as a global food exporter but have only 2.36% (as of 2018) of the global market share. How did we achieve that? Contributory factors were farmers willing and ready to adapt to new production methods and innovation, previously cheap labor (but losing the competitive edge to some neighboring countries), economies of scale, and food processing capacity. Some of these food processors collaborate with universities in Thailand. Our university—KMUTT in Thailand collaborates with two large processing companies in the country. Our students are placed in these companies after graduation and many secure good positions. Research projects we conduct are also requested by the private sector companies in the food processing sector. The government has also directly contributed to the food sector by establishing a Bank for Agriculture and Agricultural Cooperatives. The Ministry of Agriculture has a Department of Rice and an Agriculture Research and Development Agency. All are geared to supporting farmers and providing funding for projects relating to agriculture. These interventions have contributed toward Thailand's growth in food production, processing, and exports. What is next?

Thailand is progressively becoming an aging society. The government is trying to extend the retirement age of government officials to 70. Urban migration, which is happening everywhere as in Thailand, adds to the complexity of the supply chain. Food delivery services are growing in the cities and urban migration will add to changes in the future regarding processing and delivery of food. Climate change has also impacted on food production (vegetables, seed grains) and we need technology-driven knowledge and techniques so that we can cope with challenges the changing climate is bringing about in the environment. We also need a new business paradigm, as the younger generation does not wish to be farmers. Farming is no longer attractive. How do we cope with this situation?

There are technologies that can be adopted wisely instead of these becoming disruptive. Using 5G technology could perhaps help us monitor our crops remotely, use data-driven hi-resolution imaging technology to provide early warning, and keep costs down. Using artificial intelligence technology, and data analyzing techniques, we can also match demand with supply by using real-time data about consumer preferences and choices.

The technology could help us avoid overproduction of food in the future, reduce overuse or wastage of natural resources, and match plans with production. Using the internet technology and mobile applications, we can also monitor and match supply in rural areas with demand in the cities. In the inner-city areas, we can also analyze and match access to food with various food providers using simple apps. There is a movement in Thailand that focuses on resolving the food gap in Thailand. We produce a lot of food and yet we still have hungry people. Drone technology is another way of driving the cost down of crop and livestock management, monitoring conditions and taking timely remedial action, and providing accurate forecasts and yield predictions.

Lastly, when we look into the future, smart sustainable technologies and automation, create high value-added knowledge driven products, provide capacity building and an entrepreneurial ecosystem for the younger generation to operate in and provide services and shared benefits.

4. Horticulture and Agri-food Business Development
by Mustafa Erkan, Professor, Department of Horticulture, Akdeniz University, Turkey

Turkey is the only country located between Asia and Europe and has four different climate zones with rich crop diversity. Turkey is ranked the largest country in terms of agricultural economy in Europe, having the second largest agricultural economy among OECD countries, and ranked ninth globally. Agricultural land covers 25 million ha with 3 million people involved in agriculture with a value of $62 billion in agricultural trade. The average farm holding size is 6 ha. The portion of female labor in Turkey's agriculture is ranked as third largest in the world. Turkey's agriculture produces over 54 million tons of fruits and vegetables, which is 3% of the total global production. Turkey is also the world's fourth largest producer of fresh vegetables and seventh largest producer of fruits, with an annual trading volume of $2.5 billion.

With regard to vegetables, Turkey produces about 32 million tons annually, of which tomatoes consist of 12 million tons. In terms of fruits, Turkey has a total out of 22 million per annum with grapes (nearly 4 million tons) ranked as number one followed by apple (3.6 million tons).

Antalya is the greenhouse center of Turkey containing 47% (13,962 ha) of total Turkey's greenhouses (29,954 ha) covering both glasshouse and plastic. Forty years ago, farmers were using traditional heating systems and since the 2000s, modern heating systems have been introduced in the greenhouses. Banana production has now been switched to greenhouses to maintain higher quality using geothermal energy sources to keep the banana greenhouses heated during winters. Turkey has nearly 3 million tons of installed cold storage capacity, which is essential for exports and cold chain management. One of the advantages Turkey has is the availability of nearly 500,000 tons of naturally cooled underground storage facility (average 10 degree Celsius) for lemon, potato, and onions, thus saving operating costs. As cherries are the number one export product of Turkey, modern packaging facilities and sorting lines have been introduced to facilitate exports.

While Turkey has had traditionally some advantages as well as legislation that is compatible with EU import requirements, it is weak in branding, has inadequate inspection and control, inadequate share of R&D and infrastructure, inefficiencies in producer access to markets, and high dependence on external markets for agricultural inputs. Rising energy costs, political instability in the region, negative impacts of climate change on production and markets, migration from rural to urban areas that jeopardize production and sustainability and increasing input costs due to currency exchange fluctuations are some of the threats that need to be addressed.

We achieved our successes due to government support, which came in the form of loans covering 50% of costs for building greenhouses and cold chain storages. The government also provided support to producers in introducing good agricultural practices and organic farming. Financial support also was provided for refurbishment and renovation of infrastructure (cold storages) to be modernized into dynamically controlled atmosphere storages. Most companies now use cold chain management to be competitive in export markets. There is a good relationship between universities, government, growers, and private sector companies involved in the sector where knowledge, skills, and technologies are shared through annual meets and training events. Sometimes growers are taken on study tours to other countries to learn about technologies. The government has been covering 50% of the costs per grower. All these government interventions have helped the Turkish horticulture and vegetable sectors to grow.

5. Private Sector Initiatives in Agriculture
by Cedric Wijegunawardane, CFO, Silvermill, Sri Lanka

My presentation highlights how the private and the public sectors can get together to assist farmers. In Sri Lanka government support to agriculture is not remarkable. Agriculture contributes 7% to Sri Lanka's GDP while absorbing 30% of the country's labor force. It offers livelihood to about 70% of the rural population and utilizes 43%

of the total land area of the country. But agriculture provides nearly 80% of domestic food requirements.

Some of the key issues faced by the farmers are:

i. cropping in an unplanned manner with little or no market intelligence,
ii. oversupply of produce with inadequate food processing facilities locally available,
iii. no expertise to cope with natural disasters,
iv. little or no strength to cope with middlemen,
v. no buy back agreements in place,
vi. insufficient knowledge to maximize usage of water and land resources,
vii. reluctance to change traditional agricultural practices, and
viii. limited opportunities of employment for women in rural areas—who look for jobs in urban areas leaving husband and children behind, with other social consequences.

Silvermill is a coconut-based company. It ensures that coconut farmers derive better value from their land, as there is land fragmentation. Once farmers do not get good returns, they usually sell their land to real estate developers. That affects the company, which has survived for 99 years but may not go much longer in the future if coconut—the raw material—is not available. The national average yield is 45 coconuts per tree whereas expectations of yield are between 100 and 120 coconuts per tree.

Our company created a foundation under its corporate social responsibility efforts to channel its funds and those received from foreign buyers (in the US and EU) directly to improve farmers' well-being. Local banks are also interested in participating by providing some training on microcredits and lending. We also aligned ourselves with the SDGs of the United Nations (UN).

We started with agriculture livelihood improvement by conducting field demonstrations, and coconut seeding and distribution by working closely with government extension officers who train farmers while we provide the necessary funding through the foundation. That is where PPP takes place. After the war in the Northeast came to an end, we were involved in development activities such as provision of clean water and affordable energy, and thereby rely on the army to supply us with the human resources to conduct development activities. This also helps the army to build bridges and restore good relationship with the civilians. We also tie up with various government agencies to secure technologies such as drip irrigation and get these introduced to the farmers. Waste reduction is another area we work on. We get the farmers to work on beekeeping to improve pollination, solar energy projects, composting, sanitation, educational skills development and other areas.

Harnessing creative thinking and partnerships. Session panelists showed that it was possible for countries to climb up the food security and international trade ladder through innovation and technology.

Panel Discussion

Question from the audience: All your presentations are admirable. Your success stories are worth replicating. You have accomplished so much within a short period of time and enhanced global food value chain. You have started using technologies (Singapore and Thailand) to further improve production, processing, and marketing. My simple question is addressed to Singapore—you are having outgrower schemes (e.g., in Thailand). Can you come to the Philippines and set an outgrower scheme here to help us out?

Mio Oka, ADB: Relating to this question I have a supplementary one received over the EventAir App. What are the facilitating factors at the policy and governance level that supports your company to implement a successful program in Singapore? Maybe you can elaborate on your relationship with the government?

David Tan, Netatech Pte Ltd, Singapore: Singapore has lost a whole generation of agriculture talent. For many years the government did not focus on agriculture but more on food security. We have our National Trades Union Congress supermarket, Fairprice, that is owned by the government, which controls the prices and takes care of our food. Only in the last 5 years when we were feeling the impact of climate change and geopolitical tensions, has the government started to look into food security aspects and what Singapore can do to minimize risks. In the last 2 years, the government started pouring in funds to create an industry in research and training. We must be realistic about the fact that Singapore does not have enough farmland, unless Singapore decides to reclaim more land. One of the plans is to float our farm on a reservoir. As I mentioned during my presentation, the Filipino trainee we invited to our academy in Singapore is now back in the Philippines as our ambassador. We have set up our office in Bonifacio Global City to start the farming transformation. About assistance and funding, I believe the business itself must be sustainable, just like any enterprise. We cannot just depend on the government or grants forever. So, crop and multicrop planning are important. If we can plug all the leaks in the supply chain, cut down on the waste, we are able to cover costs and even increase our profit margins. What we did was to track and monitor the supply chain in order

to upstream the profit. So, our entity the CrowdFarmX is a borderless cooperative farming platform. Most of the time a cooperative is localized. We build a community that stretches across borders. That can only happen with the young generation. I talk a lot about capacity planning, meaning that we are building know-how within existing constraints. But we should be looking at capability planning and building. Under capacity planning we plan for the farmers and their families. Under capability planning we build the next generation. We need both generations to come together.

Mustafa Erkan, Akdeniz University, Turkey: Sometimes support from government with legislation and financing is important. But at other times, small teams achieve success. For example, if the government provides support to the enterprise or exporter to attend or join an international fair, it is important for the exporter to take this opportunity to know the competitor and what steps are essential in the market. Many enterprises have the financial means, but they do not know what to do because market intelligence is missing or weak. Hence, small steps are equally important that may lead to big success.

Forum Participant: My question is addressed to the Singapore presenter. In growing vegetables, is the presence of fish necessary or have you tried growing vegetables with the fish?

David Tan, Netatech Pte Ltd, Singapore: In our experience over 5 years, we found that we get optimum results by combining vegetable growing with aquaculture by topping up aquaculture wastewater with micronutrients and using this for watering the vegetables. The water flow loop need not be connected in this manner.

Forum Participant: My question is addressed to the Turkey presenter. Are you using pesticides in growing bananas? We love bananas in the Philippines but there is high pesticide use in our country. I am just wondering whether in your greenhouse bananas growers use pesticides.

Mustafa Erkan, Akdeniz University, Turkey: The answer is not always yes as we have different types of growers. Some growers grow bananas for export and these growers do not use pesticide as it is forbidden. But in some humid regions, growers have to use fungicide not pesticide. The underground storages have usually constant low temperature, and these can be used throughout the year for storage of perishable products.

Fernando Egidio Amaral, Ministry of Agriculture and Fisheries, Timor- Leste: I have been the national director for Agribusiness for almost 12 years now. I found the Singapore presentation very surprising. We are still concentrating on horizontal farming and now Singapore is promoting vertical farming. Are you interested in investing in your neighboring countries like Indonesia, Timor-Leste, Malaysia, because we still have land for you. We are all here together and we really want to solve the issue of food insecurity not simply by considering food security but linking it to employment creation and rural development. In these past 2 days we are all talking about economic structure in the rural areas linked to agribusiness, SME, private sector

involvement, and how to strengthen PPP. If you are interested, tell us because we want to solve the rural development problem in our country.

David Tan, Netatech Pte Ltd, Singapore: The short answer is yes. But recently when Ethiopian officials visited Singapore and requested us to build an urban farm, we refused. Ethiopian population is 100 million and the officials wanted to have a farm serving 5 million in the urban area. We asked them to go back and do something for the 95 million.

Fernando Egidio Amaral, Ministry of Agriculture and Fisheries, Timor- Leste: Welcome to Timor-Leste. We are looking for opportunities to visit your country to see for ourselves your farm. We would like you to invest in Timor- Leste so that we can export vegetables to your country. My question is addressed to the presenter from India. The agriculture model you are promoting in your country is for upstream or downstream and what is the share percentage?

Anoop Kumar, Farmer Producer Organization, India: We are promoting downstream at farmer-producer level. The primary producers are being organized, especially the small and marginal farmer, which do not have access to market as the large farm holders have. So basically, at bottom level and the model is value-chain integration so that we can cut the intermediate forces, which squeeze out the profitability of small farmers. That is the whole idea.

Fernando Egidio Amaral, Ministry of Agriculture and Fisheries, Timor- Leste: I found the presentation from Sri Lanka very interesting. It is difficult for us to encourage our people to grow coconut. People say it takes 4–5 years to mature. In the meantime how about our food security? Tell us a little bit about your story how you engage people to do this specific crop. When we presented a state crop policy, one professor said: "Fernando. You have to invest in cash crop because you have tropical weather conditions. Without investing in cash crop, it will be a disaster for you." But we still find difficulties in engaging rural populations to invest in industrial crops, especially coconut.

Forum Participant: I think we need to focus on healthy, nutritious, and safe food production. As a breast cancer survivor, I am very conscious of my health and so should everyone else be concerned about the health of each and everyone, especially the end consumers. My question is addressed to the experts whether we can apply specific technology geared to promote organic farming?

Mio Oka, ADB: I see your question relates to technology, which we discussed at length in one of the previous sessions. May I just request Cedric to respond on the question Fernando raised about growing coconuts?

Cedric Wijegunawardane, Silvermill, Sri Lanka: Usually a coconut tree would take 8 years to bear commercially marketable fruit. There is a long gestation period for the farmer. What we advocate to the farmer to go for multi-cropping like pepper, depending on soil conditions, while the coconut tree is growing. This will enable the farmer to have other income on short rotational basis.

Mio Oka, ADB: Charlie, I got two questions for you that I see on the EventsAir App. Could you please elaborate on the Government of Thailand's support in particular to One Tambon One Product (OTOP)? What is Thailand's approach in assessing consumer behavior to monitor supply and demand? What is your observation?

Chareonchai (Charlie) Khompatrapon, KMUTT, Thailand: OTOP was a project started over 10 years ago by the Government of Thailand to promote local products in any village. Almost every village in Thailand would compete, select the best products of that village, and then market that product in the larger province so that the products will gain the interest of the consumers and become known. That was a very good initiative as the Thai people got to know the special products of each province. Now, when we travel around, most consumers look for OTOP products. On the question related to consumer behavior, the analysis of behavior data is usually undertaken by the private sector. In the supply chain analysis, we differentiate and keep track of three factors, such as information, materials, and fund flow. Otherwise if we mix all these factors, we will be unable to solve the issues in the food supply chain. We track each aspect separately—e.g., information using new technologies, or materials dealing with, for example, delivery of food, or funding. All three are separate but we need to analyze them separately and bring them together to seek out matches in order to solve problems in the food supply chain.

Mio Oka, ADB: Mr. Kumar, to what extent has your program reached out to the extreme poor or marginal in the state? How can that affect them?

Anoop Kumar, Farmer Producer Organization, India: The program reaches out to resource poor, marginal, and small farmers. But of course, the program does not reach out to the landless and extreme poor. When farm income increases within the village, there is definitely overall prosperity and the extreme poor can get better jobs. Farming enterprise in general becomes a little bit more profitable. In future we would like to focus more on gender as women play a very important role in organizing these producers. Then we will turn to those who are not holders.

Augusto de Silva, Ministry of Agriculture and Fisheries, Timor-Leste: I have a question for the presenter from India as the program is addressing both downstream and upstream. In Timor-Leste, farmers' associations will sell the produce where the government has established a shop to receive farmer's produce. Every month, the government pays the producers 80% of their income. Farmers send their representatives, sell their produce and receive 80% of the value of their produce. The 20% retained by the shop is for the future operations of the shop and not for the government. With this model in mind (which I know from Timor-Leste), what kind of model do you use? Are you giving more to the farmers or you are retaining more for the government? The model itself is still unclear to me. That is why I wish to know whether the farmers are getting more, or the government is keeping more, or the private sector is getting more, making the farmers worse off. We are talking about food security, sustainability, and involvement of smallholder farms. Farmers are very important in the link up to all these actors.

Anoop Kumar, Farmer Producer Organization, India: The program is about improving the rural marketplace infrastructure. The Government of India has now come out with a large program to improve rural market infrastructure. But the model is integrating growers producing high-value crops with the urban consumer. For these growers, the rural markets are not the best places to sell. We have the farmer market concept, which is nothing but a temporary market on weekends where these growers go and sell their produce at a premium price and thus their profitability increases. The whole idea is to support the growers to reach paying customers who can give them the best value for their crops. We work on removing all those hindrances to promote integration of producers in the market.

Mio Oka, ADB: I have a question for David. How is the demand for your products? What is the market share? What are the marketing activities you have initially implemented to ensure demand for the product?

David Tan, Netatech Pte Ltd, Singapore: These are very important questions. Positioning and segmentation are important. In Singapore, Asian greens make up 80% of the vegetable market share. Australians may think lettuce has the highest share and Israelis may think cucumber is the most important vegetable. Even in the Asian green segment, we need to slice down to the niche. The difference in price for Asian greens starts from $0.50 per pack from the PRC to $3.00 for organic. You need to decide where you are positioning yourself. Our farm is not organic yet, but we are pesticide-free. We are doing fast rotation crops and multi-crops. We are able to operate a farm like a factory. The demand is for a multi-variety of crops and we position our product at US$2.50 per pack (which is 250g). The stratification of the market is big and so we can upstream profit back to the farm. When we help the farm, we are helping not just the farmer but a community. We help the school; we help the children. We hire the mothers and ensure that they send their kids to school. Otherwise we would not be part of a community. Segmentation and positioning are important.

Promoting inclusiveness. Several organizations and clients are joining hands on portals and apps to provide their services on an easy-to-use platform.

Financing Agripreneurs and Rural Small and Medium-Sized Enterprises

Discussion in this session focused on innovative financing mechanisms, including emerging ICT platforms and FinTech to extend credit and banking services to small and dispersed borrowers, i.e., agripreneur and SMEs for farm and nonfarm operations in rural areas. The panelists explored how they see the future and what is required from the public sector in terms of enabling policies and creating level playing field to foster and expand pro-farmer smart financing options and opportunities.

Keynote Address

David Davies, Founder and CEO, AgUnity, Australia

This $50 phone will enable a small farmer to lift herself or himself out of poverty. It may be the most single, life-changing possession she or he ever owns. It transforms the farmer into a small enterprise, have a digital identity, and provides her/him the means of tracking what the farm produces. It also enables the small farmer to become a valid recipient for loans, credit, and become part of a natural community.

The most important challenge in the world today is eliminating poverty. It is number one on the UN SDGs for a very good reason—while one-third of the world still lives in poverty, we might be unable to address other big challenges like food security, deforestation, climate change. These are all connected. Of those in poverty, the vast majority are in farming, fishing or a part of their remote community and food supply chains. And good organizations, like you all here today, struggle with the one big issue:

connecting with people in remote, rural areas effectively and efficiently. And that is what my company does: we connect good organizations with those last-mile users.

We cannot solve poverty without addressing financial inclusion, and we cannot bring about financial inclusion at any sort of scale without technology that is relevant and useful to the people you are giving it to. A bit over a decade ago, the iPhone changed the world for most people like us. These smartphones gave us convenience and entertainment in our hands in ways that was previously unimaginable. But they did not help the poor. A modern smartphone might cost as much as a year's income of a small farmer. As much as farmers might enjoy Facebook, music, and YouTube, as we all do, those things do not help them in their work, earn more, or feed their children.

Connecting with the last-mile users. David Davies, CEO of Agunity, encouraged the audience to develop technology solutions that are easy for small farmers face in remote areas to understand and helps them sort out their daily needs.

Technology Solutions

If you want to transform the lives of these people, it must be with a technology that is relevant to them. It needs to help them do the very basic things that they do daily, in a simple and intuitive way: ordering inputs, renting equipment, selling produce, and getting paid for it. The most basic thing is record keeping, something that we in most countries have taken for granted for over a hundred years. We have forgotten how important that simple accounting is to many in the world. This is the single biggest opportunity in the world: 2 billion people, of which there are half a billion farmers, most of them with no access to credit. Most of them could vastly increase their income and productivity with the right tools. But you cannot just give a smartphone to a farmer who has never had one before and expect it to be useful. How iPhone became such a game changer was how relevant it was to what we do every day. Who still remembers here in the room how we booked a hotel 20 years ago? This is how much things have changed but not for small farmers in the developing world. They still do things in same traditional way. And that is exactly what we need to change for low-income farmers of the world. Give them something that is relevant and changes the things they do daily.

The solution needs to be easy-to-understand and solve all the technical challenges of their area, such as: user experience, low literacy of people who may never have owned any technology before in their lives, poor connectivity challenges in remote regions, and securely recording transactions to improve trust and cooperation. Finally, you need a cost-effective way of deploying and supporting in remote regions so that you are not going out just to support a couple of individual users. What farmers really need is some sort of a super app where everything works together in some way, not dozens of little applications that all do small parts of the puzzle and requiring to user to struggle with separate passwords and separate applications and keeping everything updated. Even I struggle to keep everything on my iPhone working. Imagine how difficult it is for a 60-year-old farmer who has received a smartphone for the first time.

We built our platform like an app store in reverse. We encourage others to migrate their solutions onto the platform so that we can integrate with others and all work together. And all those other applications can build their own communities on the platform. Once a community builds a relevant technology, it becomes more and more

compelling for others to use it. By encouraging others to build their communities of users, the whole system links and works together. For users, what is important is that is simple to use and sort out their daily needs. But our actual customers are those organizations that need to connect with last-mile users (e.g., small farmers in remote areas). The sellers, who need a more efficient way to provide products and services at scale and solve the means of collecting payment. The commodity buyers, who want to trace produce or buy ethically or improve quality and show origin of goods to their customers. The NGOs that are already investing millions of dollars and need transparency of the impact of their projects. And most relevant to this forum, the banks, the insurances, and microcredit companies, that need a better way to connect with those last-mile communities.

The *Forbes* magazine thinks this is a $100 trillion opportunity. My background was in global investment banking, so it does not surprise me that banks see this as a last great frontier opportunity. But after spending the last 3 years working with very small communities of low-income farmers, I think that the way most are approaching the subject is dead wrong. Taking advanced technology and making it accessible might look easy, such as taking modern farming systems and disseminating knowledge to farmers might seem the best and easy way. But it is the wrong way because it excludes the very poor. You are giving middle-level farmers better technology and providing them an advantage, while the poor, the very small-scale, the illiterate get left out; it creates a big gap between the haves and the have-nots. Instead of moving the technology down the pyramid, let us try to do the reverse. Instead let us address the very basic needs of the very bottom of the pyramid and slowly make it more powerful and functional, and adding more features. Thereby, we help everyone up to a solid level. This is the key to making this a good opportunity for financial service providers as well. Once you organize very small farmers into groups or cooperatives, banks, and financial service providers can deal with them effectively as a group.

We did not reach out to banks. We were presenting this agriculture solution, when banks came up to us and said—could we roll out our mobile banking in rural areas using this platform? The simple answer was yes although there is a lot still to be done to roll out mobile banking to remote, rural areas. By us focusing on the farmer's real needs, we inadvertently solved the big challenges that were impeding the financial inclusion of the very last mile. The banks loved the idea as they linked the opening of an account with them with free delivery of an awesome smartphone with an app that has banking and other service providers on the same platform. So, whether it be financial services or any other services that improve the lives of small farmers, we are here to help connect with the last-mile users.

Panel Discussion

Donneth Walton, ADB: It seems like a great idea for providing a one-stop shop of services—you bring the farmer and the service providers together, including the banks. But how do you make money? How does the app make money? Is the app being used globally or region specifically? How do you get the message out?

David Davies, Ag Unity, Australia: There are two phases to introducing the app to farmers. In the long term we get small transaction fees from millions of farmers. Any company needs to be viable while at scale and that is where the group of service providers came. We found that many of them have a very real return on investment for connecting with last mile small users. The World Food Programme is paying for the project in Ethiopia. It is already investing millions of dollars and they are not sure what is happening. For the small cost of a $50 phone for the farmer they see the impact of the farmer and can deploy other services. Commodity buyers of coffee and cocoa often get poor produce at the end of the supply chain, but they do not know why some coffee is spoiling and not others. For $50 it is a good return on investment for them to improve the source of produce. Service providers selling inputs is a different model. But banks and financial service providers like to use the app as they have a real return on their investment. The service providers fund most of our projects and in return they get connectivity to the last mile. In the past they just lacked the appropriate tool to connect.

Coming to the forum here is important for us and so is working with NGOs. We have a pipeline of 20 different countries waiting for us to come and deploy our platform. Our challenge at the moment is to scale up all opportunities. Currently, we are in Ethiopia, Sierra Leone, Trinidad and Tobago, Indonesia, Papua New Guinea, and Solomon Islands; we are quite spread out at the moment but are preparing projects in India, Bhutan, the Philippines, Mali, and South Africa. Within the next year we aim to be across a very large part of the world.

Ramon Duarte, Union Bank Philippines: I can relate very well to what David has just described as connecting to the last mile. We in the Philippines are also trying problem-solving in that space. I just want to share with you the insights we have gained around the concept of co-creation. Our bank is responding to digitalization by developing a platform where ultimately, we seek to move all our customers, mainly private sector and large corporate players, to the online platform. Banks are required to rethink, redesign, and rejig all their products and services. We found along the way that the bank's services need to be closely integrated with the services of the online platform and in doing so we have to start from scratch and throw our conventional thinking out the window. We found it best to go about doing these changes by applying the concept of co-creation. Elinor Ostrom, Nobel laureate for Economics, said, "There is no reason that politicians and bureaucrats, no matter how well-meaning, are better at solving problems than people on the spot, who have the greater incentive to get the solutions right." That was the insight we had when it comes to solving problems in this sector. We found that the top-down approach, where designs are being rolled out from the top based on assumptions, has not worked well. Hence, we work with our customer firms, which have become agile, to design the platform and its services based on their needs and choices by fully engaging them in the process. We are still a long way from solving this problem but right now having this mindset of co-creation and using the technology and tools (availability of data, cloud, mobile phone). We have a new approach. This is certainly not the forte of the Union Bank, but we have gained confidence in our work. I have two projects, one in the southern part of the Philippines with indigenous people, working with an agripreneur, who is on the ground working with the indigenous community, and redesigning the platform with their inputs. There is a second project in the Visayas, where we are

co-creating an approach to finance tuna fishers in a sustainable manner. We also run hackathons with enterprises, fintechs and start-ups, and communities.

Donneth Walton, ADB: I still want to hear from all of you how can an organization like ADB support what you are doing? Do you see a role for government in this process at all? If yes, what should that role be?

Anil Kumar, Samunnati Finance, India: We as an entity are a private enterprise focused only on financing agriculture. We do this with two objectives: (i) how do we make the value chains that we operate in by moving to a higher equilibrium? (ii) how do we make markets work for smallholder farmers in India at this point in time? Most of us coming from a debit-credit (banking) background understand that working capital is a key constraint most of the agri-enterprises have. Removing working capital constraint could unlock a lot of potential in the value chain and that can bridge the gap between supply and demand regarding movement of cashflows. If we must do that in a sector like agriculture, we must customize these services for the agri-enterprises for each value chain. We do not consider ourselves a product company, rather a solution company. We offer working capital products from one day to investment credit up to 5 years and volumes ranging from $50 to $2 million. What is close to our heart is how to make markets work for smallholder farmers. We work with farmer collectives as a company and the moment we started working with farmer collectives we realized that finance is important but not enough. There are other dimensions—market linkages, advisory services, as well as institution-building that become relevant in addition to finance.

As a finance professional, I feel all these services need to be provided, not as a goodwill gesture or as part of corporate social responsibility but to mitigate the risk of cashflows associated with the activity. We engage with farmer collectives to build their institutional capacity, work with them in their operational structures, and more importantly to enable market linkages for them. It is not surprising that some of the farmer collectives we work ask us to link them to markets rather than lend them money. We have been active for the last 5 years and still a young organization, but we have had a reasonable scale so far and facilitated both access to finance and market linkages to about $400 million working with about 600 farmer collectives—which in turn have a membership base of about 2 million farmers. We are a unique organization because an entity like ours does not exist in India at this point in time. I am not familiar with the global landscape though. We are a lender, a market linkages company, and a capacity building organization.

One of the constraints we as a private enterprise and a nonbank finance company face in India is that government and multilateral development organizations focus on delivery of their projects through banks. Nonbanks are not considered to be part of that delivery mechanism. In my view, if the intention is to reach the ultimate beneficiary, the vehicle to reach that target group should be irrelevant. One should be agnostic to the delivery vehicle but focus on the destination. Some of the projects ADB is considering under a PPP dimension could explore other forms of entities that could make the program meaningful and successful for the intended beneficiaries. Furthermore, we as an entity also focus on SDGs and climate-smart agriculture. By

The vital role of the public ecosystem. There is a huge role for the public ecosystem, whether it is federal government, state government, institutions like ADB. They have to come together to accelerate adoption of innovations for the benefit of farmers.

their very nature, most of the projects under climate-smart agriculture are either not proven or risky. Are there guarantee structures that can come together so that farmer collectives, and ultimately the farming families, which take up climate-smart projects are protected from unintended losses that might come about? Entities like ours, which operate these programs sustainably, could also be protected should there be a loss. So ADB may want to look at specific guarantee structures and enablers so that a positive nudge is given to pursuing projects that are directly related to SDGs and climate-smart agriculture.

Donneth Walton, ADB: You have addressed one of the issues of how to manage risk. The idea of having some sort of guarantee scheme, which is an important one, maybe a challenge for some who are in public sector lending. Guarantees often come from government. The issue will be willingness of government providing guarantees to a nonbank entity. But that is food for thought.

Hemendra Mathur, ThinkAg and Bharat Innovation Fund, India: I want to talk about three points: (i) how Agripreneurship is evolving in India, and my experience has been mostly in India although this could be relevant to other developing countries in Asia too, (ii) how these innovations are enabling access to finance for smallholder farmers as well as the value chain players, (iii) the role of public ecosystem and institutions like ADB in accelerating adoption of innovations for the benefit of farmers.

On Agripreneurship or agritech, the term used in India, we have seen phenomenal progress, particularly in the last 3–5 years. We have about 2,000 registered agritech entrepreneurs as part of the start-up India program, of which at least 500 entrepreneurs have passed their prototyping stage. This is unprecedented in the history of agriculture in India that we are seeing so many entrepreneurs coming into agriculture. The most interesting part of this evolution is that many come from a non-agriculture background—many of them techies who have quit their high paying jobs and got into building models for agriculture in India. What they bring to the sector is

a lot of process orientation and understanding of technology, which is critical for the sector. These entrepreneurs are pursuing four or five themes. The first and foremost is market linkages. They are essentially trying to build a demand-driven supply chain. In India most of the supply chain has been supply driven and it continues to be that way. The new models are building demand orientation in the supply chain. In the supply chain in India there are essential 6–8 intermediaries. The new models are trying to reduce this to between 2–5. This makes the supply chain more transparent, efficient, and ultimately benefiting the farmers, who are not only assured of income because of the demand for their produce, but the ability to raise low-cost lending goes up significantly. There is a visible buyer who will pay for what the farmer is going to produce. Market linkage models will enable solutions to a lot of these financial challenges that banks and nonbanking financial corporations have.

The second theme is more around enabling access to quality agricultural inputs at the right time and price for farmers. There is some confusion that this is all about online outlets. These models require prescriptive selling, whereby product selling is also tied to diagnostics of soil, crop, and weather, to come up with solutions that are then sold to the customer, and not just products. That is one major distinction agritech models have compared to consumer-oriented internet online shops. There is also a need to have offline presence. Farmers usually do not trust online models. People on the ground must be present to establish that trust. The final delivery is an issue as unfortunately Google maps do not always work in rural India. Capabilities need to be built that enable delivery to the last mile. Interestingly, in the process, agritechs solve the issue of financing. Unfortunately, a lot of agri financing in India under private sector lending is not directed toward use of agricultural inputs. In fact, most of it is in the form of personal loans. In models targeting selling to farmers, many integrate finance for purchase of inputs. Input opportunity in India is over a $100 billion, which translates to financing opportunity. This, I think, will go a long way to enabling farmers to purchase inputs.

The third theme is around data. We have seen multiple start ups trying to capture data, and synthesize data using a combination of hardware and interesting algorithms. Hardware could be satellite imagery, drones, mobile phones, and spectrometers. Hardware is getting more commoditized. The secret lies in the algorithms that they are developing focusing around monitoring of crops from sowing to harvest, detecting farm boundaries, estimating yields, and assessing quality. If supply chain has to become truly efficient, data is critical and has a huge role to play. Unfortunately, we have so far never had accurate and timely data to enable access of farmers to finance and other goods and services. Data and financing go together. These are two big components that will integrate the entire supply chain. Samunnati (panelist Anil Kumar) has demonstrated that financing is profitable and sustainable, and we need more of such firms at a large scale. The common theme across all financial solutions is to innovate ways to onboard farmers conducting due diligence (know your customer), risk assessment, building interesting credit-scoring models, which reflect not only asset ownership or income generation potential but also behavioral parameters. We are seeing early stages of FinTech innovations in agritech. Hopefully with the ecosystem maturing we will see a lot of scalable models.

Postharvest solutions are another important theme. There is a lot of food wastage in a country like India where we have more than 1.3 billion consumers. Solutions around warehousing, cold storage, and postharvest financing are critical. Solutions around food fortification, nutrition, alternative proteins are areas that may require increased attention from start-ups building online models.

There is a huge role for the public ecosystem, whether it is federal government, state government, institutions like ADB. They have to come together to make it happen. First, there should be an open source digital platform, an Agristats, which can be accessed by banks, insurance companies, government, start-ups, and farmers. We have 150 million farmers of which 120 million are small and marginal spread across 600,000 villages. How do you reach out to them and how do they access innovations and technology? Parameters needed could be about who the farmer is, what is his or her location, what does the farm look like, what he or she is growing. Essentially, Agristats links the farmer to the farm ID. It can have multiple layers, such as soil nutrition layer, water stress layer, and mandi (market) layer, which can build a lot of interesting products and services beneficial to farmers. That is something the government feels excited about. I am not sure what role ADB can play but I am pushing for some pilots at a state level right now.

In order to reach out to farmers, there is a need for a local entrepreneurial ecosystem. Innovators and start-ups sitting in large urban centers cannot do it on their own and they need people on the ground. Building entrepreneurs and service providers at a local level is what is needed. Most of the capacity building work currently undertaken by Tata Trust or Syngenta Foundation needs to be supplemented by government efforts. There are hardly any applications of drones in India. There are a few people who know how to operate drones in rural India. We need training that will ultimately benefit farmers. Start-ups also need to connect to the corporate world, research institutions, and policymakers. Hence, there is a need to create a platform that enables this networking; I have founded ThinkAg, which is trying to do that. There are about 20 corporate members working with start-ups to pilot some of the innovations. Prototyping takes lot of time and that is where start-ups need hand holding. I am sure there is huge scope for many more such platforms to be created. And last, there is a huge need for catalytic capital if these innovations have been scaled up. Unfortunately, venture capital kicks in at a later stage, typically when prototypes have been tested and the product is ready to be serialized. The public sector needs to come in to fill the gap prior to serialization as this is a risky stage of trial-and-error and needs high risk capital. May be a small fund of $25 million–$30 million may go some way to hand hold and promote the innovations to see fruition. There has been deliberation ongoing for quite some time within government and maybe ADB could provide guidance and support. As Anil mentioned in his video, let's write this story together. We all need to come together and ADB has a huge role to play and can become an active participant in this. One of the issues you underscored is the importance of having a digital network infrastructure in place, which is critical, as a lot of rural areas do not have good functioning connectivity. There is a role for PPP. About a month ago I was in Kazakhstan where we are looking at a number of sector investments. One of them was the livestock industry. In Kazakhstan a smallholder has about 24 ha, which is unusual. One of the participants at a workshop was saying that

in the rural area he had to hunt for a high spot for his mobile phone to receive a signal. Access to correct data and information is critical. What I hear from all of you is it is not just about financing but also about a full-service provision for the farmers.

Chori Mirzaev, Turonbank, Uzbekistan: In Uzbekistan we are interested in studying and learning from other countries' experience in implementing state policy on development of agricultural production as well as providing support and financing for SMEs in rural areas. Currently, Uzbekistan is undergoing large-scale reforms aimed at modernizing economic sectors and development of private entrepreneurship including in the agriculture sector. We think that reforms in agriculture and increasing its competitiveness are key to improving the well-being of rural areas. ADB has established a long term relationship with our country initiated in 1995. Since then Uzbekistan has received more than $7 billion including two private sector loans amounting to $225 million and technical assistance at $87 million. Joint programs and projects implemented in Uzbekistan with ADB are focused mainly on key areas like support to agriculture, promotion of private entrepreneurship, regional cooperation in transport, as well as improvement of social sector such as protection of children and education. We are delighted to acknowledge that on the first day of the forum President Takehiko Nakao of ADB deemed it suitable to mention projects that are being successfully implemented in the agriculture sector of Uzbekistan. In recent years we have received loans amounting to $349 million to finance a project on Horticulture Value Chain Infrastructure.[19] As a result of this ADB-funded project more than 6,000 jobs were or are being created out of which 4,000 are for males and 2,000 for females. It is worth mentioning here that Turonbank, which I represent here, is one of the active financial institutions in Uzbekistan that finances the agricultural project. In the last 2 years our bank attracted more than $90 million from ADB to finance the farmers and small business to purchase agricultural machinery, equipment for drying vegetables and fruits as well as refrigeration equipment. Using the funds provided by ADB, our bank financed 63 projects totaling $61 million enabling the construction of greenhouse complexes for $41 million, processing of agricultural products for $12 million, and procurement of a cold storage equipment for $8 million. It is important to mention that implementation of these projects resulted in creation of more than 1,500 new jobs in the agricultural sector. In addition, the bank plans to extend financing for an additional 41 projects amounting to $30 million for supporting of similar projects. Through this additional financing another 1,000 jobs are expected to be created. Besides these investments the bank has applied for an additional $20 million for value chain improvement in the livestock sector.

We understand the significance of liberalization in the agriculture sector and its role in the provision of safe and nutritious food to a fast-growing population of the country. The state acts as a leading reformer by taking proactive measures. To foster timely implementation, Uzbekistan has created an Agroindustry and Food Security Agency responsible for realization and monitoring of the projects in the agriculture sector. Our government in Uzbekistan supports farmers and SMEs by reimbursing 50% of the interest on their loans and provides them with 50% collateral for subloans. The government also compensates the cost of pumps if farmers cultivate more than 35 ha

[19] ADB. 2018. Uzbekistan: Horticulture Value Chain Infrastructure Project.

of land by drip irrigation and rewards farmers with a $1,000 per ha if they use the drip irrigation system. Farmers also enjoy certain tax breaks. Government also supports farmers who export produce.

Subhadeep Sanyal, Omnivore Capital, India: I represent a venture capital fund from India. Let me try and illustrate some experience we have gained over the last decade coming from a venture capital lens in India. On the macro level in India, there are 150 million farmers, most of them smallholders. Rural telephony is going through the roof. We have between 500–600 million internet subscribers today in the country, half of whom are rural based. It is a well-made point that the only way to disrupt agriculture in India is to go digital.

At Omnivore Capital we believe in supporting entrepreneurs to solve three challenges: (i) technologies, which can help improve profitability of farmers; (ii) technologies, which can improve sustainability of Indian farming and, by that logic, smallholder farming; and (iii) technologies, which can reduce the uncertainty of smallholder farmers. We manage about $150 million, a fairly small fund looking at early stage enterprises and have so far invested in about 20 firms. It has been challenging. There is a portfolio company we support called DeHaat, which both Anil and Hemendra know well. DeHaat works in the most difficult states of India in terms of smallest of farm holdings, most with fragmented landholdings in the state of Bihar located in the Eastern part of India. The company is largely an agri-services platform for farmers having close to 250,000 farmers subscribing. All services such as access to inputs, finance, markets, unbiased farm advisory, are provided to farmers not only through a digital layer but also through a physical layer of entrepreneurs. That is important as we cannot expect all rural entrepreneurs to be fancy in terms of their know-how of technology. These are basically franchises or entrepreneurs themselves who can augment their income by providing services. They are farmers also, so they understand the local context required for working in that particular village or area. That is one kind of model in which we have invested between $4 million–$5 million in that company and the multiplier effect is amazing.

Another such example is Stellapps working in dairy. Milk comprises 4% of India's GDP, which is massive, but it comes with its challenges as an average dairy farmer in India may own only two cows. There are millions of dairy farmers and all that needs to be harnessed with challenges around quality, aggregation, payments, real-time services. The first problem here, as Hemendra alluded, was how to get real and live data across all small dairy farmers. Herein, cooperatives came in handy, and start-ups like Stellapps came into the picture to build an Internet of Things layer digitizing small a 2–3 animal dairy farmer in India and not a 50–100 animal farm as in New Zealand.

In the last 5 years, we have seen a lot of agritech companies in India move beyond the country to Indonesia, Viet Nam, countries in South America, and parts of Africa. Given that there is scope of connecting India and other similar developing economies, that is one area where ADB could be hugely helpful in terms of their access in South and Southeast Asian countries. What we see in India is an abundance of entrepreneurial talent and solutions that can be exported, shared, and partnered with local entrepreneurs. The other area is tackling the gap in the early stages of

product development initiated by start-ups and there is a working capital gap for companies in agriculture. Unlike a lot of purely technology companies like consumer internet companies, start-ups in the agri sector do not tend to burn money. If there is some way of boosting availability of working capital or shoring up initial costs of may be larger start-ups, this would be an area ADB could explore to support. In India we also have a massive gap in private equity. In agriculture, there is ample scope to do infrastructure development as well as scaling up companies. That is another area ADB may look at.

Alex L.J. Shyy, International Cooperation and Development Fund, Taipei, PRC: While ADB is engaged in multilateral assistance, my institution is engaged in bilateral cooperation. We have tools of technical and financial cooperation and capacity building support and we look for opportunities to integrate and use our tools to help our partners. In agriculture and financing, we see it as comprising the whole value chain and we believe financial inclusion is part of the agriculture infrastructure development. We partner with microfinance institutions as these are close to farmers' daily activities and we support agricultural infrastructure investments in roads, irrigation, and power supply to rural farmers as well as storage, including cold storage facilities. However, the most important aspect is the value chain and not just focus on investments in production. There are many stakeholders from suppliers, farmers, cooperatives, postharvest processors to customers. As development agencies, we try to fix holes in the net of the agriculture value chain. My institution provides technical assistance and financial tools to improve the value chain and put effort in institution building (cooperatives). Initially, we may provide subsidies to the beneficiaries, which are paid back by farmers to the project over its lifetime (3–4 years). During this period, our technical experts assist the cooperatives to manage accounts, deposit funds in banks or financial institutions, thus building up a relationship of trust between the financial institutions and the cooperative. This makes it easier for cooperatives to borrow. Financial specialists deployed by our institution help farmers design appropriate financial systems for the cooperative. Sometimes we use third party service providers and innovative companies to design software and simple and user- friendly smartphone apps specifically targeted to the needs of the beneficiaries. On Bali island in Indonesia we had the One Village, One Product Agribusiness project to process citrus fruits, bring about multi-stakeholders, and create a cooperative that makes it easier for farmers to access financial support and credit. One of the conditions of membership in the cooperative is that a portion must be female members and there are a number of cooperatives that are 100% organized and managed by women. On disseminating technology, we support use of remote sensing and GIS as well as monitoring sensors in the farmer's fields on the supply and/or farmer's side and setting up simple weather stations to monitor micro-climate in the communities. Use of these technologies makes smallholders more competitive and financial institutions find it easier to deal with such farmer cooperatives and provide financial services.

Suzanne Kay Robertson, ADB: The panelists have given us a lot of interesting points to think about today. Access to finance is important but it is not the only component we need when it comes to doing value chain development. We need to be looking at an integrated approach to value chain of which finance and access to finance is a crucial and integral component but not the only one. When I look at how

to deliver on this, the other issue that has been highlighted here is the cooperation between the public and private sectors. That is where ADB can come in as an added value partner to provide services. It is in that context that we can look at providing an enabling environment to improve access to finance, provide a better linkage between public and private sectors and within the value chain improving linkages between enterprises, cooperatives, and smallholder farmers and bring this all into one integrated approach. In some ADB projects we are already undertaking integrated approaches, which have components of financial intermediaries looking at different ways of applying the services that address the real need. Agriculture in every country, every area, every value chain is different. We cannot apply the same services, and do not have the same needs. ADB can help identify those gaps, look at how to link the public and private sectors, and gauge the benefit for smallholder farmers. In that sense we look forward to strengthening cooperation between public and private sectors

Forum participant: Although there are a lot of initiatives from government and the private sector working with smallholder farmers. Still, the issue is access. I am impressed with experience shared by Taipei, China as they are also working with women cooperatives and I would like to know about experience of other panelists investing in and working with smallholder cooperatives. In my view this is the only way to bundle services to farmers. There are a lot of cooperatives, though not all are well capacitated, who receive services of extension, credit, and access to market. So may be the panelists can share some of their experience in integrating services and innovative technologies for cooperatives.

Anil Kumar, Samunnati Finance, India: I would like to share information about the work the Government of India is doing to address the farmer collectives. They in fact have set up a separate division called Small Farmers Agri Consortium with the sole focus on promoting farmer collectives from scratch and have built an ecosystem of entities that are specialized in community mobilization, entities that have the capacity to deal with fledgling collectives. In addition, there are several schemes that the Government of India has brought about to support the entities in terms of capacity building grants, matching equity, price stabilization, as well as a host of subsidy measures. On the execution side, the impact could be larger if private sector is opted in. That is where we see a lot of traction, at least in the context of India. On gender, I am glad that Alex Shyy mentioned this. In our experience, we see some activities that female entrepreneurs tend to favor and women entering into agri-value chain. We realized this that 70% of the entities we were working with had women. We realized that certain activities like dairy or vegetable growing and processing tend to employ more women. Then we made sure that such or similar activities that specifically attract women constitute a significant portion of our overall investment exposure in working the agricultural value chain. Our realization is that rather than pursuing the gender dimension in isolation, we might as well integrate it in our overall strategy so that it grows as a natural part of the business.

Ramon Duarte, Union Bank Philippines: On the critical and growing role of cooperatives in the Philippines, we certainly need more cooperatives with increasing roles. As much as private banks, like ourselves, want to reach out, many times we welcome working with cooperatives on the ground who know their member-farmers

better than us. Other than the established and known roles of cooperatives, there is a new role coming with the wave of technology. To enable the use of blockchain, there is always an issue of knowing your client, who can speak for the farmers, and can attest to what is going on. In areas where we are experimenting with the smallest of farmers, there is nobody there. Even government is not really present. We do not even have access to biometric identification of these farmers. The role of cooperatives is getting bigger than ever, and they are key to making high-tech solutions feasible and we need them.

David Davies, Ag Unity, Australia: I could not agree more. We work in some remote regions and often the cooperative is the only form identity the farmer has. Farmers bring cocoa beans to the cooperatives and that is the only way we can identify them. There is no government record and the smallholder farmers' cooperative membership is the only way their identification shows up in the digital world and becomes available to access.

Forum participant: I understand that we need an integrated and holistic approach. In Southeast Asia I understand there are 60 million poverty-stricken families as well as those who belong to the hunger-stricken families and adding another 30 million unemployed youth—so 90 million are our primary target group right now. In the past few days, I have been listening to the various models as well as gaps that exist in their implementation. I understand that the challenges can be easily resolved and make those 90 million easily recover from poverty and hunger. What if ADB makes available a digital platform, wherein different countries of Southeast Asia can combine, unite, and cooperate to provide, by representing the affected segments of their people, business plans, and marketing plans that allow the affected population of 90 million to work on producing and exporting agricultural produce. The products thus produced could be branded differently—extolling virtues of climate change, free, etc. Will it be possible for ADB to provide a digital platform for ASEAN countries?

Donneth Walton, ADB: ADB would certainly be willing to engage in that sort of an undertaking if governments request it. When we mention ADB, we have to think about two different parts. We have a private sector side and a public sector side. We work with governments, put together a program, and agree on types of interventions or projects we will be supporting. If governments want to borrow for these projects and are these are feasible, we can do it. I think the question that you pose may be more suitable to the private sector side of ADB operations.

Ramon Duarte, Union Bank Philippines: Just by way of sharing, the gentleman envisions a rather large concept. We work with the Monetary Authority of Singapore and they have a program called Business sans Borders and perhaps it could be the beginning of such a concept. They plan to build a platform of platforms essentially trying to interconnect and initially to give visibility from one market to the other by making information on what one group of SMEs are producing available to the demand side across the region through the platform. This is something Singapore is championing. India is part of that and so is the Philippines.

Forum participant: I would like to direct my question to Mr. Ramon Duarte. In the Philippines we have the Agri-Agra Reform Credit Act of 2009, which mandates all

banks private or government owned to set aside 25% of total lending for agriculture and fisheries, 10% of which should be exclusively allocated to agrarian reform beneficiaries. Since its implementation, banks have not met that requirement. My question is: can you share with us mechanisms or programs undertaken by your bank that can be accessed by small farmers or fisher folk and what are the factors that hinder implementation of the law?

Ramon Duarte, Union Bank Philippines: This is a very frequent question that we get, particularly here because of the Agra Law we have. It is difficult for me to answer that and I think no bank can really answer that very easily because almost all banks are not in compliance with the Agra Law. The reasons for that are simple. It is not a workable proposition for us in the current state of things. That is why we are saying that even though agriculture is not our forte and we do not have particular strengths in this sector. We are looking at new ways of implementing it, which is why it has to come from alternative scoring models. With availability of technology, data, partners on the ground, we can look at developing those models and perhaps live up to the purpose of the law. But currently we and other banks do not see any solution to comply with the law in a sustainable way.

Hemendra Mathur, ThinkAg and Bharat Innovation Fund, India: There are also some lessons from India. We have this concept of priority sector lending, whereby banks are supposed to lend 18% of their book to farming and allied activities, including direct and indirect financing. The target for the current year is about $180 billion, which is a large number. There are two challenges: firstly, most of this lending is servicing medium and large farmers, probably 30–40 million and yet about a 100 million are deprived of this funding. There is still a huge access issue. Unfortunately, most banks do not have branches in rural areas, which is one of the reasons not to lend. So we come back to the idea of a digital platform—how do we enable a platform to solve some of the issues and most banks are quite open to such ideas where they can have access to a digital platform and can do basic compliance checks using the platform. Secondly, I think this kind of lending does not differentiate between lending for personal usage and lending for productive usage. That is another challenge. So how do we make a significant part of this lending for productive purposes, which could be buying of inputs, taking care of livestock, or paying for services etc. That is another area we need to be thinking about and make it more effective.

Forum participant: Have you considered that technology is limited on non-smartphones and most farmers cannot afford smartphones. How do you deal with that?

David Davies, Ag Unity, Australia: When we first rolled out our program in Kenya, we tried to get farmers to install apps on their phones. That was a failure. It cost us more as an organization to try to get them to set up and run on any sort of standardized system than it is to just give them the phone (loaded with all kinds of useful apps). We started with $20 phones in Kenya and we evolved to new ones which are $50, which are waterproof. If we buy phones in bulk, the price comes down and is affordable for farmers. Every organization that has worked with us on the project is happy to pay $50 per phone to give it free to the farmer, which lasts them 3 years.

Cooperation as a vital factor. Individual farmers need to acquire knowledge of practices and solutions adopted by other farmers to solve common problems.

Voices from the Field: Farmers' Experience

Carolyn Dedolph Cabrera, ADB: In this session, smallholders as well as commercial farmers share their first-hand experience of challenges, difficulties, and successes with policy makers and other stakeholders in the businesses they operate. In the early part of my career, I worked at the IRRI in the Philippines and did a report titled: Listening to the Farmers. I am pleased to have the opportunity to interact with farmers during this session. Our panelists are Jit Kumari Yogi, Nepal; Indra Gunawan, Indonesia; Paulina de Afria, Philippines; Jose Romeo Ebron, Philippines; Ganpat Parthe, India; and Sehar Iqbal, joining us via video link from India.

Panel Discussion

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: I would like to thank ADB for inviting me and the farmer's association to this forum. I am a potato and rice farmer with some small goats and am an active member of a cooperative, which is called Agriculture and Farmers' Cooperative both at the village and national levels. We organized the Philippine Family Farmers, especially Forestry Federation.

Paulina de Afria, Farmer, Philippines: I am a smallholder farmer from Nueva Ecija in the Philippines, and I grow onions, green chilies, and okra.

Jit Kumari Yogi, Sustainable Social Women Cooperative, Nepal: I am from Nepal, single mother and a smallholder farmer planting banana on 1 ha. I used to plant rice but because of the uncertainties of rice growing, I learned from others and have gone into banana farming now.

Ganpat R. Parthe, Ankur Farm (Organic Strawberry Farm), India: I am from Maharashtra, India and I grow organic strawberries in the Western Ghats. Rainfall is more than 5,000 mm and the Maharashtra state government declared this area as an eco-sensitive zone. Landholdings are quite small, but farmers work hard. I have

been growing strawberries since 1992 but in the last 4 years I have been practicing organic farming. A group of 60 farmers pooled together 100 ha of land to bring it under organic farming. The Government of India has provided support to farmers to increase their income from organic farming. We also received a Geographical Indication (GI) Certification.[20] Farmers meet weekly to discuss organic manure and bio-fertilizer compost. In the first year we cultivated boundary crop to protect strawberry crop from harmful insects coming from outside, which works as a buffer zone. We test soil from farm every year and start with green manure and after 45 days use the green manure as compost adding cow dung, neem cake phosphorus mobilizing bacteria and potassium used in farmyard manure such as cattle manure. The first 2 years is a conversion period. After year 3, we have increased the humus of the soil to get best yields. In the market nowadays there is an increased demand for organic strawberries, and we secured double the price for our organic strawberries compared to ordinary strawberries. We send the fruit directly to the consumers after receiving orders and receive online payments in advance. In future the challenge is to modify technology and provide support to our farmers. Apart from cultivating organic strawberries, I also practice apiculture, collecting honey jointly with 1,900 small farmers, who are also involved in beekeeping. We provide support to farmers to increase yields by 30% while saving bees and saving the earth.

Indra Gunawan, Farmer, Indonesia: Good morning to all participants at the RDFS Forum 2019. I would like to thank ADB for the invitation. I am a farmer from Cibunar village in Garut Regency, West Java, Indonesia. The RDFS Forum has captured the main issues that we farmers have been struggling with. Farming today is a profession with high cost and low return. It has to deal with complex problems, such as shrinking farmland, decreasing the quality of soil, lack of farmer friendly technology, climate change impacts and lack of young workers engaged in farming. In this forum I will try to share with you my experience as a farmer from a small village in Garut, Indonesia. This only reflects my individual experience, as there are other smallholder farmers who did not have the chance to come to this forum to share their similar experience. I will share problems that we face and expect solutions or at least call ADB Forum's attention to the issues. In addition to the marginal returns that we get from farming in Garut, there are other major challenges that I wish to identify: water, technology, climate, and mindset. The farmlands lack water but because there is none. During dry season we usually do not have water but recently, the government funded the construction of a reservoir, which is not yet functioning. Our paddy fields are in a mountainous area and the water reservoir is in a lower area. We do not have the equipment and technology to bring water to upper farming areas from the reservoir. In addition, the irrigation channels that were traditionally built now have leakages. Our farmland on higher ground also pose difficulties in using technology. We can hire tractors but we have to lift these to higher levels in order to use them on our farmland. Bringing other machines, such as rice threshers to the paddy fields is also difficult and time consuming.

[20] Geographical Indication Certification, which is issued by testing centers accredited by the Agricultural and Processed Food Products Export Development Authority, under the National Program for Organic Production of the Government of India.

Sehar Iqbal, Sajid Iqbal Foundation, Kedia Farming, India: I am an activist, researcher, and writer. My work covers agriculture in India, gender mainstreaming, and land reform. Today I am here to talk about a farmer-led agricultural project in Bihar, India in which I worked.

Paulina de Afria, Farmer, Philippines: I am thankful to ADB for inviting me to this forum to talk about family farming experience and conditions. I am a smallholder farmer, planting onions during the dry season and chili during the wet season. At the start of the planting season we borrow money to buy fertilizer, chemicals, and hire labor and harvesting of onions is done after 110 days. We have borrowed so much money and spent so much in planting and yet the market price of the onions for the producer is very low. In the recent cropping season, we could not even recover the cost of production. My husband and myself are wondering how we can give our children a better life. I also fear that my children will not take up farming and there will be none to farm the land we have inherited from our parents. As a smallholder farmer I hope to receive assistance and support services from the government so that our poor situation can be improved.

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: I am active in a cooperative, which is part of part of a regional network we call Asian Farmers' Association for Sustainable Rural Development. We organized ourselves in 2002 and we are present in 16 countries with a total membership of 13 million individuals. In Asia and the Pacific, we have 20 National Farmers' Organizations. For us, the challenge is not just about dysfunctional markets. We are also facing a challenge of dysfunctional agricultural production. Our agenda as a regional network is to promote secured land rights, produce diverse and nutritious food through sustainable agro-ecology, build farmer cooperatives and their enterprises, promote equitable rights and opportunities among women and men farmers, and promote young farmers. Smallholders are the main investors in the rural sector and the largest food growers in the world. But they are dispersed and fragmented and face numerous barriers, which lead to high transaction costs coupled with a lack of access to credit. In imperfect markets it is difficult to sell our products; we usually sell to traders. To some extent we also lack government support. We can only address some of these concerns by mobilizing our farmer cooperative members. A lot of farmer organizations have no professional capacity and that is why we need investments from private sector and government to strengthen and build farmer organizations and cooperatives. We want to professionalize business planning as a lot of farmer organizations in the Philippines do not know how to develop business plans. They mostly concentrate on producing and do not have capacity to manage their enterprises. Part of the challenge is access to finance. There are a lot of financial organizations, but farmers do not know how to access financial instruments. The Asian Farmers' Association is now responsible for agricultural investments. We want to facilitate positive co-op–to–co-op production. Right now, in the Philippines, a lot of rice farmers are unable to sell their produce because palay supply has exceeded demand. What we do is to promote collaboration between co-ops, where farmer co-ops can sell to big co-ops. We also need to organize commodity-specific federation. We know that a lot of private sector organizations are willing to engage with cooperatives, but the challenge lies in increasing volume to meet demand. That is why

we need to organize commodity-specific federations such as those for cocoa, banana, and other commodities. We also hope to organize federations at national level. The legal framework is also important for the policy environment.

In the Philippines, there is a Cooperative Code, which however contains only one chapter on agricultural cooperative and nothing else. In Cambodia, there is a good cooperative law, in Lao PDR there is an executive decree and we are pushing for the passage of the agriculture cooperative law. In the Philippines we need government support in insurance, procurement, and addressing climate risks. We need weather-based or weather index insurance to be able to minimize risks to farmers. And we wish to multiply partnerships. In the Philippines we have this program with the International Fund for Agricultural Development and the Department of Trade and Industry to assist small farmer cooperatives to link with the market and enhance capacities in managing their enterprises. Lastly, I attended a meeting at FAO, Rome, 2 weeks ago, which produced a high-level expert report on tackling the issue of transformative food systems. We must promote agro-ecology and must diversify farming. We must support transition to diversified and resilient food systems and establish multi-stakeholder partnerships (government-cooperatives-private sector). I would like to encourage the private sector and governments to invest in farmer organizations so that farmers will have a bigger role in the value chain processes.

Jit Kumari Yogi, Sustainable Social Women Cooperative, Nepal: One of the problems I face is unavailability of seeds. As seed is not readily available, farmers have to store seeds from the previous production. Seeds are available through agro-vets, but these are expensive. There is also no irrigation in our area and without access to electricity, pumping ground water has been an issue. We are also not knowledgeable about disease and pest control. If we are provided information regarding the kind of diseases to which the seeds being sold are susceptible to, we would be better prepared. But agro-vets lack this knowledge. We also have problems of fertilizer availability, as there is scarcity of one or the other component. That creates problems for us during the planting season. The male farmers who own bicycles go to India, which is close to our place, and get the fertilizers. As a female I cannot do that. Even if fertilizers were available in the market, there is always a risk of police arresting the farmers who are procuring individually from India. We depend on traditional seeds that have been passed down since generations and we are following traditional practices of planting. But rains do not come on time these days and that is also a big problem. A lot of people are moving out of the villages and going overseas for employment because there is no income from farming anymore. Since I do not see any future in farming, I have put all three of my sons through school giving them an education in the hope that can find other sources of income. I have had to sell my land to put them through college and I am hoping that they will not have to depend on farming in the future. I decided to send my sons to college because in 1991 when I came down from the hills, I lost my first-born child to pneumonia, as I could not afford to pay Rs. 30 to buy medicine. I was really struck by that and I wanted to put my sons to school so that they do not face challenges in society that I have had to go through in my life. One of my sons is now a health worker. One is in the education sector, and one is a sub-engineer.

Ganpat R. Parthe, Ankur Farm (Organic Strawberry Farm), India: Our organic strawberry product is a perishable commodity being grown in a remote area at high altitude. For transportation of this crop they need a pre-cooling system at the farm level and support to farmers in transportation of the produce to market. The 1,400 farmers involved in strawberry growing need to be trained, especially on how to pre-cool the fruit after harvest. Currently, we have a pre-cooling system with a capacity of about 5 tons per day, but production is about 80 tons per day. There is a huge gap of 75 tons per day. As a farmer group, they need capacity building with regard to harvesting because each farmer uses a different strawberry plucking technique. In addition, pre-cooling capacity is needed to increase the shelf-life of the strawberries. For produce from collective farming, it is difficult to determine whether a certain crop was grown organically or non-organically. Laboratory tests are needed to confirm whether the cultivation has been under strict organic conditions. The vertical cultivation of strawberries requires less farmland but requires initial capital investment.

I share my knowledge and experiences in organic farming with other farmers as well as visitors to the farm. Organically grown crops sell at higher prices compared to those grown inorganically. I recommend farmers to keep at least 2 boxes of honeybees at farm level, which increases crop yield between 25%–30% due to pollination. I also recommend keeping local varieties of bees, which are already acclimatized to local conditions. The honeybees provide additional income to farmers.

Indra Gunawan, Farmer, Indonesia: Some in my community and myself believe that use of machines makes some sources of income for locals disappear. By using tractors, friends who assist me with their labor will become jobless. If we use rice threshers, women who usually do this job will lose their income. Use of technology also creates other socioeconomic and cultural problems. Other problems relate to climate and mindset. Many farmers believe that a lot of water is required in farming. Most farmers refuse to switch to other varieties of crops and prefer paddy to other crops. Sometimes the dry season last longer and most of us wait for the rainy season to start planting paddy, leaving the land idle during dry season. The last challenge concerns the workforce. Today farmers and laborers are already middle-aged or older and young people tend to work in other sectors, such as in industries as factory workers. Their income may be at same level as ours, but they think that working on farms is not prestigious and does not suit the young men. Ironically, many old farmers encourage their children to get employment with government or work in factories because they too think that off-farm employment is more prestigious. These problems together make the situation complicated. If you ask me to prioritize, I would say that the most important problem needing immediate solution is the irrigation technology. We need a functioning irrigation system and technology to ensure that our farmlands do not lack water and we can continue planting also in the dry season.

Sehar Iqbal, Sajid Iqbal Foundation, Kedia Farming, India: The larger agriculture scenario is that we have a population of more than a billion (1.27 billion) and growing. Over 86.2% of India's farmers have land holdings of less than 2 ha. They are beset with high input costs, decreasing water availability, and price crashes because production is resource-intensive, cereal-centric and regionally biased. Systemic

failures have manifested themselves through tragedies like the rise in farmer suicides in the country. The government has promised to double farmer income by 2022 but it is clear that in doing this, it will also have to address gender issues in agriculture, high input costs, and water and soil sustainability.

A group of farmers in Kedia, Bihar have come up with a model that addresses all these concerns, and it all began with a research project, which was a participatory study into declining soil quality and productivity in six states of India including Bihar. The team of researchers were wrapping up their research in 2013 when the farmers, who were working on the research project challenged them to not just record their problems but also to address them. The villagers had seen two farmer suicides just before this and a massive failure of the onion crop. The area is a small village in Jamui district of Bihar. Farming is rain-fed and 99% of farmers are marginal. Forty percent of the adult male population work in cities as construction laborers leaving their wives and daughters to farm the land. In this respect, it is typical of agriculture in India as a whole. The women farmers cannot access fertilizer subsidies and government schemes for farmers because land title documents are not in their name. These women were beset with procuring good seed, accessing agriculture credit, and government extension programs and they were one of the first to volunteer for the pilot project. The pilot project had 38 participants out of which 20 were women. Participants were encouraged to construct concrete floor cattle sheds, ecosan toilets, establish biogas plants, and vermicompost beds. All human and animal waste collected under the first two formed the inputs for the next two, providing free fertilizer in the shape of slurry and vermicompost. The farmers were trained in watershed management and micro irrigation. They formed a cooperative called the Jeevit Mati Kisaan Samiti (All Living Souls Farmer Group). Besides this the village, farmers also founded a small savings group in which they saved money every month and lent interest-free to its members. This gave them a reliable source of short term credit.

The farmers were also introduced to mixed and multilayered cropping; flour, millets, oilseeds, and herbs were introduced for the first time. They were taught to make their own pesticides using neem and tobacco. The results were a bumper crop of onions, and other farmers joined in. Today, every farmer in Kedia is part of the project and two other villages in the neighborhood have joined in. Chemical pesticide usage is down to zero and fertilizer use has been reduced by more than 80%. Improvements in soil quality have led to greater moisture holding capacity for the soil and all 30 shallow wells are full in a year when the surrounding villages have been declared drought hit. This has reduced irrigation and tilling expenses. All told, input costs have been reduced by a whopping 92.5%. There are 22 biogas plants and 282 vermicomposting units. The easy availability of good quality fertilizer has increased potato production by 73%. There has also been an increase in millet and oilseed production. The villagers were provided with a solar-powered cold storage facility that was funded through crowd sourcing so that farmers can store their produce and get a better price in the lean season. Three more farmer cooperatives (with men and women farmers) have been registered and a sales counter in Patna established for selling produce from the cooperatives for higher prices (in collaboration with Indian Institute of Technology-IIT Kharagpur alumni).

Apart from these general benefits, women farmers now have access to vermicompost and do not need to buy fertilizer. They do not need to go through the difficult process of accessing fertilizer subsidies. Additional income comes to women farmers from selling vermicompost. Women farmers selling through cooperatives get fair prices and they get clean fuel (biogas) to cook with as opposed to respiratory disease-causing firewood. There is improved sanitation and hygiene and gains in women's and community health from Eco San toilets. Women get more privacy with Eco San toilets replacing open defaecation. And finally, improved water percolation in the soil means that the 30 shallow wells in the village are now filled. Women no longer have to travel long distances to collect water. The success of the project can be gauged by the fact that in February 2018, the Bihar state government announced that it would replicate the Kedia model in one village in each of its 118 districts, creating a green agriculture corridor around the Ganga river.

Carolyn Dedolph Cabrera, ADB: We have heard from farmers, big and small, about their challenges—irrigation, other issues with water, debt, low prices, lack of government assistance, challenges with cooperatives and associations, seeds, pests, diseases, challenges of women farmers, challenges to keep the next generation in farming, and how to afford paying for their education if that is what families want the youth to do. We have also heard about how some want to stick to traditional crops and not go into farming new crops. We have also heard about challenges of organic versus non-organic farming. So, there are a lot of challenges out there. Some, we have heard of for many years and others are new ones, particularly related to climate change risks. What is the topmost priority problem of our panelists that the audience should hear today?

Indra Gunawan, Farmer, Indonesia: The top challenge is to manage the water system because of the contours in the planting area, which if managed well, could allow them to have multiple harvests in a year.

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: The real challenge is high production cost as input costs are increasing. That is a reason why our association is supporting agri-ecology and organic farming. This also relates to the market; we know that there is high demand in the market for organic products right now, but farmers are unable to produce quantities to meet demand.

Paulina de Afria, Farmer, Philippines: Our primary problem is the high cost of inputs as we have to buy fertilizers and chemicals to control pests and diseases and hire labor. The cost of production is high and yet at harvest our crops are priced low. We can barely recover the cost of production and we cannot pay back personal loans from friends. We are now in deep debt and the ones who are gaining in profit are the middlemen and agents who buy our crops.

Jit Kumari Yogi, Sustainable Social Women Cooperative, Nepal: I would benefit most if someone can teach me how to utilize my limited farmland to make it most profitable for me. It is knowledge and skills that are the most important contribution experts can make toward improving my life.

Ganpat R. Parthe, Ankur Farm (Organic Strawberry Farm), India: We expect infrastructure in rural areas that help avoid losses and improve the shelf-life of the fruit and increases attractiveness of farming for younger generation. We also expect advice on green branded manure for the farmer.

Carolyn Dedolph Cabrera, ADB: Now I would like to invite the discussants to introduce themselves and say a few words.

Jakhongir Bektashev, "Baht Imkon Rivoj Chorvasi" (Private Farm), Uzbekistan: I would like to thank ADB for inviting me to the forum. We produce milk and provide it to a Nestle processing plant nearby. In 2017, we diversified our production by growing walnuts because there was demand from overseas customers coming from Uzbekistan to buy walnuts. We created a 415-ha walnut orchard with loan from ADB in the Ferghana valley, which is 80 km away from our farm. This has created 32 new jobs and these families asked me to convey their thanks to ADB.

Marites Alin Castre, Farmer, Philippines: I am a smallholder cultivating long chili and onions on 2 ha of land. One of problems faced by us is lack of capital as we have to seek loans to cover our production costs. We faced a volatile market price for our recent harvest of onions. For example, the price of P18 in the morning would drop to P16 by the afternoon. We spent P90,000 for production and got backed only P20,000. In addition, the floods destroyed our crops, so we had to again borrow money as we do not have financial resources to replace crops damaged by floods.

Amarjit Jagap, Farm Green Horizon, India: Farmers here have presented their problems. I would like to present some solutions. I export pomegranates to the European market. For an individual farmer there are numerous problems related to farm practices, making produce residue-free, traceability, supply chain, infrastructure, marketing, and profitability. The solutions are to promote young farmer leadership, connect the marginal farmers, share knowledge, right-person-at-the-right-place, involve women, focus on a specific crop, and establish a Farmers' Producer Company. Our Green Horizon Farm was established in 2016 and started operation with just 13 farmers. It mainly works on residue-free pomegranate. The farm has now a group of 350+ registered marginal farmers and is the first Farmers' Producer company in India, which has successfully marketed residue free pomegranate in Europe (Netherlands). It also has stakes in the domestic market, partnering with organized retail companies in India like Healthy Harvest, Reliance Fresh, Big Basket etc. Over 417 farmers are registered under "Solapur Pomegranate," an initiative under Geographical Indication (GI) No – 502. Over 49 are Good Agricultural Practices and Global Risk Assessment on Social Practices and Sedex Members Ethical Trade Audit (SMETA) Certified growers.

Patrick Renucci, Chen Yi Agventures, Philippines: I am here to share information with you what we are doing here in the Philippines. I live in the Philippines and my wife and I moved here 5 years ago to set up a sustainable business enterprise after the typhoon Yolanda struck. We are based in Visayas and we built a technologically advanced rice processing complex procuring palay from the farmers. We also launched a program to help farmers to get out of poverty and become debt-free. We

Developing resilience. It is important to diversify production within a viable and sustainable agro-ecological system—both to enhance nutritional and income security, and resilience to climate change.

provide seeds and loans at zero interest, as well as inputs like fertilizer, chemicals, and introduced mechanization. In the Philippines, the young people are increasingly getting educated and they do not want to go into farming as farming is considered to be one of the lowest professions in society. So, farmers are poor, they do not earn money, the size of farm holdings is small (average 1 ha), and the average age of the farmer is 57 years. There is a rice crisis in the Philippine as we need to import rice from Thailand and Viet Nam, without which there will be a shortage in the market. Our model is to change the way people are farming, using model farming and to increase their income. Most of money borrowed by farmers goes toward living expenses. Farmers borrow money from middlemen and pay huge interest. When farmers follow our program, they can make up to 10 times more money than from what they are doing now. Farmers need to focus on farming as an enterprise. Another major problem is that many farmers are not owners of the land they cultivate. They are not tenants and do not have a contract with the owner of the land. The farmer is only a caretaker. While the owner is an absentee, the caretaker has no resources and interest to improve the farm. That is another big problem. By following our program on mechanization, land leveling, and others. farmers can improve current yields of 2.5 tons per ha to 10 tons per ha. With the introduction of Tariffication of Rice, the price of palay is going down. The solution is to increase yield when prices of palay are going down.

Vanchin Tsogt-Ochir, Mongolian Rural Development and Relief Association NGO, Mongolia: Mongolia has its own set of problems and the list is long starting from the huge distances, sparse population, and the harsh winters. However, the last 2 days of deliberations here have shown that most problems are universally shared but the solutions are not. Lots of people say there are context-specific options and entry points proposed by various organizations and government. I would like to discuss to what extent those issues are institutional, technological, and most importantly operational.

Mariano da Costa Alves, Coffee farmer, Timor-Leste: My family has a coffee farm in Timor-Leste, and I have become a coffee farmer. I used to work as a barista in 2014. Timor-Leste is a very young country and we just celebrated our 17th anniversary. I worked with a Japanese-owned the coffee company. The company sent me abroad to learn about coffee in Indonesia and Japan. In 2017 I returned to my farm and started developing high value coffee there. In Timor-Leste, almost all would drink a cup of coffee every morning. I link the coffee farmers to end-customers like a coffee shop to eliminate the role of the middleman.

Forum participant: Have we explored the possibility of linking existing farmer cooperatives with a bigger cooperative such as the National Confederation of Cooperatives in the Philippines (NATCCO) to minimize farm-to-market linkage problems, eliminating the middleman, and increase the take home profit of the farmers?

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: Thank you for that question. In fact, I was also formerly chairperson of NATCCO and NATCCO and other federations also support this new Family Farmers Federation. There are 29 small rice producer cooperatives and because of the problem with the RTL, we consolidated the small cooperatives and linked them to larger cooperative members of NATCCO. Right now, one of the biggest members is ACES Cooperative Development Inc. They have ordered 10,000 bags of rice through the federation. Co-op trading is what we are doing right now so that the producer can link directly to the consumer.

Alessandro Marini, International Fund for Agricultural Development (IFAD): What I found quite interesting is that we have been hearing about challenges, successes, and solutions. I would like to focus on success and would like to turn my question about successes to the panelists, in particular addressing the farmer from India and our friend from AFA, Jojo: what is the key advice you may wish to provide to your fellow farmers from Asia (Philippines and Nepal) in making their business successful. It seems they are struggling in making their business successful for various reasons.

Ganpat R. Parthe, Ankur Farm (Organic Strawberry Farm), India: The farmer has to focus on his or her own field and work in cooperation with other farmers. Individual farmers cannot solve their problems on their own. They need to acquire knowledge of practices and solutions adopted by other farmers to solve similar problems.

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: For us, it is important to address the issue of food security because the issue is not just access to food but access to nutritious food. What we advise farmers in relation to climate change issues right now is to diversify production and develop agro-ecology system. Mono-cropping will not address the issue because when typhoons impact the farm, entire harvests are lost. We encourage diversified farming. Secondly, farmers need to organize themselves into cooperatives or producer organizations. For me this is the only way to link with the market and engage the private sector. Individually it is very hard but as a collective group or organization, it

will be better to have economies of scale, bargaining power, and have better access to mechanization, finance, and investments.

Forum participant: Universities and government agencies offer extension services that address the challenges pointed out by the farmers. Have any of you (addressed to all including panelists) received any kind of agriculture extension services or help with your problems?

Jose Romeo Ebron, Asian Farmers Association for Sustainable Rural Development, Philippines: Some individual farmers have received agriculture extension. But I would like to point out that in the Philippines agri-extension is being devolved to local government agencies, which is a challenge. In the cooperatives, they themselves provide extension services and help government. Co-ops have their own staff and provide agri-extension to their members.

Paulina de Afria, Farmer, Philippines: No, I have not received any extension services from government.

Jit Kumari Yogi, Sustainable Social Women Cooperative, Nepal: Yes, I have received extension advice.

Ganpat Parthe, Ankur Farm (Organic Strawberry Farm), India: Yes. I have received too.

Indra Gunawan, Farmer, Indonesia: Yes. I have also received extension advice.

Carolyn Dedolph Cabrera, ADB: Most people are getting information and knowledge shared through extension and university services. That is good news. And with all our modern technologies, hopefully the advice and services can be improved.

Forum participant: My question is addressed to the pomegranate producer from India (Ganpat Parthe). I am wondering if you store the pomegranate for a certain period. In our case in Turkey, if you store for 1 or 2 months, you can achieve at least a four-times higher selling price because of the Christmas period in Europe. I am wondering if you have any storage facilities and do you store your pomegranate produce?

Ganpat Parthe, Ankur Farm (Organic Strawberry Farm), India: In my presentation the last slide shows packaged pomegranates using modified atmospheric packaging, which is why the shelf-life of our pomegranate produce is more than 100 days. That is how we ship and export to the European market using such packaging over the last 5 years, thus increasing shelf-life to more than 100 days.

Carolyn Dedolph Cabrera, ADB: Let us give a big round of applause to all our panelists, discussants, and all who have responded with questions and answers. We truly appreciate your patience today. We have some tokens of appreciation for our

panelists and discussants that we would like to give out now. Kindly remember to put in your recommendations, feedback, insights in the insights icon in the EventsAir App so that we can capture what you thought was most meaningful about this session. There are certainly a lot of challenges that farmers continue to face; hopefully, with the help of technologies and all of us working together we will be able to help resolve some of these situations sooner for the benefit of everyone.

Akmal Siddiq, ADB: I would like to thank all the panelists and we will be issuing certificates to those who have participated.

The benefit of nurturing non cognitive skills. Investing in the non cognitive skills of young farmers such as motivation, integrity, and interpersonal communication skills will boost their ability to help transform their communities.

Voices from the Field: Youth Perspectives

Youth and youth representatives were invited to share their views about farming and employment in rural areas. They shared their aspirations and experiences to explain (i) what hindrances they face in taking up farming fulltime, and (ii) what other nonfarm employment opportunities can be developed in the rural areas.

Keynote Address

Sara Savastano, Director, Research and Impact Assessment Division, International Fund for Agricultural Development

Thank you for inviting IFAD to present the *Rural Development Report of 2019*,[21] which is on creating opportunities for rural youth. I am happy to see that four of the seven members of this panel today are women because the future of agriculture, I hope, belongs to everybody, including women. I would like to acknowledge the work of our Associate Vice President of Strategy and Knowledge Department at IFAD, Paul Winters together with Aslihan Arslan, Research and Impact Assessment Division, and Constanza Di Nucci, who have conducted this huge work of putting together 21 research papers that formed the background for writing this report. The work covers policies, advisories, and applied research and hope the content and key messages our report will be well taken.

The Youth

[21] International Fund for Agricultural Development. 2019. *Creating Opportunities for Rural Youth: 2019 Rural Development Report*.

Why youth? Because youth is a specific stage in human life. It is a critical moment and defines the transition from dependence to independence. It is also a time marked by critical decisions when, youth who are defined as being in the age group of 15–24 years make their own decisions and are empowered with the possibility to make those decisions. What does investing in youth mean? Investing in youth means the possibility to change the future generation. Why rural youth? Eighty per cent of youth aged between 15 and 24 years live in rural areas in developing countries. Most of them are in Asia and sub-Saharan Africa. However, projections for the future foresee that by 2050 the percentage of youth living in rural areas will more than double in sub-Saharan while remaining the same or declining in Asia. The density equalizing map in my presentation reflects the percentage of youth in the global share of population. Today, the map shows a large share of the youth in Asia but if we look at the situation 30 years from now, the percentage of youth in Africa will increase tremendously. Therefore, we need to analyze and identify context, area, and country-specific policies to provide support to youth development.

Youth are central for rural development, as they are the foundation of success. For successful transition, young people need to become productive, connected, and empowered for their own future. There are three building blocks that we analyze for determining policies that impact youth development.

Productive. Why do youth have to be productive? Productivity is not only output per ha but is a proxy of many factors including in relation to quality of environment, the level of people skills and learning. But learning is not schooling anymore. The *World Bank Development Report of 2018*[22] has underscored the importance of noncognitive skills, which are more important than technical skills. Therefore, investing in noncognitive skills of rural youth is of fundamental importance. **Connected** means connected to market, to service, to ideas, and information. Being connected creates new opportunities for rural youth. Empowered of their own future, with power to make decisions in their best interest. **Empowering** does not only mean giving the right but also includes the possibility of exercising those rights. For example, access to land. It is not only the right to have land but the possibility to exercise the right.

The three dimensions we are taking into account are: (i) the macroeconomic context, which is the national setting basically creating the structure; (ii) rural opportunity space; (iii) household characteristics. Based on the characteristics of countries, specific policies will be suggested to invest in rural youth. In particular, in countries that have high structure and high transformation, agricultural opportunities are tremendous. However, in these countries, the share of youth is the lowest. Therefore, one needs to identify the best policy for that particular situation. In opposition to this, countries with low level of structure and low level of transformation are fragile states and conflict areas and countries where a majority of rural youth resides. In such situations, it is important to embed policies targeted at rural youth into the broader rural development context as the challenges are more related to structure and rural transformation.

Supportive policies and partnering with the private sector. Sara Savastano, Director of the Research and Impact Assessment Division, IFAD, encouraged the development of policies to support the rural youth in accessing land and finance.

22 World Bank. 2019. *The World Bank Development Report 2018*.

Youth and the Rural Community

Then we can look at the rural opportunity space. How do we move from the macroeconomic setting to the rural opportunity space? We looked at household characteristics in three regions of interest. We see on one side the level of commercialization potential, and on the other side is the agricultural potential, which reflects the microeconomic situation. In countries with high agricultural as well as commercialization, potential youth have diverse opportunities to invest in agriculture while in countries with medium and low commercialization potential, although with high agricultural potential, there is a strong limitation of market access for youth. We have to invest in increasing and strengthening access to market in order to able to uplift the situation of rural youth.

The household characteristics where rural youth belong to mirrors the same situation; we distinguish four types of rural households: (i) transitioning rural households, (ii) diversified rural households, (iii) specialized farm households, and (iv) subsistence farm households. The same constraints we saw on the low-low category of countries we now can see in subsistence farm households. The large majority of rural youth is living either in transitioning households or fully transformed nonfarm households. For these categories of youth different types of policies are recommended. The large majority of youth, who are in transitioning households are engaged in off-farm opportunities.

The challenges that rural youth face are of four kinds: (i) capacity and skills, (ii) access to markets, (iii) access to land, and (iv) gender norms. They lack cognitive and noncognitive skills. Investing in youth will thus require investing in noncognitive abilities that are fundamental in an area of change in an era of structural and digital transformation of agriculture in order to be productive in the rural context. If access to finance is a constraint in rural areas, access to finance for rural youth is more difficult. Policies to support rural youth in accessing land and finance are of fundamental importance.

Regarding gender norms, women face triple challenges. They are female, young, and living in rural areas. They also face family pressure and social norms that make it difficult to identify appropriate policies for them. All these constraints are embedded in a broader context, which is underscored by high demographic change, challenges of climate change, gender resilience, and the digital revolution that creates and strengthens the divide between rural and urban populations.

This is more so true with rural youth. Vocational training, which was the policy followed in the past, is not sufficient anymore. Rural youth need cognitive and noncognitive skills. Noncognitive skills are equally as, if not more, important than cognitive abilities. Partnering with private sector is fundamental in an era where public funding is declining and support to agriculture by the international community is declining. Continuous support is needed to incubate ideas and finance start-ups. Rural youth need to be empowered to participate in decision-making processes. Their participation helps to make interventions more responsive to their needs, increase their ownership and enhance their agency.

Investing in rural youth requires thinking differently and out of the box. The main messages from the report are:

i. Rural investment policies for youth should be embedded in broader rural development context,
ii. Strike the "right balance" between creating broader rural opportunities and fostering youth-specific ones, and
iii. Policies and investments to foster rural transformation that is inclusive of youth and/or youth-centered need to consider the three foundations of rural development: productivity, connectivity, and agency.

There is no unique, single policy applicable to youth. The appropriate policy depends on the country, level of agricultural development, and the share of rural youth population in those countries. Low level of rural opportunity requires focusing on youth inclusion in the rural transformation policy and investment. High level of rural opportunity requires focusing on youth-specific policies and investments. In the least-transformed countries, reducing the fertility rate and improving farm productivity and the connectivity of rural areas are of central importance in addressing low productivity and a lack of agency. Countries with low levels of structural transformation but high levels of rural transformation share many characteristics with the least transformed countries. Thus, policy and investment priorities are similar, although the former group of countries may have more fiscal space for youth-specific interventions. Countries with high levels of structural transformation but limited extent of rural transformation have more room for youth-specific interventions. Highly transformed developing countries require the widest array of rural youth investments as they are the most diverse group in terms of their opportunity spaces.

Panel Discussion

William Lucht, Youth for Asia, NGO and Civil Society Center, ADB: Thank you very much for the keynote address. Just a comment to start with. In Afghanistan, youth are considered to be in the age bracket 18–35 years. I liked your statement that youth have a cross-generational impact and that youth are heterogeneous.

Fatima Moniz Soares, Coffee farmer, Timor-Leste: Youth in Timor-Leste have many challenges to face as we have recently acquired independence. Youth are important as future generation, but they now have to take over where their parents have left off.

Charlene Tan, Good Food Community, Philippines: In the Good Food Community, we run a community-shared agriculture program to make people more than consumers by becoming a cooperative with the farmers, so that community members buy a share of the harvest and get whatever is fresh in the season. It is a way of connecting with our farmers; a way of understanding what agriculture is like and a way to secure for the farmer a steady demand for goods. In a way, we support safe and nutritious food. I am not a farmer and I did not grow up on a farm. But I grew up with a sense of how things are failing and something new had to be done. I took up

civil engineering because I wanted to work on appropriate technology with farmers and serve that sector. But there were not enough opportunities. I am a founder of the Good Food Community because that is what I wanted to do and after 8 years I now see many who also want to be in the sector and use their skills, not necessarily to become farmers, although many of us want to be close to nature. But we want to offer our skills to change to new systems; where we can be more connected in a sustainable manner. It will be good to see if we can make this a sustainable livelihood option.

In the course of our work, we have also seen use of purchase-guarantees, which were built slowly from ground up, with small volumes of produce. This is very accessible for women and they can take this up as they can work in their backyards. We have young farmers who can use cell phones, which was a great moment of rejoicing as orders could be placed via apps and farmers, especially youth, do take up positions of leadership. When we bring them to another farm to demonstrate, the learning effect is amazing as they see that more young people are applying the methods and systems and the youth farmers are part of a bigger system. Rural youth will increasingly take up opportunities if we get more support.

Enzo Pinga, Earthbeat Farms, Philippines: Like Charlene, I also do not have an agricultural background. My family is not into farming. I started Earthbeat Farms mainly because I saw the potential to have an impact on the countryside and the most marginalized section of the Philippine population, which are farmers and fishers. We started by growing specialty produce, high-quality produce promoting regenerative farming practices. Later, we moved toward connecting different farming groups and farmers linking them to markets in Manila. I felt that we had a better sense of what the demand was—rather than encouraging them to plant crops they are familiar with, then sell later to the middleman. We helped them with information on what our clients needed and encouraged farmers with the production and supply of produce in demand. In the past 2 days and from discussions in other panels we have seen that we cannot blame the youth for not wanting to enter agriculture.

Agriculture is high risk and in this current food system. I am speaking from my experience in the Philippine context. In our current food system, the ones that risk the most are rewarded the least. It is hard to convince young people to get into agriculture, which does not hold much promise. We have heard of different issues and problems from previous panels, so I think this would be good place to now come up with solutions. For me some of the quickest wins in the Philippines is having more market linkages. Some panelists addressed that yesterday, which is having more direct access to markets perhaps by using the model of contract farming and the distribution of goods. In the Philippines in the past we had a lot of produce and sometimes encountered overproduction and supply issues where the prices just dropped. We heard of such issues in the previous panel and I think it is not because there is too much of rice production or onions in the country. It is that in a particular locality there is oversupply. It does not mean that other places in the Philippines have the same problem. Distribution is a key, critical success factor.

Cherrys Abrigo, Sierreza, Philippines: One thing that stuck in my mind from the keynote address is that there is no one policy that fits all rural areas or countries. In

the Philippines we have a different setting. Opportunities are not readily available as we heard success stories yesterday from some other countries in Asia. One of the constraints is language. We cannot see beyond what is behind our food we eat. We may find our food delicious, but we do not think about the farmer who produced it and there is a disconnect. The farmers who produced the vegetables, poultry, meat or fish also do not see beyond the sale of their produce to the middleman and do not know what happens to their produce. They do not see the value of what they do.

In session 7, most of the farmer visitors here had translators because there is a language barrier—another gap. Even I cannot express myself clearly in another language. So how do we connect with all the technologies that we have here in urban communities, in developed countries, and share this with those in the rural communities. Sierreza is a very small enterprise that serves to bridge the gaps, as we see them. One of the motivations I have in doing my work is my immersion in the deepest of rural communities, particularly indigenous communities in the Philippines. After almost a decade of immersing myself, I slowly learned to understand them, what the real problems are. If one of us goes to the rural communities and asks about their problems, there is usually a default response because they do not know how to connect with us from the urban communities. Sierreza works on food and social media. We try to help the indigenous farming communities by training them to improve their livelihoods, walking them through technology, and marketing their produce. We transform and market their produce through our café where we transform the produce into something that can be understood by the urban communities—food that is familiar but with a story behind it. We tell the story in the store and café and in social media. It is a simple concept. We connect people through food and through social media. In future we can bridge the gap through the youth because the youth in urban areas are slowly learning about rural communities through initiatives like ours. The youth in rural areas learn in the same manner by connecting through us and those who are immersing themselves there. So hopefully, the initiative can be replicated in the Philippines and address a significant part of the problem.

Christine Jodloman, Food Secure Philippines: I grew up in a rural farming community in North Cotabato in Mindanao. I come from a family of farmers. The most important question I ask our partner farmers is: "Are you happy? Are you proud to be a farmer?" Most of them will say yes, we are because we do not have a choice.

Three years ago, 13 powered, young agripreneur leaders, who are children of farmers, established Food Secure Philippines. We exist because our current food system is devaluing what matters most, and that is people and planet. Our vision is a sustainable farm-to-fork lifestyle for everyone, where our farmers will have a sense of ownership of their products. Foodies like us will enjoy good food that is valued and fair, and our planet will not suffer because we care. We empower rural farming communities to be food secure, healthy, and business minded. Our main program is the Agripreneurship Learning Camp and after camp activities for smallholder family farmers. Our area of operations is in North Cotabato in Mindanao and we have worked and are currently working with 300 farmers from indigenous peoples' communities. We have also built networks of share markets. Agriculture should be an inclusive and sustainable business ecosystem. Agriculture as a business opportunity

should be magnified through a refresher lens. I want to share that in our farming communities, farmers usually joke that they know two English words: short and failure. Those two words refer to their harvest of palay and corn. They have been experiencing it so much that they joke about it. But for us, the younger generation, it should be a challenge and opportunity to see this not as a joke because it contributes to the biased narrative that agriculture is for the poor. We should look through a refresher lens at agriculture as a field of opportunities. To end let me say: farming is cool, smart, sexy and humane.

Reginald Lee, Grow Asia, Singapore: I represent Grow Asia. Our mandate is to improve smallholder profitability, productivity, and environmental sustainability by working with various sectors and farmers helping them to access markets, information, and finance. My background is in banking and finance and I made the transition to development work to make a useful contribution and I hear the same from some of my esteemed panelists hearing their stories. One defining characteristic of the importance of youth for the future is their openness, adoption of new ideas, innovation and technologies. That is the key ingredient if the youth are to become the future in farming. We covered Agritech this morning and in our agritech survey a lot of our founders are young, ambitious, and digitally savvy. You might know of Cropital in the Philippines (Ruel Amparo founded Cropital when he was 22 years). This openness to digital technologies is not limited to expensive high-tech solutions. Any improvement over current practices is seen as innovative, something the youth are willing to try, adopt, and change. They are open to improved seeds, tools, mechanized improvements, and biological controls. With proper training and guidance there is a role for youth to play in the future in terms of technology disseminators or incorporate it into their livelihoods or teach it to others.

Amir Jilani, Young Professional, ADB: We know that that many countries in South and Southeast Asia are experiencing rapid urbanization and rural young are looking for opportunities in urban areas. What incentives do you see for rural youth to stay engaged in agriculture and how should policy makers be responding to the lack of incentives and create a more enabling environment for young people to engage productively in rural farm and nonfarm economy?

Sara Savastano, IFAD: I would like to encourage all panelists to share with IFAD their success stories and case studies. The answer to all the problems can be traced back in agriculture economic history. We are in an era of strong agriculture digital revolution, and it seems that we have never faced one in the last 2 decades. A disruptive, technical revolution has taken place and creates the vision of a potential investment in agriculture wherein the youth could be the first beneficiaries as they are young, quick to learn, fast, and adaptive to technology and can be involved and engaged through social media. In the past and in a different context when tractors were introduced for the first time in agriculture, farmers did not want to use these machines. But the young farmers caught on fast and started using tractors. Investing in agricultural technology at a time where agriculture is mainly labor-intensive, it is important to rely on the youth. While digital technology is internationally connected, areas within some countries may not be connected. It is thus important to link youth to the whole value chain and not just downstream to the consumers. The agri-food

value chain and agriculture as a sector is still labor-intensive and most difficult to invest in. Given the right incentive to the right person can make an impact of revolutionizing agriculture into the digital age.

Forum participant: In the context in which panelists are working, what are some of the key and specific challenges that you have observed, some of the key takeaways of specific constraints young people are facing?

William Lucht, Youth for Asia, NGO and Civil Society Center, ADB: In our preliminary survey of farming youth in rural Tarlac in the Philippines, the majority grew the staple rice with some growing calamansi, mung beans, corn and chicama (potato bean). The youth indicated that they worked on the farm every day for 3.5 hours in the morning and spent some hours in the afternoons weeding, and approximately 4 hours bi-weekly to help monitor water pumps ensuring that crops are not drowned. In total, 43 hours every week were spent on agricultural work. Some general issues mentioned consisted of land security, especially in areas where farmers were evicted as a lot of these farmers are tenants and do not actually own the land; the plots of land being tilled are small, below 1.5 ha; and change in regulatory environment. The introduction of the RTL resulted in a drop in price for farmers from P22/kg to about P8–12/kg within 1 year. That is a loss of more than 50% of a rice farmer's income. The new legislation that prevents drying of rice on roads affected production. There is also the issue of financing, but groups interviewed mentioned the timely delivery of inputs by government. Sometimes advice provided is completely out of sync with the season or not the appropriate advice related to for example postharvest treatment. Furthermore, access to postharvest facilities is limited. In particular, youth find farming unprofitable, particularly in the context of growing climate change impacts and weather instability. It has made farming increasingly unstable in the face of the number and intensity of storms. In addition, youth mentioned that farming needs a lot of work in return for little reward. Although a lot of schools in the Philippines provide free tuition, the costs of transportation and rentals are high, and youth cannot afford to attend regularly. Youth had difficulties in stating the exact size of the farm while older farmers mentioned that youth had little contribution to the farm. This generally shows a disinterest of youth in farming although they did not explicitly negate it completely. In fact, youth already in farming indicated that they would continue with farming if they had opportunities of nonfarm paid employment as well.

For farming to be considered a worthwhile choice, they indicated a harvesting return of P50,000–80,000 a month ($1,000–$1,600), without which it is better to sell the land. We noticed similar responses in our follow up interviews with youth who had left farming. They mentioned instability and low return from farming as reasons for leaving. Overall, the five challenges that need to be addressed for retaining youth in farming are: (i) how to provide timely response support (extension) and inputs to farmers, (ii) how can farmer incomes and returns be increased reliably, (iii) how can we reduce instability, (iv) how can we scale up their capacity, and (v) how can we increase their voice and participation.

Fatima Moniz Soares, Coffee farmer, Timor-Leste:: Once I graduated from high school it was very difficult to find a job. In 2014 I followed up an advertisement for

a barista position (person working in a coffee bar), which I secured. I worked for 5 years in a special coffee shop in Timor-Leste, which uses produce of local farmers. While working as barista we also faced problems in our coffee growing as customers wanted good quality coffee and we had to work very hard with farmers to produce good quality coffee. In 2016, ADB launched a project to establish a coffee association to increase quality of coffee. During this time, I used to work as a volunteer helping farmers to improve coffee quality in Timor-Leste. We approached the government for advice and support in producing coffee of an international, export quality. ADB recruited experts from Columbia to support coffee farmers in Timor-Leste. During training farmers and baristas worked together to improve production of good quality coffee. In 2017, we received expertise from Columbia, Australia, and Indonesia who shared their experience with us and learned how to link the farmers with the market. After working 5 years as an employee I set up in 2019 my own coffee shop on my farm (which is not a coffee farm) and processed coffee bought from farmers. I introduced these products to the market and contacted buyers. Although lacking financial means, farmers of Timor-Leste are not poor. They have potential. We can help farmers come out of poverty by developing their product and help them secure a good income from the produce. Youth are sometimes not taken seriously when they approach government agencies in Timor-Leste. The challenge that we face is bringing our good quality coffee to the market—convincing farmers as well as linking them to markets. My coffee shop has been in operation for 5 years and buyers have bought about 5 tons of coffee through our efforts this year. I feel happy that young people like me can help farmers to improve livelihoods and start coming out of poverty.

Matthias Leitner, Young Professional, ADB: I work on linking agriculture to the education sector. I am always impressed when meeting farmers as farming is indeed very knowledge intensive. Farmers need to be a soil scientist, an agronomist, a financial manager. It requires intense knowledge to do farming. Moving farmers from primary production further up the value chain requires more skills. They need business skills, and managerial skills, among others. How do we get those skills to the farmers? There are a couple of options we have: face-to-face interaction using FAO and IFAD field school models and strengthening extension workers. These are capital resource intensive. We also use tech-savvy youth and install remote learning systems. That is only one piece of the puzzle. I would also like to hear from the consumer side. In the end we need to embed knowledge of healthy diet into primary education. In the end, consumers are the ones who will demand and buy food. We need to raise the profile of good food and agriculture in the eyes and minds of the consumers. We need to tackle both the farming side and the consumers to get to producing, marketing, and consuming good food.

Jules Hugot, Young Professional, ADB: There is a broad consensus that productivity needs to increase to lift people out of poverty in rural areas. Apparently, the youth have special virtues, relative to the rest of the population, that are useful to increase productivity. You all mentioned in one way or another innovation, and the ability of youth to grasp faster and implement new technology. By definition, youth have a longer time horizon and hence have a longer trial-and-error period. We need youth in agriculture. The problem seems to be that they are pushed out of agriculture while pull-factors toward urban areas are stronger—the relatively low profitability

of farming contrasted with the attractiveness of cities in general. Land, which is an asset in farming, is expensive and often the youth do not have access to that type of an asset as opposed to working in the service sector, which does not require an initial investment. In that context I would like to know what have you seen in your experience in terms of public policies that support involvement of youth in agriculture, whether through dedicated education programs, legislation favorable to attracting the youth, or even targeted direct support program and subsidies? Is that something you have seen and is that something that could be part of the policy context?

Charlene Tan, Good Food Community, Philippines: I am not aware of particular policy that favors or targets the youth in the Philippines. I think that any policy that supports small businesses or helps improve family farming i.e., enabling as in my case, having a stand for organic food in every barangay, raises the level of my produce at the markets. When the farming family businesses make more money, everyone in the family business gets a role applying individual skills to carry out specialized tasks (social media, collections etc.). For entrepreneurs, the market context has changed and helped may be because of global attention to food and organic food, farm-to-fork, and chefs paying attention to quality and healthy food have helped make our proposition more valuable.

Enzo Pinga, Earthbeat Farms, Philippines: I concur with Charlene. I have not seen any national policy that targets the youth. Efforts to bring youth into farming or help them succeed in farming have emanated from the private sector. A lot of this comes in the form of mentorship or support network or companionship, like a community of young farmers talking with each other and bouncing ideas off each other. We have been actively trying to grow the food movement here in the Philippines, and from my perspective I can say that Filipinos do not value fresh produce as much as other countries. We still highly value imported goods and on our local fresh produce we do not put a fair value for farmers to survive and thrive. Thus, lot of our heirloom, indigenous products (fruits and vegetables) are disappearing as farmers see less value and return in caring for traditional products that have decreasing commercial interest from the market. That is where we have been trying to reverse this situation by promoting the food movement, making consumers more conscious about the variety of endemic produce, and to be more conscious about where their food comes from and what effort has gone into getting that food from farm-to-table.

Reginald Lee, Grow Asia, Singapore: I want to respond to the question about policies, for example the role of education policy. In Sara's slide on agricultural transformation, the general path is that as the share of agriculture in the GDP decreases, the share of population engaged in agriculture also decreases. The exodus is inevitable but the role of education is integral in helping to manage that transition for those that acquire better skills and capacity to secure nonfarm employment, and for those that choose to stay behind—the point that Matthias made in terms of getting numeracy, critical business skills that enable them to manage their farms better.

Cherrys Abrigo, Founder, Sierreza, Philippines: Making consumers aware of an existing gap or disconnect between producers and consumers can be tackled by demonstrating to consumers the importance of this linkage. But who is supposed to demonstrate this to the consumers? Not a lot of people know both sides of the story so not a lot of people can demonstrate to consumers how we can be part of the solution. It is a collection of many issues but maybe as individuals we can encourage people to think outside the box, to go beyond their world. Our world is offices, salaries, business, all that relates to urban living and we have no idea what happens in rural communities. If we increase the exposure to actual windows of rural communities, then there will be more understanding of what happens, how hard it is to produce the food, how blessed we are with all endemic agricultural products. As consumers we do not appreciate because we do not see. Nowadays, those who show to the consumers the other side of the story are entrepreneurs like me. Maybe we have a lot of good policies but implementation and the connection of various policies with each other need to be worked on. We may need new policies, but we do need to integrate these with other existing policies. If we succeed in showing and convincing consumers the rural and farming side, how are we going to deal with those in power who are busy converting agricultural land to build urban infrastructure (malls, mega cities). Then there is nothing left to work on.

Forum participant: We teach people how to farm using natural farming techniques in communities and we are also trying to establish farms on vacant lots so that people with no prior access to technologies will be able to set up farms. I love what you have all been doing and for the past 3 days you are part of a pool of champions the world needs in terms of food security. We could agree that agriculture is the new dream. But I think only people with agency and access to information could say the same. The vast majority of farmers in the Philippines are subsistence or smallholder farmers, a part of whom are disinterested, have no agency, or are hungry and it is hard for them to make decisions and to think of agriculture as the new dream. In our work we encounter a lot of people, who are fairly well off, who are capable and have agency. With this in mind, people think of the youth as change agents. But people who are maintaining the status quo are not the youth. The ones who are making policies and running institutions are the ones who can distribute material and immaterial support. My question is directed to everyone in the panel: In relation to that, how do you think we will be able to encourage people without agency, people running small farms to think in the same way as we do? How do we find an entry point and think of agriculture as the new dream?

Christine Jodloman, Food Secure Philippines: We are working with rural farmers most of whom are, as you mentioned, subsistence family farmers. Many are aging and when asked about the youth they respond that they discouraged their children from becoming farmers as there is no future in farming. The best way to resolve this is through communication. We need a fresher lens and a fresher view that sees agriculture in a more positive light. When we Google about agriculture in the Philippines or in the world, negative news will always be at the top. In communication, the agenda-setting theory describes the ability (of the news media) to influence the importance placed on the topics of the public agenda by covering a news item

frequently and prominently, thus leading the audience to regard the issue as more important. Agriculture has become a negative narrative and it is a challenge to make the new narrative bringing agriculture into a positive light. We focus on success stories of technologies we have and are using, and we should focus on that.

Sara Savastano, IFAD: One of the panelists mentioned earlier the question they ask farmers: are you happy working in agriculture; and the answer is usually yes, they are happy, but they have no choice. When an activity is labor-intensive, it is difficult to wake up happy in the morning when an intense labor day starts. When smallholders lack assets, it is extremely difficult to give them hope. If farming is so tiring, time consuming, and engaging in physical activity smallholders will not see much positives in farming. We start with giving basic rights such as access to land, access to credit etc. but still the youth may not see the future in agriculture. In developed countries agriculture is important because it is part of the agri-food value chain; in developing countries agriculture is important because it is a form of subsistence. Policies and interventions should be targeted to improving the option, even if it is the only option. Success depends not only on cognitive skills but also on the personality of the people. Transforming a challenge into an opportunity cannot be done all by themselves. No matter how determined and strong we are in life to make agriculture the most beautiful thing on earth, we need policies and institutions. Once these are in place the private sector will accompany the public sector. IFAD is moving toward a concept called IFAD 2.0 – the Future, where there is not only the intervention of the public sector. Funds we receive from member countries are now being opened up for use by private sector. In future, private sector funding projects in agriculture may see an opportunity in investing in rural youth.

Christine Jodloman, Food Secure Philippines: The negative narrative of agriculture is perhaps embedded in our culture. Educating our children about the positives of agriculture is important.

Forum participant: At this moment we are talking about perspectives for youth in agriculture. I want to introduce senior citizens in agriculture. We interviewed some retirees and asked them what they wish to do after their retirement. Almost 80% of them want to have a farm. They want to produce their own food, which should be organic. They are looking at farming as a hobby but later, it becomes a business. The retirees have money, have experience, and probably wisdom. We have young ambitious people with aspiration of doing things differently. Is there any example where you can tandem youth with the senior citizens so that they start a business, which is quite different than what they are doing right now?

Charlene Tan, Good Food Community, Philippines: By virtue of working with farmers here we already have a number of senior citizens in farming. That is already a given. It has been a great experience learning from them, especially indigenous folks, asking them about their knowledge and translating that to the wider audience has been meaningful. The more bridges we can build as social entrepreneurs, the more successful is our work. We have had retired NGO workers who have lived

with farmers and then become community organizers. Retirement plans to become farmers or working with farming communities is a factor for success. But it is true that we need to dialogue properly to build up an appropriate place both for senior citizens and the youth.

Forum participant: I work in policy advocacy and consumer food safety, but I am here representing the Philippines for Natural Farming Inc. I know that sometimes we really need to start small somewhere. However, impact indicators are normally associated with economies of scale. I admire all of you and the work you are doing, and I have followed the work of some with great admiration. The farmer-consumer models shared by the panelists though were mostly targeting the high-to mid-end markets. That will only be producing for the tip of the food pyramid. Most of you are involved in marketing but Singapore has been targeting the total population. The demographics of both countries are different. My question is since you are producing for a small market, are there any ideas applied to uplift youth and a much wider section of the population in the agriculture sector? What incentives or drivers would likely help generate youth interest in going into novel marketing systems at broader scale? Any good news on the way forward?

Enzo Pinga, Earthbeat Farms, Philippines: In our case, like I mentioned earlier Filipinos do not put a high value on our agricultural produce. What we tried to do by getting the endemic varieties we partnered up with chefs, who created dishes and cuisine and we created something aspirational out of that produce. We hope that side of farming becomes cool and sexy. Given the constraints of land and other factors like access to market, we chose this approach—creating something aspirational with a produce we already have available in the Philippines. I agree with you that all good produce needs to be accessible to a wider group of consumers. But for us, those were the first steps we had to tackle.

Forum participant: I just want to share our childhood experience because when I mentioned to my grandparents that I want to become a farmer one day, they told me not to become a farmer because it is a hard life. The mindsets being formed in children direct them to go to college and work in the corporate world. I am from the private sector. The enacting of the RTL has downgraded the Philippine farmers by devaluing their produce. How can we, in such circumstances, increasingly persuade the youth, especially here in the Philippines to work in our rural areas? How can we change the cultural mindset of the young? The movies we are watching encourage people to migrate to large urban centers—everyone needs to go to Manila.

Cherrys Abrigo, Sierreza, Philippines: Our work is more than just marketing the produce and service a niche market. There is a huge problem in the mindset of the majority and as a result, agricultural products are undervalued. The organic vegetables we sell are not expensive. Most of our lives we have been fed this information that agriculture produce must be cheap. But organic produce requires one of the most intensive labor and resource inputs and yet we expect the product to be cheap. We do not complain when we buy a P200 cup of coffee. We do not complain about buying consumer electronics. But we do complain about necessities of life, which is food. So, it will require a change of mindset, change in our thinking.

Enzo Pinga, Earthbeat Farms, Philippines: If we shift the approach and take the farm as an entity and see it as a business, it is not a bad idea for senior citizens to get into farming as they have access to finance and they have agency. If these farms become successful and as a business with access to finance and having agency already gives them a head start as compared to starting from scratch. If these farms are successful, it will prove to the younger people that you can make a good living out of farming. That is a way to attract younger people. Young people want to find meaning in their work and business is a big multiplier. Agricultural impact is probably the best meaning you could get.

Sara Savastano, IFAD: Based on the characteristics of countries that are more relevant for the ADB and the analysis that has been done through IFAD's *Rural Development Report*, I think the one message which sticks out as the most important one is that if we want to invest in youth, embed your youth policies into a broader set of rural development policies.

Multiplier effect. Helping farmers increase their income has a multiplier effect on the rest of the economy.

Closing Session

Akmal Siddiq, ADB: We would like to bring some of the lessons together in this session and helping me do this are my colleagues from the operations departments. I will now invite them to join me for this session: Donneth Walton, director, Environment, Natural Resources and Agriculture Division, Central and West Asia Department; Mio Oka, director, Environment, Natural Resources and Agriculture Division, South Asia Department; Jiangfeng Zhang, director, Environment, Natural Resources and Agriculture Division, Southeast Asia Department; Suzanne Robertson, principal natural resources and agriculture specialist, Environment, Natural Resources and Agriculture Division, East Asia Department; and Martin Lemoine, head, Agribusiness Team, Private Sector Operations Department.

We set out our forum to discuss the transformative changes in rural development and food security and I would like to hear your expectations from the forum, and how far you were successful in discussing the burning questions in our sector—what are some of the takeaways. I must add that we were aware of the challenges in the sector. Many of us work very closely in the sector and are knowledgeable about what works and what does not work. But the effort really was to see if there are opportunities to do things differently and maybe try out new ideas. Let us start our discussion.

Martin Lemoine, ADB: From my perspective, what I found successful in this forum is that there was a great share of private sector participation in the panel discussions. I think this dialogue between private sector companies and governments, who have been traditionally coming to ADB, has been very fruitful. To me that was the most interesting part. Also, we had people from different parts of the private sector. We had finance sector and agribusiness companies. We tend to be working in silos sometimes and that it is an eye opener for others to hear what others in the value chain are doing. That is my main takeaway from the forum.

Suzanne Kay Robertson, ADB: One of the key benefits we have from this forum is an acknowledgment to a new approach to agriculture. Agriculture is seen as an old sector and we often seem to do the same things same way all the time, which leaves us with the same limited result. I have seen from this forum that we have been able to acknowledge that agriculture is a transforming sector, we do need to think of new approaches in tackling this.

That has come through not only with examples of adoption of technology that can be used in this sector but also at the additional elements like partnership with the private sector. How we can have that integrated approach, which is not only looking at technical issues but also at policy and regulatory frameworks that we need to for agriculture to be more efficient and successful. One of the main benefits we will get from this is a platform for knowledge exchange and discussion. This we can achieve to a certain level here in this forum as well as how we take this forward to our DMCs with other development partners like IFAD and FAO. We can build on the discussion that we have started here.

Jiangfeng Zhang, ADB: The key theme of this forum is rural prosperity and nutrition. The theme guides us to two major groups of beneficiaries we need to address from ADB's operational perspective. One is the farmer and the other is the consumer. For farmers, we understand that the key objective is to enhance agriculture productivity and profitability. For consumers, it is important to get quality, safe, and nutritious food at affordable prices—how to help the farmers and consumers to meet these two objectives as sometimes these two objectives may not align with each other—for example on the agri-food prices that farmers receive versus what consumers pay.

Looking from the agriculture value chains perspective, there are three key parts. The first key part is on the production side. It is important to introduce new technologies, provide good infrastructure, new crop varieties that are climate- or disaster-resilient, and good information to farmers. The second key part of the value chain is the postharvesting and marketing side. Most of the food losses happen at the immediate postharvesting stage. It is important to support the postharvesting and marketing side. Enhancing quality and reducing postharvest losses will help farmers secure increased prices of agricultural commodities. As we talked about dysfunctional markets in session 2 of this forum, it became clear that it is important to provide storage facilities, assist the farmers in quality control including simple washing, grading, packaging of the agricultural produce. That is very important. The third important aspect I would like to highlight is the trading part. I am separating trading here from marketing as it requires a different kind of contribution from the private sector. The private sector requires reliable supply of high-quality agricultural products, which links up the private sector closely with farmers. An important point here lies in the traceability of produce, which is important if agricultural commodities are to fetch higher prices in the international markets. It is necessary to make these three parts work together to deliver successful impacts in agriculture. Across all these three key parts of the agriculture value chains are four important elements as highlighted in the forum: technology, infrastructure particularly irrigation, financing, and enabling policy. These are four elements we need to work together with DMC governments to achieve the objective of food security.

Mio Oka, ADB: Yesterday, I moderated the session on Knowledge Sharing among Developing Member Countries. There were presentations from five leading experts from agribusiness and agri-marketing. Their presentations showcased concrete examples from the government and private sector perspectives. We got particularly excited about hearing experience from Singapore on vertical farming. My takeaway from the forum is that our world of agriculture is increasingly becoming borderless.

I can sit here in my office and yet look after my greenhouse in Nagano prefecture in Japan (how much water my plants need) and could be in an urban center to look after my farm on the roof of our building. We even had participation at this forum through Skype. We are becoming borderless and have a lot of technologies available. On the other hand, however, I thought that a forum like this, meeting with you all and sharing and exchanging or experience in person was extremely important. It made me realize that the basics are important. We talked a lot about trading and marketing. But production is important. We need a good seed and that is also important. That made me realize that we may work on new technology, but we cannot forget what we have been doing and what we have been good at. That also needs strengthening and continuation as well.

Donneth Walton, ADB: Unfortunately, I was not able to attend all the sessions. Overall, I think this forum was very much needed. I was happy to see how many participants there were over the 3 days and people are still here at the closing session. So that is very good. First thing for me was that ADB is reengaging in the agriculture and rural development space. For a few years these topics were not a priority. There have been some lessons learned by ADB and I think it is excellent to see our reengagement in this space. Recognizing the importance of the rural economy, in particular, rural–urban linkages, highlights the importance of having economically viable rural hubs, where you have all the provided and not just for the production side but also education and skills development, water and sanitation services, financial services—everything that you need for a rural space to be sustainable and continue to succeed. Rural–urban linkages are important but viable rural spaces are also very important.

One issue for me is that I expected a lot of innovative ideas expounded during the 3 days. However, one point I underscored in the session that I moderated this morning is replicability and scalability of those ideas. How replicable are these ideas for ADB or an international finance institution? How easy would be to take those innovative approaches and scale them out and replicate them with adaptations in the different regions and countries that we work in? Another important issue that came out is the role of the private sector, Martin has alluded to that. Farmers are private sector entities. They are entrepreneurs, small businesses. Many governments do not regard farmers as such, but they are businesses and need to be treated as such. I see a strong role for PPP in targeting farmers and differentiating between services that can be provided by government and private sector and how to get them to work together. There is an important role for government to play in this. And my colleagues have also mentioned this here.

Government is important for setting a conducive policy and regulatory environment to facilitate private sector. That is extremely important. Government can provide various risk-mitigation measures whether it is insurance, guarantee schemes, loans, subsidies, tax exemptions and other incentives to support farmers and rural development; supporting rural infrastructure like irrigation, transportation networks, and information platforms to facilitate digital technologies. These are not easy but there is a role for government partnering with the private sector. Overall the 3-day

forum was encouraging. It is not easy to move forward, but I think this is a very good first step.

Akmal Siddiq, ADB: Thank you all. You have summarized well many of the discussions and takeaways. You brought out very clearly the rural development aspects of the discussions. I attended all the sessions and my experience was that about 85% of the time, discussion was on farming, issues dealing with inputs, irrigation, etc. Firstly, I see farming as a part of the rural economy. If we observe transformation in developed countries as well, rural areas do not just remain farmland. Small towns become centers of economic activity, and much of those activities are related to farming. But the areas do include nonfarm activities as well. Secondly, farmers have seasonality in their labor usage. If you calculate the number of hours farmers spend over a year, there are intensive months as well as slack ones. That provides them a slot of time that can be used for labor-intensive nonfarm activities, whereby industry comes into rural space, rather than promoting rural people to out-migrate to urban and industrial centers. Cities in our region are bursting at the seams. They hardly have any space to absorb in-migration from rural areas. If we want to urbanize Asian economies the governments will have to establish new cities because the current urban centers are running out of space for optimal economic activities. For me that was the missing link. If we had more discussion on fresh ideas you alluded to, we can articulate this concept of developing rural economic hubs as outlined in our operational plan. As you are the leaders of ADB operations, I want to ask you, considering the next 5–10 years, how should ADB's own approach adjust?

Donneth Walton, ADB: I have always taken the position that rural development is a mirror image of urban development. I think in an institution like ADB, we can somehow understand urban development easier than we understand rural development. There needs to be a bit of a mindset change. Rural spaces may need the same services as in urban areas but on a smaller scale as we are dealing with a smaller population and the economic base would be different as agriculture will be an important part of the rural economy. There is a fundamental misunderstanding in an institution like ADB and probably in other institutions as well—when we talk about urban development it is clear what we need to do in the big urban centers. However, rural spaces are also important, and I was mentioning the need for economically viable rural spaces. How do we change that in ADB? We still have our silos, and until something tremendous happens we will continue to have our silos. If we are doing something in rural development, we are very keen to work with the transport or energy teams to work with other sectors. Now, there is the "One ADB" approach, which means sovereign side working with the nonsovereign side but also entails working across sectors. Within our own departments we must think about how we can target a few areas and go fully in to provide different services to ensure that we have an economically viable rural space.

Akmal Siddiq, ADB: These are some of the good ideas that should be part of our discussion and I fully agree with you. We have friends in the urban sector, we have lunch with them but do not really engage with them more seriously on new development paradigms. Suzanne, you work in the PRC where the government has in its current Five-Year Plan set out laudable targets for rural revitalization. Can you

enlighten us on how these initiatives are creative or different and what government expects to achieve?

Suzanne Kay Robertson, ADB: In the PRC there is a new program on Rural Vitalization by which the government has set strategic priorities on how it wants to implement a new approach to rural development. The program starts off with a good basis, which identifies that farming and agriculture alone are not the only ways to do rural development. There are different aspects that need to be considered within this. Agriculture modernization is a key priority, but it is not the only priority. We have talked about rural–urban integration, how to get services into rural areas. Many of these aspects are to be driven from a rural economy perspective targeting more than just agriculture or farming. It is a holistic development process and one of the key elements we in ADB are supporting in the Rural Vitalization program is taking an integrated approach to development. When we are preparing projects, we look at a regional approach to determine the right development agenda for a certain location. Some areas have better rural–urban linkages and there are a lot of advantages we can build on. There are areas that have high value ecological conservation priorities and we need to address those issues. Under the Rural Vitalization program, PRC is taking a geographic and strategic approach to identifying location-specific need without applying a general one-system-fits all approach. This program is challenging but the most interesting aspect is how to do rural development including agricultural modernization using new approaches and initiatives.

Jiangfeng Zhang, ADB: Akmal, I agree with you that farming is just a part of the rural activities. However, we also need to understand that farming is a very important aspect, especially with population growth. I feel it is important to change the mindset of farmers. Farming is not just for producing some products; it needs to be market oriented. What consumers demand from the farmers is important for farmers to understand. Let us also bring the linkage to private sector. As I mentioned earlier, with quality produce, farmers can achieve much better prices. At the same time with new technologies being used, farmers can improve the quality of produce and with linkage to private sector, farmers can become organized in agro-enterprises. On economic architecture or subsidies, we understand that some policies are stimulating the sector, while others may distort the market. From ADB's side, I suggest we should help governments create more enabling policies and environment. For example, early this year, the government in the Philippines has enacted the Rice Tariffication Act to transit from quota-based rice importation system to a tariff system. We understand that at this moment some farmers are suffering because of this policy. The government is looking into initiatives to help farmers move from rice production to crop diversification and stimulate farmers to grow premier quality rice and other high value crops. From ADB side, we can work with governments to stimulate the diversification of the agriculture sector.

Martin Lemoine, ADB: Just to build on that, you are asking, what is there in the future based on what we have learned today. In the coming 5 years I see more integration, which is what Suzanne and Jiangfeng mentioned. I used to look at the sector as distinct segments of a value chain, i.e., agricultural inputs, farming, primary processing, secondary processing, marketing, and distribution. That framework

ADB's assistance to governments. ADB can examine some of the structural constraints and help the government design enabling policies.

does not work in reality as most of our clients are completely integrated along the value chain. They belong to more than one segment and I see that more and more enterprises will integrate and come closer to the farmers. Yesterday, I talked about contract farming. That is one model of integration, but we are increasingly seeing food companies and supermarket chains that own farms. They can ensure complete traceability as products come from their own farms. This is one of the ways the sector will modernize. Integration is one thing that I see in the future.

Akmal Siddiq, ADB: The other point, which left me puzzled, was use of technology. There is a perception that with widespread adoption of communication technology, smartphones, Internet of Things—and there is no doubt that these are powerful tools—issues will be resolved. If we look at rural areas, practically there is not much to offer. If markets are inefficient, dysfunctional, or broken, just bringing in smartphone technology is not going to fix this problem. The markets do not work for a variety of reasons: we launched four policy briefs based on studies in four countries on horticulture crops and the lessons learned are: markets do not work because infrastructure does not exist and cold chain is almost nonexistent. In different countries the level of development is different. Generally, about 10% of perishables are put through the cold chain system. Similarly, we hear about financing, which is not available to majority of the farmers and I would like to hear from you. Donneth you were moderating the session on financing. What is the takeaway from the discussion in that session? How are farmers now able to access financing more with this technicalal revolution than they were able to do so 5 or 10 years ago?

Donneth Walton, ADB: On accessing finance, and I see Ramon (Union Bank Philippines) is still here, so maybe he can say something about that. The countries are very different. Recently, I was in Tajikistan and we were working on this livestock project. Ideally, we would have liked to pass funds through the banking sector, but the banking sector in that country is totally dysfunctional. As a fiduciary institution, there is no way that ADB would be able to sign off on financing components that

are not fulfilling compliance requirements. So that is a major financial challenge that international finance institutions (ADB, EBRD) had to deal with. We had to come up with innovative approaches, as farmers need access to capital. Some of these approaches included providing matching grants, putting together cooperatives, which later become self-financing. What I heard in the session on financing were some very good ideas, but they did not dig down deep enough. It is difficult to talk about such a subject in an hour and a half. There are still a lot of challenges. Banks regard farming as high risk. The issue and challenge we still face is how to make farmers bankable, how financial institutions can see farmers as small bankable businesses. Banks are out there to make money, so how are they going to lend money to smallholder farmers? I think it is an ongoing dialogue. Some of the approaches discussed this morning were like venture capital. Maybe that can work in some countries but there is a regulatory environment that needs to facilitate that sort of financing support. One has to be creative. It is still important to work with banks and come up with agri-lending products, which makes sense to banks. This is where you may need to have some subsidies kicking in to help banks see opportunities to lend to such clients.

Akmal Siddiq, ADB: Mio, regarding this model of FPO from Maharashtra that was underpinned with some good examples that show how this model is helping thousands of farmers—what is the main difference between the FPO and the classic cooperative model? Why do you think this model has better chances of success in the future? In the early years of the model, a lot of hand holding is done, and support is provided. But do you think this model can be replicated at a larger scale? Does it have potential for a much bigger impact?

Mio Oka, ADB: Yes, because the idea of scaling up and grouping of farmers is similar to that for cooperatives. However, business operations and government commitment are different in the case of FPOs. Compared to cooperatives, FPOs are less politicized, larger in scale, and with the right incentives it can work in a state like Maharashtra. I can see that the central government is fully committed to this vehicle. I am quite certain that the FPO will move. The main difference being that earlier, we just organized a group and imparted skills but now the FPOs are geared toward products. The members in an FPO are all aiming for the same purpose.

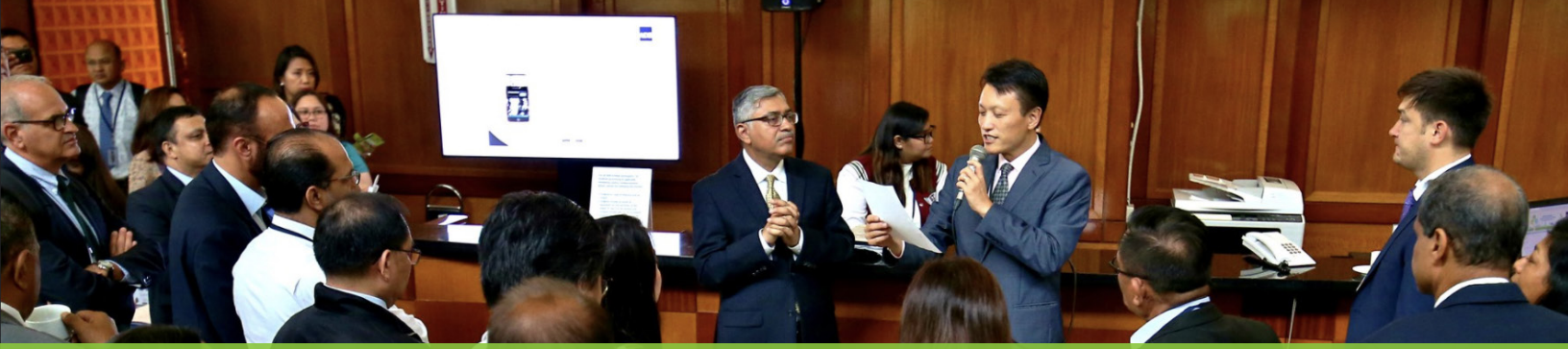
Jiangfeng Zhang, ADB: Akmal, on your comment that IT / technology does not help because markets are not working well, I do not see one type of technology working against another. We need all kinds of technologies or infrastructure to support farmers. For example, IT helps farmers get market information. The mobile extension services will help farmers reduce production costs and enhance quality. Yes, the market infrastructure is important. However, other infrastructure is equally important, for example irrigation efficiency and irrigation modernization. I would also like to mention that we should consider how we can use blockchain to support linkage between farmers and private sector (buyers). This is an important aspect and an area we would like to look into.

Suzanne Kay Robertson, ADB: Just coming back on the technology issue. It is often though that technology of any kind is a solution to every problem we have and that

is not really the case. The technology can be a catalyst for change, but we need to have associated with that all the underlying institutional elements, policies, as well as capacity building, and links in the value chain put together so that this technology can be used efficiently and effectively. That is what we are missing in this story. We roll out technology, but we do not have the adequate support services in place. It is the type of mainstreaming activity that some of these technologies need, either with the public sector or driven by the private sector. But if we do not have all the structure and institutional settings in place, then the technology has limited value. That is something we must work on to ensure that technology and modernization fits the need we have.

Martin Lemoine, ADB: Coming back to the private sector, I believe that the private sector can create a lot of value. I have explained some of the models that can double farmer income, but private sector investments only react to incentives. Firstly, that is where governments must take the lead. If I look at where my clients are based, I see the PRC where government is spending a lot of money in rural areas. Government is putting their money first. If government goes first, private sector will put more. $1 from government will trigger $3–$4 of private sector funding. Secondly, we have a lot of clients in Viet Nam because investors can own 100% FDI in Viet Nam. I do not know why other countries are not open to foreign investments but to me that is an important tool. Thirdly, we have a lot of clients in Singapore because the tax rate for food traders is very low there. An attractive tax policy is a tool that governments should consider if they want more investment in this sector. Finally, we touched upon the issue of land constraint. In the Philippines, the major issue is concerning land aggregation (due to some historical reasons)—that is an issue that government needs to fix because it is not even possible to rent land from someone because if the owner rents out land he/she has to give up part of the ownership to the tenant after 5 years. It is a disincentive to even lease out land. The land issue is critical for agriculture and part of the enabling policies that government should consider if they are serious about attracting investments in the sector.

Akmal Siddiq, ADB: Yes, as you pointed out there are all kinds of structural constraints, which are beyond the scope of any project. But as you said, the other intervention ADB can make is to examine some of these structural constraints and help the government design enabling policies. Let me conclude here with a parting thought: I think this point was put on the table in the very first session by our keynote speaker Mekhala and rightly so. In fact, the freshly minted Nobel laureate, Abhijit Banerjee, was also talking about it a couple of weeks ago. In India, half the population lives in rural areas and if their demand for consumer goods goes down, it pulls the nonfarm sector down. That is a powerful message to planners everywhere, not just in India. You are not just doing a favor to the farmers by helping them increase their incomes. That income has a multiplier effect on the rest of the economy. That is a major lesson we have learned from what is going on in India. On that thought let me, on behalf of SDCC colleagues, sincerely thank all of you. You have worked very hard with our team to put together this forum. Furthermore, the support in the future has to come from operations and you all are very important actors. Let us all give a big hand of applause to our colleagues.



Call for greater investments. It is important to increase the private sector investment projects within the next 5 years from around 10% to at least 30% to help achieve the goals in rural development and food security.

Next Steps and Closing Remarks

Message

Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB

Whatever we have learned from you is highly valuable. Many of the ideas, though not brand new, have some new nuances regarding policies and new concepts. This collective wisdom we have gained is useful and we will take these forum deliberations, recommendations, and compile them for our collective use. That is the first step we will take. Secondly, of course we will engage the governments, our partners, and all of you, and will certainly try to see what collective actions we can take. The third action we propose is to follow up with ideas about PPP and expand this concept. This will require analytical rigor and good concepts to try out these ideas. We will get back to you with a compendium and if you have more ideas, we will seek your guidance. Last but not least, we mentioned a few times during the forum that this particular effort is important because it follows ADB adopting its Strategy 2030. In that strategy, we have seven priority areas and Rural Development and Food Security is operational priority No. 5. We must keep the momentum going and, hopefully, we will be able to hold a forum of this magnitude or scale at least every 2 years. However, that does not mean you have to wait for 2 years to share your creative ideas with us. We will set up other platforms where at a regional or national level we will be in touch with you. Every 2 years, we will make an effort to bring you and our colleagues together under one roof. It will be ADB's pleasure to host you once again in the near future. I would like to thank you all sincerely. I would now like to invite Director General Woochong Um to deliver the closing remarks.

Closing Remarks

Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB

I love giving closing remarks because I know I am facing people who are truly committed to this cause and stay all the way to the end. You all have heard the substantive discussions, especially the discussion in the last session consisting of all the key people delivering this program. Let me thank and congratulate that group again. Also more importantly the audience and participants who came from within this building and outside. I know they have to travel to come here. This forum is also not happening miraculously. There are a lot of people behind the scenes who are making this happen. I would like to thank all of you.

This is a very important topic for ADB and one of the key things that is different from previous long term strategies is the area of agriculture, food security, and rural development. We have the space for us to thrive, but the challenge is daunting. We need to work with everybody to help us achieve this.

Below are some takeaways from this forum:

i. We need to continue to focus on smallholders.
ii. We should invest in infrastructure in rural areas as much as in urban areas.
iii. Governments should ensure that there is an enabling environment;
iv. We all have to work collectively in the countries as well as in this building to make sure that there is no urban bias.
v. Under ADB's Strategy 2030, the role of digital technology is highlighted, and with this new generation it is everywhere. We need to harness potential from AgTech and FinTech as well and all the other digital technologies.
vi. We have to ensure that women, girls, and youth continue to thrive by creating an enabling environment.
vii. We cannot forget about climate change challenges that we are facing in all our priority areas, especially in rural development.
viii. Within the next 5 years we have to increase our private sector investment from around 10% to at least 30%; so, we need to crowd in private resources.

With all these great ideas, we now have enough knowledge to move forward until the next time we meet. We will be interacting with many of you throughout our operations and work.

On behalf of President Nakao, and Vice-President Susantono, I am very happy to bring this forum to a close and thank everyone for being here.

Thank you.

APPENDIX 1

Program

Day 1: Monday, 28 October 2019	
7:00 – 8:30	**Arrival and Registration**
8:30 – 8:40	Opening Session Welcome Remarks Takehiko Nakao, President, ADB
8:40 – 8:45	Screening of Video
8:45 - 9:00	Session 1: Farming Crisis—The session describes the current challenges of farming and proposes transformative changes in policies and approaches to make farming profitable, highly productive, and attractive to youth in the region. Keynote Address Mekhala Krishnamurthy, Ashoka University, India
9:00 – 10:00	Plenary Session Moderator: Chiara Bronchi, Chief Thematic Officer, Sustainable Development and Climate Change Department, ADB Panelists • Mekhala Krishnamurthy, Ashoka University, India • William Dar, Secretary, Department of Agriculture, Philippines • Shenggen Fan, Director General, International Food Policy Research Institute, Washington, DC • Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB
10:00 – 10:15	Group Photo: ADB Management, Keynote Speakers, Panelists, Partners, Invited Guests

10:15 – 10:20	**Opening of the Technology and Innovation Marketplace**—International research institutions, technology firms, banks, and agribusiness firms showcase their modern technologies and services, and best practices to support rural development and food security. **Remarks** Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB
10:20 – 11:00	**Coffee Break**
11:00 – 11:05	**Insights and Recommendations from Session 1**—Insights and recommendations are crowdsourced from all participants via a mobile application.
11:05 – 11:45	**Introduction of Exhibitors and Technologies**—Exhibitors may present their technologies and innovations during coffee breaks. Hasan Moinuddin, Program Specialist (Consultant), Sustainable Development and Climate Change Department, ADB
11:45 – 12:30	**Introduction of Guests, Farmers, and Youth**— Farmers and youth participants to express their expectations from the Forum or submit a question. Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB
12:30 – 14:00	**Networking Lunch**
14:00 – 14:15	**Session 2: Dysfunctional Agriculture Markets and Malnutrition**—The session discusses the impacts of dysfunctional agricultural markets on profits, farm productivity, food quality, high prices for consumers, and malnutrition. **Keynote Address** Irakli Loladze, Associate Professor, Bryan College of Health Sciences and Adjunct Faculty, Arizona State University, United States
14:15 – 15:45	**Panel Discussion** **Moderator:** Jiangfeng Zhang, Director, Environment, Natural Resources & Agriculture Division, Southeast Asia Department, ADB **Panelists** • Martien van Nieuwkoop, Global Director of Agriculture and Food, Sustainable Development Practice Group, The World Bank, Washington, DC • Diwakar Gupta, Vice-President, Private Sector and Public-Private Partnerships, ADB

	• Irakli Loladze, Associate Professor, Bryan College of Health Sciences and Adjunct Faculty, Arizona State University, United States • Marco Wopereis, Director General, World Vegetable Center, Taipei,China • Anthea Webb, Deputy Regional Director, World Food Programme, Italy • Jane Gerardo-Abaya, Director, Department of Technical Cooperation Asia and Pacific Division, International Atomic Energy Agency, Austria Discussants • Jonathan Hellin, Sustainable Impact Platform Leader, International Rice Research Institute, Philippines • Howarth Bouis, Founder and Former Interim CEO, HarvestPlus, Washington, DC • Lee Pai-Po, Deputy Secretary General, International Cooperation and Development Fund, Taipei,China • Hean Vanhan, Secretary of State, Ministry of Agriculture, Forestry and Fisheries, Royal Government of Cambodia
15:45 – 15:50	Insights and Recommendations from Session 2—Insights and recommendations are crowdsourced from all participants via a mobile application.
15:50 – 16:15	Coffee Break
16:15 – 18:00	Discussions at the Technology and Innovation Marketplace
18:30	Networking Dinner
Day 2: Tuesday, 29 October 2019	
8:30 – 8:35	Recap of Day 1 Marzia Mongiorgi-Lorenzo, Principal Country Specialist, PRC Resident Mission, ADB
8:35 – 8:50	Session 3: Rural Distress—The session highlights the imbalance in rural-urban development and its significant negative impacts on national economic growth; rural employment; country's food security and nutrition; and urbanization. Specific recommendations are discussed and finalized for governments to consider for focused rural development. Keynote Address Mihir Shah, Distinguished Professor, Shiv Nadar University and Former Member, Planning Commission, Government of India
8:50 – 10:25	Panel Discussion Moderator: Albert Atkinson, Department of Communications, ADB Panelists • Mihir Shah, Distinguished Professor, Shiv Nadar University and Former Member, Planning Commission, Government of India

	• Thierry Giordano, Deputy Director, Impact and Marketing of Science Directorate, CIRAD • Montserrat López Jerez, Lecturer in Global Economic History, University of St. Andrews, Fife, Scotland • David Dawe, Senior Economist, Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Thailand Discussants • Saulye Janimkhan, Vice-Minister of Food, Agriculture and Light Industry, Mongolia • Cesar Jose da Cruz, Secretary General, Ministry of Agriculture and Fisheries, Timor-Leste • Duc Chien Dang, Researcher, Head of Division of Commodity Chain and Branding Development, Rural Development Center, Institute of Policy and Strategy for Agriculture and Rural Development, Viet Nam
10:25 – 10:30	Insights and Recommendations from Session 3—Insights and recommendations are crowdsourced from all participants via a mobile application.
10:30 – 11:00	Coffee Break
11:00 – 12:00	Publications Launch Opening Remarks Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB Keynote Address Bambang Susantono, Vice-President, Knowledge Management and Sustainable Development, ADB Special Remarks Matthew Morrell, Director General, International Rice Research Institute, Philippines Presentations • Mark Rosegrant, Research Fellow Emeritus, International Food Policy Research Institute, Washington, DC • Arvind Kumar, Director, South Asia Regional Center, International Rice Research Institute, India • Md. Abul Basher, Natural Resources and Agriculture Specialist, Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB 1. Ending Hunger in Asia and the Pacific by 2030: An Assessment of Investment Requirements in Agriculture—The report analyzes the impacts of different challenges faced by the agriculture sector in ADB's developing member countries and quantifies the investments required to end hunger in these countries by 2030. 2. Policies to Support Investment Requirements in Indonesia's Food and Agriculture Development for 2020–2045—The report evaluates Indonesia's agricultural investments and policies and presents the pathways to end hunger by 2030 with an appropriate mix of investments in agricultural research and development, irrigation expansion and water use efficiency, and rural infrastructure.

	3. **Application of Information and Communication Technology in the Agriculture Sector of Rural China**—The report evaluates the use of information and communication technologies to improve food production and distribution in the People's Republic of China and identifies the major constraints and enabling factors in the use of such applications. 4. **Climate-Smart Practices for Intensive Rice-Based Systems in Bangladesh, Cambodia, and Nepal**—The study captures the learning, technologies and outcomes from disseminating climate-smart practices and climate-resilient crop varieties for intensive rice-based systems, and water-saving and direct-seed rice technologies to farmers in Bangladesh, Nepal and Cambodia. The report also provides policy recommendations to promote climate-smart agriculture in these countries. 5. **Country Briefs on Dysfunctional Horticulture Value Chains and the Need for Modern Marketing Infrastructure for Bangladesh, Nepal, Pakistan and Viet Nam**—The briefs present country snapshots of wholesale markets in Bangladesh, Nepal, Pakistan and Viet Nam and offer short- and long term recommendations to transform these into modern wholesale markets.
12:00 – 13:30	**Networking Lunch**
13:30 – 13:45	**Session 4: ADB Knowledge Sharing and Experience on Climate Change, Gender, High-Level Technology, and Natural Resources Management**—The session showcases some of ADB's innovative projects and highlights the lessons learned so that other countries may consider adopting similar approaches and designs for their projects.
13:45 – 15:25	**Panel Discussion** **Moderator:** Ramesh Subramaniam, Director General, Southeast Asia Department **Panelists** • Donneth A. Walton, Director, Environment, Natural Resources & Agriculture Division, Central and West Asia Department, ADB • Qingfeng Zhang, Director, Environment, Natural Resources & Agriculture Division, East Asia Departments, ADB • Mio Oka, Director, Environment, Natural Resources & Agriculture Division, South Asia Department, ADB • Srinivasan Ancha, Principal Climate Change Specialist, Environment, Natural Resources & Agriculture Division, Southeast Asia Department, ADB • Martin Lemoine, Head, Agribusiness Investment Team, Private Sector Operations Department, ADB
15:25 – 15:30	**Insights and Recommendations from Session 4**—Insights and recommendations are crowdsourced from all participants via a mobile application.
15:30 – 16:00	**Coffee Break**

16:00 – 17:30	**Session 5: Knowledge Sharing among Developing Member Countries—** Some countries in the region have adopted creative and out-of-the-box initiatives on public policy for both public and private investments. Discussions focus on what has been done so far, how these can be used by the governments, and further identify ways to promote policy dialogue and reforms, and public-private partnerships. Panel Discussion **Moderator:** Mio Oka, Director, Environment, Natural Resources & Agriculture Division, South Asia, ADB Panelists • India: Farmer-Producer Organization in Maharashtra Anoop Kumar, Principal Secretary for Marketing Department, Maharashtra, India • PRC: ADB's framework approach for supporting PRC's rural vitalization strategy Suzanne Kay Robertson, Principal Natural Resources and Agriculture Specialist, Environment, Natural Resources & Agriculture Division, East Asia Department, ADB • Singapore: Vertical Farming David Tan, Founder and CEO, CrowdFarmX, Singapore • Thailand: Food Processing and Supply Chain Management Charoenchai (Charlie) Khompatraporn, Head of Sustainable Technology, Management and Design Research Cluster, King Mongkut's University of Technology Thonburi (KMUTT), Thailand • Turkey: Horticulture and Agri-food Business Development Mustafa Erkan, Professor, Department of Horticulture, Akdeniz University, Antalya, Turkey • Regional: Private Sector Initiatives in Agriculture Cedric Wijegunawardane, CFO, Silvermill, Sri Lanka
17:30 – 17:05	**Insights and Recommendations from Session 5—**Insights and recommendations are crowdsourced from all participants via a mobile application.
Day 3: Wednesday, 30 October 2019	
8:30 – 8:35	Recap of Day 2 Eric Quincieu, Senior Water Resources Specialist, Environment, Natural Resources & Agriculture Division, Southeast Asia, ADB
8:35 – 8:50	**Session 6: Financing Agripreneurs and Rural SMEs—**Banks, venture capital firms, ICT and FinTech companies who have used successful models to serve rural areas will share their business models and success stories. The gaps in public policies and regulatory frameworks are identified and good practices are showcased through examples shared by panelists for policymakers to emulate. Recommendations to further strengthen and expand such services are discussed. Keynote Address David Davies, Founder and Chief Executive Officer, Ag Unity, Australia

8:50 – 10:25	Panel Discussion Moderator: Donneth A. Walton, Director, Environment, Natural Resources & Agriculture Division, Central and West Asia, ADB Panelists • David Davies, Founding Chief Executive Officer, Ag Unity, Australia • Anna Charlotte Schou-Zibell, Pacific Liaison and Coordination Office in Australia, ADB • Ramon Duarte, Head, Platform Development at UnionBank of the Philippines • Anil Kumar, Samunnati Finance (Financial Intermediary), India • Hemendra Mathur, Venture Partner, Bharat Innovation Fund and Co-founder, ThinkAg, India Discussants • Chori Mirzaev, Chairman of the Management Board, Joint-Stock Commercial Bank "Turonbank," Uzbekistan • Subhadeep Sanyal, Partner, Omnivore, India • Alex L. J. Shyy, Deputy Secretary General, International Cooperation and Development Fund, Taipei,China
10:25 – 10:30	Insights and Recommendations from Session 6—Insights and recommendations are crowdsourced from all participants via a mobile application.
10:30 – 11:00	Coffee Break Venue: Auditorium Hallway
11:00 – 12:30	Session 7: Voices from the Field–Farmers' Roundtable Discussion—Smallholders and commercial farmers share their experiences firsthand with policymakers and other stakeholders, while expressing the concerns and aspirations of their communities at the international level. Panel Discussion Moderator: Carolyn Dedolph Cabrera, Principal IT Specialist (Business Change Management), Office of Information Systems and Technology, ADB Panelists • Jit Kumari Yogi (Farmer), Bardiya, Nepal • Indra Gunawan (Farmer), Member of Mekar Tani II, Indonesia • Paulina de Afria (Farmer), Nueva Ecija, Philippines • Jose Romeo Ebron, Cooperative Development Program Manager, Asian Farmers' Association for Sustainable Rural Development, Philippines • Sehar Iqbal, Executive Director, Sajid Iqbal Foundation, Kedia Farming, India • Ganpat R. Parthe, Ankur Farm (Organic Strawberry Farm), India Discussants • Marites Alin Castre (Farmer), Nueva Ecija, Philippines • Bektashev Jakhongir Rakhimovich, Manager, "Baht Imkon Rivoj Chorvasi" (Private Farm), Uzbekistan

	• Amarjit Jagap, Director, Farm Green Horizon (Pomegranate), India • Patrick Renucci, Co-Founder, Chen Yi Agventures, Philippines • Vanchin Tsogt-Ochir, Mongolian Rural Development and Relief Association NGO, Mongolia • Mariano da Costa Alves, Coffee Farmer, Timor-Leste
12:30 – 14:00	Networking Lunch
14:00 - 14:05	Insights and Recommendations from Session 7—Insights and recommendations are crowdsourced from all participants via a mobile application.
14:05 – 14:20	Session 8: Voices from the Field–Youth Perspectives—In this session, the youth representatives explain the challenges they face in taking up farming fulltime, and other non-farm employment opportunities that can be developed in the rural areas. Potential solutions and constraining factors as well as enabling policies for sustainable rural development and job creation are also discussed. Keynote Address Sara Savastano, Director, Research and Impact Assessment Division, International Fund for Agriculture Development
14:20 – 15:50	Panel Discussion Moderator: Amir Jilani, Young Professional, ADB Panelists • Reginald Lee, GrowAsia, Singapore • Christine Jodloman, Founder, Palay and Food Secure Philippines • Cherrys Abrigo, Founder, Sierreza, Philippines • Enzo Pinga, Farmer and CEO, Earthbeat Farms, Philippines • Charlene Tan, Founder, Good Food Community, Philippines • Fatima de Moniz Soares, Timor-Leste • William Lucht, Youth for Asia, NGO and Civil Society Center, Sustainable Development and Climate Change Department, ADB Discussants • Matthias Leitner, Young Professional, Environment, Natural Resources & Agriculture Division, Southeast Asia Department, ADB • Jules Hugot, Young Professional, Private Sector Operations Department, ADB
15:50 – 15:55	Insights and Recommendations from Session 8—Insights and recommendations are crowdsourced from all participants via a mobile application.
15:55 – 16:25	Coffee Break

16:25 – 17:15	**Closing Session** **Moderator:** Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB **Insights** • Donneth A. Walton, Director, Environment, Natural Resources & Agriculture Division, Central and West Asia Department, ADB • Mio Oka, Director, Environment, Natural Resources & Agriculture Division, South Asia Department, ADB • Jiangfeng Zhang, Director, Environment, Natural Resources & Agriculture Division, Southeast Asia Department, ADB • Suzanne Kay Robertson, Principal Natural Resources and Agriculture Specialist, Environment, Natural Resources & Agriculture Division, East Asia Department, ADB • Martin Lemoine, Head, Agribusiness Investment Team, Private Sector Operations Department, ADB
17:15 – 17:20	**Forum Highlights and Next Steps** **Acknowledgment of Partners and Organizers** Akmal Siddiq, Chief of Rural Development and Food Security (Agriculture) Thematic Group, Sustainable Development and Climate Change Department, ADB
17:20 – 17:30	**Closing Remarks** Woochong Um, Director General, Sustainable Development and Climate Change Department, ADB
17:30	**Networking and Departure**

APPENDIX 2

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

APPENDIX 3

Forum Advisory Committee, Working Group and Secretariat

Advisory Committee

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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.

ADB

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