



RURAL DEVELOPMENT AND FOOD SECURITY FORUM 2019 PROCEEDINGS

DECEMBER 2020

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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.

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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



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 (CO₂) levels. Plants take CO₂ from the air and water from the soil, which they split into hydrogen and oxygen to make sugars and starches. CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ decreases nutrient densities, we would need to measure plant samples from CO₂ experiments. For example, in rice, CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ levels on nutrient density of plants is found in temperate areas, in subtropics, and every country for which we have sufficient data. Elevated CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ work against us. The nutrient density of most crops and wild plants globally will keep declining with every passing year as CO₂ 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 CO₂ 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 report⁸, 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 Center⁹ 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 Programme¹⁰ 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 CO₂ 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 CO₂ 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 CO₂ that do the same.

Jonathan Hellin, IIRI: 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 report¹¹, 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.

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.

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