Healthy Food for a Healthy World

HEALTHY FOOD FOR A HEALTHY WORLD:

LEVERAGING AGRICULTURE AND FOOD TO IMPROVE GLOBAL NUTRITION

Douglas Bereuter and Dan Glickman, cochairs

The Chicago Council on Global Affairs

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A Report Issued by an Independent Advisory Group
Douglas Bereuter and Dan Glickman, cochairs

April 2015

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ON GLOBAL AFFAIRS

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Foreword

The world is facing the growing challenge of malnutrition. More than one in four people in the world suffer from malnutrition, placing a tremendous burden on the global healthcare system and the global economy as a result of rising costs and lost productivity.

In the effort to produce enough calories to sustain the global population, we have neglected the importance of nutrition. Food systems today simply are not structured to provide the most nutritious food possible to the greatest number of people. We need a new approach to address not just the quantity of food to be produced, but also its quality.

This report puts forward recommendations for how the US government can better promote nutrition as part of its global food security strategy. It presents evidence and analysis on the threats that malnutrition poses to countries and economies and argues that the global food system must be part of mitigating them. It makes recommendations for how food systems can be made more productive, nutritious, and sustainable. This analysis builds on the 2013 Chicago Council report *Advancing Global Food Security: The Power of Science, Trade, and Business*, which laid out an overarching strategy to prioritize science and improve the incentives for businesses to invest in low-income countries. The findings and recommendations put forward in this report were developed by a group of experts led by Catherine Bertini and cochaired by Dan Glickman and Doug Bereuter. The work of this group was supported by interviews with numerous subject-matter experts from government, business, civil society, and academia.

I would like to thank Catherine Bertini, Doug Bereuter, and Dan Glickman for their skillful and dedicated leadership throughout this study's demanding process. The issues surrounding malnutrition and the food supply are complex and require expertise from individuals from a wide array of disciplines and backgrounds. The cochairs and task force head assembled a diverse group of people with wide-ranging expertise and were able to incorporate these perspectives into a thorough, balanced report. I would also like to thank the report's signatories. Each offered different expertise and views on the issues considered, yet collaborated effectively to achieve consensus on the report's content and recommendations.

I am grateful to Andrew Jones, who served as the principal author of this report. Dr. Jones brought his great wealth of knowledge of food security and the nutrition and agriculture nexus to the framing of the study's agenda and spearheaded the writing of the findings and recommendations.

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Ivo H. Daalder
President
The Chicago Council on Global Affairs

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EXECUTIVE SUMMARY

Jeremy Woodhouse/Getty Images

Nutrition is essential to global food security

Malnutrition—from undernourishment to obesity—is a global challenge affecting every country on earth and placing more than a quarter of the world's people at serious health risk.[1] The agriculture and food sectors are uniquely positioned to be driving forces in overcoming this challenge. The global food system can provide nutritious foods reliably at an affordable price and offer higher incomes for some of the world's most undernourished. Through collaboration and innovation, the agriculture and food sectors can produce life-changing progress in reducing the reality and risks of malnutrition.

Malnutrition is imperiling health and hampering economies

More than 800 million people suffer from chronic hunger, and as many as two billion people suffer from micronutrient deficiencies.[2] At the same time, 1.9 billion people are overweight, including 600 million who are obese, leading them down the dangerous path towards greater risk for chronic diseases.[3] Chronic disease, caused in large part by unhealthy diets, is now the number one cause of death worldwide.[4,*]

Global malnutrition increasingly saddles economies with lower productivity and higher health-care costs. Adults who were undernourished as children earn at least 20 percent less than those who were not.[5] By 2030 the global decline in productivity resulting from chronic disease will come with the steep price tag of $35 trillion.[6] Currently, a staggering 4 to 9 percent of most countries' gross domestic product (GDP) must cover the cost of treating those who are overweight or obese. Countries in Asia and Africa lose 11 percent of gross national product (GNP) each year due solely to poor nutrition.[7]

Food systems can play a key role in improving global nutrition

- **The global food system can drive economic growth while delivering healthier diets for billions of farming households.** In many low-income countries agriculture generates one-third of GDP and employs as much as two-thirds of the labor force.[8] Making agriculture more productive raises incomes for farming families, which can increase access to nutrient-rich foods. Women, who comprise nearly half of the world's farmers, can also be empowered to make better nutritional decisions for themselves and their families. If women farmers were given access to the same productive resources as men, malnutrition could decrease by 12 to 17 percent.[9]
- **The global food system can reduce food waste and want while increasing food safety.** In many countries 40 to 50 percent of fruits and vegetables and 35 percent of fish are wasted simply because of inadequate storage and refrigeration facilities.[10] Expanding primary processing and building cold chains can help reduce this waste and increase fortification of staple foods with key vitamins and minerals to reduce micronutrient deficiencies. Further, as much as one-fourth of all agricultural harvests worldwide are contaminated with mycotoxins, a poisonous fungus, while meats, poultry, fish, and other animal products are at high risk for spoilage and contamination.[11] Simple processing improvements in the global food chain can greatly reduce these risks.

* Tobacco is still by far the major preventable cause of noncommunicable disease, followed by high blood pressure and excess diets. However, excess calories fuel cardiovascular disease, diabetes, and obesity, making diet an important contributor to chronic disease.

Improving nutrition through the agriculture and food system is in the interest of the United States

Investing in food security and improved health and nutrition for the world's people is not simply a humanitarian matter. It is squarely in the interests of the United States. Such investments can help build self-reliant and stable nations that are less likely to succumb to conflicts and humanitarian disasters that are even more costly and destabilizing.

With a growing global middle class, nutrition investments can also bring business opportunities that can further develop markets for US trade and exports. Market research suggests that the global fruit and vegetable market is projected to be valued at $2.3 trillion by 2017.[12] Investments in agriculture and nutrition also position the United States to be a trading partner with countries in Asia and Africa, where markets for US agricultural goods are growing the fastest.

Recommendations

This report lays out four key actions that can be taken by the US government—in partnership with researchers, business, and civil society—to leverage the agriculture and food sectors to improve nutrition. It recommends that the White House provide leadership and oversee implementation through the forthcoming Global Nutrition Coordination Plan, which is currently being developed by a panel of US agencies. Congress should also provide leadership by creating a bipartisan commission to tackle global malnutrition that includes members of Congress, key administration officials, and scientific and business leaders from the agriculture and health sectors.

Recommendation 1: Strengthen policies to support nutrition-sensitive food systems.

The long-term nature of food and nutrition security challenges requires an enduring commitment from the US government. This recommendation calls for:

- Congress to pass authorizing legislation that commits the United States to a global food and nutrition security strategy;
- the US government to expand access to and incentivize consumption of healthy foods through its food aid and social protection programs;
- the US government to align investments in nutrition and ramp up collaborative transdisciplinary research and programs.

Recommendation 2: Expand the research agenda for nutrition-sensitive food systems.

The US government should increase funding for nutrition research to expand access to diverse, nutrient-rich foods and address malnutrition. This recommendation calls on the government to work in partnership with universities, business, and civil society to:

- invest in research to improve access to diverse, healthy foods (Research priorities should include improving access to diverse, health-promoting diets, improving the safety and nutrition sensitivity of food value chains, expanding access to

labor-saving agricultural technologies and techniques, and reducing the unit costs of production of nutrient-rich crops);

- Measure the nutrition and health impacts of agricultural development programs.

Recommendation 3: Prepare the next generation of leaders in food and nutrition security.

The US should leverage the strength of its research and education infrastructure to train the next generation of agriculture, food, and nutrition leaders in Africa, Asia, and Latin America. This recommendation calls for:

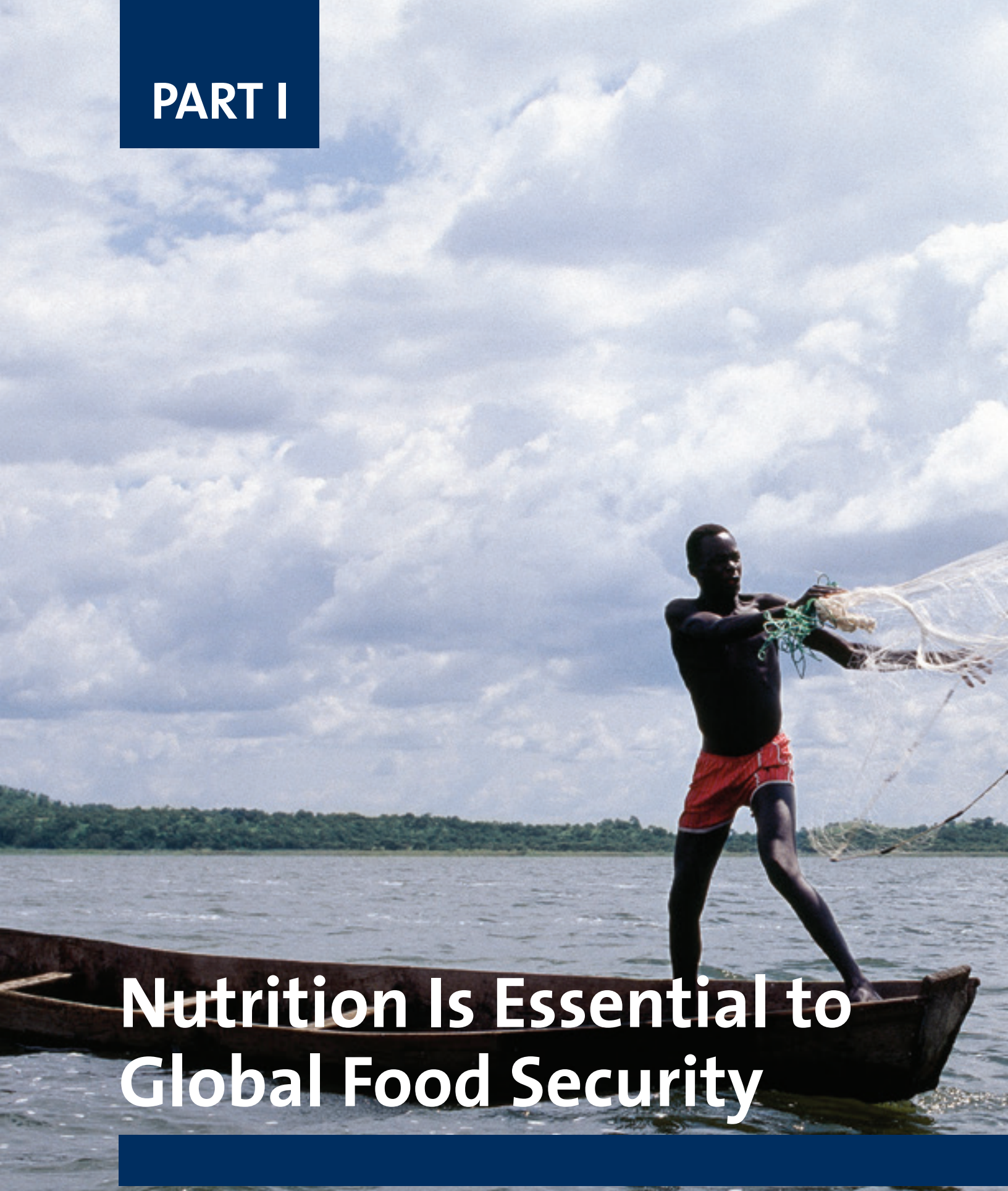
- investing in transforming universities, research institutions, and training facilities in agriculture and nutrition and beyond, including science, technology, engineering, math, business, and management in low-income countries;
- creating a prize fund for food system innovations that modernize agriculture and nutrition knowledge exchange;
- providing training to Peace Corps volunteers to incorporate nutrition-sensitive activities into their outreach work in agriculture, health, natural resources, and other relevant sectors.

Recommendation 4: Develop public-private partnerships to support nutrition-sensitive food systems.

Partnerships between the public and private sectors are of critical importance to re-aligning the food system to better meet nutrition goals. This recommendation calls for:

- leveraging private-sector investment to reduce postharvest loss and increase primary processing and fortification with an emphasis on food safety;
- promoting and strengthening voluntary guidelines to limit marketing of foods and beverages to children globally;
- increasing technical assistance on food safety regulations through US regional trade hubs in Africa;
- funding accelerator programs to encourage the development of entrepreneurial activity in local food systems to improve access to diverse, nutrient-rich foods.

PART I



Nutrition Is Essential to Global Food Security

Nigel Pavitt/Getty Images

Malnutrition affects every country in the world. Although impressive gains have been made in feeding the world's hungry, not enough attention is being paid to nourishing them. Today more than 800 million people still suffer from chronic hunger, and as many as two billion suffer from deficiencies of essential micronutrients.[13] At the same time, approximately 1.9 billion people are overweight, of which 600 million are obese, putting them at greater risk for chronic diseases.[14] This double burden of malnutrition—undernutrition and obesity—increasingly threatens the economies of countries that must underwrite the health-care costs and lost productivity associated with nutrition-related illnesses.

Box 1 – Definitions

FOOD SYSTEM—the set of institutions, resources, stakeholders, and behaviors involved in the production, processing, transportation, marketing, sale, and purchase of food.

FOOD SECURITY—includes the three main components of availability, access, and utilization of food:

- **Availability.** For an individual or household to be food secure, food must first be available to them, either in markets or through their own production.
- **Access.** Next, they must have the economic resources to access the food. For foods available in markets, this means having the means to both reach markets and purchase the foods sold. The quality of diets is also central to food security. Food secure households must have access to not only sufficient calories, but a diversity of foods that contribute to a healthy diet.
- **Utilization.** The utilization component of food security refers to how food is distributed within households to vulnerable individuals and the ability of individuals to make the best use of the nutrients in foods. For example, the nutrients in foods may be not as easily absorbed by individuals who are ill.

Finally, households and individuals are not truly food secure if they can only access diverse foods for a limited number of months per year. Therefore, the stability or consistency of food security over time—and with a minimal impact to the environment—is also important.

MALNUTRITION—refers to both undernutrition (when caloric intake is not sufficient to meet dietary requirements and/or when there are deficiencies in macro- or micronutrients) and overweight or obesity.

NONCOMMUNICABLE OR CHRONIC DISEASES—medical conditions or diseases that are noninfectious (e.g., heart disease, cancer, diabetes).

Sources: Barrett, 2010; FAO, WFP, and IFAD, 2012; Global Panel on Agriculture and Food Systems for Nutrition, 2014.

 Albert González Farran/UN Photo

The agriculture and food systems are uniquely positioned to be driving forces in overcoming malnutrition. The food system—which involves the production, processing, marketing, transformation, and purchase of food, along with the resources, institutions, and consumer practices that go along with them—lies at the heart of human health.[15] It supports the livelihoods of millions, especially the rural poor in developing countries. It can provide healthy diets, which can significantly remedy malnutrition in all its forms. Yet right now, nutritious food is not as accessible and affordable as it needs to be. While many people living in poor or remote areas do not have reliable access to nutritious foods, others simply cannot afford foods that are available. And all too often, those who can access *and* afford nutritious foods do not eat them because of limited knowledge or time to prepare nutritious meals.

The agriculture and food sectors have an essential role to play in addressing many of these challenges. Although these sectors cannot do it alone, they can and must promote nutritious diets and a healthy, productive society. They should be at the table—working alongside health-care professionals, environmentalists, businesses, entrepreneurs, donors, development practitioners, and educators—to move the needle on nutrition. The conspicuous divide between those with access to abundant quantities of safe and diverse foods and those struggling just to meet their basic dietary requirements highlights the urgent need to realign the goals of food systems with those of human health and well-being.

The time to act is now. Urbanization, climate change, and scarce land and water resources are reshaping food production, distribution systems, and access. As diets shift toward highly processed foods, especially in the rapidly urbanizing regions of low- and middle-income countries, the resulting increase in diet-related noncommunicable

The agriculture and food sectors should be at the table—working alongside health-care professionals, environmentalists, businesses, entrepreneurs, donors, development practitioners, and educators—to move the needle on nutrition.

diseases (NCDs) poses dangerously high economic and social costs. As populations and cities grow, there is less land and water for food production, which will require agriculture to become even more efficient. And climate change, if not planned for, will place additional downward pressure on agricultural production. If we don't meet these challenges head on, they will have serious negative impacts on human health and well-being.

New approaches to these challenges are desperately needed. Some experts have suggested that changes as radical as those realized during the industrial and agricultural revolutions of the past two centuries will be required along the entire food supply chain to overcome the challenges that lie ahead.[16] Yet these challenges also offer an opportunity to reshape the global food system to sustainably provide nutritious foods while supporting economic growth.

Building on the policy analyses put forward in previous Chicago Council studies, this report identifies ways the US government—in partnership with business, national governments, and civil society—can increase production and consumption of safe

Box 2 – A healthy diet defined

A healthy diet is primarily about dietary diversity—consuming a variety of foods across and within food groups to meet energy and essential nutrient requirements. Consumption of a wide variety of whole foods, especially vegetables, fruits, legumes, whole grains and nuts, is particularly important.

In some cases, where diets are inadequate to meet normal physiologic and work demands, an additional focus on meeting energy requirements is also essential. Animal-source foods may make an important contribution to overall dietary diversity, providing a rich source of easily absorbed essential micronutrients and dietary energy.

Because dietary patterns differ from place to place, foods that contribute to diet diversity must be identified based on their local availability throughout the year, their utilizable nutritional content, and the extent to which they are commonly consumed. Regional differences in food safety must also be taken into account. Food choices that are otherwise diverse are likely to adversely affect overall health if exposed to chemical or microbial contaminants through the food supply chain.

Limiting consumption of highly processed foods is also important for healthy diets and prevention of chronic disease. Such foods—including sugar-sweetened beverages, snack foods, and processed meat products—are commonly high in refined sugars, salt, and saturated fat and low in dietary fiber. In addition, these foods are often energy dense (high in energy per unit weight) and may contribute to excessive calorie consumption or displace whole foods rich in dietary fiber and micronutrients. A simple approach to assessing the healthfulness of diets, therefore, is to look at the contribution of whole foods to the diet overall rather than individual food products, ingredients, or nutrients.

Evariste Bagambiki/One Acre Fund

and nutritious foods. It assesses the unique role of the agriculture and food sectors in confronting both undernutrition and obesity and offers policy recommendations to achieve triple wins for nutrition, economic, and environmental goals.

In the face of global pressures on agricultural productivity from climate change and rapidly changing food demands, achieving these goals will require collaboration and strong leadership. Historically, the US government has played a leading role in supporting the sustainable development of agriculture and food systems throughout the globe. The recommendations proposed in this report will strengthen current US leadership in this arena and support systems that are productive, sustainable, and rich in nutritious foods. To achieve triple wins for health, economic, and environmental goals, the recommendations are to:

- strengthen policies to support nutrition-sensitive food systems,
- expand the research agenda for nutrition-sensitive food systems,
- prepare the next generation of leaders in food and nutrition security,
- develop public-private partnerships to support nutrition-sensitive food systems.

A global double burden of malnutrition is imperiling health and hampering economies

Despite tremendous progress over the past 25 years in reducing hunger and severe undernutrition, millions of people across the globe still suffer from food insecurity, and billions more lack access to essential vitamins and minerals and otherwise healthy diets. Chronic disease, caused in large part by unhealthy diets, has become the main cause of illness and death worldwide.[17] Malnutrition is also responsible for costly losses to economic productivity.[18] The agriculture and food sectors are uniquely positioned to address the factors that underlie these global health concerns.

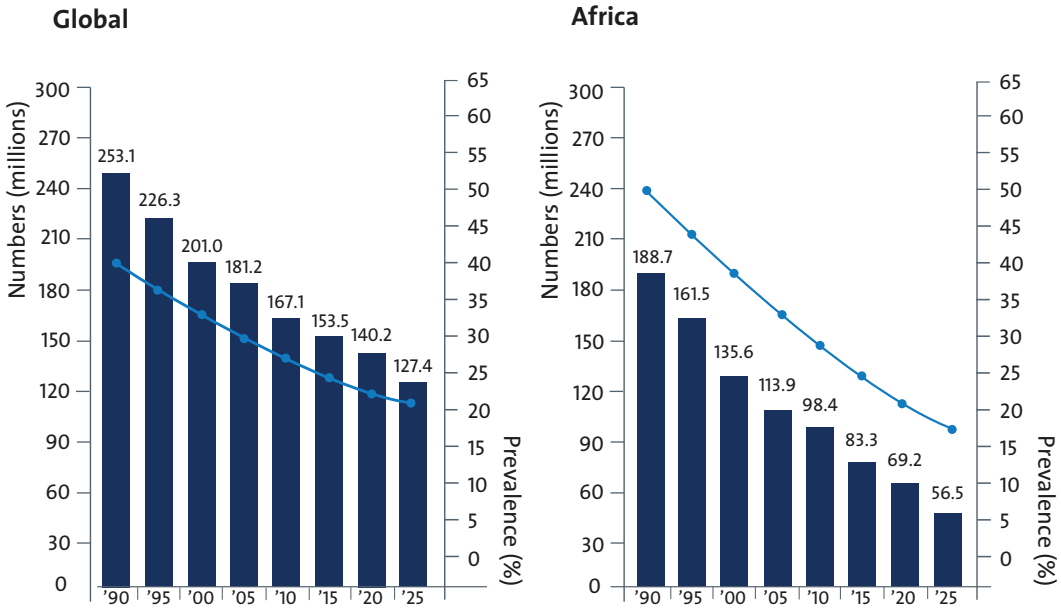
Global patterns of diet and disease are rapidly changing

Unprecedented changes are taking place in the way food is produced, distributed, and consumed around the world. Driven by urbanization, increased foreign direct investment in raw and processed foods, and income growth, a "nutrition transition" is taking hold in many low- and middle-income countries (LMICs). This transition is characterized by increased consumption of vegetable oils, refined and processed foods, sugar-sweetened beverages such as soda and fruit drinks, and more sedentary lifestyles and has been linked to a sharp increase in obesity and diet-related NCDs in LMICs over the past three decades.[19]

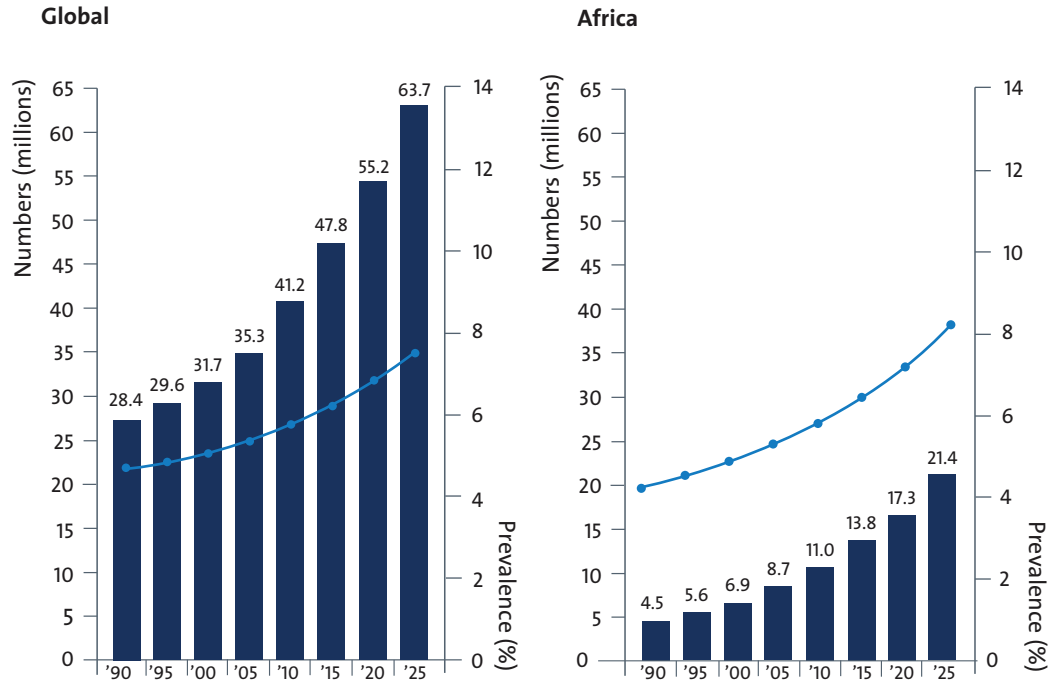
As a result, many LMICs are now facing a "double burden" of malnutrition.[20] These countries are simultaneously confronting both high rates of obesity and undernutrition without the resources, infrastructure, or support of strong institutions needed to combat them. In Nigeria, for example, more than one-third (37 percent) of children under the age of five are stunted.[21] Almost no progress has been made in reducing this percentage over the past 10 years (38 percent of children were stunted in 2003). Yet one-quarter of adult women of reproductive age (15 to 49 years) are now overweight or obese—a 25 percent increase over the past 10 years.[22]

Figure 1 – Global trends in stunting and overweight among children, 1990 to 2025

Stunting



Overweight



Source: Black et al., 2013.

Box 3 – The nutrition transition

The ways that human diets and physical activity have shifted over time and the effects on health is known as the "nutrition transition." Modernization, urbanization, and economic growth have contributed to the latest changes in diet, activity levels, and health and nutrition. This transition is reflected in the shift from infectious diseases associated with famine and malnutrition to the prevalence of diet-related chronic disease.

The nutrition transition is divided into five patterns:

- Pattern 1: Hunter Gatherer—Active lifestyles and diets based on foraged food such as plants and wild animals
- Pattern 2: Early Agriculture—Diet becomes less diverse; famine is common
- Pattern 3: End of Famine—Incomes rise and nutrition improves
- Pattern 4: Overeating, Obesity-Related Diseases—Continued rise in income leads to increased access to abundant, high-calorie foods and decreased physical activity; leads to obesity and related chronic diseases
- Pattern 5: Behavior Change—Individuals change their behavior and communities promote behavior change to prevent obesity and related chronic disease

Today, many low- and middle-income countries find themselves at the end of famine and in a pattern of overeating due to the accessibility of highly processed foods, while urban areas tend to be further along the nutrition transition than rural areas. Countries like India are moving rapidly through the nutrition transition, as rapid economic growth and urbanization alter diets and activity levels, with significant ramifications for health.

Sources: Harvard School of Public Health; FAO.

Philippe Marion/Getty Images

Box 4 – Stunting up close—a story from Ethiopia

Stunted. It is a harsh, ugly word. Often spoken of in detached, clinical, analytic terms—"below standard deviations" of height and weight, "suboptimal" brain development—stunting is the result of malnutrition early in life. It leads to diminished physical and cognitive capacity.

But what does it really mean to be stunted? What does it look like? What does it feel like?

In 2003 during a great famine, an Ethiopian boy named Hagirso was carried by his father, Tesfaye, to an emergency feeding tent on the Boricha plateau. Hagirso was five years old and weighed just 27 pounds. He was severely malnourished, on the verge of starvation. The nurses and doctors didn't know if he would survive.

Thankfully, miraculously, he did. But the consequences of the hunger and malnutrition were painfully clear. Ten years later, as a teenager, Hagirso was barely four feet tall. Tesfaye said his son was often sick and wasn't strong enough to do much work on the small family farm. He was certainly physically stunted.

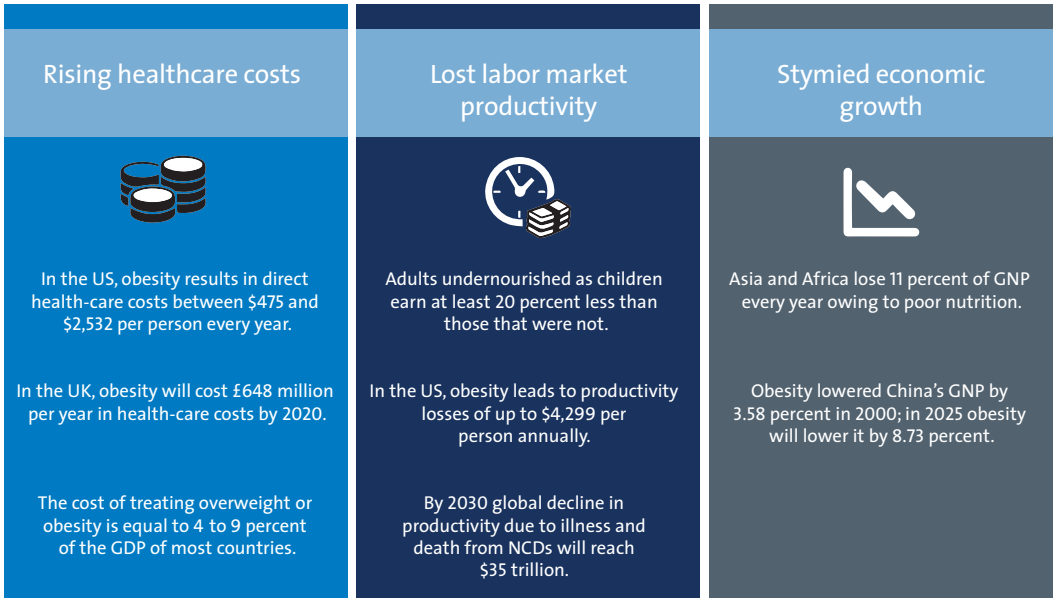
Hagirso proudly announced that he was in school. It is true, Tesfaye said, adding that he had just started. Hagirso was in first grade. He and his classmates were studying the alphabet. In his tattered notebook, Hagirso had written some consonant-vowel combinations: ba, be, bi, bo, bu. Fifteen years old, in first grade, learning the alphabet. Clearly, Hagirso was cognitively stunted as well. Tesfaye doubted that Hagirso would ever learn enough to get a job off the farm that would earn more money. Hagirso was the embodiment of all the statistics on the cost of malnutrition and stunting: lost health, lost education, lost work, lost wages, lost opportunity.

Stunted. What does it mean? It means a life of diminished potential, dashed dreams, underachievement. It is the life of Hagirso. It is the life of one of every four children in the world.

Source: Thurow, 2015.

 Roger Thurow

Figure 2 – Economic costs of global malnutrition



Sources: IFPRI, 2014; Nugent, 2011.

These trends are common in many LMICs. The prevalence of diet-related NCDs in low-income countries in particular is increasing faster than the decline in disability and mortality from infectious diseases.[23] The health and economic costs are significant. The global decline in productivity due to illness and death from diet-related NCDs may in fact reach $35 trillion by 2030—seven times the current level of global health spending.[24]

Malnutrition leads to poor health and weakens economies

Unhealthy diets are the leading risk factor for disease and disability in both developed and developing countries.[25] Malnutrition—both undernutrition and obesity—contributes to poor health in a variety of ways across different populations. Undernutrition is linked to infection, which impairs children's growth and development.[26] Undernourished children are more susceptible to illness and are more likely to experience severe infections and longer bouts of illness.[27] More than three million children die each year due to undernutrition.[28] Micronutrient deficiencies in particular can lead to serious

Stunted. What does it mean? It means a life of diminished potential, dashed dreams, underachievement. It is the life of one of every four children in the world.

health risks such as anemia from iron deficiency or blindness from severe vitamin A deficiency.[29] Obesity has also dramatically increased, according to new World Health Organization (WHO) statistics released in January 2015.[30] It has adverse effects on nearly every aspect of health, including cardiovascular, reproductive, respiratory, and mental health.[31]

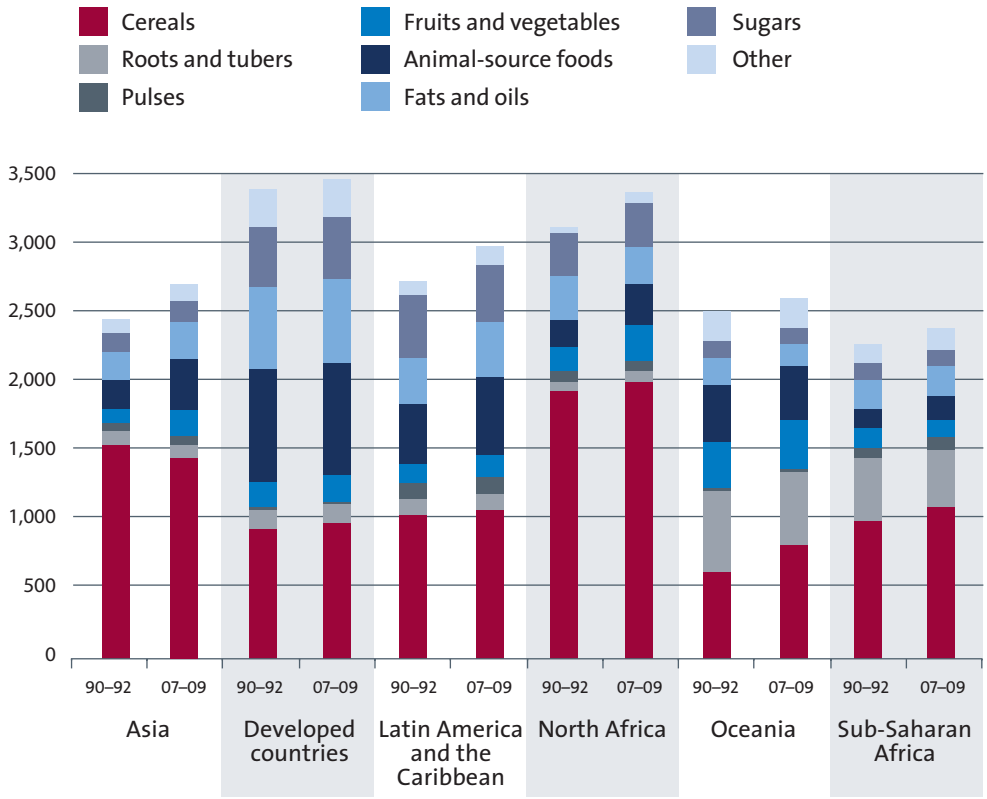
Beyond the individual health impacts, malnutrition weakens economies through decreased productivity, diminished educational achievement and income-earning potential, and increased health-care costs.[32] Undernutrition in early life is associated with permanent IQ loss, impaired cognitive function, and decreased lifelong earning potential.[33] In some countries of Sub-Saharan Africa, child undernutrition may be responsible for losses as high as 16 percent of GDP.[34]

The global decline in productivity due to illness and death from diet-related NCDs will reach $35 trillion by 2030—seven times the current level of global health spending.

Poorly nourished or unhealthy workers are less productive, less likely to innovate, and more likely to leave agriculture due to poor health.[35] At the same time, health-care expenditures on obesity-related medical problems have risen sharply over the past 20 years in the United States and in many developed countries. In China, for example, in 2002 obesity led to a nearly 3.6 percent decline in GNP, a percentage that is expected to more than double by 2025 (8.7%).[36] Between 1996 and 2006 obesity-related medi-

Figure 3 – Average diets worldwide

The chart compares the changes in diet from 1990-92 to 2007-09 by region.



Source: FAO, 2012.

Box 5 – Insufficient nutrition—snapshots of diets in four countries

India

This example of a child's meal in India includes wheat, eggplant, and potato.

What's missing:

Vitamin A: 62 percent of children under five are deficient in vitamin A
Iodine: Only 71 percent of households consume adequately iodized salt
Iron: 70 percent of children under five are anemic

Kenya

This example of a child's meal in Kenya includes corn flour and cabbage.

What's missing:

Vitamin A: 84 percent of children under five are deficient in vitamin A
Iodine: 37 percent of Kenyans are iodine deficient
Iron: 69 percent of children under five are anemic

Senegal

This example of a child's meal in Senegal includes cassava and milk.

What's missing:

Vitamin A: 61 percent of children under five are deficient in vitamin A
Iodine: 75 percent of school-aged children are iodine deficient
Iron: 80 percent of children under five are anemic

Guatemala

This example of a child's meal in Guatemala includes corn flour, black beans, and greens.

What's missing:

Vitamin A: 16 percent of children under five are deficient in vitamin A
Iodine: 14 percent of Guatemalans are iodine deficient
Iron: 39 percent of children under five are anemic

Source: The Micronutrient Initiative is working to provide these and other essential vitamins and minerals through supplements, fortified foods, and through other innovative delivery models.

Micronutrient Initiative

cal costs in the United States rose from 5.5 percent to 10 percent of medical costs, an increase of $47 billion per year.[37] In the United Kingdom obesity-related health-care costs will consume £648 million per year by 2020.[38] Of particular concern for LMICs are children undernourished in the womb or early in life who may be more vulnerable to NCDs as adults. This compounds the health and economic costs of malnutrition for these individuals and for the countries that are confronting the double burden of mal-

Malnutrition is not just a social welfare concern, but a key challenge for economic development globally.

nutrition.[39] Given the substantial costs, malnutrition is not just a social welfare concern, but a key challenge for economic development globally.

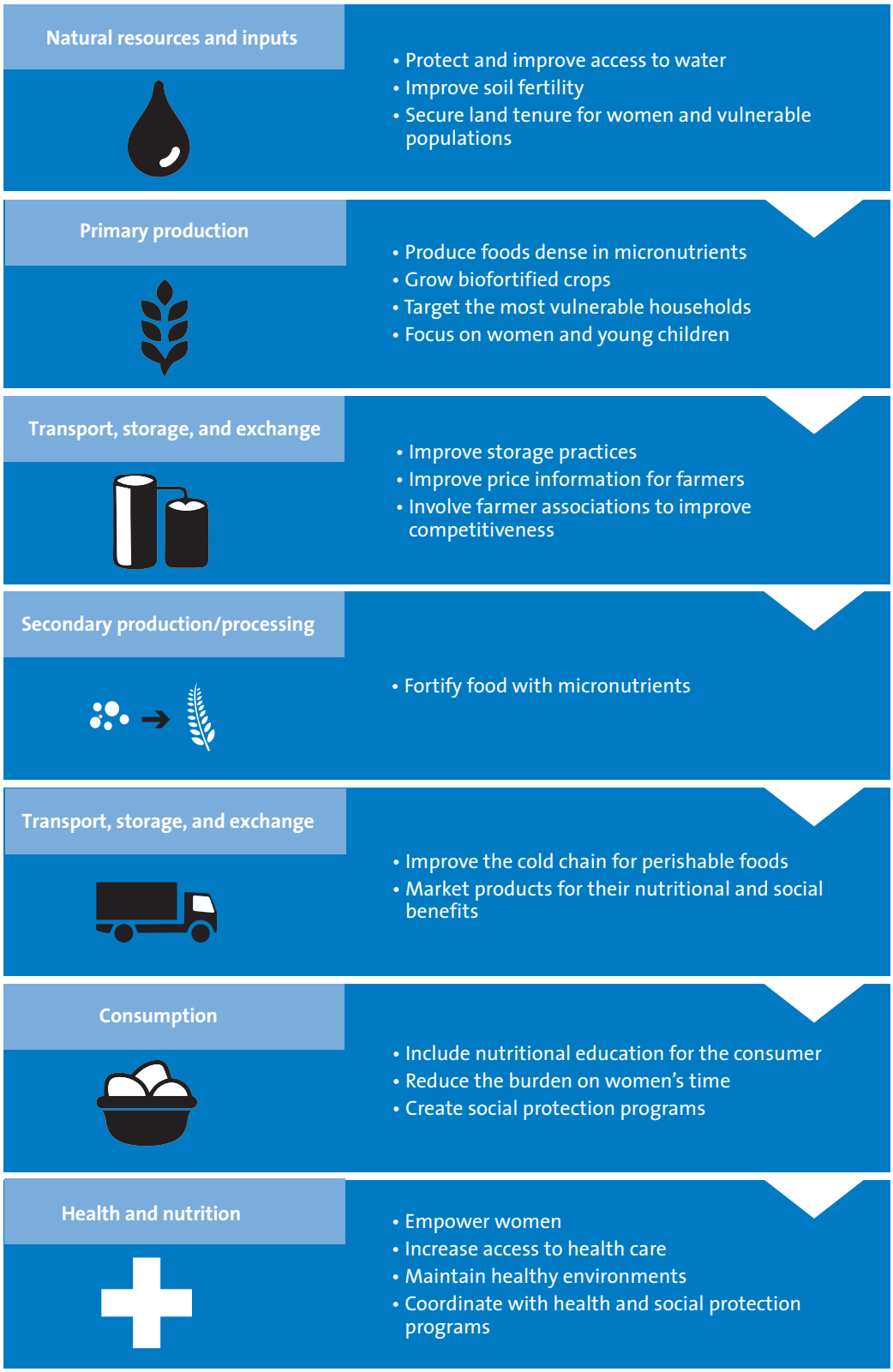
Food systems can play a crucial role in reducing the underlying causes of malnutrition

Improving nutrition has traditionally been the business of the health sector. Yet the causes of malnutrition span many sectors—not just the political and economic systems of nations, but infrastructure and institutions. Drinking dirty water and using unsanitary practices can lead to diarrheal diseases, limiting a person's ability to absorb nutrients. Access to safe and sufficient water and improved sanitation, therefore, is crucially important for ensuring safe and adequate nutrition. Provision of these basic services can be as important to nutrition as ensuring that families have access to high-quality health care or affordable, healthy foods. Therefore, preventing and reducing malnutrition requires sustained efforts across government sectors. Far too often, however, nutrition has fallen through the cracks or has been included only in health-sector initiatives. This has been a major factor in the slow progress on reducing malnutrition in many countries. Multisectoral problems require multisectoral solutions. Without more comprehensive approaches to addressing malnutrition that adopt multisectoral planning and implementation, progress will likely continue to falter.

Broad-based economic growth has been viewed as one such comprehensive approach and has certainly been an important force for reducing malnutrition in many countries. However, relying on economic growth alone is not sufficient.[40] Investments in programs and policies that explicitly address the causes of poor nutrition are essential.

As the world's food suppliers, the food and agriculture sectors have critical roles to play in addressing the causes of malnutrition. Modern food systems have been engineered to be enormously successful at producing vast quantities of food, fiber, feed, and fuel. The emphasis on quantity in particular has helped to avert food shortages and spur the growth of national economies. However, there remains significant untapped potential for food systems to meet the nutrition and health needs of populations. Rather than simply focusing on *quantity* of calorie production, a food system that also focuses on the *quality* of the food produced, taking nutrients and diversity of diets into account, stands to significantly improve global health outcomes. Strategies to realign the goals of food systems with those of human health and nutrition are therefore urgently needed. Through such realignment, there is potential for a range of win-win

Figure 4 – Nutrition-sensitive policy interventions along the food system value chain



Source: Herforth, Jones, and Pinstrup-Andersen, 2012.

solutions that can simultaneously improve nutrition, strengthen economies, and provide for a more sustainable future.

The food and agriculture sectors are among the most important sectors for strengthening and scaling up "nutrition-sensitive approaches" to reducing malnutrition, or approaches that aim to address the underlying causes of poor nutrition that lead to poor diets and illness. Such causes include the limited availability and affordability of healthy foods, limited access to health services and improved water and sanitation, and a lack of support for women in their roles as caregivers.[41]

"Nutrition-sensitive" approaches are needed to supplement "nutrition-specific" interventions that address the immediate causes of malnutrition, commonly implemented through health systems. Nutrition-specific interventions include management of severe acute malnutrition, exclusive breastfeeding, and supplements to address nutrient deficiencies. These interventions have been proven to effectively reduce malnutrition. Yet alone they are not enough. Even if these nutrition-specific interventions could be scaled up to universal coverage in the 34 countries with the highest undernu-

Modern food systems have successfully produced vast quantities of food, fiber, and feed, which has helped avert food shortages and spur economic growth. A food system that also focuses on the quality of the food produced, taking nutrients and diversity of diets into account, stands to significantly improve nutrition.

trition levels, these interventions would only reduce deaths among children under five by nearly 15 percent and global child stunting by 20 percent.[42]

Nutrition-sensitive approaches are needed across a range of sectors, including health, education, social welfare, and environmental protection. Yet the food and agriculture sectors play critical roles and are essential to reducing malnutrition. These sectors have the unique potential to effectively address many of the underlying causes of malnutrition through their influence on factors that affect health across the entire food value chain, including:

- productivity and crop diversity on small-scale farms,
- incomes of farmers and workers throughout the food system,
- social status and productive capacity of women,
- postharvest processing and associated challenges of food waste,
- food marketing and retailing,
- exposure to unsafe food due to inadequate practices, screening, and safety controls.

Productivity and crop diversity on small-scale farms

Agriculture can play a prominent role in addressing household food security in the developing world. In many low-income countries, agriculture generates nearly one-third of GDP and employs as much as two-thirds of the labor force.[43] Agriculture and food systems are important drivers of economic growth in these countries, supporting the livelihoods of millions, especially the poor.[44] Agriculture is also a direct source of food for millions of farming households throughout the globe.

Small-scale agriculture constitutes the majority of agricultural land and produces a significant portion of the food consumed in LMICs.[45] Many of these poor smallholder farmers depend in part on their own production to provide for their food and nutrition needs. For these households, farm productivity directly affects food access, and the diversity and nutritional quality of their crops directly affects household diets.[46] Programs to diversify diets and improve nutrition among smallholder farmers have specifically attempted to increase homestead production of perishable, nutrient-rich foods, including fruits, vegetables, eggs, and meat.[47] Producing such foods on the farm make them readily accessible and less vulnerable to losses during storage and transport. Though there is little evidence of improvement in nutritional outcomes from these programs, increased homestead production of nutrient-rich foods has been consistently shown to diversify the diets of the producing households.[48] Therefore, such programs are an important approach to diversifying diets and strengthening the potential of agriculture to contribute to improved nutrition.

Incomes of farmers and workers throughout the food system

Perhaps even more importantly, many smallholder farmers earn a living through agriculture by growing crops for sale on local, regional, or international markets.[49] Agriculture is a predominant form of cash income, especially for the poor. Therefore, the direct influence of agriculture on diets is likely less important than the income-generating opportunities agriculture provides—directly or through multiplier effects on local economies—that allow poor households to diversify their food purchases and escape poverty.[50] This is particularly true for landless households that depend heavily on cash income for their livelihoods.[51] In fact, most poor households in both rural and urban areas are actually net purchasers of food, commonly spending more than half of their income on food.[52] Therefore, the postharvest actions that are taken to transform agricultural goods into value-added food products and to influence the reach and price of foods in markets are vitally important to promoting better health.

The income-generating opportunities agriculture provides—directly or through multiplier effects on local economies—allow poor households to diversify their food purchases and escape poverty.

Social status and productive capacity of women

Women make up nearly half of the labor force in the agricultural sector and provide as much as three-quarters of the labor for subsistence crops in developing countries.[53] Women not only grow and harvest much of the food that is produced in these countries, but they are also the nutritional gatekeepers within households, responsible for preparing food and feeding and caring for children and other household members. In addition, income controlled by women is more likely to positively influence child nutrition and household food security than income controlled by men.[54] Therefore, women's access to productive resources and involvement in household decisions are critical both for agricultural productivity as well as household nutrition.

Box 6 – Women as farmers and mothers—a story from Kenya

Investing in women farmers is a powerful way to improve nutrition. In many African countries and throughout the developing world, women cultivate the staple crops like corn and beans that make up the daily meals. But it is all too common that they fail to produce enough food to feed their families throughout the year.

A lack of access to land, seeds, financing, and markets leads to meager harvests and a descent into an annual hunger season, the period between harvests when food stocks dwindle and disappear. It is a time of profound deprivation when meals shrink from three a day, to two, to one, to sometimes none. It is a cruel irony that the world's hungriest people are smallholder farmers, and most often those farmers are women.

"When you, as a parent, see your child not eating enough to be satisfied, you are hurt, but you are not in a position to control the situation," Zipporah Biketi, a farmer in western Kenya, lamented. Her family was deep into the hunger season. Her youngest child, a two-year-old son, was manifestly malnourished, and the three older children were becoming thinner by the day. Zipporah agonized over their declining nutrition and health. She felt she was failing on two fronts: as a farmer with low crop yields and as a mother unable to properly nourish her children.

But later that season, when the new harvest came in, Zipporah experienced a remarkable transformation in her family's life. She had joined One Acre Fund, a social enterprise organization working to end the hunger season. For the first time she received access to better quality seeds, microdosing levels of fertilizer, technical training, and the financing to pay for it all. Zipporah and her husband Sanet were astonished when their maize harvest increased tenfold. Not only did they have enough food to conquer the hunger season, they had a surplus of maize they could sell to raise money to build a new, sturdier house and to plant a second season of crops—a rich variety of vegetables—that diversified their diets and knocked back malnutrition.

Zipporah was finally in a position to control her family's well-being and to proudly declare herself a success as both farmer and mother.

Source: Thurow, 2015.

 Anne Thurow

Yet women face serious constraints to productivity, including weak or nonexistent land and water use rights; little control over income; limited power to make decisions; and poor access to cooperatives, production inputs, extension services, technology, knowledge, credit, and labor markets.[55] Even within comparable levels of wealth, the agricultural yields of male farmers are consistently higher than those of women farmers in many regions.[56] These constraints increase the time and energy women must put into agricultural activities and can adversely impact their own nutritional status as well as their capacity to feed and care for nutritionally vulnerable children.[57] Therefore, food systems that support women's empowerment and productivity throughout the value chain—from agricultural production to postharvest processing—are also likely to improve nutritional outcomes.

It is a cruel irony that the world's hungriest people are smallholder farmers, and most often those farmers are women.

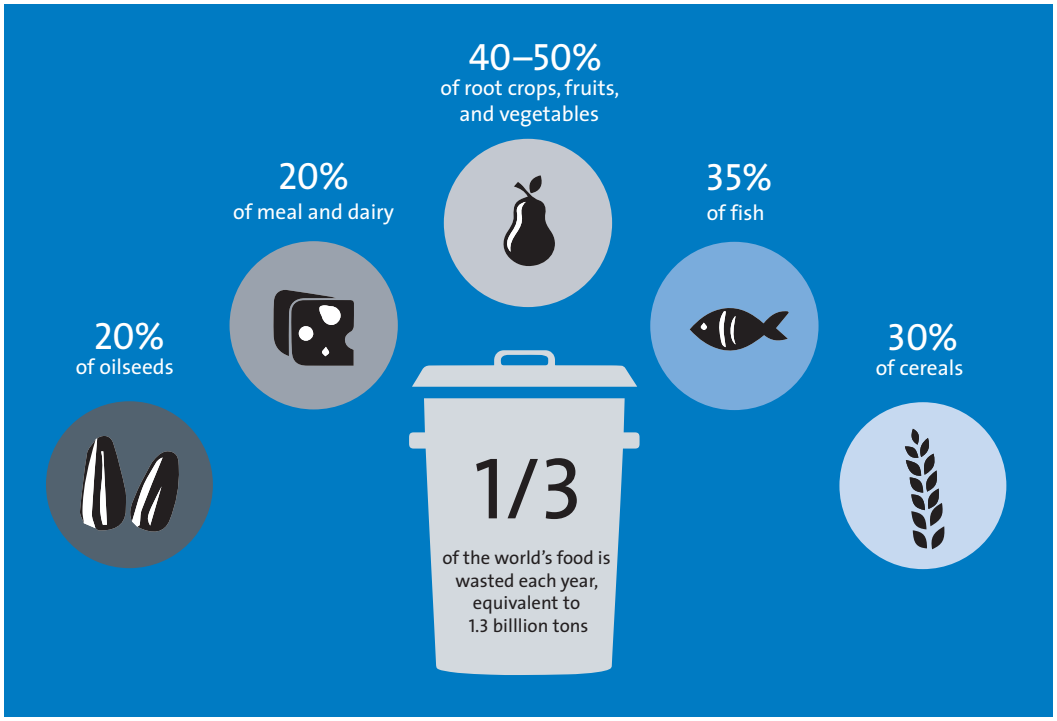
Postharvest processing challenges and food waste

Food processing is important for increasing access to nutrient-rich foods. Limited seasonal availability of fruits, vegetables, and other perishable foods such as milk, fish, and meat is a major barrier to improving nutrition in LMICs. There is an estimated 58 percent supply gap in the production of fruits and vegetables to meet current need for these nutrient-dense foods in the diets of populations of low-income countries.[58] And this gap is expected to increase in the coming decades.[59] Minimal processing and preservation techniques, including drying meat and fish, freezing or canning fruits and vegetables, and pasteurizing milk can improve access to nutrient-rich foods by extending the seasonality of perishable produce. Other postharvest processing approaches can also improve the nutritional profiles of foods, especially staple foods. Industrial fortification, for example, aims to make staple foods more nutritious by adding essential vitamins and minerals. In the United States, fortifying cereals with folic acid reduced the prevalence of neural tube defects in newborns.[60] In some developing countries, fortifying vegetable oil with vitamin A has helped reduce vitamin A deficiencies.[61]

Food processing and preservation can also help to reduce postharvest food waste and address food safety issues.[62] Poor storage facilities, transportation infrastructure, and cold chain capacity in LMICs contribute to an enormous amount of food wasted in these countries—as much as half of all perishable produce.[63] Food waste could be reduced by approximately one-quarter by expanding refrigeration and cooling facilities and other infrastructure for minimal postharvest processing.[64] These same efforts can also improve food safety. For example, pasteurization, sterilization, and fermentation—or even simple washing of produce—can reduce foodborne exposure to pathogenic microorganisms.[65]

These examples of postharvest processing can also improve nutrition and health through poverty reduction. Local processing and fortification can generate economic activity and employment opportunities, spurring growth in local economies and providing substantial income for farmers.[66]

Figure 5 – Annual global food waste



Source: FAO, 2014.

While there is clearly a need for certain types of postharvest processing of whole foods and basic commodities in many LMICs, not all types of processing enhance the nutritional value of food. For example the ultra-processing of foods can in many cases actually be harmful to nutrition and health. Ultraprocessed food products such as sugar-sweetened beverages like soda and fruit drinks, some breakfast cereals, chips, candies, and processed meats are increasingly common in both developed and developing countries. These highly refined products are often energy dense but lacking in micronutrients, dietary fiber, and antioxidants and can be high in saturated fat, salt, and sugar.[67] If consumed in small amounts as part of an otherwise healthy diet, these foods may not lead to increased health risks.[68] However, the convenience and low cost of these products,[69] their replacement of home-prepared meals, and the fact that they taste good all contribute to overconsumption.[70] These factors are especially relevant for urban residents in LMICs who are increasingly substituting foods consumed away from home for home-prepared meals.[71] The consumption of these ultraprocessed products has been linked to an increased risk of obesity, metabolic syndrome, and diet-related NCDs.[72]

Food marketing and retailing

Food and beverage companies and retailers strongly influence consumer demand through marketing. These companies spend billions of dollars each year in promotional food and beverage marketing, even reaching remote rural areas of LMICS to influence consumption habits and create more demand for their products.[73]

The enormous influence of promotional marketing by food and beverage companies on consumer preferences can negatively shape nutrition and health outcomes,

Box 7 – Ultraprocessed products

Ultraprocessed products are made from processed substances extracted or refined from whole foods—e.g., oils, hydrogenated oils and fats, flours and starches, variants of sugar, and cheap parts or remnants of animal foods—with little or no whole foods. Ultraprocessed products are typically energy dense; have a high glycemic load; are low in dietary fiber, micronutrients, and phytochemicals; and are high in unhealthy types of dietary fat, sugars, and sodium.

Source: Monteiro et al., 2011; Moodie et al., 2013.

but can also be leveraged to improve nutrition. Highly processed, nutrient-poor foods are the most heavily marketed foods sold by the food and beverage industry.[74] These foods often lack essential vitamins and minerals, dietary fiber, and important phytochemicals, but are also usually high in sugar, salt, and/or fat. Because they are engineered to be tasty, convenient, and ready to eat right out of the package, they are easily overconsumed and can displace more healthy options. They are also affordably priced and therefore may be more appealing to low-income consumers who cannot afford to purchase more expensive fresh ingredients. The marketing of these foods to children

Product reformulation to decrease sugar, salt, and fat can contribute to reducing the unhealthy nutritional profiles of processed foods, if they are not overconsumed or substituted for healthy foods.

in particular may be especially harmful, as children do not understand the persuasive intent of marketing and may develop long-term, unhealthy consumption habits that lead to diet-related NCDs, even before adulthood.

However, the power of promotional marketing to shape consumer demand also means that such approaches can be leveraged to promote nutritious diets and create healthy dietary habits among children from an early age. Education through schools and mass media is certainly important, but social marketing approaches using sophisticated techniques such as those expertly wielded by food and beverage companies to sell highly processed foods hold even greater potential to shift attitudes and food preferences. Therefore, working in partnership with food and beverage companies to improve nutrition through the promotion of healthy foods in line with dietary guidelines (e.g., fresh fruits and vegetables and whole grains) can contribute to making nutritious foods affordable and desirable to consumers.

Furthermore, efforts by some food and beverage companies to reformulate products to reduce their sugar, salt, and fat content may also contribute to incremental progress toward reducing the unhealthy nutritional profiles of these foods. Additional evidence is needed, however, to understand the nutritional benefits of product reformulation,

especially if highly processed foods are still commonly overconsumed and substituted for healthy foods in diets.

Exposure to unsafe food due to inadequate practices, screening, and safety controls

Human health may also be directly impacted by food systems, especially agricultural production, through exposure to toxins, contaminants, and disease. Mycotoxins,[75] for example, are estimated to contaminate as much as one-quarter of all agricultural harvests worldwide.[76] These toxins, produced by fungi, are carcinogens, but are also associated with child stunting.[77] Food supplies in LMICs are especially vulnerable to mycotoxin contamination because of inadequate postharvest storage practices as well as poor screening and food safety controls.[78]

Irrigation water, largely seen as a boon for agricultural production, also has the potential for negative health effects. Irrigation schemes may create breeding sites for mosquitoes and other insects that transmit infectious diseases.[79] At the same time, however, irrigation may not only boost yields, but may also reduce susceptibility of crops to infection with mycotoxins by reducing drought stress. This potential for both increased risk of infectious illness and improved food safety from irrigation is one example among

One-quarter of agricultural harvests worldwide are contaminated with mycotoxins, poisonous carcinogens that are associated with cancer and kidney, liver, and immune system disease.

many that illustrates the trade-offs observed as food systems evolve and change. For example, raising livestock provides cash income and a source of organic fertilizer that is critical to the livelihoods of many farming families. Animal-source foods are also an important source of easily absorbable micronutrients. However, as production of meat and milk products has grown in recent years, the housing of animals in close quarters with humans, especially in densely populated urban areas, has increased the risk of zoonotic diseases.[80] Furthermore, exposure to bacteria in animal feces is a common way of transmitting disease and is hypothesized to lead to child stunting and anemia.[81]

Trade-offs between the outcomes and goals of food systems are common and present challenges for designing programs and policies that safeguard health and nutrition while improving the productivity, profitability, and environmental sustainability of these systems. Yet because food systems have the potential to influence health and nutrition outcomes in so many ways, there are abundant opportunities to identify innovative, win-win strategies that, at a minimum, do no harm to nutrition and health outcomes and support productive and sustainable food systems.

Population growth, urbanization, climate change, and resource scarcity compound the challenges to food systems and health

In the coming decades, strategies to achieve these win-win solutions will need to be designed and implemented taking into account the constraints being placed on food systems by the global dynamics of population growth, urbanization, climate change, and the degradation of natural resources and ecosystems. These dynamics have the poten-

Box 8 – The role of food safety in nutrition

Food safety and clean water play a critical role in nutrition. Even if a food is healthy, it can do more harm than good if contamination or unclean water interfere with the absorption of the nutrients or cause disease or illness.

Mycotoxins are carcinogens produced by fungi caused by poor practices during the harvest, production, and storage of grains, nuts, and other crops. They are associated with cancer and kidney, liver, and immune system disease. Aflatoxins, a type of mycotoxin, can lead to stunted growth in children and other diseases through adulthood. Aflatoxins primarily affect maize and peanuts, which are key dietary staples in developing countries. While modern agricultural practices and regulations in the food processing system have greatly reduced exposure to mycotoxins in developed countries, they are a significant problem in developing countries.

Foodborne illnesses also inhibit nutrition and health, particularly in developing countries, due to unclean water used to clean and process food, poor processing and storage practices, and weak regulatory systems. As a result, foodborne illness is a significant cause of mortality worldwide, particularly among infants and young children, pregnant women, the elderly, and others with weak immune systems. Approximately one in three people in the world lack access to clean water, and an estimated 1.9 million children die annually due to diarrheal disease, to which foodborne illness is a major contributor.

Foodborne illness is not limited to low-income countries. In the United States foodborne diseases lead to sickness in 76 million people and 5,000 deaths annually. In China food safety issues have plagued the food industry and unnerved consumers. To ensure that diets are healthy and nutritious, especially in low-income countries that lack infrastructure, technology, and other resources to properly harvest and store food, it will be crucial to address the causes of unsafe food.

Sources: Bhat and Vasanth, 2003; Cardwell et al., 2001; Jacobs, 2008; Milićević, Škrinjar, and Baltić, 2010; WHO, 2008.

Klaus Vedfelt/Getty Images

Box 9 – Urbanization and malnutrition

The world's population is becoming increasingly urban. Today, more people worldwide live in urban areas than in rural ones, and the trend will only continue. In 1950, 30 percent of the world's population (746 million people) were urban; by 2014, 54 percent of the world's population (3.9 billion people) was urban; and by 2050 that figure is projected to reach 66 percent of the world's population (6.3 billion people).

The most rapid urbanization is taking place in low- and middle-income countries. Africa and Asia are urbanizing faster than any other region. Africa is projected to grow from 40 to 56 percent urban, and Asia from 48 to 64 percent urban by 2050. India, China, and Nigeria together will account for more than a third of the projected growth of the world's urban population between now and 2050. This rapid rural-to-urban transition will change how and where people get their food and how they eat, posing new and significant challenges to health.

For example, as populations become increasingly urban, they have greater access to processed foods, while fruits and vegetables become less accessible and more costly. In China the average urban resident gets nearly a third of their calories from fat, compared to an average 25 percent calories from fat consumed by rural residents. In India urban residents are consuming more sugar. At the same time, rates of diet-related NCDs such as diabetes in India and hypertension in China are increasing rapidly. Nourishing the world's cities, then, depends on the accessibility and affordability of healthy foods.

Sources: Leon, 2008; Popkin et al., 2001; United Nations, Department of Economic and Social Affairs, 2014.

Mohd Irman Ismail

tial to simultaneously disrupt food systems and negatively impact health and nutrition. This makes the integration of health and nutrition goals into food and agriculture sector initiatives that much more imperative. Strategies and efficiencies across sectors will be essential to meeting these enormous challenges.

Population growth and urbanization are advancing rapidly

There are more than 7 billion people on the planet today, and the global population is expected to exceed 9 billion by 2050.[82] By 2050, approximately two-thirds of the world's population is projected to live in cities.[83] The rapid growth of urban areas, particularly in LMICs, has outpaced the development of institutions, infrastructure, and employment opportunities to support the population in many regions.[84] This lag in development has contributed to widespread disparities in access to the resources available in urban areas and as a result, in health outcomes.[85] Hundreds of millions of city dwellers struggle with poverty and food insecurity.

At the same time, the incomes of many urban residents are increasing, driving dramatic changes in diets. Global demand for meat and milk products, for example, has risen markedly and is expected to increase by as much as 75 percent from 2005 levels by 2050, compared to an increase of just 40 percent for cereals.[86] Assuming that global food waste continues unabated, it is estimated that global production of staple crops will need to increase by 50 to 60 percent by 2050 to meet the projected increases in demand associated with population growth, urbanization, and changes in dietary preferences toward increased consumption of animal-source foods.[87]

There has also been a substantial shift away from consumption of legumes and coarse grains (e.g., millets) toward refined grains as well as increased consumption of edible oils, fats, and products with added sugar.[88] Many of these changes have been adopted not only by wealthy consumers, but by the urban poor. Low-income urban residents, for example, are often unable to afford nutrient-rich fruits, vegetables, meat, and milk products and rely heavily on low-quality, processed foods.[89]

Climate change poses risks to food and nutrition security

Meeting the increased demand for food will be further complicated by the added constraints facing food systems from climate change. Surface temperatures are already warming throughout the globe and are expected to increase, accompanied by more frequent and severe droughts and floods and more volatile weather patterns.[90] The warming of surface temperatures around the globe will impact agricultural production differently from region to region. Warmer temperatures can reduce critical growth periods for plants, which will likely accelerate crop ripening and decrease yields.[91] Scientists have found evidence suggesting that elevated carbon dioxide concentrations will reduce plant concentrations of key micronutrients such as iron and zinc, which could have serious implications for human health.[92]

At the same time, climate change may also adversely affect food security by contributing to food price volatility. While many factors affect food prices, production shifts and crop losses from weather events linked to climate change will likely cause food prices to remain volatile.[93] Food price volatility can have serious effects on the budgets of low-income households, which may spend half or more of their income on food.[94] For poor agricultural households, volatile weather patterns and food prices can disrupt

Box 10 – Climate change and nutrition security

Climate change studies typically focus on crop yields and calories and overwhelmingly suggest that climate change will negatively affect food production. However, increased CO_2 levels that accompany climate change result in "CO_2 fertilization" of crops, which may help offset declining yields, but will also reduce the crops' nutrient content.

As the figure below illustrates, in a changing climate crop yields are expected to decrease, reducing the calorie supply (red circle in the middle figure). At the same time, increasing levels of CO_2 will positively affect plant growth (especially in crops like wheat, rice, and soy), making up for some of the calories lost to other aspects of climate change (red circle in the righthand figure). Yet higher CO_2 levels will also reduce the essential mineral and protein content of crops (grey wedges). Future food security assessments should consider these important implications for health and nutrition.

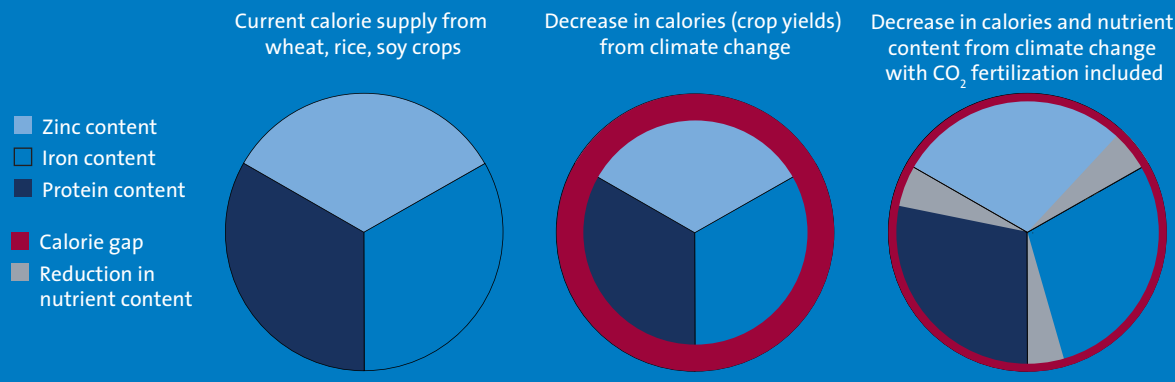
The Agricultural Model Intercomparison and Improvement Project (AgMIP) and the International Life Sciences Institute Research Foundation's Center for Integrated Modeling of Sustainable Agriculture and Nutrition Security (CIMSANS) are working to incorporate nutrition into crop models to better understand the potential impacts of climate change on food and nutrition security. AgMIP is a global community of modelers working to understand the impacts of climate change both globally and regionally.

CIMSANS recently began a collaborative project to develop a set of quantitative food system metrics for sustainability and nutrition. Their goal is to incorporate all relevant information, especially datasets potentially available from the private sector, to assist public-sector decision makers and private-sector investors in assessing alternative adaptation strategies and potential interventions in food systems intended to sustainably improve human nutrition and health outcomes. The proposed metrics include:

1. Dietary adequacy
2. Environmental sustainability
3. Affordability and accessibility
4. Cultural appropriateness
5. Resilience
6. Food safety
7. Waste and loss minimization

Over the next three years, CIMSANS will continue to refine these metrics and assemble the necessary data and modeling improvements needed to apply them for regional and global assessments of sustainable nutrition security.

Effects of climate change on calorie supply and nutrient content of wheat, rice, and soy



Note: Figure uses a high emissions scenario for climate change (RCP8.5 from the IPCC's Fifth Assessment Report).
Sources: ILSI Research Foundation, 2015; Müller et al., 2014; Rosenzweig et al., 2013. Chart adapted from Müller et al., 2014.

livelihoods as well as investments in health, education, and nutrition. The consequences of climate change will be most severe in the low-latitude tropical regions where the vast majority of the world's poor reside.[95] With so many individuals in these regions already enduring chronic food insecurity,

Climate change could reduce concentrations of essential minerals and proteins in some crops, which could have serious implications for human health.

warming temperatures and climate-related shocks have the potential to negatively affect nutrition and health.[96]

Environmental constraints will negatively affect nutrition

Growing constraints on soil and water resources will make agricultural production more challenging in years to come. In particular, given the fact that most fruits and vegetables require irrigation and are relatively water-intensive to produce, new methods are needed to produce these nutrient-rich crops more sustainably and cost-effectively. Global food systems do not produce enough fruits and vegetables for consumers to meet recommended dietary intakes, and production will face increasing challenges in the future under more severe environmental constraints. Significant investments in research and development to sustainably increase the production of nutrient-rich crops are urgently needed.

Soil health and water quality also play an important role in food safety. China, for example, has had problems with declining soil quality due to industrial waste and heavy metal contamination, affecting some of the country's largest rice-producing areas. In 2014 the Chinese government released a report indicating that 16.1 percent of the country's soil was polluted, including 19.4 percent of farmland, with officials declaring eight million acres of land too polluted to be farmed.[97]

Improving nutrition through the agriculture and food system is in the interests of the United States

Investing in food security and improved health and nutrition for the world's people is not simply a humanitarian matter. It is squarely in the interests of the United States. Such investments can help build self-reliant and stable nations that are less likely to succumb to conflicts and humanitarian disasters that are even more costly and destabilizing. With a growing global middle class, these investments can also bring business opportunities that can further develop markets for US trade and exports.

Since the outset of the Marshall Plan, the United States has been a global leader in the provision of basic health care, disaster assistance, and agricultural development activities to some of the world's neediest populations. US leadership on agriculture, food, and nutrition provides definitive support for the interests of the American public. With growing unrest around the globe, investments that lead to healthy and prosperous economies are worthy of US policymakers' time and attention.

Market opportunities will grow

The agriculture and food business sectors are important partners in improving nutrition, and businesses stand to gain from growing consumer demand for produce and nutritious foods. Market

research projects the global fruit and vegetable market to be valued at $2.3 trillion by 2017, an increase of nearly 52 percent from its value in 2012.[98]

Global survey data on consumer preferences indicate that consumers prefer healthier foods and, in many cases, are willing to pay a premium for them. The 2015 Nielsen's Global Health and Wellness Survey, which polled 30,000 people in 60 countries, found that 88 percent of consumers are willing to pay more for healthier foods.[99] Nearly 80 percent of respondents said they actively use foods to forestall health and medical problems such as obesity, diabetes, high cholesterol, and hypertension. Thirty-seven percent are choosing to consume fewer processed foods.[100]

The global fruit and vegetable market is expected to be valued at $2.3 trillion by 2017, an increase of more than 50 percent of its value in 2012.

Sixty-five percent of consumers were moderately or very willing (38 and 27 percent, respectively) to pay a premium for healthier foods. Willingness to pay more for such foods is highest among younger consumers. Thirty-one percent of consumers under 20 years old and 29 percent of those between ages 21 and 34 were very willing to pay a premium for healthier foods, compared with 23 percent of Baby Boomers. The willingness to pay a premium for healthier food was highest in emerging markets: 94 percent of respondents in Latin America, 93 percent in Asia-Pacific, and 92 percent in Africa and the Middle East, compared with 80 percent of North American and 79 percent of European respondents.[101]

Such findings support projected growth in demand in agricultural markets for nutrient-rich foods and the business opportunities this demand will generate. The United States is well positioned to help develop these markets and take advantage of the opportunities they offer.

Regional growth in Asia and Africa will be facilitated

The world's fastest-growing economies are in Asia and Africa.[102] Nigeria is currently the third-largest market for US wheat exports, and food sales in Sub-Saharan Africa are expected to increase 60 percent over the next decade.[103] US exports to Sub-Saharan Africa have increased 200 percent since 2004, and in 2012 North Asia became the largest market for US agricultural goods.[104] At the same time, almost half of projected global population growth will be in Africa and Asia.[105] Despite development improvements, massive population growth means these countries will remain net importers. Income increases from $2 to $10 a day drastically change the diets and food purchases of consumers. People with higher incomes are more likely to buy meat, vegetables, processed products, and modern agriculture tools, which make up a large percentage of US exports.[106]

Malnutrition in Africa and Asia could significantly hamper the speed of growth. Chronic undernutrition suppresses income by hindering production. Obesity further reduces labor productivity and puts people at risk for diet-related NCDs, shortening productive lifespans. Without action, countries in these regions will be overwhelmed with health-care costs at both ends of the nutrition spectrum. US leadership in alleviating malnutrition can be a safeguard against economic stagnation while developing new

Box 11 – Nutrition and the "1,000 days"

The 1,000 days from pregnancy through a child's second birthday are a profoundly important time of development. The nutrition that a child receives during this period affects the child's physical and mental development. Children poorly nourished during the 1,000-day window are more likely to be physically stunted and suffer from cognitive deficits. The consequences can be irreversible and last a lifetime.

Adults who were undernourished as children are more likely to suffer from chronic disease, have lower average hourly earnings, and live in households below the poverty line. Poor nutrition can weaken immune systems, increasing children's susceptibility to potentially fatal illnesses such as pneumonia, diarrhea, and malaria. Women who were stunted as children have higher rates of maternal mortality and babies with low birth weight. Good nutrition during the 1,000-day window, on the other hand, is linked to school completion and achievement and improved mental capacity.

Ensuring that women receive adequate nutrition before and during pregnancy and while breastfeeding ensures that children are also nourished during this crucial period. Women's ability to purchase, prepare, and consume nutritious foods is therefore critical to their children's lifelong health. Simple interventions such as community outreach and education can play a major role in promoting good nutrition among women.

Worldwide, governments, nongovernmental organizations (NGOs), and the private sector are taking action to support women's nutrition during this 1,000-day window. The Scaling Up Nutrition movement emphasizes the importance of women's empowerment. The 1,000 Days Initiative engages with partners from business, government, and civil society to facilitate collaboration and inform investments in maternal and child nutrition. Ensuring good nutrition during the 1,000-day window is a cost-effective and vital way to promote health and well-being in early childhood and throughout a lifetime.

Sources: 1,000 Days Partnership; IFPRI, 2014; Scaling Up Nutrition.

Greg Elms/Getty Images

markets and opportunities for US businesses to provide needed products and agribusiness services.

Returns on current investments in global health, food aid, and global food security will increase

Investing in nutrition is the foundation for securing a nation's health and economic potential. Investments in nutrition have reduced infant mortality, increased life expectancy, and enhanced economic productivity.[107] While undernutrition is not a conspicuous problem in the United States, more than 1 in 10 families in the United States suffers from food insecurity.[108] Children and the elderly are most at risk for food insecurity. In addition, more than two-thirds of Americans are still overweight or obese today despite the leveling off of obesity after decades of increases.[109] Although this report does not provide specific policy recommendations to confront nutritional challenges in the United States, addressing malnutrition and diet-related NCDs in particular are critical to the health and economic development of the United States.

In the past decade, the United States has made extraordinary investments in health and agriculture globally, and the world is better off because of it. Between 2010 and 2014, the US government spent $40 billion investing in programs such as the President's Emergency Plan for AIDS Relief (PEPFAR) and malaria and tuberculosis initiatives. It spent approximately $1 billion annually on Feed the Future, a program to increase the production and incomes of small-scale farmers in developing countries.[110] These investments have provided vital, life-saving services and have lifted countless people out of poverty.

Investing in nutrition will further improve the results of all of these programs, generating a greater return on investment. It is more difficult for those who are sick with HIV/AIDS or malaria to recover and stay healthy if they are malnourished. Furthermore, small-scale farmers, who are some of the world's poorest people, are not able to be as

US leadership in alleviating malnutrition can be a safeguard against economic stagnation while developing new markets and opportunities for US businesses to provide needed products and agribusiness services.

productive as they could be when they are malnourished. Given the important links among malnutrition and both health and labor productivity, even modest investments in nutrition can yield bigger returns for health and agriculture programs.

American institutions will be strengthened and scientific frontiers advanced

Increasing America's role in nutrition-sensitive agricultural production and research can spur creative public-private partnerships with America's land-grant universities and NGOs, leveraging government investments with private contributions. The reverberations of these investments are global. Expanding partnerships between US universities and developing country institutions can help increase the understanding of contemporary social, agricultural, and cultural realities in both South Asia and Sub-Saharan Africa, build critical training and dissemination opportunities, and lead to long-term local ownership and expertise. The US land-grant university system has made important

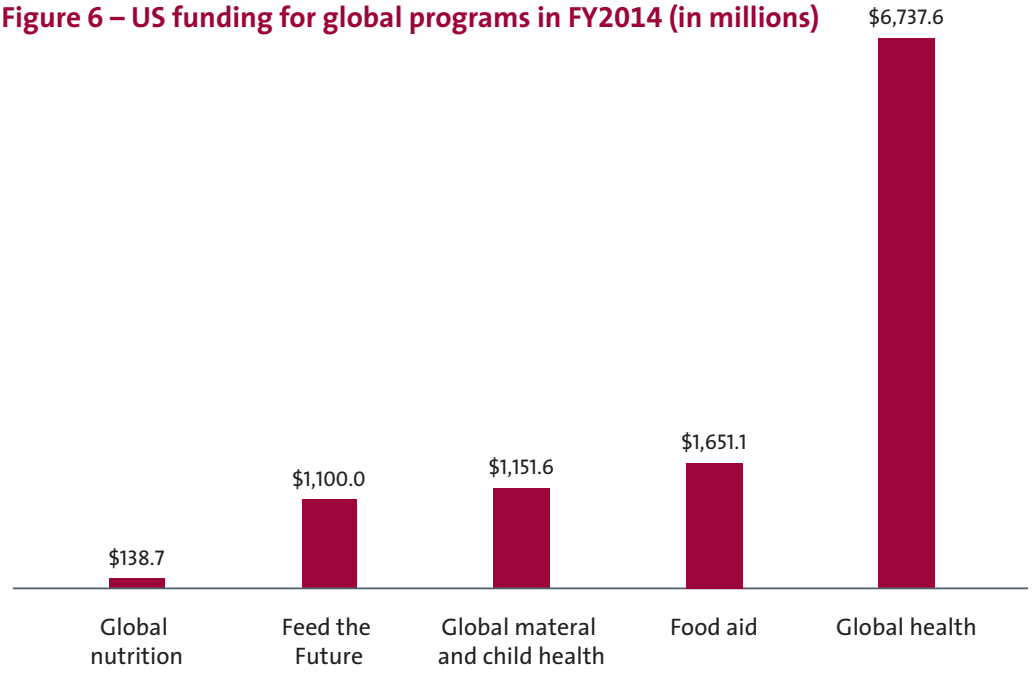
contributions to agriculture around the world and should be at the center of a cooperative international effort to reduce hunger and malnutrition around the world.

Political ties will be strengthened

PEPFAR, the Millennium Challenge Corporation, and Feed the Future have strengthened US ties in Africa, Asia, and Latin America. Prioritizing nutrition, an issue of high priority to these governments, can further restore and enhance America's policy influence. Mobilizing American institutions—especially its universities—to address hunger and malnutrition in these regions is a wise and efficient deployment of America's "soft power." National leaders in Africa, Asia, and Latin America are fully aware of the peril they face from pervasive hunger and malnutrition, and they will welcome American efforts to take these concerns seriously. The leaders, scientists, and educators responsible for agricultural development in Sub-Saharan Africa, Asia, and Latin America have repeatedly stated they would welcome American support of increased local food production.

Investing in nutrition will yield greater returns on US investments in global health and agricultural development.

Figure 6 – US funding for global programs in FY2014 (in millions)



Note: These accounts include the following agencies and programs—Global Nutrition: USAID's Global Health Programs, Economic Support Fund Account, and Development Assistance Account; Feed the Future: total program spending; Global Maternal and Child Health: USAID's Global Health Programs and Economic Support Fund Account, State Department's International Organizations and Programs, and the CDC; Food Aid: USDA's McGovern-Dole and Food for Peace; Global Health: HIV funding via PEPFAR, malaria funding via the President's Malaria Initiative, USAID's neglected tropical diseases, pandemics, tuberculosis, and water funding, and other health spending via State Department, CDC, and HHS's Fogarty International Center.

Sources: Interaction, 2015; Kaiser Family Foundation.

PART II

Recommendations

Building on the recommendations of previous Chicago Council on Global Affairs' reports, this section identifies actions that can be taken by the US government—in collaboration with stakeholders from multiple sectors, including researchers, policymakers, private companies, civil society, and practitioners—to strengthen the capacity of food systems to improve nutrition and health outcomes. Included are strategies to address not only undernutrition, but the growing burden of obesity and diet-related noncommunicable diseases that are contributing to a nutritional "double burden" in many low- and middle-income countries. The recommendations support three broad goals, namely, to foster food systems that:

- produce and promote foods that contribute to diverse, healthy diets;
- improve accessibility by low-income and nutritionally vulnerable groups to productive assets for agriculture; sustainable livelihood opportunities throughout the food system; and sufficient, safe, and nutritious foods; and
- promote sustainability and reduce environmental impacts.

Food insecurity and malnutrition are complex challenges that require coordinated action across US government agencies—including the US Department of Agriculture (USDA), the State Department, the Centers for Disease Control and Prevention, the National Science Foundation, and the Department of Health and Human Services—as well as by the US Congress. Strong leadership is essential to making this happen.

Leadership by the White House can drive agencies to implement many of the recommendations in this report through the US Agency for International Development's (USAID) Multi-Sectoral Nutrition Strategy. The White House can facilitate collaboration through the US Government Global Nutrition Coordination Plan, which is currently being developed by a panel of US agencies.

Leadership by Congress can also drive coordination and implementation. In 2014 Congress created a bipartisan commission to put forward recommendations on how America can tackle its costly nutrition challenges. Congress should create a second commission to review and drive action to address nutrition challenges globally. The commission should be bipartisan and include members of Congress, key administration officials, and select scientific and business leaders, including those in both agriculture and health. The commission would be charged with working with Congress and US government agencies to fund and carry out these recommendations and monitor progress. This commission could potentially operate for a five-year period with the possibility for renewal.

Through these initiatives, both the administration and Congress can provide strong leadership toward improving food security and nutrition. This would not only benefit millions of food-insecure and malnourished people around the world, but bring about economic, political, and health gains for the United States that are in America's own interests.

RECOMMENDATION 1

Strengthen policies to support nutrition-sensitive food systems

Neil Palmer/CIAT

There has been a resurgence of interest in recent years among policymakers, researchers, practitioners, and consumers to unlock the potential of food systems to improve nutrition. Several high-level, intergovernmental policy and research conferences have focused on this topic, and many governments have formulated national nutrition policies to address the linkage. Public, private, and civil society stakeholders are already responding to the persistent threat of food insecurity that is hindering the economic development of high- and low-income countries alike. This growing momentum across sectors and the groundswell of public interest in reshaping food systems to better support human health and nutrition suggest that now is a critical time to act to bring about broad-based, sustainable change.

Action 1a: Commit to a long-term global food and nutrition security strategy.

Since 2009 the US government has invested approximately $1 billion annually in strengthening food systems in low-income countries in Africa, Asia, and Latin America. This program, entitled Feed the Future, has made numerous gains. It includes a focus area on nutrition and in 2014 reached more than 12.5 million children globally with interventions designed to improve nutrition.[111]

This program was initially suggested by members of Congress and has enjoyed bipartisan support. Former Senator Richard Lugar (R-IN) and Senator Robert Casey (D-PA) introduced legislation on this concept in 2008, and legislation has been introduced in every session since that time. Congress has continued to appropriate support for the program over the past six years.

Congress should pass authorizing legislation to cement a long-term strategy for advancing food security and nutrition through agricultural development in the same way it committed the United States to a long-term focus on HIV/AIDS through the President's Emergency Plan for Aids Relief.

Investments in agriculture and food systems need to be sustained over the long term to have lasting results. Congress should pass authorizing legislation to cement a long-term strategy for advancing food security and nutrition through agricultural development in the same way it committed the United States to a long-term focus on HIV/AIDS through the passage of PEPFAR.

A long-term strategy should include a focus on raising the incomes of small-scale farmers through increases in productivity and market access, but also on improving nutrition, empowering women, and responding to climate change. Such a strategy would provide a common roadmap across all relevant US federal agencies and bureaus for achieving sustainable gains in food security while also promoting the health and nutrition of all populations. A long-term strategy would also give policies and programs the time needed to shift deeply engrained practices, norms, and priorities that can only be overcome with long-term investments and incremental progress.

A focus on nutrition in postharvest value chains is essential to this strategy. Many households in low- and middle-income countries only have access to fresh fruits and vegetables for a short time each year, in part because there are too few processing facilities that can preserve these foods and poor systems for aggregating produce to create

Box 12 – USAID Multi-Sectoral Nutrition Strategy 2014-2025

In May 2014 at The Chicago Council's Global Food Security Symposium, national security advisor Susan Rice announced the release of USAID's Multi-Sectoral Nutrition Strategy 2014-2025. With this strategy USAID highlights the importance of nutrition to their broader mission of alleviating poverty and promoting resilient societies. Aligned with the 2025 World Health Assembly Nutrition Targets, the goal of the strategy is to improve nutrition to save lives, build resilience, increase economic productivity, and advance development.

The strategy aims to scale up effective interventions and programs with a specific focus on the 1,000-day window to improve nutrition among children under five as well as among women of reproductive age. The goal is to decrease stunting by 20 percent through the Feed the Future and Global Health initiatives, the Office of Food for Peace, and other investments.

In addition, the US government is developing a whole-of-government approach through the US Government Global Nutrition Coordination Plan, which aims to improve nutrition to enhance health, productivity, and human potential. The plan will support country-led efforts; promote leadership and partnership; and generate, share, and apply knowledge and evidence to accelerate progress towards World Health Assembly targets. The plan includes participation from numerous government agencies, including the Department of State, Department of Treasury, Department of Agriculture, and others.

Sources: USAID, 2014; US Department of Health and Human Services, 2014; the White House, 2014.

Keren Su/Getty Images

economies of scale to make such facilities profitable. Investments in improved facilities for minimal processing of foods such as drying, freezing, and vacuum packing can help increase the shelf life and accessibility of perishable produce. Increasing access to nutrient-rich fruits and vegetables, even for a few additional months per year, if not year-round, can make an important contribution to improved diets.

Investments in postharvest processing facilities would also help minimize food waste, improve food safety, lower food prices in rural regions, and provide job opportunities, further multiplying the benefits. Finally, functioning and profitable facilities would increase access to markets, information, and services and facilitate the smooth functioning of postharvest value chain for perishable crops.

Any long-term food and nutrition security strategy that aims to strengthen both food systems and nutrition must include investing in women at its core. Women are the cornerstone of the agriculture sector in most developing countries. Yet they must work harder and longer than their male counterparts to achieve the same levels of productivity because of poor access to information, technology, secure property rights, and many other productive assets. Their roles as mothers and caregivers also mean that women are the critical link for ensuring the survival, health, and well-being of children.

Strengthening the climate resilience of agriculture has multiplier effects, helping sustain livelihoods and promote more diverse farming systems that include a range of vegetables, fruits, and indigenous crops, thereby improving access to healthier diets.

Another key focal area for a long-term global food and nutrition security strategy lies at the intersection of agriculture and climate change. Previous work by The Chicago Council on Global Affairs has examined this nexus in depth, warning of the urgency to strengthen the climate resilience of agriculture.[112] Agricultural practices that enhance water use efficiency, soil fertility, nutrient uptake, and energy efficiency are especially important and can also benefit human health. For example, rotating crops with legumes can help replenish depleted nutrients and organic matter in the soil, improve the capacity of soils to hold water, and limit the need for inorganic fertilizers. This would, in turn, reduce greenhouse gas emissions associated with the manufacturing and use of fertilizers.[113]

As with so many food and agriculture sector solutions, strengthening the climate resilience of agriculture has multiplier effects, helping sustain livelihoods and promote more diverse farming systems that include a range of vegetables, fruits, and indigenous crops, thereby improving access to healthier diets.[114]

Action 1b. Ensure that food aid and social protection programs expand access to and incentivize consumption of healthy foods.

Since World War II, the United States has been a global leader in the fight against hunger. Food aid and broader social protection programs have saved lives, prevented malnutrition, and provided hope for millions of people facing dire food shortages due to natural disasters and civil conflict.[115]

Today, US food assistance remains one of our nation's most critical humanitarian assistance tools as increased natural disasters, climate change, and man-made crises impact millions of families. Even as food security and nutrition initiatives aim to reduce the amount of food aid necessary through the development of productive, self-sustaining agriculture and food systems in the developing world, food assistance will continue to be an important vehicle for providing emergency relief to those in need. Assistance that maximizes the benefits to hungry and malnourished recipients and minimizes waste and taxpayer burden is crucial to the success of food aid programs.

Nevertheless, while the United States provides roughly $2.2 billion in food assistance annually, program restrictions and outdated policy regulations create costly inefficiencies that severely limit the number of people that can be reached.[116] For every tax dollar spent on food assistance programs today, less than 50 cents directly supports the intended beneficiaries. Shipping and administrative costs consume the rest.[117] Due to a bill dating back to 1954, at least 50 percent of US food aid must be shipped on American flag carriers, which costs nearly three times as much as their international competitors.[118] According to the Government Accountability Office, this requirement alone consumes roughly 25 cents per taxpayer dollar spent on food aid each year.[119]

Sixty years after its launch, it is time to reform food aid to improve program efficiency and allow millions more people to be reached during life-threatening situations. In addition, integrating a focus on nutrition into these programs is essential to helping address the challenges of malnutrition. The solution is simple—untie aid and end the

Assistance that maximizes the benefits to hungry and malnourished recipients and minimizes waste and taxpayer burden is crucial to the success of food aid programs.

regulations that hamper the current program. Key reforms include allowing more funds to buy food locally, eliminating the sale of US food aid in developing countries known as "monetization," and addressing transportation and shipping restrictions. These reforms are long overdue and would allow the US to reach millions more beneficiaries without spending additional money.

In recent years, the US Congress has made significant improvements to the program, and the administration has called for large-scale reforms. Legislators on both sides of the aisle have attempted to change the status quo. Previously, Representatives Ed Royce (R-CA) and Eliot Engel (D-NY) introduced an amendment to increase USAID's flexibility.[120] A current effort by Senators Bob Corker (R-TN) and Chris Coons (D-DE) does the same, while eliminating the cargo preference and monetization requirements. While Congress' attempts to reform food aid are commendable, these simple solutions are still facing obstacles. Future reform efforts need to ensure that US development assistance employs best practices to increase the efficiency of taxpayer-funded assistance and maximize its impact on reducing food insecurity and malnutrition.

In addition to food aid, development assistance programs more generally must incorporate nutrition-sensitive approaches to combat malnutrition. Recipients of development assistance are not always incentivized to consume healthy foods, and in

Box 13 – Global Food Security Act of 2015

The US House of Representatives introduced legislation in March of 2015 to codify a global food security strategy. It aims to solidify a "whole of government" approach that calls for the president to coordinate food production and distribution efforts across a variety of government agencies. The bill authorizes a roughly $1 billion appropriation. The legislative language proposes nutritional interventions for mothers and infants during the 1,000 days between pregnancy and a child's second birthday, along with partnerships to improve agricultural productivity using science and technology. A companion bill is expected to be introduced in the Senate later in 2015. Supporters of the bill hope to combat poverty and malnutrition, particularly for women and children, while also stimulating economic growth, reducing dependence on food aid, and preventing security threats that emerge from hunger. Similar legislation was introduced in both houses at the end of the 113th congressional session, but the Senate was unable to act before the session concluded.

Sources: H.R. 1567 2015, InterAction, 2014; H.R. 5656 2014; S. 2909 2014.

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Box 14 – Women's role in alleviating malnutrition

As farmers and as mothers, women can play a crucial role in alleviating malnutrition. Too often, a lack of information or empowerment prevents women in developing countries from fulfilling their potential to produce healthy foods and ensure their families are adequately nourished. Women must be empowered so they can provide nourishment in their homes, in their communities, and in the broader agricultural marketplace.

As the majority of smallholder farmers worldwide, women are central to the production of healthy foods. As the nutritional gatekeepers of their households, mothers are vital to ensuring that children get the healthy food needed to grow and thrive.

Yet women farmers in developing countries often lack access to land, credit, education, extension services, and crucial inputs compared to their male counterparts. Closing this gender gap by making productive resources available to both men and women could increase women farmers' yields by 20 to 30 percent, raise total agricultural output in developing countries by 2.5 to 4 percent, and reduce the global number of undernourished people by 12 to 17 percent. This would improve the nutrition of 150 million people, more than the populations of France and the United Kingdom combined.

Programs to increase women's productivity or earning potential from agriculture can inadvertently overburden women with additional work. Labor-saving technologies in particular would prevent women, especially pregnant and lactating women, from depleting valuable energy and nutrient stores. Such technologies would also allow more time for caregiving and income-generating activities—both of which could improve the nutrition and health of women and their children.

Improved access to markets would help women generate income, which could be spent on nutritious foods. Studies have shown that women are more likely than men to devote income to nutrition and health. By creating an enabling environment that helps women farmers identify markets, access current market information, participate in cooperatives, and connect with traders and processors, they can more fully realize their entrepreneurial potential, resulting in reductions in poverty and improved nutrition and health.

Investments aimed at supporting women must also target spouses and family members, who often constrain women's productivity and may strongly influence nutrition behaviors. In many settings, grandmothers in particular are powerful arbiters of household decisions related to childcare, diets, and agricultural practices. Development programs focused on empowering women and improving maternal and child nutrition must involve families in supporting women to reach their potential.

Sources: Aubel, 2011; Bezner Kerr et al., 2008; FAO, 2011; McGuire and Popkin, 1990.

Jorgen Schytte / StillPictures / Aurora Photos

many cases, low-income households that benefit from foreign assistance or domestic welfare programs still lack access to healthy foods. The US government should encourage and support the efforts of low- and middle-income countries to develop nutrition-sensitive social protection programs that expand access to and promote balanced consumption of healthy foods, including fresh fruits, vegetables, legumes, protein, and whole grains.

Social protection and conditional cash transfer (CCT) programs have demonstrated marked success in improving diets and education outcomes as well as reducing poverty in low- and middle-income countries. Mexico's *Oportunidades* program, for example, provides cash payments to households that obtain preventive medical care and whose children have a strong school attendance record. Children of cash transfer recipients have been shown to have improved growth, cognitive development, and better health outcomes overall compared to children of nonrecipients.[121] Evaluations from CCT programs in many countries (e.g., Colombia, Honduras, Jamaica, and Nicaragua) have demonstrated similar success in overcoming previous failures in delivering social assistance and in improving diets and health.[122]

Giving women farmers the same access to productive agricultural resources as men would nourish 150 million people, more than the populations of France and the United Kingdom combined.

Such approaches hold great potential for incentivizing positive nutrition and health behaviors. Yet as more and more low- and middle-income countries transition to new diets and physical activity patterns akin to those in high-income countries, social protection programs and the food system will need to be monitored more diligently to ensure that unintended health outcomes such as rises in obesity are not incentivized alongside positive change. For example, those receiving higher cumulative cash transfers through the *Oportunidades* program had higher incidence of adult overweight and cardiometabolic disease.[123] The seemingly contradictory potential for both improved nutrition among children and poorer outcomes among adults suggests that CCT and other incentive programs must be coupled with food policies and communications that encourage positive changes in diets to help families make healthy decisions amidst the inundation of unhealthy options that is the new normal in markets around the world.

School feeding programs offer another opportunity to incentivize improved nutrition. Nearly all countries in the world have school feeding programs, whether implemented by national governments or international agencies such as the World Food Program. These programs help encourage school attendance, yet can also help improve iron intake among adolescent girls and are increasingly being designed to address childhood obesity.[124] Home Grown School Feeding programs, a particular approach to school feeding programs that helps create stable markets for smallholder farmers by procuring food from them for schools, may be an especially important link between local food systems and child and adolescent nutrition outcomes.[125] These programs can help ensure that school meals are diverse and prepared with fresh rather than highly processed ingredients. At the same time they can help support the livelihoods of farm-

Box 15 – McGovern-Dole International Food for Education and Child Nutrition Program

Roughly 120 million school-age children worldwide are not enrolled in school, partly due to hunger and malnutrition. The need to earn a living and care for family members can result in children, especially girls, missing school. The McGovern-Dole International Food for Education and Child Nutrition Program (McGovern-Dole) provides meals, teacher training, and related support in developing countries to improve poverty, hunger, literacy, and academic performance. The program gives special attention to girls, who tend to have lower attendance than boys and whose education benefits the entire family. Since the program's inception, it has provided food to an estimated 28 million children in 37 countries.

Through the McGovern-Dole program, the USDA donates US agricultural commodities to school feeding programs in developing countries in order to improve school attendance and childhood development. The ultimate goal is to contribute to more self-reliant, productive societies by fostering universal access to primary education. In 2014 McGovern-Dole provided $183 million for food-related programs in 10 developing countries in Africa, Asia, and Latin America that benefited around 2.7 million children. It has recently increased emphasis on providing micronutrients by incorporating a pilot fortified food aid project targeted toward school-aged children, children under five, and infants as well as pregnant and lactating mothers.

In addition to improving nutrition, the McGovern-Dole programs have collectively led to higher average attendance in school, improved student performance, and greater community involvement in education. Enrollment and attendance rates for girls increase significantly in areas where school meal programs are offered. During a school feeding program's first year, average enrollment at the highest primary school grade has been shown to increase by 28 percent for girls. The figure is 46 percent for schools where take-home and on-site food rations are provided.

Sources: InterAction; Lewis and Lockheed, 2007; USDA, 2014; USDA/USAID, 2013; World Food Program USA.

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ing families in local communities by reducing postharvest losses from inefficient storage and transport and removing barriers to markets.

Action 1c: Align US government investments in nutrition and ramp up collaborative, transdisciplinary research and programs.

Nutrition must become a focal point for US development investments in agriculture and food security and global health. Because what is measured is often what is emphasized in programs and policies, indicators for nutrition must be included prominently as part of a comprehensive set of development indicators to ensure that nutrition is explicitly prioritized in the design of development programs.

As part of the US Government Global Nutrition Coordination Plan's implementation, the US government should work to ensure all federal agencies and bureaus (1) collect and report on the same information, (2) include a clear accounting of nutrition spending, and (3) are guided by a shared roadmap for ramping up collaborative, transdisciplinary research and programs to improve nutrition. Overall, US programs should work towards achieving the 2025 nutrition targets set by the World Health Assembly:

- 40 percent reduction in the number of children under five who are stunted,
- 50 percent reduction of anemia in women of reproductive age,
- 30 percent reduction in low birth weight,
- no increase in childhood overweight,
- increase in the rate of exclusive breastfeeding in the first six months of life up to at least 50 percent.

Indicators for nutrition must be included prominently as part of a comprehensive set of development indicators to ensure that nutrition is explicitly prioritized in the design of development programs.

Within the United States, many federal agencies and private foundations have invested substantially in transdisciplinary research focused on problems like obesity, cancer, and substance addiction.[126] Distinct from *multidisciplinary* research (different fields working independently on the same project) and *interdisciplinary* research (close coordination but distinct disciplinary models), *transdisciplinary* research promotes the development of new concepts, methods, and questions across disciplines through shared frameworks and integrated approaches.[127] This type of research is especially relevant for addressing so-called "wicked problems" for which there may be many interdependent causes and for which efforts to solve one part of the problem may create new concerns.[128]

The development goal of simultaneously improving productivity, profitability, nutritional outcomes, and environmental sustainability through food systems requires solutions based in transdisciplinary collaboration and thinking that involve not only researchers and subject matter experts, but the direct participation of community

Box 16 – Nutrition should be a key component of the Sustainable Development Goals

For 15 years, the Millennium Development Goals (MDGs) have served as milestones for human development, galvanizing investments from governments and donors around the world to address poverty, hunger, health, illiteracy, and environmental degradation. Through the concerted efforts of governments, donors, and civil society, the last round of MDGs helped achieve the goal of cutting extreme poverty in half.

As negotiations continue to develop a new set of Sustainable Development Goals (SDGs), the US government should play a leading role in shaping the priorities. Nutrition should be at the core of these new goals based on indicators of undernutrition such as wasting among children under five, infants born with low birth weight, and stunting. Stunting is one of the best indicators of chronic undernourishment.

The goals should also incorporate diet-related NCD risk such as child overweight and other indicators in alignment with World Health Assembly (WHA) targets. The US government should prioritize stunting in particular to ensure it is incorporated as a key indicator of chronic malnutrition in the SDG framework.

Beyond the WHA targets, dietary diversity and adult overweight and obesity indicators should also be included in relevant SDGs. While standalone nutrition goals are not necessarily needed, nutrition indicators should be incorporated to ensure the use of nutrition-sensitive approaches. US government leadership can help make certain that nutrition goals form the foundation of future human development efforts across sectors.

 Christopher Herwig / Aurora Photos

members and local practitioners who have insights into the most locally relevant and practical approaches.

Federal agencies—including the National Institute of Food and Agriculture, the National Institutes of Health, the National Science Foundation, USAID, and the Centers for Disease Control and Prevention—should develop requests for research proposals and graduate-level training aimed at generating new knowledge and developing innovative solutions to food system challenges critical for improving health and nutrition. These requests for proposals should involve teams of researchers, or teams of faculty in

Requests for research proposals should involve teams that span disciplinary boundaries and that integrate research approaches and disciplinary frameworks to tackle food system questions that cannot be adequately answered in isolation.

the case of graduate training, that span disciplinary boundaries (e.g., agriculture, environmental science, economics, nutrition, public health, social and behavioral science, and medicine) and that integrate research approaches and disciplinary frameworks to tackle food system questions that cannot be adequately answered in isolation. Reducing the threat of mycotoxins in the food chain is one such example. Researchers in plant physiology and nutrition, respectively, are independently investigating the mechanisms of aflatoxin contamination of maize pre- and postharvest and the potential adverse effects of aflatoxin exposure *in utero* on postnatal infant growth. Although this research is of significant value, transdisciplinary research that builds on single discipline work can provide solutions and insights that would not be possible through single discipline modes of inquiry.

Box 17 – Scaling Up Nutrition

The Scaling Up Nutrition (SUN) movement is an international platform where the United States could incentivize countries to scale up their commitments to reducing malnutrition through investments in nutrition-specific and nutrition-sensitive actions. With 54 countries already committed to the SUN movement, the US government should maintain its high-level leadership in the SUN Lead Group and continue to catalyze ownership and implementation of country-costed plans.

Implementation of the USAID Multi-Sectoral Nutrition Strategy in SUN-member countries should be aligned with SUN plans and contribute to the evidence base of those plans. By working alongside these countries to mainstream nutrition into policy priorities, the US government will contribute to the promotion of nutrition-sensitive food systems within and across borders that are sustainable, equitable, and health-promoting.

Source: Scaling Up Nutrition.

Neil Palmer/CIAT

Manon Koningstein/CIAT

Box 18 – Transdisciplinary research in agriculture and health: Soils, Food, and Healthy Communities project

Transdisciplinary research can identify ways to improve health through agricultural production. The Soils, Food, and Healthy Communities (SFHC) project is a farmer-led organization that uses agroecological methods to improve food security and nutrition among smallholder farmers in Malawi.

Smallholder farmers make up 60 percent of the population in Malawi, and women face limited access to agricultural resources and poor dietary diversity. The initial focus of SFHC was introducing legumes to diversify agricultural production and improve soil fertility. The project has since expanded to include agroforestry, mulching, and animal manure practices.

Through innovative educational strategies such as their farmer-to-farmer teaching model and sustainable agriculture practices, SFHC has observed significant improvement in crop diversity. The proportion of farmers incorporating nutrient-rich legumes into their traditionally maize-based crop production increased from 15 percent in 2000 to over 70 percent of farmers by 2011. Improvements have also been seen in child growth and household food security.

SFHC is now in the process of becoming a nonprofit trust, with the majority of its board of directors comprised of farmers involved in the project. SFHC is extending its work to another project, the Malawi Farmer to Farmer Agroecology Project, in collaboration with the University of Malawi, Cornell University, Western Ontario University, and the University of Manitoba. The project involves 6,000 farming households in participatory nutrition education with a focus on gender and farmer-to-farmer teaching of agroecological methods. The project aims to improve food security, nutrition, and community resilience.

Sources: Bezner Kerr et al., 2013; Soils, Food and Healthy Communities.

RECOMMENDATION 2

Expand the research agenda for nutrition-sensitive food systems

Neil Palmer/CIAT

Action 2a. Invest in research to improve access to diverse, healthy foods.

Diversity has long been recognized as a hallmark of healthy diets. Diets that include a variety of foods and food groups are more likely to provide the essential vitamins, minerals, and other food components that support healthy growth, development, and disease prevention.[129] Research investments to increase access to diverse, nutrient-rich foods are essential to addressing malnutrition. For too long, food systems have focused disproportionately on calories rather than nutrients and the diverse foods that supply them. Yet the potential for food systems to enhance access to healthy diets is perhaps greater than that of any other single sector.

Investments in agriculture and agricultural research have traditionally prioritized a limited number of crops, especially rice, wheat, and corn. High-yielding varieties of coarse grain crops such as sorghum, millet, and barley as well as legumes, fruits, and vegetables have lagged decades behind the development of modern varieties of major cereal crops in part because of inadequate investment in research and development.[130] Though investments in research to enhance the productivity of alternative crops have increased in recent years, support is still far below that of the major cereal crops.

In 2002, for example, the CGIAR Consortium, a global partnership that unites organizations engaged in research for a food-secure future, invested US$118 million on research for cereals—nearly 40 percent of all expenditures—but just US$15.7 million on research for fruits and vegetables.[131] The CGIAR Consortium should enhance its collaborations with external organizations such as the World Vegetable Center and national

Investments in agriculture and agricultural research have traditionally prioritized a limited number of crops, especially rice, wheat, and corn.

research organizations to advance horticultural research throughout the supply chain. Low-income countries currently face serious agronomic and supply chain constraints on fruit and vegetable production, including a dearth of breeders in African countries focused on horticultural crops. Research investments aimed at reducing the unit costs of production of micronutrient-rich vegetables and fruits are urgently needed. These investments should not be limited to reducing production costs, but should also seek greater efficiencies along the entire value chain, including processing and distribution.

The global supply of fruits and vegetables has been estimated to be far from sufficient to meet recommended nutrient intakes for populations, especially in low-income countries.[132] This deficit could increase substantially in the future if anticipated production increases do not outpace population growth.[133] Low production levels and lack of demand for these foods could contribute in part to higher prices and inadequate intakes. With growing constraints on land and water resources, research is needed to more efficiently produce these nutrient-rich crops sustainably and cost effectively.

In many low-income countries, limited availability of fruits and vegetables is compounded by inadequate postharvest storage infrastructure, limited access to cold chains, and poor transportation networks to carry these perishable, high-value crops intact and unspoiled to markets. Some estimates indicate that as much as one-quarter of food waste in developing countries could be eliminated by increasing access to refrig-

Box 19 – Research priorities

Few studies have been conducted that rigorously evaluate the nutrition or health impacts of programs and policies that intervene in the food system. More research is needed to generate an evidence base to identify food systems approaches that work for improving nutrition and health outcomes. Research identifying the mechanisms by which these approaches achieve outcomes is also important as well as how approaches might be more or less effective—including cost effective—in different contexts.

Randomized controlled trials are desirable, as they are the gold standard in establishing causality. But they are only one approach and are often impractical to implement in the necessary context. Other approaches that take into account counterfactual methods or use analytic approaches to establish causality and measure impact should be developed and implemented. Qualitative research is also indispensable for complementing empirical approaches and allowing for more reasoned interpretation of findings.

Beyond the need for a stronger base of evidence broadly, specific research investments should prioritize gaps in our understanding of how to:

1. improve access to diverse, health-promoting diets;
2. improve the safety and nutrition sensitivity of food value chains;
3. improve the productivity of agriculture while reducing its environmental footprint;
4. address emerging challenges for nutrition and food systems;
5. implement cost-effective, nutrition-sensitive agriculture interventions; and
6. develop nutrition-sensitive food and agriculture policies.

Following are specific examples of research areas that might be emphasized within each of these broad investment priorities.

Improve access to diverse, health-promoting diets

Priorities include:

- research and technology across the entire food value chain to increase production (e.g., through efficient water use and enhanced nonchemical pest controls) and improve the storage, processing, and transport of horticultural crops;
- breeding nutrient-rich staple crops and increasing availability of quality planting material to enhance crop and varietal diversity and improve year-round access to nutrient-rich foods;
- identifying behavior-change strategies that effectively promote diverse, health-promoting diets and complement improvements in food access.

Improve the safety and nutrition sensitivity of food value chains

Priorities include:

- developing technology to manage and mitigate food safety risks along the entire food value chain;
- understanding how efforts to improve food safety throughout the value chain are affecting the livelihoods of low-income producers and impacting the health and nutrition of producers and consumers;
- reducing preharvest, postharvest, and postconsumer food waste, especially of perishable, nutrient-rich foods;
- decreasing food contamination risks (e.g., through application of chemical inputs, damage during transport, and washing in grey water);
- identifying the positive and negative impacts of private-sector investments in food value chains on nutrition and health.

Improve the productivity and climate footprint of agriculture

Priorities include:

- expanding access to labor-saving and productivity-enhancing agricultural technologies and techniques, especially among women;
- developing climate-smart approaches and technologies that reduce the unit costs of agricultural production, while simultaneously minimizing the use of nonrenewable resources (e.g., water, fossil fuels) and investing in the long-term health of soils and agroecosystems.

Address emerging challenges for nutrition and food systems

Priorities include:

- understanding how to support the dynamic livelihood strategies of farmers and food systems actors to maximize nutrition and health benefits;
- determining the drivers of food and nutrition insecurity in urban and periurban regions and its consequences for undernutrition and overweight;
- investigating how urban agricultural production affects the livelihoods, diets, nutrition, and health of urban residents.

Implement cost-effective, nutrition-sensitive agriculture interventions

Priorities include analyzing the cost-effectiveness of interventions to improve nutrition through agriculture and food systems (e.g., homestead food production, changes in crop management practices, biofortification, expanded access to processing facilities, and training and behavior-change efforts focused on increasing market access and improving income through agriculture).

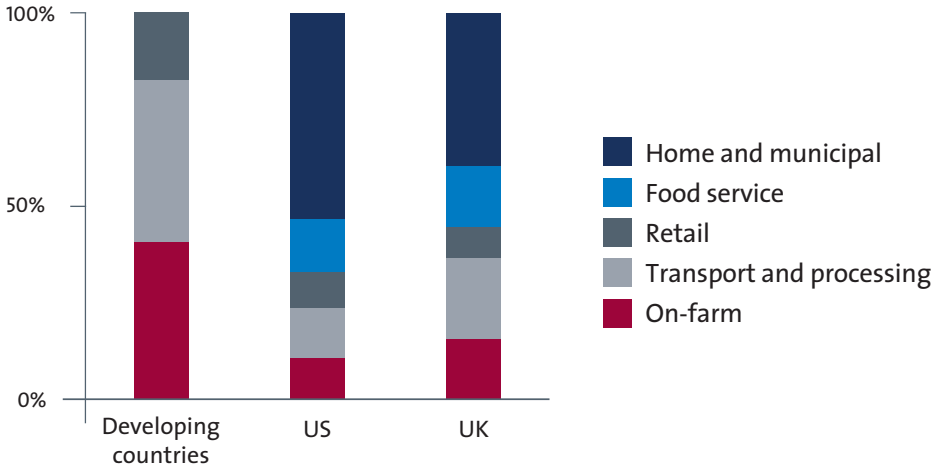
Develop nutrition-sensitive food and agriculture policies

Priorities include:

- identifying appropriate policies and implementation strategies across the agriculture, food, and health sectors to support improved nutrition, including economic, agricultural, and trade policies;
- assessing the strengths and weaknesses of policy environments within countries to identify potential opportunities and bottlenecks for implementing effective agriculture and nutrition policies;
- changing planting dates for food crops, feeds, and forage.

C. Schubert/CCAFS

Figure 7 – Makeup of food waste in developed and developing countries



Source: Godfray et al., 2010.

eration equipment.[134] Therefore, in addition to sustained investments in improved crop varieties adapted to regional climate conditions, research investments are needed to extend the seasonal availability and reach of fruits and vegetables. Innovative solutions are needed in crop management, harvesting practices, postharvest storage, processing, and transportation to achieve these goals. The use of renewable energy resources to provide cooling through solar-driven absorption or to power existing technologies holds great promise, especially in Sub-Saharan Africa and Asia where these resources are abundant.[135] Bolstering linkages between seasonal horticultural production and local markets that require minimal transport would further complement these efforts.

Investments in research on pulse crops and coarse and perennial grains are also needed and could results in wins for both diet diversity and sustainability. Legumes, for example, enhance soil nitrogen content—a critical need for many nutrient-depleted tropical soils—while reducing the need for inorganic fertilizer.[136] Use of legumes in crop rotations has been shown to improve soil carbon content and, when used as a cover crop, can help reduce runoff and soil erosion, thus improving groundwater reserves.[137] Millets and other coarse grains may be especially well adapted for success under future climate conditions. They are commonly adapted to thrive in semiarid and dryland conditions, which are projected to become increasingly common in tropical regions due to more frequent and severe droughts occurring across all latitudes.[138] Similarly, perennial grain crops, compared to annual grain monocultures that predominate today, generally have longer growing seasons and deeper roots that allow them to not only reduce erosion and maintain soil carbon, but to use water more efficiently—traits of critical importance under increasingly arid conditions.[139]

Furthermore, investing in research to increase the productivity and adoption of "orphan crops" is equally important for strengthening the resilience of agriculture while also promoting nutrition-sensitive food systems. Orphan crops, also called "neglected" or "underutilized" crops, have not received the same attention as mainstream crops. They are often cultivated in smaller areas and have limited markets despite their significance for food security and nutrition, especially for the poor. Examples include millets, sorghum, cassava, and many traditional fruits and vegetables. These crops are

Box 20 – Data gaps

There are still too many unknowns about nutrition and nutrition-sensitive food systems. Governments, businesses, international organizations, universities, and civil society should work to close the following data gaps:

- integrated household-level data sets that include rigorously collected information on agricultural production, labor and income, food system activities, diet, and nutrition and health outcomes (Such data, especially if collected at regular intervals and with some households followed longitudinally over time, would help to address many questions regarding the influence of food systems on nutrition and health. In addition to new data collection efforts, there is considerable potential to strengthen the integrated assessment of agriculture, diet, and nutrition in existing household surveys.);
- data and methods to understand the nature and scale of investments in food systems needed for populations to meet dietary recommendations;
- national-level data on the production and availability of specific fruits and vegetables;
- more complete dietary data from national-level surveys that regularly monitor health and nutrition, including data on consumption of specific foods, including foods consumed away from home;
- data on the expected and actual coverage of specific agriculture and food systems programs with the potential to influence nutrition and health outcomes;
- research and development investment data disaggregated by crop as well as by whether the investment is in breeding, crop management, or postharvest along with additional monitoring of investments by the CGIAR and other donors and governments.

V. Meadu / CCAFS

Box 21 – Realigning Agriculture to Improve Nutrition (RAIN) project

Stunting affects one million children under five years old (45%) in Zambia. The Realigning Agriculture to Improve Nutrition (RAIN) project, a collaborative effort between Concern Worldwide and the International Food Policy Research Institute (IFPRI), aims to reduce stunting in children through integrated agriculture, health, and nutrition interventions during the critical 1,000 days from conception until 24 months of age. Concern Worldwide is the primary RAIN project implementer, while IFPRI leads a rigorous data collection and analysis component that is integrated into the program design.

The RAIN project supports agriculture interventions to increase year-round availability of and access to healthy, safe foods. The project aims to improve production and deliver social behavior change communication on optimal nutrition and health practices. Early results of the RAIN project have shown increased production of various micronutrient-rich crops such as leafy green vegetables and increased dietary diversity during both the hunger and postharvest seasons.

This innovative project is designed to generate evidence on the best approaches and optimal impacts. The approach focuses on addressing the multisectoral causes of malnutrition and on learning how to effectively address the challenges of multisectoral collaboration. The project will rigorously evaluate the impact of the RAIN model, monitor process indicators to understand the intended impacts, and disseminate learning from the project at local, national, and international levels.

Sources: Concern Worldwide; Harris and Drimie, 2012.

valued culturally in local communities, are often highly nutritious, require minimal external inputs, are genetically diverse, and are adapted to harsh environments. They have important ecological niches and help farmers mitigate the risk of crop failure. They have the potential to create new markets for rural farmers and increase household incomes, ultimately improving food security.

The vital role of wild, semidomesticated, and underdeveloped crops to food, nutrition, and livelihood security is recognized by virtually all UN food and health agencies and in agreements such as the World Food Summit Plan of Action and the Convention on Biological Diversity.[140] Yet there has been little investment in research and promotion of these crops. A promising initiative is the African Orphan Crops Consortium launched in 2011 with the goal of improving the nutrition, productivity, and climatic adaptability of some of Africa's most important food crops. The consortium will train 250 plant breeders over a five-year period to improve planting materials for varieties that are more nutritious, productive, and robust for smallholder farmers throughout Africa.[141]

Investments to strengthen breeding research programs for perennial grains will pay dividends in the future for climate resilient agriculture. Legumes and alternative grains are also important sources of protein and dietary fiber and contain essential micronutrients such as B vitamins, iron, and zinc. Perennial grains can contribute to diet diversity, especially among those who are getting calories largely from starchy, staple foods.[142] Research investments to reduce the per-unit costs of producing these crops would result in multiple wins for farm productivity, climate resilience, and nutrition.

Research investments are also needed to strengthen livestock production in low-income countries. Meat, fish, and other animal products are important sources of protein

Food crop development programs must include efforts to improve the nutrient composition of crops while breeding for other qualities such as yield and drought tolerance.

and bioavailable micronutrients such as iron, zinc, and vitamin A. These nutrients are easily absorbed but are often lacking in the diets of women of childbearing age and young children in low- and middle-income countries. Including animal-source foods in the diets of individuals who rarely consume them can improve nutrition and contribute to healthy growth and development in children.[143] Livestock also support the livelihoods of many low-income households. They can provide additional labor, assets, and capital and can appreciate in value through reproduction even when prices are stable. Finally, they provide manure, which can substitute for costly inorganic fertilizers.[144]

While livestock production is critically important for low-income populations, it also presents challenges. Most high- and middle-income country populations do not face the same protein deficiencies seen in low-income countries. On the contrary, protein consumption by adults in the United States, much of it from animal sources, far exceeds recommendations.[145] In the United States and many other high-income countries, the animal food sector, including the production of feed crops for livestock such as soybeans and maize is well developed.[146] It is estimated that nearly three-quarters of the world's agricultural land is devoted to raising livestock or growing feed for animals.[147]

Raising livestock also contributes nearly one-fifth of all greenhouse gas emissions and requires an enormous amount of water and fossil fuel.[148] The scale of animal production and consumption in high- and middle-income countries is unsustainable, and new approaches, guided in part by targeted research investments, are needed to reduce the environmental impacts of this sector and increase the sustainability of fisheries. Innovative approaches to sustainably increasing access to protein-rich foods should be explored, including expanded production of aquatic plants and edible insects.

While research investments should prioritize access to diverse, healthy diets, efforts to improve the nutritional value of staple crops can also play an important role in improving nutrition. In the past, plant breeders have typically bred crops for size, visual appeal, and yield, neglecting or unintentionally removing nutrients. Food crop development programs must include efforts to improve the nutrient composition of crops while breeding for other qualities such as yield and drought tolerance. In 2014 the CGIAR consortium committed to developing a plan to include mineral and vitamin traits in its crop breeding programs.[149] Examples include high-iron beans, cassava rich in vitamin A, and micronutrient-enriched lentils, pearl millet, and sorghum.

In addition to providing access to diverse, nutrient-rich foods, research into effective ways to integrate social behavior change efforts into agriculture and food security programs will help ensure that investments in agricultural productivity, livelihoods, and the food value chain achieve maximum nutritional benefits.

The HarvestPlus initiative, building on previous efforts by the International Maize and Wheat Improvement Center to breed maize varieties with improved protein quality, has spearheaded efforts to scale up biofortification of staple crops such as rice, wheat, and maize. Sweet potatoes biofortified with b-carotene, for example, have been proven to improve vitamin A intakes of women and children and the vitamin A status of children in several countries of Sub-Saharan Africa.[150] Other research has shown nutritional benefits from consuming pearl millet or rice biofortified with iron and maize biofortified with b-carotene.[151] Continued research investments in plant breeding are needed to develop new biofortified varieties with both enhanced micronutrient levels and desirable agronomic traits. Research is also needed to understand the nutritional impacts of consuming these crops. Further, research is needed to evaluate cost-effective methods for increasing access to biofortified planting material and for creating demand among farmers and consumers for biofortified crops and foods without compromising existing farm and diet diversity.

In addition to providing access to diverse, nutrient-rich foods, research into effective ways to integrate social behavior change efforts into agriculture and food security programs will help ensure that investments in agricultural productivity, livelihoods, and the food value chain achieve maximum nutritional benefits. Though often difficult to change, behaviors are anything but fixed. Recent research continues to identify the numerous, subtle environmental cues that unconsciously drive much of human behavior, including diet and health-related behaviors.[152] This research must be built upon to complement investments in new technologies and infrastructure.

For example, agricultural investments aimed at improving production of nutrient-rich foods can be coupled with behavior-change efforts to encourage consumption of those foods or foods purchased with earnings from surplus production. And, behavior-change efforts focused on improving breastfeeding or feeding practices may be made more "agriculture sensitive" by taking into account the time and resource constraints of women farmers and by involving men, parents-in-law, employers, and entire communities. For example, optimal times, places, and resources for improving feeding practices should be included as part of both agriculture and nutrition programs.

Action 2b. Measure the nutrition and health impacts of agricultural development programs.

Initiatives funded by USAID to monitor and evaluate the nutrition and health impacts of agriculture and food systems programs should continue and be strengthened. USAID's Multi-Sectoral Nutrition Strategy provides a strong framework for monitoring and evaluating the nutrition impacts of its diverse programs across domains of gender, equity, sustainability, and cost-effectiveness.[153] Adequate support to fully implement this strategy should be a top priority.

The scientific evidence to date supporting the nutritional impacts of agriculture programs at scale is limited. Studies have been hampered by weak research designs and small sample sizes that have prevented them from detecting potentially important changes in nutrition outcomes from these programs.[154] Evidence is critically important to designing and implementing more effective programs with improved nutrition outcomes. Targeted investments in more rigorous evaluation designs are needed for programs with unique opportunities for learning that can advance the knowledge base.

Regular data collection disaggregated by gender and age on the nutrition and health status of populations is also important. Surveillance data such as the Demographic and Health Surveys that collect periodic, nationally representative data on important health and nutrition indicators in LMICs are widely used. The data help track country progress on meeting specific health and nutrition goals, identifying at-risk populations, targeting resources, and informing and evaluating policies. Continued US government support for the collection of these data and other surveillance efforts such as the World Bank Living Standards Measurement Study surveys is paramount.

Data sets that integrate sufficient and rigorously collected data across the domains of agriculture, food systems, nutrition, and health are desperately needed.

At the same time, data sets that integrate sufficient and rigorously collected data across the domains of agriculture, food systems, nutrition, and health are desperately needed, as few such data sets exist. Investments in the regular collection of nationally representative data to inform such integrated data sets would substantially strengthen research capacity to examine and address food and health policy questions.

RECOMMENDATION 3

Prepare the next generation of leaders in food and nutrition security

Chris Hepburn/Getty Images

The United States should leverage the strength of its research infrastructure to introduce a major transdisciplinary initiative to train the next generation of agriculture, food, and nutrition leaders through research partnerships, workforce development, and outreach services in developing countries. This initiative should emphasize training to help students become experts in their fields, but also focus on broad training across disciplines to ensure that future leaders can work productively as part of transdisciplinary teams to address the most challenging food systems and nutrition concerns. Such an effort would uniquely position the United States as a leader in the food sectors on these continents, which are expected to grow by trillions of dollars in the decades to come.

Insufficient investment in agriculture and food systems research in many countries of Sub-Saharan Africa continues to contribute to a lack of qualified researchers because of low salaries and high turnover rates.[155] The most highly qualified researchers, frequently those trained at foreign institutions, often seek better paying opportunities in high-income countries that allow access to abundant resources and advanced technologies.[156] Loss of these talented individuals directly impacts the capacity of low-income countries to find solutions to the challenges most relevant to their locales and can have long-term impacts on the health and economic productivity of their populations.[157] Female scientists in particular are underrepresented in agricultural and food systems research in low-income countries, despite their unique potential to address the challenges faced by female farmers, especially across Sub-Saharan Africa.[158] The African Women in Agricultural Research and Development (AWARD) Program established by the CGIAR consortium is one program designed to boost the careers of promising African women scientists. AWARD offers a series of two-year fellowships to support professional growth and focuses on increasing skills, visibility, networks, and scientific contributions in the service of fighting hunger and poverty in Sub-Saharan Africa.[159]

Similarly, academic departments focused on nutrition are far too rare in low-income countries. The absence of undergraduate or graduate training programs in nutrition in many countries is not only hampering the development of qualified nutrition researchers, but depriving countries of nutrition practitioners with the expertise to monitor and evaluate social programs, fill policy and advocacy positions, and help develop nutrition-sensitive development initiatives across sectors.

In general, medical schools in both the United States and low-income countries need to include much more robust training on nutrition. The majority of health-care professionals receive very limited training on nutritional issues and, as a result, do not view nutrition as a preventative tool for diet-related NCDs. As medical professionals interact most with the public and are often the most trusted source of information for people on topics related to health, it is essential that the medical community be knowledgeable about nutrition and discuss it with their patients as a prevention tool.

Action 3a. Invest in transforming universities, research institutions, and training facilities in low-income countries to address agriculture and nutrition across disciplines, including science, technology, engineering, math, business, and management.

Researchers in low-income countries must have the technical capacity and resources necessary to addresses the health and economic challenges facing their countries. The

Box 22 – Knowledge platforms for improved information sharing

Young Professionals for Agricultural Development (YPARD) is a global network of young agriculture and development professionals who are coming together to create innovative and sustainable agricultural development. YPARD enables its young members to share knowledge and information, participate in meetings and debates, promote agriculture among young people, and organize workshops.

The Agroecological Intensification Exchange (AIEx), developed by the McKnight Foundation's Collaborative Crop Research Program, is an online platform that engages farmers, innovators, and researchers all over the world in conversations about innovations in farming. Agroecological intensification aims to improve productivity and efficiency through better farm management, improved stability and diversity of yields, and enhanced use of local resources. The site's database, complete with case studies and research on topics from crop ecology to disease management, is a resource for practitioners and researchers in developing countries seeking to improve agricultural systems and adapt to the changing climate.

Sources: AIEx; YPARD.

Michael Hall/Getty Images

US government should invest in building the technical and research capacity of researchers and transforming institutions in these countries with an emphasis on training the next generation of agriculture, nutrition, and health researchers and practitioners.

Although investment in agriculture, nutrition, and food sciences is essential, the focus must expand beyond the traditional agricultural sciences. The next generation of leaders in agriculture and food need to come from a wide range of disciplines and acquire a variety of skills to address the multidisciplinary problems facing food systems today. A sustainable, nutritious food system will require that leaders in a range of fields—including engineering, business, finance, and law—be tapped. The US government should expand its higher education programming to include a wider range of disciplines that better address the needs of the future. US land-grant universities have played a vital role in spurring technological innovation in the food system by educating the next generation of leaders in Latin America, Africa, and Asia and building up the capacity of research and education facilities in these regions through partnerships with other countries.

Beyond universities, the US government should provide direct support for education and training for the professionals needed to build nutrition-sensitive food systems. Such professionals include agronomists, dietitians, public health professionals, women's health advocates, journalists, and citizen scientists. A focus on workforce development, whether through management institutes, laboratories, community colleges, or technological institutes, would help educational institutions across the spectrum respond to changing labor market needs and better prepare the workforce.

A sustainable and nutritious food system will require that leaders in a range of fields—including engineering, business, finance, and law—be tapped.

Capacity building may be most effective when it focuses on long-term training opportunities. The Fogarty International Center of the National Institutes of Health, in collaboration with other US and foreign agencies, sponsors many such programs that invest in the training of young scientists from low-income countries to confront significant biomedical challenges.[160] Similar investments are needed for food systems researchers. Support will be needed for scientists and institutions across disciplines and agencies, as the most significant food system challenges span disciplinary boundaries and require innovative solutions that defy siloed thinking.

The US government should increase the number and extent of US partnerships with universities in Africa, Asia, and Latin America. LMICs urgently need to transform their own educational institutions to take over training in food, nutrition, and agriculture in the long run. Scientists leading efforts in low-income countries to nourish the world must be equipped with the know-how and resources to undertake rigorous research. This includes not only technical training, but also institutional support. Research partnerships between US universities and research institutions in low-income countries are critical for exchanging knowledge, coordinating field research methods, and collaborating on research proposals and scientific publications. Through the US Government

Box 23 – Partnership between Tufts University and Makerere University in Uganda

Tufts University and Makerere University in Uganda have established extensive partnerships in public health and nutrition. The collaboration involves the College of Agricultural and Environmental Sciences and the School of Public Health at Makerere and the Schools of Nutrition and Medicine at Tufts. It aims to understand how interventions designed to boost agricultural productivity and nutrition benefit smallholder farm households.

This project takes a holistic approach, studying the importance of crop production, water and sanitation, fungal toxin contaminants (mycotoxins) in the food supply, and program implementation at the district and household level. Over 8,000 households across Uganda are enrolled in repeated panel studies focused on maternal and young child nutrition.

A key goal is to understand which programs, when implemented on a national scale, actually benefit poor farmers. Over 20 students have received support for their master's or doctoral degrees in this area, and both traditional and Internet-based nutrition curricula have been developed.

Another joint project, One Health Workforce, is working on strengthening the response to new outbreaks of disease (such as Ebola virus). It focuses on disease surveillance, training, and outbreak response. Makerere University's Schools of Medicine and Veterinary Medicine are part of this project through an East African consortium of schools of public health and veterinary medicine, paralleling partnerships with their Tufts peers.

Sources: USAID and Tufts.

Bioversity International / A. Vezina

Box 24 – Innovation labs

Adapting Livestock Systems to Climate Change Innovation Lab
Colorado State University

Applied Wheat Genomics Innovation Lab
Kansas State University

Aquaculture & Fisheries Innovation Lab
Oregon State University

Assets and Market Access Innovation Lab
University of California, Davis

Climate Resilient Beans Innovation Lab
The Pennsylvania State University

Climate Resilient Chickpea Innovation Lab
University of California, Davis

Climate Resilient Cowpea Innovation Lab
University of California, Riverside

Climate Resilient Millet Innovation Lab
University of California, Davis

Climate Resilient Sorghum Innovation Lab
University of Georgia

Climate Resilient Wheat Innovation Lab
Washington State University

Food Processing and Post-Harvest Handling Innovation Lab
Purdue University

Food Security Policy Innovation Lab
Michigan State University

Genomics to Improve Poultry Innovation Lab
University of California, Davis

Grain Legumes Innovation Lab
Michigan State University

Horticulture Innovation Lab
University of California, Davis

Integrated Pest Management Innovation Lab
Virginia Polytechnic Institute and State University

Nutrition Innovation Labs: Africa and Asia
Tufts University

Peanut Productivity and Mycotoxin Control Innovation Lab
University of Georgia

Reduction of Post-Harvest Loss Innovation Lab
Kansas State University

Rift Valley Fever Control in Agriculture Innovation Lab
University of Texas, El Paso

Small-Scale Irrigation Innovation Lab
Texas A&M University

Sorghum and Millet Innovation Lab
Kansas State University

Soybean Value Chain Research Innovation Lab
University of Illinois

Sustainable Intensification Innovation Lab
Kansas State University

Sources: USAID, 2015.

Global Coordination Plan on Nutrition, which provides for interagency collaboration, the US government can strengthen incentives for North-South research and training partnerships across disciplines. University partnerships should extend beyond the traditional land-grant programs in agricultural science to include business and management schools and training in other science, technology, engineering, and mathematics (STEM) disciplines.

The US government should increase funding for African and Asian students—as well as younger teachers, researchers, and policymakers—seeking to study agriculture, food, and nutrition at American universities. In the past 25 years, the United States has gradually decreased its support for international students. Today, through its Innovation

The US government should increase funding for African and Asian students—as well as younger teachers, researchers, and policymakers—seeking to study agriculture, food, and nutrition at American universities.

Labs, Feed the Future supports only 78 young people to study at 31 US universities.[161] With the economy rebounding and food, agriculture, and nutrition issues being among of the most pressing global challenges, the US government should scale up the number of international students it sponsors to study in these areas.

The cost of fellowships can be reduced through innovative new training methods. Since 2004 USAID has piloted several approaches to international agricultural education and training that are less costly, including long-term training using the "sandwich" degree method for regional agricultural development in East Africa and in Mali. This method "sandwiches" time spent at a US university between initial class work and degree completion in Africa. Master's degree students have been supported successfully with such programs at Ohio State, Michigan State, Montana State, and the University of St. Thomas in Minnesota. With added resources, these approaches can be expanded. Expanding such programs and ensuring adequate inclusion for women is entirely affordable. For example, with the sandwich program, high-quality advanced degree training in the US can be provided at a cost of only $30,000 per student. Using this program, USAID could return to the 1990 level of international agricultural students (310) at a total annual cost of less than $10 million.[162]

Other programs could be expanded to give international students a chance to benefit from the US educational system without taking on the full cost of a degree program. The Young Africa Leaders Initiative was launched in 2010 to support an emerging generation of African leaders as they work to drive economic growth, enhance democratic governance, and strengthen the civil society structures that will help the continent grow and prosper. The initiative connects young African leaders to training opportunities at some of America's top universities to expand their leadership skills and knowledge. Each host university provides a six-week mission for 25 students currently focused on public service, business and entrepreneurship, and civic engagement. Creating interdisciplinary training modules in the fields of agriculture, nutrition, and health to complement these missions would provide an excellent training opportunity for the next generation of African leaders in these fields.

Box 25 – Engaging Africa's youth in agriculture and nutrition through entrepreneurship

Regional Leadership Centers

As part of the Young African Leaders Initiative (YALI) launched by President Obama in 2010, the US government is opening four Regional Leadership Centers in 2015 in Ghana, Kenya, Senegal, and South Africa. The goal is to improve the availability and quality of leadership training programs and professional development opportunities for young African leaders. The centers will be run as public-private partnerships, capitalizing on the energy and dynamism of the private sector, the knowledge of African and American institutions, and the programmatic and educational resources of the US government. They will engage young leaders from a wide range of organizations and backgrounds to provide quality leadership training, support entrepreneurship, and enhance professional networking.

International Institute of Tropical Agriculture's (IITA) Youth Agripreneurs

IITA aims to engage young people in contributing to Africa's food and nutrition security and demonstrate the role agriculture can play in boosting employment and economic growth. IITA engaged an initial group of 30 young university graduates from the Nigerian Youth Corps to be trained in various parts of the agriculture value chain, from production to storage, processing, marketing, and service delivery. The young people came from a wide range of academic backgrounds, and 50 percent of them were female. Based on the success of their pilot project, IITA is currently searching for additional support and has plans to scale up this program across Africa.

Songhai Center

Established in 1985 in Benin, this innovation and incubation center fosters the emergence of a new African society by engaging unemployed youths and training them in various aspects of agriculture, including aquaculture, food crops, and livestock. Based on the principle of learning by doing, young people aged 18 to 35 are trained in production, research, entrepreneurship, and agribusiness. After a training program, ranging from three to six months for short-term programs and up to 18 months for long-term programs, students present business plans for their future agricultural businesses. The best proposals are awarded grants of $6,000 to $20,000 to launch their businesses. Songhai Center now has five centers in Benin and has trained over 7,000 young people from 12 African countries. The success of the Songhai model has led several other African countries to set up similar centers.

Sources: IITA; MEAS; Young African Leaders Initiative.

Neil Palmer/CIAT

Box 26 – Shamba Shape Up

Around the world, innovative efforts are under way to use media to educate and empower smallholder farmers. In Kenya, Shamba Shape Up is a television series that aims to give farmers the tools they need to improve their farms' productivity—and increase their incomes as a result. Shamba—Swahili for farm—has an estimated 11 million viewers and is dedicated to educating farmers about a variety of issues, from irrigation and pest control to financial management.

In the model of a household renovation reality television series, the Shamba crew spends four days each week with a single farming household. The crew includes experts such as veterinarians and soil analysts from Shamba's partner organizations, including the International Fund for Agricultural Development and the African Agricultural Technology Foundation. At the end of every episode, viewers are invited to send their address via text message to receive free leaflets on the topic covered in that week's show.

Given the size of their audience and the scope of the topics, Shamba's "edu-tainment" approach could have a significant ability to improve smallholder farmer production in Kenya. According to Shamba, "If even just 10 percent of the viewers of the first series adopt new practices as a result of the show, that's one million farmers whose sustainable livelihoods have become more informed and productive."

Source: Shamba Shape Up; Trescowthick, 2014.

Action 3b. Create a prize fund for food system innovations that modernize agriculture and nutrition knowledge exchange.

In addition to transforming research and education institutions, there is a need to modernize knowledge exchange in agriculture and nutrition to ensure that nutrition goals are built into agriculture and food programs and that programs are responsive to both male and female farmers. Digital and information technologies are changing the way people produce food and the way services are provided in the agriculture, nutrition, and health sectors. Taking advantage of this digital revolution can modernize public and private service delivery, enhance farmer-to-farmer interactions, strengthen the interface of extension agents with producers, and improve data collection. Data collected and analyzed in real time could be used to rapidly assess the impact of newly adopted practices on productivity, livelihoods, and even the health and nutrition of farmers and their families. There is also great potential to incorporate messaging aimed at improving nutrition and changing social behaviors into digital and information technologies for outreach across sectors.

Competitions to incentivize innovation can help identify solutions that utilize digital and information technologies in agriculture and nutrition. USAID should partner with multilateral institutions and private foundations to fund an agriculture and nutrition prize to support new solutions—or innovative uses of existing resources and technologies—to modernize knowledge exchange and increase the nutrition sensitivity of public and private service delivery in agriculture.

Hosting the prize fund at a university and engaging students from a wide range of traditional and nontraditional disciplines and backgrounds would energize young innovators and entrepreneurs across a wide range of sectors. Partnering with entrepreneurship centers at universities around the United States would provide applicants with mentors and opportunities to pitch their ideas to venture capitalists and others. The prize could provide technical support and mentoring in designing business plans as well as seed funds to launch successful businesses. Because many such centers are hosted by business schools, schools of engineering, and technology institutes, the prize recipients could benefit from expertise in these areas as they develop solutions for the food and agriculture sectors.

One such prize fund, the Agricultural Innovation Prize, was funded by the Howard G. Buffett Foundation and developed in collaboration with USDA and the White House Office of Science and Technology Policy. In its inaugural year, the Ag Prize was administered by students from the University of Wisconsin–Madison. Coolify, a micro-cold-storage–based business solution, was awarded the grand prize of $100,000 for its network of cooler storage units for fruit and vegetable producers in India to reduce food waste. Another finalist, Mission to Improve Global Health Through Insects (MIGHTi), was awarded $25,000 for its mealworm protein powder designed for sustainable protein consumption. MIGHTi has since won a second prize through the University of Wisconsin–Madison Climate Quest competition and will receive support to research and pilot mealworm microlivestock farming as an inexpensive and environmentally sustainable food production system.

The Barilla Center for Food and Nutrition also hosts the Young Earth Solutions prize fund to encourage innovation and sustainable solutions from young people for reducing food waste, promoting sustainable agriculture, promoting healthy lifestyles, and combatting obesity. They award a prize of €10,000 for the winning team of university students from around the world to implement their project.[163] These prize funds are prime examples of the kinds of initiatives that, if expanded, could help to spur innovation for action on creating nutrition-sensitive food systems.

Action 3c. Provide training to Peace Corps volunteers to incorporate nutrition-sensitive activities into their outreach work in agriculture, health, natural resources, and other relevant sectors.

Peace Corps volunteers are valuable assets at the field level in development. They serve in "last mile" communities, working side-by-side with their local counterparts in health and agriculture extension services, train-the-trainer programs, and economic development programs. Providing nutrition training to these volunteers could help increase the nutrition sensitivity of their activities in agriculture, natural resources, health, and economic development. Furthermore, it is important to ensure that Peace Corps volunteers are provided opportunities to share their nutrition training with professionals and community members in the countries in which they are serving.

Peace Corps volunteers are also well placed to promote changes in nutrition behaviors because they live and work so closely with the urban and rural communities where they serve. By incorporating social behavior change efforts into their sectoral activities, Peace Corps volunteers can encourage consumption of nutritious foods. For example, efforts to change social behavior can be incorporated into economic development projects to help channel increased incomes towards healthier foods for families.

RECOMMENDATION 4

Develop public-private partnerships to support nutrition-sensitive food systems

Christopher Herwig/Aurora Photos

Partnerships between the US government and the private sector can play an important role in advancing the goals of nutrition-sensitive food systems. In particular, such partnerships could support US investments made as part of a long-term global food and nutrition security strategy.

Action 4a. Through the New Alliance for Food Security and Nutrition, leverage private-sector investment to reduce postharvest loss and increase primary processing and fortification with an emphasis on food safety.

Private-sector firms play a leading role in shaping agricultural value chains throughout the globe. While value chains have traditionally emphasized adding economic value to agricultural goods while making foods safe, investments are needed to simultaneously improve the nutritional value of foods. Through the New Alliance for Food Security and Nutrition, the US government should ensure that cooperative frameworks between country governments, G8 countries, and private-sector companies include clearly stated goals and target outcomes on nutrition. Building primary processing capabilities and improving rural infrastructure are examples of win-win investments that can help reduce food losses, enhance food safety, create jobs, and increase access to nutrient-rich foods.

Basic investments in electrical grids, sewage and water systems, roads, rails, and access to other public services should be at the forefront of efforts to improve supply chains in low- and middle-income countries. In addition to US government support as part of its long-term food and nutrition security strategy, development assistance funding through the Millennium Challenge Corporation could be directed toward strengthening rural infrastructure. Using renewable energy sources, especially solar power, to generate electricity for refrigeration and freezing of harvested crops, for example, could help to improve access to perishable foods, reduce food waste, increase incomes through new job opportunities, and minimize greenhouse gas emissions associated with postharvest processing. Similarly, financing from the Overseas Private Investment Corporation, the US government's development finance institution, could be directed to firms that are leading efforts to reduce postharvest losses to ensure that initiatives enhance or maintain rather than diminish the nutritional quality of foods.

An essential goal in protecting the health and welfare of poor farming households and consumers in low-income countries is reducing exposure to mycotoxins. Mycotoxin contamination of food crops is one of the most pressing food safety challenges in developing countries. Maize in particular, a staple crop for much of Sub-Saharan Africa, is especially vulnerable to contamination with aflatoxin.[164] Public-private partnerships comprised of leading seed, processing, and storage companies could be established with the specific objective of reducing mycotoxin exposure in the global food supply by 50 percent by 2030. Such a partnership would require investments in training farmers, extension agents, and stakeholders throughout the food supply chain in appropriate crop management and harvest practices as well as in the equipment, facilities, and technologies necessary to properly harvest, store, screen, and transport agricultural goods.

Box 27 – Partners in Food Solutions

Partners in Food Solutions (PFS) is a public-private partnership that helps fight malnourishment in East Africa by matching private-sector expertise with the needs of local food processors. Four companies participate, each lending expertise from their core business competencies: General Mills (blended flours), Cargill (vegetable oils), Royal DSM (fortification of staple foods), and Bühler (process engineering).

With funding from USAID, TechnoServe is the implementing partner in the field, facilitating relationships with small business to enhance capacity of food processors, create sustainable linkages throughout the value chain, build the local environment for sustained processor growth, and promote a learning agenda.

TechnoServe works with local companies to identify areas where outside guidance can help the companies produce better, more nutritious food. Experts from the PFS companies then develop solutions remotely, applying cutting-edge industry expertise. Working in five countries—Kenya, Zambia, Tanzania, Malawi, and Ethiopia—the partnership helps processors increase the annual volume of nutritious food products sold to aid markets by 18.6 percent. Last year, annual sales of improved nutritious products grew 35 percent over the previous year, with approximately 100 companies supported.

Sources: Partners in Food Solutions.

Action 4b. Promote and strengthen voluntary guidelines to limit marketing of foods and beverages to children.

Promotional food and beverage marketing designed to influence consumption habits is now ubiquitous throughout the globe, reaching even remote rural areas. Ultraprocessed food products are among the most profitable for food companies and are therefore aggressively marketed.[165] Between 1980 and 2012 global advertising expenditures increased from US$216 billion to US$497 billion.[166] In the United States food and beverage companies spend more than US$2 billion annually to market food and beverages to children in particular.[167] Marketing of these products is commonly targeted to children because it creates brand loyalty from an early age and strongly influences long-term consumer behavior.[168] Studies by the Institute of Medicine of the National Academies and numerous other independent investigations have concluded that food advertising impacts children's food preferences, diets, and health.[169] Unfortunately, the overwhelming majority of food product and beverage advertisements viewed by children are for foods and beverages high in fat, sugar, and sodium.[170] Because children do not understand the marketing intent of these advertisements, they are particularly vulnerable to messages that encourage them to eat foods or drink beverages that have limited to no nutritional value and that can displace healthy foods.[171]

In response to concerns about marketing unhealthy foods to children, the US Congress directed the Federal Trade Commission, USDA, the Food and Drug Administration, and the Centers for Disease Control and Prevention to form an Interagency Working Group on Food Marketed to Children (IWG) to develop voluntary

guidelines limiting the marketing of unhealthy foods to children in the United States. The food and beverage industry found these recommendations to be overly restrictive, but through the Better Business Bureau Children's Food and Beverage Advertising Initiative (CFBAI), 18 companies signed on to a set of their own voluntary standards for marketing to children.[172] Self-monitoring by the CFBAI, supported by independent investigations, has shown progress in reducing advertising of unhealthy snacks and beverages to children.[173] Furthermore, products have been increasingly reformulated to meet stricter nutritional standards regarding saturated fat, trans fat, added sugars, and sodium, demonstrating potential for incremental change. In January 2014 CFBAI adopted new standards with stricter limits on overall calories, sugar, and fat in foods marketed to children, so many CFBAI-approved products now meet the IWG standards for specific limits on saturated fat and added sugars.[174]

However, despite such changes to make products healthier, unhealthy foods and beverages continue to be widely marketed to young people. Over time, the CFBAI should work to better align their nutrition standards for marketing of foods and beverages to children with the recommendations set out by the IWG.

Voluntary guidelines, however, do not apply to marketing practices outside the United States. Development and enforcement of child marketing guidelines are particularly needed in low- and middle-income countries, where investments in the marketing and advertising of ultraprocessed foods by transnational food corporations have increased enormously in recent decades.[175] As the nutrition transition continues

Promotional food and beverage marketing designed to influence consumption habits is now ubiquitous throughout the globe, reaching even remote rural areas.

to unfold in these countries and the prevalence of overweight and obesity continues to climb, especially among youth, it is critically important to limit exposure by children to advertising that could create long-term, unhealthy dietary patterns.

At least 20 countries around the globe already have explicit policies addressing food and beverage marketing to children.[176] In addition, the WHO and Pan American Health Organization (PAHO) have published voluntary guidelines that can be used by countries around the world or specifically in Latin America.[177] For voluntary guidelines like these to have a global impact, restaurants, food and beverage companies, and media companies across the globe must be aligned in their commitment to nutrition-sensitive marketing to children. Using the WHO and PAHO guidelines and the WHO Implementation Framework,, the US government should partner with WHO and other international agencies to disseminate and further specify voluntary guidelines that could be adopted by a broad range of restaurants, food and beverage companies, and media companies.[178]

Establishing an independent monitoring system to track adherence to voluntary commitments is essential to the success of these efforts. When voluntary commitments are adopted by industry based on public health and environmental concerns, there are clear benefits to the private sector's image and bottom line. However, the success of such efforts hinges on regular, unbiased data to track progress. Progress toward

Box 28 – Access to Nutrition Index

The Access to Nutrition Index (ATNI) assesses and ranks the world's largest food and beverage manufacturers on their nutrition-related commitments, practices, and performance globally. With support from the Bill & Melinda Gates Foundation and the Wellcome Trust, ATNI was founded on the premise that food and beverage manufacturers can contribute to global efforts to address poor nutrition and related diseases.

Through its assessment, ATNI aims to encourage companies to increase consumer access to nutritious and affordable foods and responsibly exercise their influence on consumer choice and behavior through marketing, labeling, and the promotion of healthy diets and lifestyles. By serving as a means for companies to benchmark their approaches to nutrition and identify areas for improvement, ATNI seeks to stimulate dialogue about the ways in which companies might improve their nutrition practices.

The ATNI Global Index 2013 ranked 25 companies, with Danone, Unilever, Nestlé, PepsiCo, and Kraft Foods Inc. identified as the top five performing companies across all categories. The second ATNI Global Index will be released in late 2015. In addition to the Global Index ranking, Access to Nutrition also intends to develop and publish "Spotlight Indexes" that rate the largest manufacturers for each of its spotlight countries—India, South Africa, and Mexico. These indexes underscore the importance of food and beverage manufacturers in addressing obesity and undernourishment.

Source: Access to Nutrition Foundation.

commitments should be published by companies as part of their annual sustainability reports. Yet investments for independent data collection such as the Access to Nutrition Index are also needed.[179]

Action 4c. Increase technical assistance on food safety regulations through US regional trade hubs in Africa.

One of the ways the US government supports private-sector engagement and investment in Africa is through three regional trade hubs. USAID has trade hubs in west Africa, east and central Africa, and southern Africa that work to increase each region's competitiveness in world markets, provide technical assistance, and promote regional trade.

In addition to promoting direct business linkages between US and African firms, these trade hubs provide technical assistance to help African countries expand their exports. Capacity building to meet market requirements and international standards for exports is an essential component of this. USAID should increase technical assistance to these trade hubs to address critical food safety issues, including mycotoxin contamination.

In addition to "good agricultural practices" before and during harvest, preventing exposure to mycotoxin contamination after harvest through proper storage techniques is critical. Investments in postharvest storage facilities, new detection and diagnostic tools for monitoring, and training farmers on proper management practices for handling and storing crops can serve as a first line of defense in strengthening food safety and preventing food waste early in the postharvest value chain.

Action 4d. Fund accelerator programs to encourage the development of entrepreneurial activity in local food systems to improve access to diverse, nutrient-rich foods.

Angel investors and venture capitalists from Silicon Valley to Shanghai are finding ways to invest in food accelerator programs that have the potential to kick-start small- and medium-sized food businesses that focus on nutrient density or improving access and affordability of healthy foods.[180] This is a unique way for corporations and business to support the work of small and midsize for-profit companies that are trying to improve nutrition.

The Global Alliance for Improved Nutrition (GAIN) has pioneered one model for channeling private-sector entrepreneurship in LMICs toward the elimination of global malnutrition through their Marketplace for Nutritious Foods. Through three pilots developed in Mozambique, Kenya, and Tanzania, the Marketplace has helped local entrepreneurs bring nutrition-enhancing innovations to market by providing networking, knowledge sharing and technical and financial assistance. With the goal of improving access to nutritious foods for low-income consumers, the project serves as a catalyst for innovators and provides donors, investors, and GAIN with investment opportunities. Technical support and initial seed funds help reduce the risks associated with investing in new small- and medium-sized enterprises (SMEs), making them more viable candidates for donor and private-sector investment.[181]

As part of the Marketplace, the Innovation Accelerator program draws on private-sector investment to help budding nutrition-oriented SMEs overcome financing and other barriers to profitability and nutritional impact. Each country's accelerator requests applications, and winners receive intensive coaching as they develop business plans, which, if accepted, are then brought to life through privately funded grants and loans. Similarly, GAIN works with larger companies to support outgrower schemes that provide technical support and financing to smaller rural producers, allowing them to sell through the larger company's network.

Accelerator programs provide significant opportunity for private-sector investment by reducing the risk of investing in small- and medium-sized enterprises.

A second component of the Marketplace involves the development of a Community of Practice that brings together a larger group of SMEs with government officials, investors, donors, and academics. This helps build an enabling environment for SMEs to succeed, providing opportunities for networking, additional investment, and training on issues such as food safety, marketing, financing, and quality control.

Through the Marketplace, GAIN has demonstrated the potential for accelerator programs to spur innovation and solve malnutrition issues. The initial programs have been funded by each country's USAID mission, and the Marketplace teams collaborate to provide entrepreneurial and technical assistance in support of relevant USAID programs. In addition to the potential for donor investment, these accelerator programs also provide significant opportunity for private-sector investment by reducing the risk

Box 29 – ENGINE: Reducing stunting through poultry in Ethiopia

Poor dietary diversity, particularly a lack of food from animal sources, is a primary driver of stunting in children under two in Ethiopia, even in food secure areas. To improve dietary diversity among vulnerable households, Save the Children and USAID's Empowering New Generations for Improved Nutrition and Economic Opportunities (ENGINE) project links access to higher quality chickens with social and behavior change strategies to promote egg consumption among pregnant and lactating women and children from six to 24 months of age.

ENGINE partnered with two private chicken breeders to establish a new supply of chickens that were more productive and required minimal care. These "ideal" chicken breeds, along with training and supplies, allowed households to effectively breed, hatch, and sell the improved breed of chicks. Additional private chicken growers are being provided with technical support and links to the breeders to further increase supply in the region.

District agriculture offices are supporting the collaboration and see great promise in the availability of the new, improved chicken breeds for household production and consumption. Early results show that both breeders and growers are able to operate their businesses at a profit and are successfully hatching and growing chicks.

Despite early success in increasing the availability of poultry and eggs in the household, cultural and religious barriers often work against increased consumption. To address this challenge, ENGINE simultaneously creates demand for eggs and poultry through counseling of government health personnel and innovative social and behavior change approaches in the community.

ENGINE builds the counseling capacity of staff in health centers and health posts. Community-level cooking demonstrations are provided to show how to prepare foods that include poultry and eggs with locally available staple foods. ENGINE also engages the whole community through conversations led by trained community change agents. These agents use prerecorded materials designed for different audiences (mothers, fathers, and mothers-in-law) and different regions to facilitate discussions. Sessions promote raising poultry; spending money on food, including food from animal sources; and encouraging household consumption of poultry and eggs. The project demonstrates the potential of livelihood interventions combined with social and behavior change strategies to reduce stunting.

Source: Save the Children.

 P. Kimeli/CCAFS

of investing in SMEs. With the provision of business services, investment opportunities, and informal networking, successful SMEs emerge as sustainable firms with high-growth potential.

Conclusion

Action must be taken now. Reaching the world's people with adequate food has been a challenge for modern agriculture and foods systems for more than half a century. The success of the agricultural revolution of the 1960s and 1970s in dramatically increasing staple crop production and reducing the numbers of hungry people in many parts of the world is a testament to what can be achieved when nations and people come together to tackle great challenges. Yet hunger has not yet been eradicated, especially in areas missed by this most recent agricultural revolution. And now it has become painfully clear that calories alone are not enough. Indeed, even as hunger in many areas is reduced, malnutrition and the diseases it engenders are draining the health and productivity of millions and sapping the economic potential of nations.

Even as hunger in many areas is reduced, malnutrition and the diseases it engenders are draining the health and productivity of millions and sapping the economic potential of nations.

The United States now faces the challenge of realigning agriculture and food systems to address the growing double burden of undernutrition and obesity that is costing lives and trillions of dollars in health care and lost productivity. Alongside efforts to sustainably increase production, nutrition must become a priority. The onward march of population growth, urbanization, and climate change make these efforts all the more imperative. Success will mean not only increasing access to healthy food for poor and vulnerable populations, but also creating a virtuous cycle of productivity, sustainability, growing markets, stable societies, and thriving economies, all of which are in the interests of the United States. Leadership by the US administration and Congress will be vital to bringing people and nations together again to spark the next food revolution. The recommendations in this report can help begin this process.

About The Chicago Council on Global Affairs

The Chicago Council on Global Affairs, founded in 1922, is an independent, nonpartisan organization committed to educating the public—and influencing the public discourse—on global issues of the day. The Council provides a forum in Chicago for world leaders, policymakers, and other experts to speak to its members and the public on these issues. Long known for its public opinion surveys of American views on foreign policy, The Chicago Council also brings together stakeholders to examine issues and offer policy insight into areas such as global agriculture, the global economy, global energy, global cities, global security, and global immigration. Learn more at thechicagocouncil.org and follow @ChicagoCouncil for updates.

The Chicago Council's global agriculture and food work, launched in 2008 and expanded in 2010, provides policy innovation and accountability for a long-term US commitment to agricultural development as a means to alleviate global poverty. It aims to maintain the policy impetus towards a renewed US focus on agricultural development, provide technical assistance to agricultural development policies' formulation and implementation, and offer external evaluation and accountability for US progress on food security. The initiative is led by Doug Bereuter, president emeritus, the Asia Foundation, and Dan Glickman, former secretary, US Department of Agriculture, and is overseen by an advisory group comprised of leaders from government, business, civic, academic, and NGO sectors. For further information, please visit thechicagocouncil.org/globalagdevelopment.

Advisory Group Biographies

COCHAIRS

Douglas Bereuter

President Emeritus, The Asia Foundation
Former Member, US House of Representatives, Nebraska

Douglas Bereuter is president emeritus of the Asia Foundation, a nongovernmental development organization he led for more than six years following his 26-year service as a member of the US House of Representatives. During his congressional career, he was a leading member of the House International Relations Committee, where he served as vice chairman for six years, chaired the Asia-Pacific Subcommittee and later the Europe Subcommittee, had long tenures on its subcommittees on Economic Policy & Trade and Human Rights, and was president of the NATO Parliamentary Assembly. He also served on the House Financial Services Committee for 23 years and on the House Permanent Select Committee on Intelligence, retiring as its vice chairman. Mr. Bereuter graduated Phi Beta Kappa from the University of Nebraska and has master's degrees from Harvard University in city planning and public administration. He served as an infantry and intelligence officer in the US Army, practiced and taught graduate courses in urban and regional planning, led various agencies and programs in the Nebraska state government, and served one four-year term as a Nebraska state senator. He is a member of the Council on Foreign Relations, the World Affairs Council of Northern California, and the State Department's International Security Advisory Board. He is also board chairman of the Arbor Day Foundation and the treasurer of the Nebraska Community Foundation.

Dan Glickman

Former US Secretary of Agriculture
Former Member, US House of Representatives, Kansas
Senior Fellow, The Bipartisan Policy Center
Vice President, The Aspen Institute

Dan Glickman is cochair of The Chicago Council's Global Agricultural Development Initiative. He is vice president of the Aspen Institute and executive director of the Aspen Institute Congressional Program, which was established in 1983. Mr. Glickman also serves as a senior fellow at the Bipartisan Policy Center, where he is cochair of its Democracy Project. Prior to joining the Aspen Institute, Mr. Glickman served as US secretary of agriculture in the Clinton administration. He also represented the 4th congressional district of Kansas for 18 years in the US House of Representatives, where he was involved in federal farm policy on the House Agriculture Committee. He also served on the House Judiciary Committee as chairman of the House Permanent Select Committee on Intelligence. In addition, he is the former chairman of the Motion Picture Association of America, Inc. and former director of the Institute of Politics at Harvard University's John F. Kennedy School of Government. Mr. Glickman has served as president of the Wichita, Kansas, school board; was a partner in the law firm of Sargent, Klenda, and Glickman; and worked as a trial attorney at the US Securities and Exchange Commission. He

received his BA in history from the University of Michigan and his JD from the George Washington University. He is a member of the Kansas and District of Columbia bars.

SIGNATORIES

Catherine Bertini (task force chair)

Distinguished Fellow, Global Agriculture & Food, The Chicago Council on Global Affairs
Professor of Public Administration and International Affairs, Maxwell School of Citizenship and Public Affairs, Syracuse University

Catherine Bertini is a senior fellow at The Chicago Council on Global Affairs. For five years she cochaired the Council's Global Agricultural Development Initiative. She also chaired the Council's Girls in Rural Economies project as well as the Council's work on domestic agriculture. Ms. Bertini is a professor of public administration and international affairs at the Maxwell School of Citizenship and Public Affairs at Syracuse University. She previously served as UN under-secretary-general for management (2003 to 2005) and as executive director of the UN World Food Program, the world's largest international humanitarian agency (1992 to 2002).

For two years she was senior fellow, agricultural development, at the Bill & Melinda Gates Foundation. Before serving in the UN, Ms. Bertini was USDA assistant secretary for food and consumer services, where she ran the nation's then $33 billion domestic food assistance programs. She was fellow at the John F. Kennedy School of Government at Harvard University and policymaker in residence at the Gerald R. Ford School of Public Policy at the University of Michigan.

Ms. Bertini is the 2003 World Food Prize Laureate. She is a presidential appointee to the Board of International Food and Agricultural Development. In 2012 she served as a member of the Department of State's Accountability Review Board on Benghazi.

Ekin Birol

Head, Impact Research Unit, HarvestPlus
Senior Research Fellow, International Food Policy Research Institute

Ekin Birol is the head of the Impact Research unit at HarvestPlus and a senior research fellow of the International Food Policy Research Institute (IFPRI). She has over 10 years of post-PhD experience working as an applied economist and a principal investigator on various agriculture, health, and environment-related projects in both developed and developing countries. At HarvestPlus her research focuses on adoption, consumer acceptance and impact evaluation of nutritious staple crops in several countries in Africa, Asia, and Latin America and the Caribbean. Prior to joining HarvestPlus in 2010, she was a research fellow with IFPRI's Markets, Trade, and Institutions division (2007-2010), where she worked on various food safety issues, including aflatoxins and zoonotic diseases in several countries in Africa and Asia. From 2004 to 2007 she was a postdoctoral research fellow at the University of Cambridge, and from 2000 to 2004 she was a research fellow of the Centre for Social and Economic Research on the Global Environment at University College London (UCL). While at Cambridge and UCL, she conducted research on sustainable agriculture, environmental conservation, and natural resource

management in Asia and the European Union. Ekin holds a PhD in economics from the University of London.

Marshall M. Bouton

President Emeritus, The Chicago Council on Global Affairs

Marshall M. Bouton is president emeritus of The Chicago Council on Global Affairs, having served as its president from 2001 to 2013. Under his leadership, The Chicago Council became a national and international thought leader on the subject of global agricultural development and food security. Dr. Bouton currently serves as a member of the advisory group for the Council's Global Agricultural Development Initiative, a member of the advisory board for Omnivore, a venture capital firm investing in Indian agricultural and food companies, and an affiliated expert of the Lugar Center focusing on issues of global food security. Dr. Bouton is a senior fellow at the Asia Society Policy Institute and at the Center for the Advanced Study of India at the University of Pennsylvania. He speaks and writes on India, Asia, and US-Asia relations.

Dr. Bouton came to The Chicago Council from Asia Society, New York, where he was executive vice president from 1990 to 2001. His previous positions include director of policy analysis for Near East, Africa, and South Asia in the US Defense Department, special assistant to the US ambassador to India, and founding US executive secretary of the Indo-US Subcommission on Education and Culture. He holds an AB cum laude in history from Harvard College, an MA in South Asian studies from the University of Pennsylvania, and a PhD in political science from the University of Chicago. He is married and has two grown children and three grandchildren.

Howard W. Buffett

President, Buffett Farms Nebraska LLC

Howard W. Buffett is a lecturer in international and public affairs at Columbia University, where he teaches management techniques for improving the effectiveness of foreign aid and global philanthropy. Buffett also teaches at the University of Nebraska-Lincoln, lecturing on topics related to international food and agricultural policy. Prior to that he was the executive director of the Howard G. Buffett Foundation, which strengthens food security for vulnerable populations throughout the world.

Mr. Buffett previously served in the US Department of Defense, overseeing agriculture-based economic stabilization and redevelopment programs in Iraq and Afghanistan. He received the Joint Civilian Service Commendation Award, the highest-ranking civilian honor presented by the Joint Chiefs of Staff at the request and approval of the Combatant Commanders. Prior to that Mr. Buffett was a policy advisor for the White House Domestic Policy Council, where he coauthored the president's cross-sector partnership strategy. Prior to serving in the White House, he was a special assistant in the Office of the Secretary at the US Department of Agriculture, where he authored the expansion strategy for the nation's Cooperative Extension System.

Mr. Buffett earned his BA from Northwestern University and his MPA in Advanced Management and Finance from Columbia University. He coauthored the *New York Times* bestselling book *40 Chances: Finding Hope in a Hungry World,* which examines global hunger and food system challenges, drawing from his experiences while traveling

in more than 70 countries across six continents. He is from Omaha, Nebraska, where he operates a 400-acre conservation-based farm.

John Carlin

Visiting Professor and Executive-in-Residence, Kansas State University
Former Governor, Kansas

John Carlin is currently a visiting professor/executive-in-residence at Kansas State University in the School of Leadership Studies. He teaches a master's-level class in executive leadership and an undergraduate class in practical politics. He also currently chairs the board for the Kansas Bioscience Authority. This authority was created in 2004 for the purpose of advancing the biosciences in Kansas. For three years Mr. Carlin chaired the Pew Trust Commission on Industrial Farm Animal Production. Their final report was issued in 2008 and it has helped inform policymakers in Washington on key issues facing agriculture and our food supply. Mr. Carlin had returned to his home state of Kansas after serving 10 years as archivist of the United States, being appointed by President Clinton in 1995. He served two four-year terms as governor of Kansas, leaving office in January of 1987. He was chairman of the National Governors Association from 1984 to 1985. After leaving public office he taught at Wichita State University, was involved in two small business ventures, and traveled internationally on behalf of Kansas businesses. Prior to being governor he served four terms in the Kansas House of Representatives, the last term as speaker of the house. Mr. Carlin has a BS degree in dairy husbandry from Kansas State University, graduating in 1962. He then returned to the family farm to manage the Registered Holstein herd and diverse farming operations.

Jason Clay

Senior Vice President, Markets and Food, World Wildlife Fund

Jason Clay leads the market transformation work of WWF-US for agriculture, aquaculture, business and industry, finance, fisheries, and forests. Over the course of his career he has worked on a family farm and in the US Department of Agriculture. He has taught at Harvard and Yale and spent more than 30 years with human rights and environmental organizations. In 1989 Dr. Clay invented Rainforest Marketing, one of the first fair-trade ecolabels in the United States, and was responsible for cocreating Rainforest Crunch and more than 200 other products with combined retail sales of $100 million. From 1999 to 2003 he codirected a consortium with the WWF, World Bank, UN Food and Agriculture Organization, and National Aquaculture Centres of Asia/Pacific to identify the most significant environmental and social impacts of shrimp aquaculture and analyze better management practices that measurably reduce them. Since then he has coconvened (with the World Bank's International Finance Corporation and others) multistakeholder roundtables of producers, investors, buyers, researchers, and nongovernmental organizations to identify and reduce the social and environmental impacts of such products as salmon, soy, sugarcane, cotton, and tilapia. Dr. Clay leads WWF's efforts to work with private-sector companies to improve their supply chain management, particularly with regard to ingredient sourcing as well as carbon and water impacts. He also leads WWF's efforts to transform entire sectors by improving their overall performance. Dr. Clay is the author of more than 15 books, 400 articles, and 700 invited

presentations. His most recent books are *World Aquaculture and the Environment*, *Exploring the Links between International Business and Poverty Reduction: A Case Study of Unilever in Indonesia*, and *World Agriculture and the Environment*. In addition to his role at WWF, Dr. Clay is *National Geographic's* first-ever Food and Agriculture fellow. He also won the 2012 James Beard Award for his work on global food sustainability. Dr. Clay studied at Harvard University and the London School of Economics before receiving a PhD in anthropology and international agriculture from Cornell University.

Gordon Conway

Professor of International Development, Imperial College London

Gordon Conway is a professor of international development at Imperial College, London, and director of Agriculture for Impact, a grant funded by the Bill & Melinda Gates Foundation, which focuses on European support of agricultural development in Africa. From 2005 to 2009 he was chief scientific adviser to the Department for International Development. Previously he was president of the Rockefeller Foundation and vice-chancellor of the University of Sussex. He was educated at the Universities of Wales (Bangor), Cambridge, West Indies (Trinidad), and California (Davis). His discipline is agricultural ecology. In the early 1960s, working in Sabah, North Borneo, he became one of the pioneers of sustainable agriculture. He was elected a fellow of the Royal Society in 2004 and an honorary fellow of the Royal Academy of Engineering in 2007. He was made a Knight Commander of the Order of Saint Michael and Saint George in 2005. He was recently president of the Royal Geographical Society. He has authored *The Doubly Green Revolution: Food for all in the 21st century* (Penguin and University Press, Cornell) and coauthored *Science and Innovation for Development* (UK Collaborative on Development Sciences). His most recent book *One Billion Hungry: Can We Feed the World?* was published in October 2012.

Gebisa Ejeta

Distinguished Professor of Plant Breeding & Genetics and International Agriculture, and Executive Director, Center for Global Food Security, Purdue University

Gebisa Ejeta is Distinguished Professor of Plant Breeding & Genetics and International Agriculture and serves as executive director of the Center for Global Food Security at Purdue University. Professor Ejeta has been a member of the faculty of Purdue University since 1984. His career has been devoted to education, research, and international development with contributions in human and institutional capacity building, in technology development and transfer, and in advocacy for science in support of the cause of the poor. Professor Ejeta has served in advisory roles to several international development agencies. He currently serves on the boards of The Chicago Council on Global Affairs Global Agricultural Development Initiative, the National Academy of Sciences Board on Agriculture and Natural Resources, and the Global Crop Diversity Trust. Professor Ejeta is the 2009 World Food Prize Laureate and a recipient of a national medal of honor from the president of Ethiopia. He is a fellow of the American Association for the Advancement of Sciences, the American Society of Agronomy, and the Crop Science Society of America. Professor Ejeta has served the US government in several capacities, including as special advisor to USAID administrator Dr. Rajiv Shah and as

science envoy of the US State Department. He was appointed by President Obama as member of the Board for International Food and Agricultural Development in 2010. He was more recently appointed by Secretary-General Ban Ki-moon to the first UN Scientific Advisory Board.

Cutberto Garza

University Professor, Boston College
Visiting Professor, Johns Hopkins Bloomberg School of Public Health
Visiting Professor, George Washington University School of Public Health

Cutberto Garza previously held appointments as professor of pediatrics at Baylor College of Medicine and of nutrition at Cornell University, where he served as director of the Division of Nutritional Sciences and vice provost. His major research interests are in pediatric and maternal nutrition. He has worked with the United Nations University (as director of the UNU Food and Nutrition Program), World Health Organization (WHO) and other international and national organizations. He served as chair of the WHO Steering Committee that developed the new WHO Child Growth Standards, the Institute of Medicine's (IOM) Food and Nutrition Board, and the Natural Research Council's Board on International Scientific Organizations. He currently serves as chair of the World Food Program's Technical Advisory Group. He is a member of the IOM. He received the Alan Shawn Feinstein World Hunger Prize for Education and Research, awarded by Brown University, in 1996. He delivered the first Founders' Lecture sponsored by the American Academy of Breastfeeding Medicine in 2006 and received the Conrad Elvehjem Award for Public Service in Nutrition, awarded by the American Society for Nutrition in 2008. He also received the Samuel J. Fomon Nutrition Award in 2011 from the American Academy of Pediatrics.

Carl Hausmann

Former CEO, Bunge North America

Carl Hausmann has more than 35 years of experience in the agribusiness and food industries and has successfully led a publicly held company in Europe as well as businesses in North America, South America, and Africa. Mr. Hausmann previously served as managing director of global government and corporate affairs of Bunge Limited ("Bunge"), a leading global agribusiness and food company, from 2010 until his retirement in 2012. Prior to that he was CEO of Bunge Europe and Bunge North America. He began his career at Continental Grain, serving in increasingly senior positions, and served as CEO at Central Soya, Cerestar USA, and Cereol SA. Mr. Hausmann served as the vice chair of the Consortium of International Agricultural Research Centers (CGIAR), a global partnership that unites organizations engaged in research for a food secure future. He currently is the vice chair of Bioversity International, one of the 15 member centers that form the CGIAR. He is also a member of the International Food and Agricultural Trade Policy Council and a past president of Fediol, the European association of oilseed crushers. Mr. Hausmann received a bachelor's degree from Boston College and an MBA from the Institut Européen d'Administration des Affaires in France.

Andrew Jones

Assistant Professor, School of Public Health, University of Michigan

Andrew Jones is a public health nutritionist, interested in understanding the influence of agriculture and food systems on household food security and the nutritional status of women and children in low-income settings. As part of his research he examines the role of food security in shaping the co-occurrence of micronutrient deficiencies and overweight among women of childbearing age and the intergenerational consequences of this "double burden" on infant and child nutrition. His research also includes a focus on the evaluation of programs and policies that aim to improve maternal and child nutrition, especially through agriculture and food systems-based approaches. Andrew has ongoing research projects in India, southern Africa, and throughout the Andean region of South America.

Andrew is currently assistant professor in the School of Public Health at the University of Michigan. Prior to this appointment, Andrew worked as a research associate in the Division of Nutritional Sciences at Cornell University. He has also worked as a consultant for several institutions, including the World Bank, the International Food Policy Research Institute, and the United Nations Children's Fund. He served as a Peace Corps volunteer in Kazakhstan from 2002 to 2004. Andrew received his PhD in International Nutrition from Cornell University and holds BA degrees from the Pennsylvania State University in geography and film production.

A.G. Kawamura

Cochair, Solutions from the Land Dialogue

A.G. Kawamura is a third generation grower and shipper from Orange County, California. From 2003 to 2010 he was the secretary of the California Department of Food and Agriculture. He is cochair of Solutions from the Land, a nationally acclaimed project that is developing an innovative and sustainable roadmap for 21st century agriculture. He serves on several boards and committees, including the Ag Advisory Committee for the AGree Initiative and the Board on Agriculture and Natural Resources, a policy arm of the National Academy of Sciences' Natural Resource Council. He is trustee for the Council on Agriculture, Science, and Technology; a member of the American Farmland Trust Board; a member of the Farm Foundation Round Table; a member and former chair of the Western Growers Association Board; and a 25x25 steering committee member. Mr. Kawamura serves on the boards of the California State University Foundation, the Delta Vision Foundation, and the California Agricultural Leadership Foundation. For over 30 years Mr. Kawamura has pursued a lifelong goal to work towards an end to hunger and malnutrition. He has worked closely with Second Harvest and Orange County Food Banks to create exciting projects that address nutrition and hunger. As a progressive urban farmer, Mr. Kawamura has a lifetime of experience working within the shrinking rural and urban boundaries of southern California. Through their company, Orange County Produce, LLC, he and his brother Matt are engaged in building an interactive, 21st century, 100-acre agricultural showcase at the Orange County Great Park in Irvine, California.

Mark E. Keenum

President, Mississippi State University

Dr. Mark Everett Keenum became Mississippi State's 19th president on January 5, 2009, following a distinguished public service career. After completing his bachelor's and master's degrees in agricultural economics at Mississippi State University (MSU), Dr. Keenum joined the university faculty in 1984 as a marketing specialist with the Mississippi Cooperative Extension Service. Two years later he accepted a position as a research associate with the Mississippi Agricultural and Forestry Experiment Station at MSU. He continued his education at the university, in 1988 receiving a doctorate in agricultural economics, and he joined the faculty of that department as assistant professor/economist. In 1989 Dr. Keenum joined the Washington, DC, staff of US Senator Thad Cochran as legislative assistant for agriculture and natural resources. As Senator Cochran's adviser on agricultural affairs, he worked on numerous issues important to US agriculture, including the 1990, 1996, and 2002 farm bills. From 1996 to 2006 he served as chief of staff for Senator Cochran. In this role Dr. Keenum was the chief adviser to the senator on political, legislative, and appropriations issues. He also was responsible for managing all administrative and legislative functions of Senator Cochran's Washington, DC, office and three Mississippi offices, including direct oversight of the US Senate Committee on Agriculture, Nutrition, and Forestry and the US Senate Committee on Appropriations. Prior to being named president of Mississippi State in November 2008, Dr. Keenum served as undersecretary of the US Department of Agriculture for two years, where he provided leadership and oversight for the Farm Service Agency, the Risk Management Agency, and the Foreign Agricultural Service.

Shiriki K. Kumanyika

Professor Emerita of Epidemiology, University of Pennsylvania

Shiriki Kumanyika, PhD, MPH, is emerita professor of epidemiology in the Department of Biostatistics and Epidemiology at the University of Pennsylvania's Perelman School of Medicine. During her tenure on the Penn Medicine faculty she also served as associate dean for health promotion and held a secondary appointment in the Department of Pediatrics, Nutrition Section. Dr. Kumanyika chairs the African American Collaborative Obesity Research Network (AACORN), a national network that seeks to improve the quality, quantity, and effective translation of research on obesity and related issues in African American communities (see www.AACORN.org). She has extensive experience in advisory roles related to public health and nutrition policy in the United States and abroad. Dr. Kumanyika is currently a member of the Centers for Disease Control and Prevention's Task Force on Community Preventive Services, cochair of the Policy and Prevention Section of the World Obesity Federation, and a nutrition advisor to the World Health Organization. She is also the president of the American Public Health Association for 2015.

Carolyn Miles

President and CEO, Save the Children

Carolyn Miles is president and chief executive officer of Save the Children, the leading independent organization inspiring breakthroughs in how the world treats children, achieving immediate and lasting change in their lives. The global Save the Children movement currently serves over 140 million children in the United States and in 120 countries.

Ms. Miles joined the organization in 1998, was chief operating officer from 2004 to 2011, and became president and CEO in September 2011. During her senior leadership tenure, the organization has more than doubled the number of children it reaches with nutrition, health, education, and other programs. Resources have gone from $250 million to almost $700 million, with 89 percent spent on programs for children. Ms. Miles has focused on hunger, learning outcomes, and ending preventable child deaths as her signature issues.

Earlier, she worked in the private sector in Hong Kong for American Express and as an entrepreneur. While in Asia she confronted the deprivation of the region's children and committed herself to their welfare. Ms. Miles has served on numerous boards, including Blackbaud, InterAction, USGLC, MFAN, Academy of Education Arts and Sciences, and the University of Virginia's Darden School of Business, where she received her MBA. She is married with three children.

Robert H. Miller

Divisional Vice President, R&D and Scientific and Medical Affairs, Abbott Nutrition

Robert Miller is divisional vice president of R&D and scientific and medical affairs at Abbott Nutrition. He is responsible for pediatric, adult, and performance nutrition product development, innovation, education, clinical and preclinical research. He joined Abbott in 1987 and has held several management positions in R&D, business development, and innovation. Dr. Miller also directed Advanced Technology Development as director of biotechnology at Battelle Memorial Institute. He is cochair of the Abbott Scientific Governing Board overseeing talent development and programmatic efforts of Abbott's 2,500 scientists.

Dr. Miller earned his bachelor's degree in biochemistry from the University of Minnesota and his PhD in nutritional science from the University of Wisconsin-Madison, followed by a staff fellowship at the National Institutes of Health. Dr. Miller is married to Anita Miller, an artist whose image of the fallen Marines of Lima Company was recently featured at the Ohio Statehouse and the Marine Corp Museum. They have three children.

A. Namanga Ngongi

Chairperson, African Fertilizer and Agribusiness Partnership
Former President, Alliance for a Green Revolution in Africa
Former Deputy Executive Director, World Food Program

Dr. Namanga Ngongi has had extensive experience in international affairs. He was counselor at the Cameroon Embassy in Rome, Italy, from 1980 to 1984. In this position

he represented Cameroon to the United Nations Food Agencies and held positions in the governance structures of the International Fund for Agricultural Development and the Food and Agriculture Organization.

He joined the World Food Program in 1984 and rose to the position of deputy executive director from 1994 to 2001. In that capacity he worked with leaders of countries in Africa and elsewhere in various stages of democratization and witnessed the ravages of war caused by flawed elections and unrepresentative electoral systems. He served as chairperson of the Standing Committee on Nutrition of the United Nations from 2000 to 2002.

Dr. Namanga Ngongi was appointed UN under-secretary-general and special representative of the UN secretary-general in the Democratic Republic of the Congo in 2001 and led the peacekeeping mission MONUC until 2003. In that function he facilitated local negotiations that led to the establishment of a transitional government. This paved the way to the organization of democratic elections and the formation of a stable government. He took special interest in the nutrition and humanitarian situation in the country and facilitated the work of humanitarian agencies in the country.

He was appointed president of the Alliance for a Green Revolution in Africa (AGRA) in 2007, a position he held until 2012. As president of AGRA he established innovative programs, including innovative financing schemes for accelerating the pace towards an African Green Revolution. These programs greatly facilitated access to finance by resource-poor smallholder farmers, especially women. The crop improvement work of AGRA contributed immensely to the advancement of the breeding of higher quality staple foods, especially the yellow-fleshed sweet potato.

Upon return to Cameroon, Dr. Ngongi was elected a municipal councilor of Buea, his home town, in 2013. He is board chair of the African Fertilizer and Agribusiness Partnership, vice board chair of the International Institute of Tropical Agriculture, member of the Montpellier Panel and board chair of the Common Initiative Group Empowerment for Poverty Alleviation that works with communities to improve food security and nutrition.

Dr. Namanga Ngongi has received two national honors: Knight of the Cameroon National Order of Valor and Officer of the Cameroon National Order of Valor.

Danielle Nierenberg

President, Food Tank: The Food Think Tank

Danielle Nierenberg is president of Food Tank and an expert on sustainable agriculture and food issues. She has written extensively on gender and population, the spread of factory farming in the developing world and innovations in sustainable agriculture. Danielle co-founded Food Tank, a 501(c)(3) nonprofit organization, in 2013 as an organization focused on building a global community for safe, healthy, nourished eaters.

Prior to starting Food Tank, Ms. Nierenberg spent two years traveling to more than 35 countries across Sub-Saharan Africa, Asia, and Latin America, meeting with farmers and farmers' groups, scientists, researchers, policymakers, government leaders, students, academics, and journalists, documenting what's working to help alleviate hunger and poverty, while protecting the environment.

Her knowledge of global agriculture issues has been cited widely in more than 8,000 major print and broadcast outlets worldwide. Ms. Nierenberg has an MS in

Agriculture, Food, and Environment from the Tufts University Friedman School of Nutrition Science and Policy and spent two years volunteering for the Peace Corps in the Dominican Republic.

Thomas R. Pickering

Vice Chairman, Hills and Company

Thomas R. Pickering, currently vice chairman at Hills and Company, retired as senior vice president, international relations and a member of the executive council of the Boeing Company in July 2006. He served in that position for five-and-half years. Ambassador Pickering joined Boeing in January 2001 upon his retirement as US undersecretary of state for political affairs, where he had served since May 1997. Pickering holds the personal rank of career ambassador, the highest in the US Foreign Service. In a diplomatic career spanning five decades, he was US ambassador to the Russian Federation, India, Israel, El Salvador, Nigeria, and the Hashemite Kingdom of Jordan. From 1989 to 1992 he was ambassador and representative to the United Nations in New York. Pickering entered on active duty in the US Navy from 1956 to 1959 and later served in the Naval Reserve to the grade of lieutenant commander. Between 1959 and 1961 he was assigned to the Bureau of Intelligence and Research of the State Department and later to the Arms Control and Disarmament Agency. Ambassador Pickering received a bachelor's degree cum laude from Bowdoin College in Brunswick, Maine, in 1953. In 1954 he received a master's degree from the Fletcher School of Law and Diplomacy at Tufts University. In 2012 he chaired the Benghazi Accountability Review Board at the request of secretary of state Hillary R. Clinton, which made recommendations on improving security stemming from the attack on the US Mission at Benghazi, Libya, on September 11, 2012. In 1983 and in 1986 Ambassador Pickering won the Distinguished Presidential Award and in 1996 the Department of State's highest award—the Distinguished Service Award.

Per Pinstrup-Andersen

Graduate School Professor, Cornell University
Adjunct Professor, University of Copenhagen
Chair, High Level Panel of Experts on Food Security and Nutrition

Per Pinstrup-Andersen is professor emeritus and graduate school professor at Cornell University and adjunct professor at Copenhagen University. He is past chairman of the Science Council of the Consultative Group on International Agricultural Research and past president of the American Agricultural Economics Association. He has a BS from Copenhagen University, an MS and PhD from Oklahoma State University and honorary doctoral degrees from universities in the United States, the United Kingdom, Netherlands, Switzerland, and India. He is a fellow of the American Association for the Advancement of Science and the American Agricultural Economics Association. In addition to his 15 years as professor at Cornell University, he served 10 years as the International Food Policy Research Institute's director general and seven years as department head; seven years as an economist at the International Center for Tropical Agriculture, Colombia; and six years as a distinguished professor at Wageningen Univer-

sity. He is the 2001 World Food Prize Laureate and the recipient of several awards for his research and communication of research results.

Steven Radelet

Donald F. McHenry Chair in Global Human Development and Director of the Global Human Development Program, Edmund A. Walsh School of Foreign Service, Georgetown University

Steven Radelet is a development economist whose work focuses on economic growth, poverty reduction, foreign aid, and debt, primarily in Africa and Asia. Professor Radelet has extensive experience as a policymaker in the US government as an adviser to developing country leaders and as a researcher, teacher, and writer. He previously served as chief economist for USAID, senior adviser for development to secretary of state Hillary Clinton, and deputy assistant secretary of the Treasury for Africa, the Middle East, and Asia. He currently serves as an economic adviser to President Ellen Johnson Sirleaf of Liberia. He spent four years as an adviser to the Ministry of Finance in Jakarta, Indonesia, and two years as adviser in the Ministry of Finance in The Gambia. He was a Peace Corps volunteer in Western Samoa. From 2002 to 2009 Dr. Radelet was senior fellow at the Center for Global Development. From 1990 to 2000 he was on the faculty of Harvard University, where he was a fellow at the Harvard Institute for International Development and a lecturer on economics and public policy. He is author of *Emerging Africa: How 17 Countries Are Leading the Way,* the textbook *Economics of Development,* and dozens of other publications.

Cynthia E. Rosenzweig

Senior Research Scientist, Columbia University

Dr. Cynthia Rosenzweig is a senior research scientist at the NASA Goddard Institute for Space Studies, where she heads the Climate Impacts Group. She is a senior research scientist at Columbia University's Center for Climate Systems Research and a professor in the Department of Environmental Science at Barnard College. She is the cofounder of the Agricultural Model Intercomparison and Improvement Project, a major international collaboration to improve global agricultural modeling, understand climate impacts on the agricultural sector, and enhance adaptation capacity in developing and developed countries. She is cochair of the New York City Panel on Climate Change, a body of experts convened by the mayor to advise the city on adaptation for its critical infrastructure. She co-led the Metropolitan East Coast Regional Assessment of the US National Assessment of the Potential Consequences of Climate Variability and Change, sponsored by the US Global Change Research Program. She was a coordinating lead author of the Intergovernmental Panel on Climate Change Working Group II's Fourth Assessment Report. She is codirector of the Urban Climate Change Research Network (UCCRN) and coeditor of the First UCCRN Assessment Report on Climate Change and Cities, the first-ever global, interdisciplinary, cross-regional, science-based assessment to address climate risks, adaptation, mitigation, and policy mechanisms relevant to cities. She was named one of "Nature's 10: Ten People Who Mattered in 2012" by the science journal *Nature.* A recipient of a Guggenheim Fellowship, she joins impact models

with climate models to project future outcomes of both land-based and urban systems under altered climate conditions.

Navyn Salem

Founder, Edesia/Global Nutrition Solutions

In 2007 Navyn Salem set out to help end the crisis of malnutrition for over 250 million children around the world. Her approach was simple: increase access to innovative, ready-to-use foods like Plumpy'Nut and Nutributter in developing countries, while building on the success of these fortified, peanut-based solutions to reach greater numbers of vulnerable, malnourished populations. In 2009, after first establishing a factory in her father's home country of Tanzania, Ms. Salem founded Edesia, a nonprofit food aid manufacturer in Providence, Rhode Island. This factory now produces over 8,000 metric tons each year of ready-to-use foods for humanitarian agencies such as the United Nations Children's Fund, the World Food Program, and the US Agenciy for International Development, working on behalf of children in emergency situations and conflict zones. Since production began in March 2010, Edesia has reached over 2.5 million children in 46 countries, including Chad, Guatemala, Pakistan, Senegal, and Syria. In 2012 Ms. Salem was named New England Business Woman of the Year by Bryant University, received the Roger E. Joseph Prize from Hebrew Union College for being an outstanding humanitarian, and was awarded an honorary doctorate in social sciences from Boston College, her alma mater. In 2013 she received an honorary degree in business administration from Bryant University. In 2014 she was named a Henry Crown fellow at the Aspen Institute.

Paul E. Schickler

President, DuPont Pioneer

Paul E. Schickler is president of DuPont Pioneer, the advanced seed genetics business of DuPont. In this role, which he has held since 2007, he has continued to expand Pioneer's global business by remaining focused on innovation that improves local productivity and profitability of farmers in more than 90 countries. Since joining Pioneer in 1974, Schickler has served in a variety of finance and administrative leadership roles throughout the business, including vice president of international operations from 1999 to 2007. He currently serves on the DuPont Committee on Agricultural Innovation and Productivity in the 21st Century and the DuPont Agriculture Decision Board and is a member of the DuPont Operating Team. Mr. Schickler is a graduate of Drake University, where he received BS and MA degrees in business administration. He currently serves on The Chicago Council on Global Affairs board of directors; The Chicago Council's Global Agricultural Development Initiative advisory group; the Greater Des Moines Partnership board of directors; the Grand View University board of directors; the STEM Food and Ag Council; and the Iowa Business Council. A strong contributor to the community, Mr. Schickler is an active supporter of United Way, the World Food Prize Foundation, Meals from the Heartland, and the Farm Journal Legacy Project.

Lindiwe Majele Sibanda

CEO and Head of Mission, Food, Agriculture, and Natural Resources Policy Analysis Network

Dr. Lindiwe Majele Sibanda is the CEO and head of mission of the Food, Agriculture, and Natural Resources Policy Analysis Network. She works with governments, farmers, the private sector, and researchers and is currently coordinating food security policy research and advocacy initiatives aimed at making Africa a food-secure continent. She is an animal scientist by training and a practicing commercial beef cattle farmer. She has been at the forefront of the global agriculture, food security, and climate change policy agenda. She received her BSc degree at the University of Alexandria in Egypt and her MSc and PhD at the University of Reading in the UK. Dr. Sibanda serves on numerous international boards and is currently the board chair of the International Livestock Research Institute, which is one of the 15 members of the Consultative Group on International Agricultural Research.

Robert L. Thompson

Visiting Scholar, John Hopkins University's School of Advanced International Studies
Professor Emeritus, University of Illinois

Robert L. Thompson is a visiting scholar at Johns Hopkins University's School of Advanced International Studies and professor emeritus at the University of Illinois, where he held the Gardner Endowed Chair in Agricultural Policy from 2004 to 2010. He is a senior fellow with The Chicago Council on Global Affairs and serves on the International Food and Agricultural Trade Policy Council. Previously, Dr. Thompson served as director of rural development at the World Bank (1998 to 2002); president of Winrock International Institute for Agricultural Development (1993 to 1998); dean of agriculture (1987 to 1993) and professor of agricultural economics (1974 to 1993) at Purdue University; assistant secretary for economics at the US Department of Agriculture (1985 to 87) and senior staff economist for food and agriculture at the President's Council of Economic Advisers (1983 to 1985).

Thompson received his BS degree from Cornell University and MS and PhD degrees from Purdue University and holds honorary doctorates from Pennsylvania State University and Dalhousie University (Canada). He is a fellow of the American Agricultural Economics Association and the American Association for the Advancement of Science and a foreign member of the Royal Swedish Academy of Agriculture and Forestry and the Ukrainian Academy of Agricultural Sciences. He is a former president of the International Association of Agricultural Economists.

Ann M. Veneman

Executive Director, UN Children's Fund (2005 to 2010)
United States Secretary of Agriculture (2001 to 2005)

Ann M. Veneman has a distinguished career in public service, serving as the executive director of the United Nations Children's Fund (UNICEF) from 2005 to 2010 and as US secretary of agriculture from 2001 to 2005. Ms. Veneman's leadership and vision has been recognized both nationally and internationally. In 2009 she was named to the

Forbes 100 Most Powerful Women list, and she has been the recipient of numerous awards and honors.

At UNICEF Ms. Veneman directed a staff of over 11,000 in more than 150 countries around the world. She worked to support child health and nutrition; quality basic education for all; access to clean water and sanitation; and the protection of children and women from violence, exploitation, and HIV/AIDS. She traveled to more than 70 countries to review the plight of children; to witness the devastation caused by natural disaster, conflict, disease and exploitation; and to advance programs aimed at improving and saving lives.

As secretary of the US Department of Agriculture (USDA), Ms. Veneman directed one of most diverse federal agencies with a budget of $113 billion and 110,000 employees. She also served as secretary of the California Department of Food and Agriculture from 1995 to 1999, overseeing the state agency responsible for nation's largest agricultural producing region. From 1986 to 1993 she served in various positions in the USDA, including deputy secretary, deputy undersecretary for international affairs, and associate administrator of the Foreign Agricultural Service. At USDA Ms. Veneman advanced an expanded trade agenda, food protection, progressive farm policy, responsible forest policy, and stronger nutrition programs.

Ms. Veneman currently serves on the boards of directors for Alexion and Nestlé S.A. Alexion is a global biopharmaceutical company that combines groundbreaking science with a steadfast commitment to meeting the needs of patients living with severe, life-threatening, and often ultra-rare diseases. Nestlé is the world's leading nutrition, health, and wellness company, providing consumers a wide range of food and beverage products. Ms. Veneman is also a member of the Council on Foreign Relations and the Trilateral Commission. She is a frequent speaker on a range of topics, including poverty alleviation, empowering women and girls, food security and nutrition, and global health.

Throughout her career Ms. Veneman has served on a number of advisory councils, committees, and nonprofit boards, particularly those involving higher education. Currently she is on the boards of the National 4-H Council, Malaria No More, the Global Innovative Health Technology Fund, and Landesa. She is also a cochair of the Bipartisan Policy Center initiative on Obesity and Physical Activity and on the Bipartisan Policy Center Commission on Political Reform. She serves on the advisory boards of BRAC, the FEED Project, Pencils of Promise, Roosevelt House, Terra Vesco, The Chicago Council's Global Agricultural Development Initiative, the Omega Women's Leadership Center, Living Goods, Runa Tea, Aloha, and Driptech. In 2012 she served as a fellow at the Harvard School of Public Health and the U.C. Berkeley Goldman School of Public Policy.

A lawyer by training, Ms. Veneman has practiced law in both California and in Washington, DC. Early in her career she was a deputy public defender. She holds a bachelor's degree in political science from the University of California, Davis; a master's degree in public policy from the University of California, Berkeley; and a JD degree from the University of California, Hastings College of the Law. She has been awarded honorary doctorate degrees from several universities and colleges.

Derek Yach

Senior Vice President, The Vitality Group

Derek Yach has focused his career on advancing global health. He is senior vice president of the Vitality Group, part of Discovery Holdings Ltd, where he leads the Vitality Institute for Health Promotion. Prior to that he was senior vice president of global health and agriculture policy at PepsiCo, where he supported portfolio transformation and led engagement with major international groups and new African initiatives at the nexus of agriculture and nutrition. He has headed global health at the Rockefeller Foundation, has been a professor of Global Health at Yale University, and is a former executive director for Noncommunicable Diseases and Mental Health of the World Health Organization (WHO). At WHO he served as cabinet director under director-general Gro Harlem Brundtland, where he led the development of WHO's Framework Convention on Tobacco Control and the Global Strategy on Diet and Physical Activity. Dr. Yach established the Centre for Epidemiological Research at the South African Medical Research Council. He has authored or coauthored over 200 articles covering the breadth of global health. Dr. Yach serves on several advisory boards, including those of the Clinton Global Initiative, the World Economic Forum, the NIH's Fogarty International Center, and PepsiCo's Scientific Advisory Board. His degrees include an MBChB from the University of Cape Town, BSc (Hons Epi) from the University of Stellenbosch, and an MPH from the Johns Hopkins Bloomberg School of Public Health.

Acronyms

AgMIP — The Agricultural Model Intercomparison and Improvement Project

AIEx — The Agroecological Intensification Exchange

ATNI — Access to Nutrition Index

AWARD — African Women in Agricultural Research and Development

CCT — Conditional Cash Transfer

CFBAI — Better Business Bureau Children's Food and Beverage Advertising Initiative

CGIAR — Consortium of International Agricultural Research Centers

CIMSANS — International Life Science Institute Research Foundation's Center for Integrated Modeling of Sustainable Agriculture and Nutrition Security

ENGINE — Empowering New Generations for Improved Nutrition and Economic Opportunities

GAIN — Global Alliance for Improved Nutrition

GDP — Gross Domestic Product

GNP — Gross National Product

IITA — International Institute of Tropical Agriculture

IWG — US Government's Interagency Working Group on Food Marketed to Children

LMICs — Low- and Middle-Income Countries

MDGs — Millennium Development Goals

MIGHTi — Mission to Improve Global Health Through Insects

NGO — Nongovernmental Organization

NCD — Noncommunicable Disease

PAHO — Pan American Health Organization

PEPFAR — President's Emergency Plan for AIDS Relief

PFS — Partners in Food Solutions

SDGs — Sustainable Development Goals

SME — Small- and Medium-Sized Enterprise

STEM — Science, Technology, Engineering, and Mathematics

SUN — Scaling Up Nutrition

USAID — US Agency for International Development

USDA — US Department of Agriculture

WHA — World Health Assembly

WHO — World Health Organization

YALI — Young African Leaders Initiative

YPARD — Young Professionals for Agricultural Development

Endnotes

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