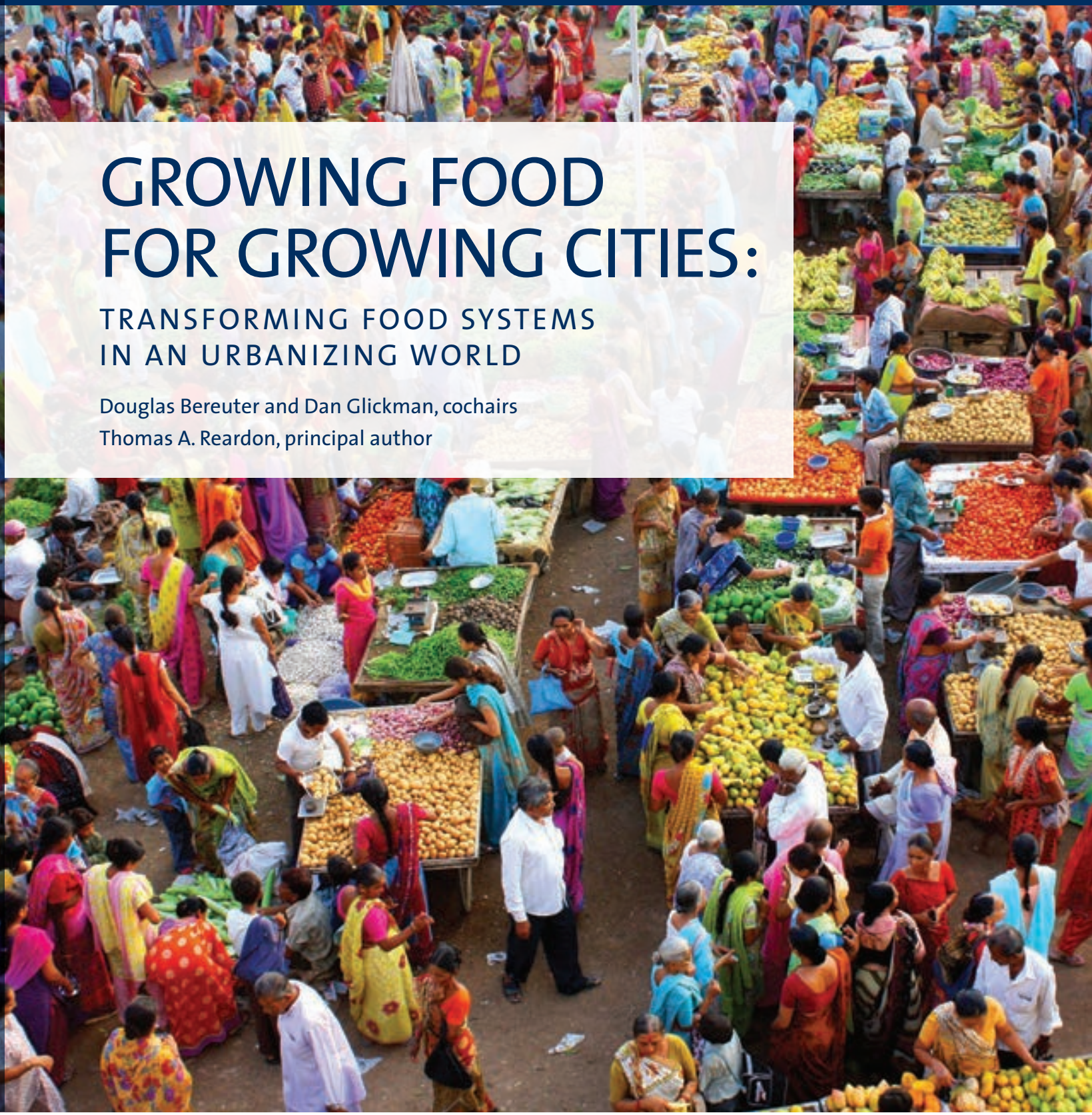
GROWING FOOD FOR GROWING CITIES:

TRANSFORMING FOOD SYSTEMS IN AN URBANIZING WORLD

Douglas Bereuter and Dan Glickman, cochairs
Thomas A. Reardon, principal author



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Endorsed by an Independent Advisory Group

April 2016

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Printed in the United States of America.

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Foreword

The world is becoming increasingly urban. Today, more people live in urban than in rural areas, and by 2050 two-thirds of the world's population will live in cities. This immense demographic shift is changing the world's food systems, and feeding the rapidly expanding populations in the world's cities is a pressing global concern.

To meet booming urban demand, the world's food producers and food systems will need to transform themselves to deliver a safe, sustainable, and nutritious food supply to growing cities. And care must be taken to ensure that farmers and rural economies can benefit—rather than be excluded—from this transformation.

This report is the third in a series of Council reports to examine thematic issues in the food and agriculture system that have dramatic effects on the health, well-being, and overall development of our world. In the 2014 report, *Advancing Global Food Security in the Face of a Changing Climate,* the Council looked at the impact of climate change on agriculture and made recommendations for how investments in key areas could help farmers adapt to and mitigate the effects of climate change. In 2015, with the report *Healthy Food for a Healthy World,* the Council examined the changing state of nutrition and the costs of malnourishment as well as the relationship between agriculture, food, and overall health and development in emerging economies. This year's report is an opportunity to step back even further and examine how a confluence of system changes and global trends, chief among them urbanization, are transforming the structure and conduct of the entire food system, from the farm to the consumer.

As with previous reports, the cochairs make recommendations for how the US government can lead global efforts to promote agriculture and food security, but also pay special attention to the private sector, given its role in building the emerging global food system. The report also looks at the pivotal role of national and local governments and civil society in low- and middle-income countries in creating inclusive and enabling policies for growth. As with previous reports, the findings and recommendations put forward in this report were developed by the project's cochairs, Douglas Bereuter and Dan Glickman, with key thought leadership by the principal author and in consultation with the project's advisory group and numerous subject-matter experts from government, business, civil society, and academia.

I would like to thank the cochairs for their skillful and dedicated leadership throughout this study's demanding process. The issues surrounding urbanization and global food systems are complex and require expertise from individuals from a wide array of disciplines and backgrounds. 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 especially grateful to Tom Reardon, who served as the principal author of this report. Dr. Reardon brought his great wealth of knowledge of global food systems to the framing of the study's agenda, led the research process, and spearheaded the writing of the findings and recommendations. Finally, the Council would like to express its deep appreciation and thanks to the Bill & Melinda Gates Foundation and the Stuart Family Foundation for the generous support that made this report possible.

Ivo H. Daalder
President

Acknowledgments

The Council would also like to acknowledge those that met with the research team:

Wanjiru Kamau-Rutenberg from African Women in Agricultural Research and Development; Hanna Abou-El-Seoud and John Gordley from the American Soybean Association; Sara Boettiger, Brantley Browning, Tom Kehoe, Alan Rennison, Kate Schneider, and Rinn Self from the Bill & Melinda Gates Foundation; Susan Owens from the Board for International Food and Agricultural Development; Elsa A. Murano from the Borlaug Institute at Texas A&M University; Asif Saleh from BRAC and BRAC International; John McArthur, Sinead Mowlds, and Krista Rasmussen from the Brookings Institution; Sarah Rose from the Center for Global Development; Kimberly Flowers and Islam Siddiqui from the Center for Strategic and International Studies.

Alicia McManus from Chemonics International; Martha Brantley and Walker Morris from the Clinton Development Initiative; Jennifer Ragland from Coca-Cola; Ronnie Coffman from Cornell University; Angela Hansen from Dalberg Global Development Advisors; James C. Borel, formerly from DuPont; Grady Bishop and Jose Simas from Elanco; Rob Dongoski and Jason Hamill from Ernst & Young LLP; Arni M. Mathiesen from the Food and Agriculture Organization of the United Nations; Jennifer Goldston from FarmLink; Sunniva Bloem from the Global Alliance for Improved Nutrition; Michiel Bakker from Google; Amy Braun from the Kellogg Company.

Howard-Yana Shapiro from Mars, Incorporated; Thomas Jayne from Michigan State University; Damiana Astudillo, Katherine Farley, Rick Gaynor, Tim Mooney, and Jill Pike from the Millennium Challenge Corporation; Greg Bohach from Mississippi State University; Michael K. Doane formerly from Monsanto; Steve Brown and Riley Pagett from the National FFA Organization; Magdi Batato from Nestlé; Sharon Bomer Lauritsen from the Office of the US Trade Representative; Bruce Cameron from the Overseas Private Investment Corporation; Cara Bradley and Peiman Milani from PATH; Mehmood A. Khan from PepsiCo.

William J. Binder, Sierk Plaat, Clara van de Elst, and Tjard Westbroek from Rabobank; Andrea Durkin from Sparkplug LLC; Roger Beachy from the University of California at Davis; Alison Cairns from Unilever; Brady Deaton from the University of Missouri and the PUSH Steering Committee; Brian Dillon from the University of Washington; Charles Cadwell, Ben Edwards, Ammar A. Malik, and Dana Schmidt from the Urban Institute; David Atwood, Robert Bertram, Beth Dunford, Justin Finnegan, David Hegwood, James Oehmke, Peter Richards, and Kate Steel from the US Agency for International Development; Ann Bartuska, Don Evans, Fred Gale, Phil Karsting, Suzanne Palmieri, Laura Scandurra, Jim Suits, and Harold Tarver from the US Department of Agriculture; Elizabeth Buckingham, Julia Duncan, Ted Lyng and Caitlin E. Welsh from the US Department of State; Luc Christiaensen and Thomas Farole from the World Bank; Brett Rierson from the World Food Programme; and Beth Sauerhaft.

Several members of the Council staff played key roles in bringing this report to fruition. Alesha Black, director, Global Food and Agriculture Program, directed the study. Louise Iverson, assistant director, expertly oversaw the day-to-day management of all aspects and participants in the report's development. Andre Nickow played a key role in the research and report drafting processes with unmatched dedication and accuracy.

Erik Pederson and Grace Burton provided guidance on the recommendations for US action. Rajiv Shah and Phil Levy lent their expertise on US policy. Trace Carlson assisted with collecting report photos. Catherine Hug of Chicago Creative Group provided valuable editorial direction and oversaw the design of the report.

EXECUTIVE SUMMARY

Growth in the world's cities is exploding. Today, more people live in urban areas than in rural areas. By 2050, 66 percent of the world's people are expected to live in cities, fueling unprecedented demand for food.[1] Especially in low- and middle-income countries (LMICs) in Asia, Africa, and Latin America, feeding urban populations has become an urgent and critical challenge.

As cities grow, diets are changing. Urban consumers are demanding a more diversified diet, including fruits, vegetables, dairy, and meat, and are increasingly consuming processed foods. Accompanying these shifts is the transformation of supply chains, affecting farmers, small- and medium-sized enterprises (SMEs), and consumers. A process has begun, which will continue for decades, that is transforming food systems from farm to fork.

These trends are occurring alongside other pressures on food systems. Explosive population growth, both rural and urban, will require 50 to 60 percent increases in global food production by 2050 in order to meet demand.[2] Climate change is increasing weather volatility such as droughts, floods, and natural disasters. Obesity rates are skyrocketing, even as nearly 800 million people worldwide are still chronically hungry and two billion suffer from micronutrient deficiency, creating a triple burden of malnutrition.[3] Refugees are migrating across the globe in the highest numbers since World War II.[4] In the face of these challenges, it is clear that coordinated support and commitment to the development of nutritious, safe, affordable, and sustainable food systems in rapidly urbanizing LMICs is essential to global food security.

Feeding cities presents a major opportunity to improve the plight of millions of small-scale farmers and rural residents trapped in subsistence agriculture and joblessness. Participation in growing urban food markets can provide the rising incomes and rural employment urgently needed to meet rural food security challenges, alleviate rural poverty, and address the devastating lack of jobs among the demographic "youth bulge" in low-income countries.

Up to 90 percent of food consumption in low-income countries comes from domestic sources in rural areas.[5] To supply increased volumes of food demanded by urban consumers, supply chains must lengthen geographically, increasing the potential to reach farmers in more and more distant areas. This not only benefits farmers, but also the rural enterprises along the supply chain like wholesalers, transporters, processors, and input suppliers.

Cities also contain the lion's share of demand for high-value products such as fruits, vegetables, and dairy, where small-scale farmers can have an advantage because the products are labor intensive. Since the urban market is year-round, farmers are incentivized to grow crops in multiple seasons and to grow higher-value products. Developing the food systems that link farmers to cities will have an enormous impact on rural poverty alleviation and agricultural development.

Meeting urban demand in low-income countries is also a major market opportunity for the private sector, from large domestic local firms and multinational corporations to SMEs. In Africa alone, the agriculture and food sector is expected to reach $1 trillion by 2030.[6] Moreover, the scale of investment needed for food systems to meet urban demand makes it evident that action, innovation, and investment by the private sector will be essential to feeding cities.

Despite the opportunities, the transformation of food systems and the development of supply chains will not inherently include small-scale farmers. There is a risk that many will be left behind. Especially vulnerable are farmers in areas far removed from cities and farmers who lack the resources needed to increase production and meet the standards often required by urban markets. Women farmers, for example, are often already more marginalized than their male counterparts and may find it difficult to access these new markets. If small farmers are excluded from urban markets and food system transformation now, they risk being stuck in perpetual, semisubsistence farming for generations to come and becoming part of the "lagging regions" of tomorrow, persisting in poverty decades after their compatriots have climbed the economic ladder to greater health and well-being.

It is critical that the development of food systems to meet urban demand includes small farmers and also the rural entrepreneurs in the small enterprises along the supply chain. Inclusive growth will require smart and deliberate investments by governments and the private sector. Inclusive investments are a win-win for everyone. Analysis has found that the $7 trillion global food and beverage industry will not be able to continue delivering the financial returns expected by companies' shareholders without tapping into small-scale farmers' productivity.[7] Government policies in LMICs from the national to the municipal level must also support small farmers and rural economies and create an enabling environment for investment.

But US leadership will be essential. Since World War II the United States has led global efforts to mitigate hunger and malnutrition, and US policymakers must lead global food security efforts today. This leadership must come from both the current and the next presidential administration as well as bipartisan leadership in Congress.

US interests are at stake. Growing markets offer enormous new investment opportunities for US business, and strong global food systems will contribute to the long-term affordability and safety of food for consumers around the globe, including US consumers. On the flip side, food insecurity as a result of high and volatile food prices and lack of secure livelihoods can aggravate already unstable environments, particularly in urban areas around the world. The potential for political, economic, and civil unrest that results is a threat to global security and to US national security.

This report puts forward recommendations for how the US government—in partnership with governments, the private sector, the scientific community, and civil society—can lead the way in ensuring that food systems can feed the world's cities sustainably while lifting all boats.

Recommendation 1: Develop, implement, and strengthen policies for global food security

The urgency of the global food and nutrition security challenge cannot be overstated. Exploding populations are increasing demand in cities at unprecedented rates. Investments in agriculture and food systems often take years if not decades to come to fruition and need to be sustained and predictable over the long term in order to yield lasting results. In the absence of a food crisis, agricultural investment often dips, only to leave the world vulnerable to crisis. Without a long-term commitment, the gains that have already been made will be in jeopardy and the challenges of meeting global food demand more difficult if not impossible to achieve. Long-term leadership by the United

States will ensure the global community also stays the course in its commitment to this issue. This recommendation calls for:

- Congress to pass authorizing legislation that commits the United States to a long-term global food and nutrition security strategy.
- Agencies to increase support for strengthening low-income countries' policymaking. Priority areas should include infrastructure development, land tenure, gender and nutrition sensitive agricultural policy, and food safety.
- The administration to lead G7 and G20 global food security discussions and reinvigorate global commitments to food security and agricultural development using the Sustainable Development Goals as a common framework.
- Agencies to support the development of early warning systems in low-income countries to monitor threats to food systems such as food contamination, crop pest and disease outbreaks, livestock disease, and zoonotic threats.
- Congress to pass legislation authorizing the Millennium Challenge Corporation to make regional compacts in order to build regional food systems.

Neil Palmer/CIAT

Recommendation 2: Enable and leverage private-sector investment that includes small-scale farmers and rural SMEs in the food system

Meeting the scale of the challenges posed by urbanization will require investment and innovation by the private sector, from large multinational corporations to small, local enterprises and entrepreneurs. This recommendation calls for the US government, alongside US businesses, to:

- Enable and leverage private-sector investment by US firms and lead multinational efforts to spur private-sector investment.
- Partner with and support local SMEs in low-income countries to foster employment opportunities and build rural economies.

Recommendation 3: Improve regional trade capacity to build efficient and sustainable food systems across national borders through trade policy

Too often, food systems in low-income countries are hindered by regional trade capacity. The United States should build countries' regional trade capacity through its trade policies by taking the following actions:

- Promote transparent legal and customs infrastructure, harmonization, standardization, and implementation of procedures and efforts to reduce corruption to help accelerate regional economic integration.
- Encourage use of regional food balance sheets to inform national policies and avoid unnecessary protectionism.
- Establish and designate the position of US Department of Agriculture (USDA) undersecretary of trade and foreign agricultural affairs.

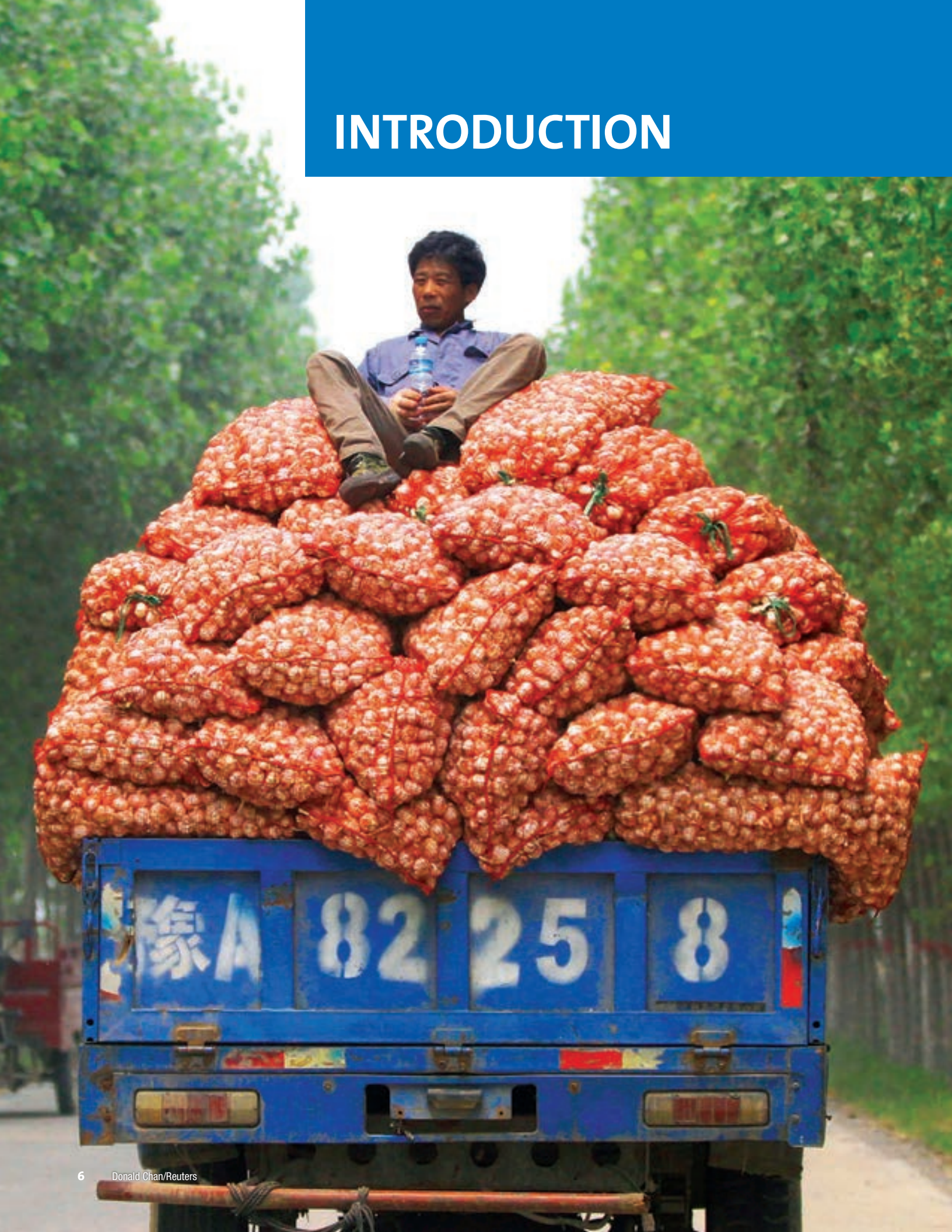
Recommendation 4: Strengthen research support and expand the research agenda to build food systems

In light of the growing pressures from urban demand, the entire agriculture research enterprise in the United States and around the world needs to focus on solving the challenges facing food systems. This recommendation calls on the United States to:

- Increase research investment for building productive, sustainable, and efficient food systems. Areas of focus include increased productivity, resilience, and transportability of foods; improved harvesting and storage technologies; water utilization and conservation; climate resilience from farm to fork; and leapfrog technologies.
- Launch a new Feed the Future Innovation Lab focused on food systems' efficiency.
- Invest in the next generation of scientists, entrepreneurs, and leaders in low-income countries.

Neil Palmer/CIAT

INTRODUCTION



6 Donald Chan/Reuters

Growth in the world's cities is exploding, fueling an unprecedented demand for food in urban areas. Especially in LMICs in Asia, Africa, and Latin America, feeding urban populations has become an urgent and critical challenge. This includes meeting the food and nutritional demands of people with rising incomes and changing diets as well as the demands of the growing number of poor and hungry.

These trends are occurring alongside other pressures on food systems. Explosive population growth, both rural and urban, will require 50 to 60 percent increases in global food production by 2050 to meet demand.[8] Increasing weather volatility such as droughts, floods, and natural disasters as a result of climate change threaten production. Obesity rates are skyrocketing, even as nearly 800 million people worldwide are still chronically hungry and two billion suffer from micronutrient deficiency, creating a triple burden of malnutrition.[9] Refugees are migrating across the globe in the highest numbers since World War II.[10] In the face of these challenges, coordinated support and commitment to the development of nutritious, sustainable food systems in rapidly urbanizing LMICs will be essential to global food security.

While much attention has been given to increased production on the farm to meet demands, equally critical are the supply chains that connect farmers to urban markets. Efficient, resilient, and sustainable supply chains will not only help deliver sufficient and healthy foods to the urban residents who need it, but also offer an opportunity for

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small-scale farmers, rural workers, and owners of SMEs to lift themselves out of poverty. Cities consume the lion's share of demand for high-value, perishable agricultural products like fruit, vegetables, meat, fish, and dairy, where small-scale farmers can have an advantage. Supplying these goods can help raise incomes and create desperately needed jobs among rural residents, especially among the growing youth demographic. These supply chains are a path to food security and economic security in cities and the countryside, which can lead to more stable, productive societies better able to sustain themselves.

The transformation of food systems and supply chains to meet rising demand is also a major market opportunity for the private sector, from SMEs to large, local firms to multinational corporations. Over the past four decades African food markets have expanded as much as eightfold in volume, with most of that growth occurring in the past two decades.[11] The African food market is expected to grow another sixfold in the next four decades.[12] Similar growth has occurred in South Asian and Southeast Asian markets. Many US and foreign companies are already taking advantage of this opportunity to get in at the ground level and are poised to benefit from the explosive growth in these markets.

While food systems have been modernizing quickly, they still face important challenges and will require substantial investment to reach their potential to provide affordable, safe, and nutritious food to consumers—and to raise incomes and employment in towns, small cities, and rural areas. Indeed, food system transformation does not inher-


Tiksa Negeri/Reuters

ently have to include small-scale farmers, and there is a risk of many being left behind. While many small-scale farmers are already within reach of cities and have the opportunity to participate in a market that can lift all boats, farmers far removed from cities and those who lack the resources needed to increase production and meet quality and reliability standards are especially vulnerable.[13] Women farmers, for example, are already often more marginalized than their male counterparts and may find it difficult to access these new markets. If small farmers are excluded from urban markets and food system transformation now, they risk being stuck in perpetual semisubsistence farming for generations to come, living in the "lagging regions" of tomorrow where poverty persists decades after their compatriots have climbed the economic ladder to greater health and well-being.

There is much to be done by governments, donors, and the private sector to enable these developments. Investments must be made in everything from input supply and agricultural extension to processing, cold storage, wholesaling, logistics, and retail. The

challenge is both to increase the food supply and ensure the quality, safety, and nutritional value of the food delivered from farmers to the consumer.

US leadership will be essential to meet the challenge of feeding an increasingly urban world. With the announcement of the Sustainable Development Goals (SDGs) in 2015, the United States has an opportunity to continue to lead global efforts to combat poverty and hunger and promote improved nutrition and health in the face of new pressures on the food system. Indeed, other nations such as China are also accelerating the pace and scale of their investments to assure their food security and trading relationships for the future, while contributing to reducing poverty and hunger.

US interests are at stake. Growing markets offer enormous new investment opportunities for US business, and strong global food systems will contribute to the long-term affordability and safety of food for consumers around the globe, including US consumers. On the flip side, food insecurity as a result of high and volatile food prices and lack of secure livelihoods can aggravate already unstable environments, particularly in urban areas around the world. The potential for political, economic, and civil unrest that results is a threat to global security and to US national security.

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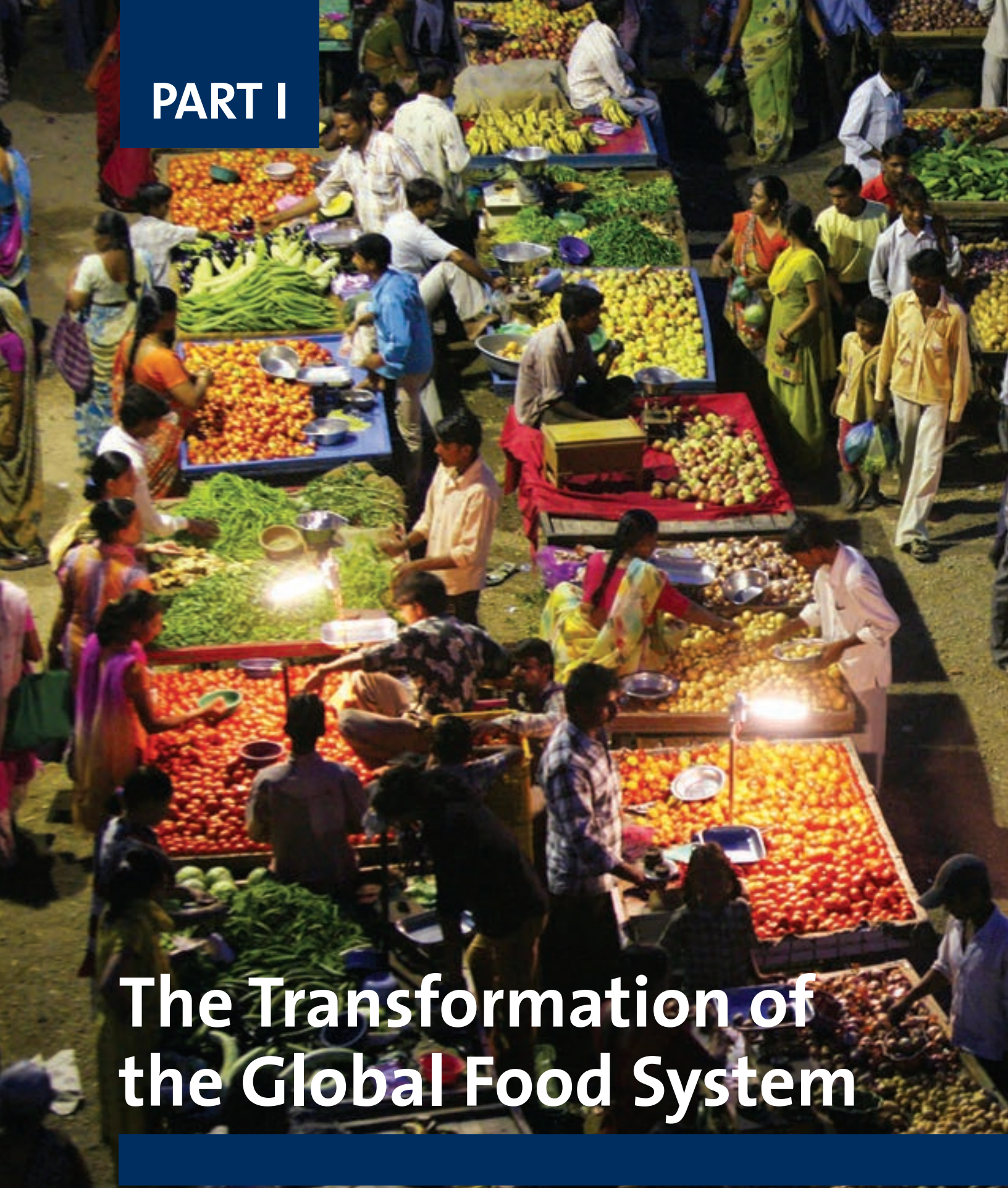
This report outlines the background, challenges, and opportunities of feeding the world's cities and makes recommendations on how the global food system can ensure a sustainable, affordable, and nutritious food supply for an increasingly urban population while increasing the incomes, employment, and market opportunities of farmers, rural enterprises, and workers. It addresses global priorities to leverage opportunities for investment and to minimize risks. It includes specific actions the US government can take to leverage its leadership in the agriculture and food sector in partnership with other countries, international organizations, businesses, and civil society to advance these recommendations.

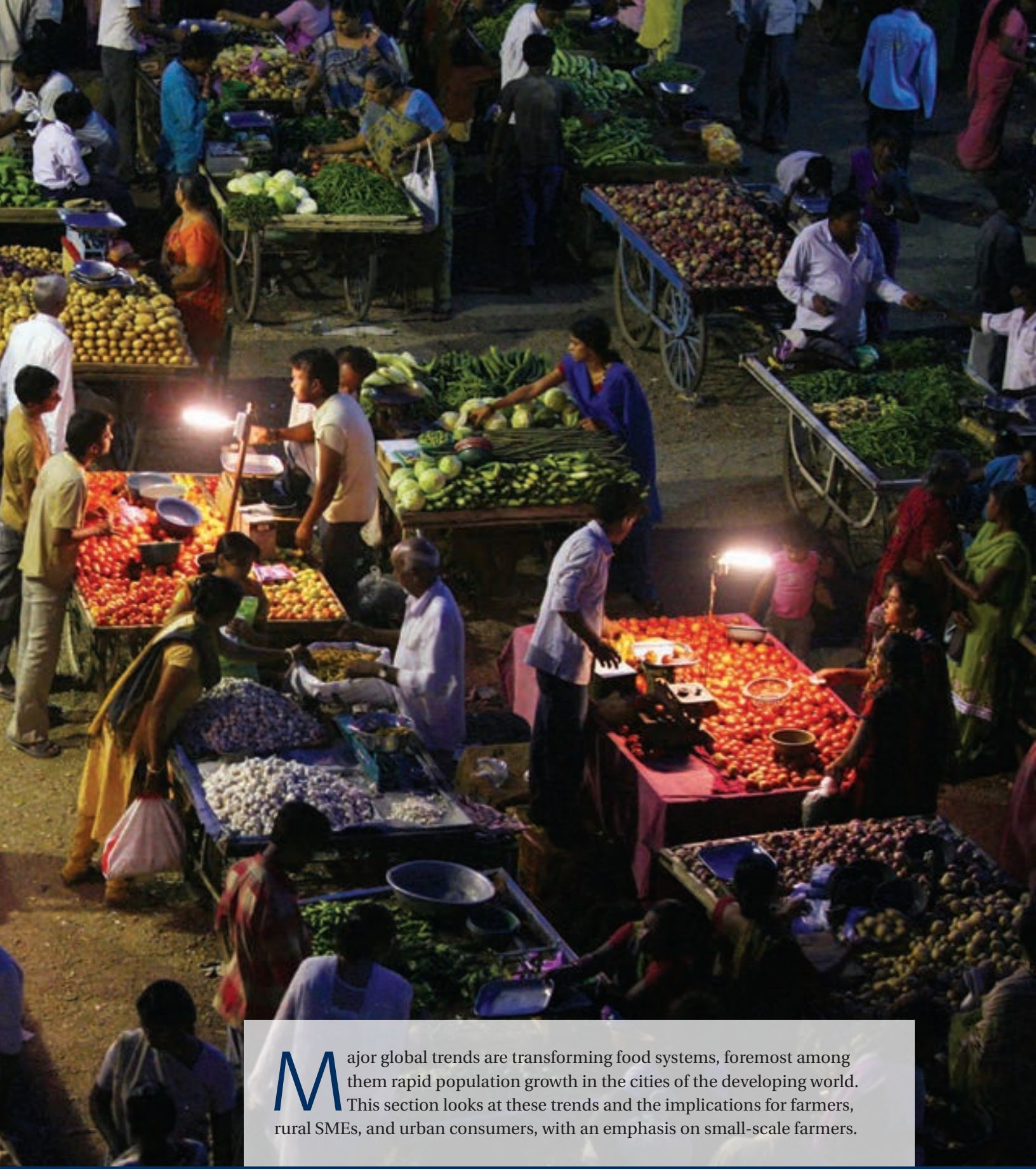
Part I outlines the trends transforming the global food system, especially urbanization, as well as the opportunities and challenges for farmers in low-income countries related to supply chains. Part II looks at private-sector investment opportunities that are inclusive of small-scale farmers and SMEs, while also examining the role of national and local governments to enable investment, ensure inclusivity, and mitigate negative impacts as food systems develop. Part III recommends actions the US government should take to support and accelerate inclusive food system development.

PART I



The Transformation of the Global Food System

Dave Amit/Reuters



Major global trends are transforming food systems, foremost among them rapid population growth in the cities of the developing world. This section looks at these trends and the implications for farmers, rural SMEs, and urban consumers, with an emphasis on small-scale farmers.

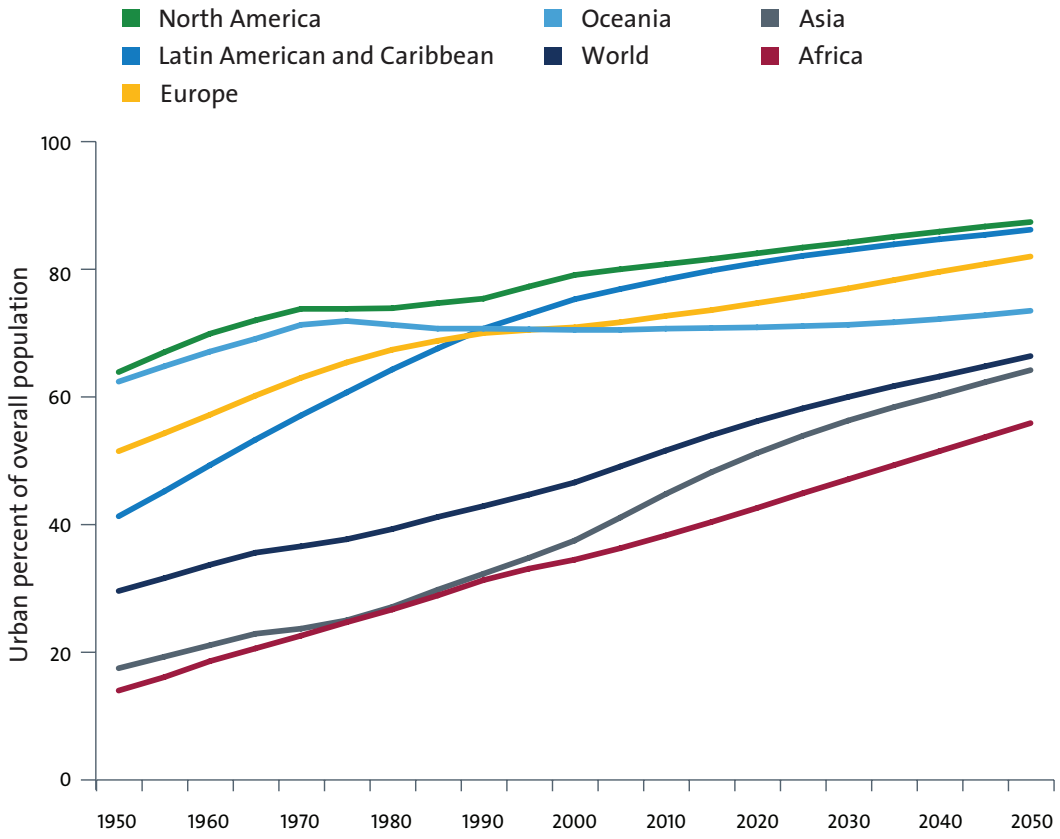
Cities are growing rapidly

The globe is rapidly moving toward a majority-urban world. Today, 54 percent of the world's people live in cities. By 2050 that figure is expected to be 66 percent.[14] The most rapid growth is taking place in cities of the developing world. Africa's population is projected to grow from 40 percent urban today to 56 percent in 2050, with the urban population growing from 48 to 64 percent in Asia and from 80 to 90 percent in Latin America. Some countries in Southeast Asia and Latin America are on track to triple their urban share of population in 60 years, about twice as fast as urbanization occurred in the United States.

Growth in cities is primarily "organic"

The rapid growth of cities is not likely to slow anytime soon. Growth is resulting less from a shift of populations from rural to urban areas than from rapid population growth within cities themselves. On average, with a few exceptions such as China, 75 percent of urban growth is "organic," or the result of net urban births and the reclassification of growing rural areas as urban, with only 25 percent of growth from permanent rural to urban migration.[15] Advances in hygiene and medicine have contributed to this trend, resulting in much lower urban death rates, including lower infant mortality. While rural

Figure 1 – Urbanization trends by region



Source: UN DESA, 2014.

Box 1 – The "youth bulge" and youth unemployment

Many LMICs, particularly those in Africa and South Asia, are experiencing large "youth bulges," or a large proportion of young adults and children in their populations. This demographic trend places enormous pressure on food systems, employment, and other institutions within low-income countries.

The youth bulge is greatest in Africa, where half the population is age 19 or under. Two hundred million people are between the ages of 15 and 24, and this number is expected to double by 2045 as population grows at an annual rate of 2.6 percent. South Asia is also experiencing a youth bulge and has the world's next highest population growth rate at 1.29 percent annually.

This vast number of young people strains resources and social structures, including the labor market. The International Labour Organization estimates that while 73 million jobs were created in Africa between 2000 and 2008, only 16 million of these jobs were filled by people ages 15 to 24. As a result, many young Africans are unemployed, underemployed, or working in the informal economy. Sixty percent of Africa's unemployed are young people, and in most African countries youth unemployment rates are double those of adults.

As large youth populations start families, population growth will increase further, leading to an even larger youth bulge. This will intensify demand for food and jobs, magnifying the need to create employment solutions within the food and agriculture sectors.

Sources: African Economic Outlook; World Bank.

Bernardo Ricci Armani

Figure 2 – World's largest cities in 2025 and 2050

Cities by rank in 2050	Projected population 2050 (millions)	Rank in 2025	Population change 2025 to 2050
1 Mumbai	42.40	2	+16.01
2 Delhi	36.16	3	+13.66
3 Dhaka	35.19	4	+13.17
4 Kinshasa	35.00	11	+18.24
5 Kolkata	33.04	8	+12.48
6 Lagos	32.63	12	+16.83
7 Tokyo	32.62	1	–3.78
8 Karachi	31.70	10	+12.60
9 New York	24.77	7	+4.14
10 Mexico City	24.33	6	+3.32
11 Cairo	24.04	13	+8.48
12 Manila	23.55	14	+8.74
13 São Paulo	22.83	5	+1.40
14 Shanghai	21.32	9	+1.91
15 Lahore	17.45	24	+6.94
16 Kabul	17.09	47	+9.91
17 Los Angeles	16.42	17	+2.75
18 Chennai	16.28	26	+6.15
19 Khartoum	16.00	44	+8.16
20 Dar es Salaam	15.97	65	+10.28
21 Beijing	15.97	15	+1.42
22 Jakarta	15.92	19	+3.56
23 Bangalore	15.62	31	+5.90
24 Buenos Aires	15.55	16	+1.78
25 Baghdad	15.09	43	+7.03

Source: Global Cities Institute, 2014.


Beijing 21
Tokyo 7
Baghdad 25
Kabul 16
15 Lahore
Delhi
2
14 Shanghai
11 Cairo
3 Dhaka
Karachi 8
5
Mumbai 1
Kolkata
19 Khartoum
12 Manila
Bangalore 23
18 Chennai
6 Lagos
Kinshasa
4
20 Dar es Salaam
Jakarta 22
Population in 2025
Population in 2050
Map ranking based on projected population in 2050

to urban migration is still contributing to urban growth—and affecting many rural areas and rural households' well-being—increases in rural nonfarm employment, including jobs in services and manufacturing, have helped struggling farmers diversify their incomes and remain in rural areas rather than migrate to cities.

Small cities and towns are as important as "megacities"

Urbanization is usually associated with "megacities"—such as Beijing and Mumbai and Nairobi—which in 2012 represented 40 percent of total urban populations in LMICs, up from 26 percent in 1970.[16] With this figure expected to reach 48 percent by 2025, megacities are having a profound influence on the food industry and agricultural production zones because of the sheer size of demand and the supply chains that are needed to meet it.

At the same time, 60 percent of the urban population lives in cities and towns smaller than 1 million in developing regions overall. In Africa 40 percent of the urban population is in towns over 1 million, and 40 percent in small towns under 250,000.[17]

In 2013, 863 million people lived in urban slums of developing regions. By 2020 there are projected to be 500 million more. At the same time, the world's poorest and most vulnerable people continue to be those living in rural areas, many of whom depend on agriculture for their livelihoods.

Food systems that serve these smaller cities will be equally important in meeting food demand and improving livelihoods through the food system. In Ethiopia, Malawi, and Niger the majority of economic activity of small towns has been found to be linked to food supply chains.[18] In India and China 50 to 60 percent of local rural nonfarm employment was found to be the result of commuting or short-term migration to or from local towns.[19]

As a result, the importance of small cities and towns in reducing poverty is clear. In studies in Tanzania and Uganda, small cities had a much broader effect on reducing poverty for rural households that moved or commuted to them compared to large cities.[20] Focusing on ways to assist farmers in capturing these opportunities will be critical for helping reduce poverty. This poverty reduction impact comes from both the opportunities for small farmers to access nearby cities' and towns' markets through supply chain development and from rural nonfarm employment opportunities generated within the towns' perimeters.[21] The economies of small towns and cities are also more closely integrated with the surrounding rural areas, depending on them for food, influencing rural employment, and supplying farmers with agricultural services, such as tractor services.[22]

Urban areas contain a large number of the poor and hungry

While people in the cities of LMICs tend to have higher average incomes and better nutrition than those in rural areas, this masks the substantial presence of poverty and malnutrition in urban areas as well as stark differences between megacities and small cities and towns.

Box 2 – The Sustainable Development Goals

In 2015 the United Nations announced the SDGs, setting a development agenda for the global community to meet by 2030. The SDGs succeed the Millennium Development Goals, which expired in 2015. The SDGs have set an ambitious framework for LMICs and high-income countries for alleviating poverty and hunger and improving well-being:

- Goal 1—End poverty in all its forms everywhere.
- Goal 2—End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
- Goal 3—Ensure healthy lives and promote well-being for all at all ages.
- Goal 4—Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Goal 5—Achieve gender equality and empower all women and girls.
- Goal 6—Ensure availability and sustainable management of water and sanitation for all.
- Goal 7—Ensure access to affordable, reliable, sustainable, and modern energy for all.
- Goal 8—Promote sustained, inclusive, and sustainable economic growth; full and productive employment; and decent work for all.
- Goal 9—Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
- Goal 10—Reduce inequality within and among countries.
- Goal 11—Make cities and human settlements inclusive, safe, resilient, and sustainable.
- Goal 12—Ensure sustainable consumption and production patterns.
- Goal 13—Take urgent action to combat climate change and its impacts.
- Goal 14—Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
- Goal 15—Protect, restore, and promote sustainable use of terrestrial ecosystems; sustainably manage forests; combat desertification; halt and reverse land degradation; and halt biodiversity loss.
- Goal 16—Promote peaceful and inclusive societies for sustainable development; provide access to justice for all; and build effective, accountable, and inclusive institutions at all levels.
- Goal 17—Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Source: UN.

Akintunde Akinleye/Reuters

Box 3 – Refugee migration and new pressures on cities

By the end of 2014 the world's population of refugees and internally displaced persons was to exceed 60 million, the largest number on record since the international community started collecting displaced persons data after World War II. In addition to incalculable human costs, this crisis has an estimated monetary cost of $100 billion annually. A growing share of the victims of humanitarian disasters has been migrating to cities, posing grave challenges for urban food systems.

First, displaced populations often face severe food insecurity that underdeveloped host food systems struggle to accommodate. One recent study found that 88 percent of sample Afghan refugee households living in Tehran were food insecure. Some observers argue that the struggle to accommodate displaced persons often decreases the host city's "resilience and stability." For example, in some cases the food security situation for Syrian refugees has become so dire that they have returned to active conflict zones in Syria.

Second, the violent conflicts that cause displacement often directly disrupt food production, thus shrinking the food supply and raising food prices precisely at the times and places that more food is most desperately needed. Armed conflict destroys cropland, processing centers, and sanitation facilities and disrupts food transportation. Results can be devastating enough when they are byproducts of war, but in many instances hunger has been intentionally used as a weapon of war through strategic destruction of food systems.

The Syrian conflict and the displacement it has caused embody many of these trends. Up to 85 percent of Syrian refugees live outside of refugee camps, many in cities. Syrian refugees now constitute 10 percent of Jordan's population and 25 percent of Lebanon's, exerting enormous pressure on urban areas there and in southern Turkey. Yemen has also seen displaced persons move into urban areas, as have a range of other countries across the developing world, from South Sudan and Democratic Republic of Congo to Myanmar and Colombia. These pressures add to the challenge of feeding the world's cities.

Sources: Abdollahi et al. 2015; Berti 2015; Graham 2015; Hendrix, 2016; Messer and Cohen 2015; NPR, 2015; UNHCR 2015.

Eirik Johan Solheim/iStock

While poverty is more prevalent in small cities and towns—roughly 70 percent of the poor in LMICs live in small and medium cities and the surrounding rural areas—there are also large and growing numbers of poor and malnourished in the urban slums of large cities.[23] In 2013, 863 million people lived in urban slums of developing regions, up from 650 million in 1990. By 2020, 500 million more are projected to be living in urban slums.[24] On average, about one-third of the overall population in low-income countries live in slums. In Africa roughly 70 percent of the urban population lives in slums, with the majority of slum dwellers between 15 and 24 years of age.[25]

At the same time, the world's poorest and most vulnerable people continue to be those living in rural areas, many of whom depend on agriculture for their livelihood. Considering ways that the food system can help feed people and alleviate food insecurity at both ends and throughout the supply chain will have the greatest impact on overall poverty reduction.

A middle class is emerging

Another important development is the rapid emergence of a middle class. The middle class is very large in Asia and Latin America and is mainly in the cities.

The middle class is also emerging rapidly in Africa. The middle class nearly tripled in size from 1980 to 2010.[26] At 350 million, Africa's middle class is comparable in size to India's. Forty-five percent of the region's middle class live in urban areas. Being in the middle class does not, however, mean that one is invulnerable to income risk or potential poverty: 60 percent of Africa's middle class is considered "vulnerable," with the potential to slip back into poverty.

Demand for food in cities is growing even faster

Even as urban population rates grow, the rates of urban food consumption are increasing even more. Because of higher incomes and appetite for more expensive foods, the urban resident actually consumes a larger share of the total value of food than the rural

Box 4 – Middle class defined

In Africa, the middle class is defined as having a purchasing power parity (PPP) between $2 and $20 per day. It is divided into three subclasses: (1) "vulnerable middle" at PPP of $2 to $4 a day, just out of poverty and with the potential to slip back; (2) the "lower middle" class at PPP of $4 to $ 10 a day; and (3) the "upper middle" class with PPP of $10 to $20 a day.

Source: Tschirley et al., 2015.

consumer. Urban areas today represent 50 to 70 percent of national food consumption in value terms, depending on country and region. The importance of cities to national food security cannot be underestimated. Yet this has been under-recognized in food security discussions over the past decades.

For example, in Eastern and Southern Africa and India roughly 30 percent of the total population live in urban areas, yet urban areas represent about 40 percent of total food consumption (purchased plus self-produced food) and about 50 percent of the total value of the commercial food market.[27] For Southeast Asia, 40 percent of people live in urban areas, representing 50 percent of total food consumption and 60 percent of total market value.[28]

The importance—and challenge—of feeding the cities has grown extremely quickly over the past decades and is set to keep growing quickly. This huge volume of food consumed by cities translates into an enormous daily logistical challenge. Take, for example, the greater Mexico City area, with a population of 21 million. The Mexico City Wholesale Market, the largest wholesale market in the world, covers over 350 hectares and moves 11 million tons of food annually—equivalent to about six times all the maize produced in Ghana each year in tonnage—with annual sales of about $9 billion.

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In addition, Walmart Mexico, the leading modern retailer in Mexico, moves another estimated 42,000 tons of food per day to cities and towns across Mexico, with annual sales of approximately $13 billion. That means that just one big wholesale market and one big supermarket chain in Mexico have to move about 70,000 tons of food each day from farm fields to the city—from dairies and chicken sheds and aquaculture ponds and food processing factories and cold storage facilities to the millions of people in cities who consume it. As pivotal actors in feeding cities, wholesale markets and supermarket chains are handling enormous quantities of food every day globally and depend on long supply chains stretching within national borders and around the world to do so.

Demand for more diverse foods is on the rise

Urban diets are transforming rapidly, shifting beyond staple foods to a wider variety of foods, including processed foods. In addition, rural households are increasingly purchasing more of the food they consume.

Staple foods, including cereals, roots, tubers, and basic pulses, remain a critically important source of calories for households worldwide. However, given their low overall value, they comprise a minority of food expenditures for most households. The exception is the world's poorest households, who spend a disproportionately high share of their overall income on food, largely comprised of staples. As household incomes rise, consumers move away from a staples-driven diet, and there is a disproportionate rise in consumption of nonstarchy products such as meat and vegetables. With urban incomes rising, urban food demand is growing fastest for two sets of products: (1) meat, fish, dairy, fruits, vegetables, and oilseed-oil; and (2) feed-grains such as corn and soy due to

demand for livestock and fish. Demand is growing much more slowly for cereals used for food such as rice, wheat, maize, and coarse grains (millet and sorghum).

The result is that grains become a minority of overall food expenditures in value terms. For example, in Eastern and Southern African countries such as Ethiopia, Mozambique, Tanzania, and Uganda, the share of nongrains in total food expenditures by the average urban household is 66 percent.[29] In Bangladesh, Nepal, Indonesia, and Vietnam the share of nongrains in total expenditures in value terms in urban areas is 74 percent.[30]

Given the high urban share of total food market value, the lion's share of demand for nonstaple products is in urban areas.[31] For example, in developing Eastern and Southern Africa (which excludes South Africa), the urban market is already two-thirds of the market for nonstaples. This makes the urban market the most important "diversification market" for high-value products for farmers. While a focus on staple commodities will continue to be important for poverty reduction among small-scale farming families, production of these higher-value foods will become increasingly important, attractive, and feasible for these families to increase incomes as urbanization presses forward. Investments in agricultural development that help small-scale farmers with access to urban markets transition to higher-value crops will be critical to allow small farmers to benefit from urban markets and also to meet urban consumers' growing and diversifying demands.

Demand for processed food is also expanding rapidly in urban areas as well as more slowly in rural areas.[32] This is mainly being driven by rising incomes and employment factors. As incomes increase and women enter the workforce, demand for prepared food also increases as traditional food preparation methods can be time consuming.[33] In the example of Eastern and Southern African countries, spending on processed foods among urban households was 56 percent of their total food expenditures.[34] In the Asian countries' example, this figure was 73 percent.[35]

As household incomes rise, consumers move away from a staples-driven diet, and there is a disproportionate rise in consumption of nonstarchy products such as meat and vegetables.

Diets are changing among the urban and rural poor

Diet transformation is also happening among segments of the poor as they move from incomes below a dollar a day to one to two dollars a day.[36] Low-income households, both rural and urban, are eager to upgrade their diets to include a greater variety of foods. Households are also upgrading for greater convenience. Women in LMICs are buying processed foods as they enter the workforce outside the home, indicating the priority being placed on better time utilization. These trends recall those in the United States in the 1950s and 1960s, when processed food represented a boon to women in general and working women in particular. Processed foods, plus labor saving devices in the kitchen, liberated women and allowed them to work outside the home, pursuing professional ambitions and increasing household income.

Box 5 – The triple burden of malnutrition

One in three people worldwide is affected by malnutrition. Nearly 800 million people remain chronically undernourished, consistently consuming too few calories. More than 2 billion people are micronutrient deficient, consuming too little of the essential nutrients like vitamin A and iron. At the same time, the global rates of overweight and obesity are skyrocketing, and diet-related noncommunicable diseases (NCDs) such as type 2 diabetes and hypertension are rising dramatically in LMICs. The simultaneous challenges of undernourishment, micronutrient deficiency, and overweight and obesity together pose a "triple burden of malnutrition" for LMICs, particularly as cities grow and diets change.

Source: IFPRI, 2015; PATH, 2015.

Today, processed foods, including products that are frozen, vacuum sealed, and dried, are allowing food in LMICs to be available year-round and save families time over canning and pickling foods at home. There are also nutritional benefits. For example, there has been a massive increase in juice and milk consumption year-round in LMICs because of pasteurization, ultra-high-temperature processing (UHT), and Tetrapak sealing techniques.[37]

Importantly, while small-scale farmers are often thought to rely exclusively on their own production for food, rural households, including farmers, are also food purchasers. In Bangladesh and Nepal rural households purchase 80 percent and 62 percent, respectively, of the food in their diets, while in developing areas of Eastern and Southern Africa rural households purchase 45 percent of their total food in value terms. The reasons for this can be varied and complex, from low food prices to low productivity. But it is clear that low-income households—both rural and urban—are an important market for suppliers in the changing food system.

The benefits of changing diets must be balanced with increased health risks

Changing dietary preferences can lead to more diverse, nutritious diets, particularly if food systems are in place to deliver a steady supply of nutritious but highly perishable foods such as fruits and vegetables, meat, dairy, and fish. Yet these dietary changes also raise concerns about consumer health. It is known that excessive consumption of ultraprocessed food is linked to health problems like obesity, type 2 diabetes, hypertension, and other diet-related NCDs that are quickly spreading in LMICs, just as they have in high-income countries.[38] The prevalence of diet-related NCDs is growing more quickly in urban areas, particularly in LMICs.[39]

Diet-related NCDs put significant strain on emerging national economies due to healthcare costs and lost labor market productivity.[40] With NCDs now the leading cause of death worldwide, the challenge of overconsumption of ultraprocessed, nutrient-poor foods will be of increasing global concern. This will make it critically important that food systems can deliver on the promise of access to fresh, healthy, nutritious foods.

The opportunity for small farmers

The combination of poverty and hunger and a soaring middle class in the cities of developing regions presents challenges and opportunities for feeding urban areas. The challenge is not just to send vast quantities of food to cities, but to increase efficiency to make food more affordable for the millions of people living in the slums and to ensure a nutritious, safe, and sustainable food supply for all consumers. While safeguarding the food system for rich and poor alike is a global priority, the substantial and growing purchasing power of the emerging middle class will likely be the factor that drives the private sector to invest in the food systems of these growing cities. That means that for small-scale farmers and rural entrepreneurs along the supply chain, supplying cities will increasingly be the key to alleviating poverty and increasing incomes.

Demand in cities is being met mainly with domestic food supplies

Domestic food supply chains deliver 80 to 90 percent of food consumed in developing regions, with only 10 to 20 percent from imports. This means that farmers—small-scale farmers as well as medium- and large-size farms, depending on the product—are the main domestic food suppliers and that cities are fed through domestic supply chains that handle, package, or process food, providing critical rural employment opportunities.

To be sure, supply chains for imports from ports to cities, for example, are crucial to meeting urban and national food demand and require careful attention. Liberalized trade regimes are also needed to reduce barriers to imported food when countries want or need it. Yet new evidence shows that in Africa, as incomes rise the share of household food consumption coming from imports does not increase and in some cases actually declines.[41]

To feed cities, supply chains are reaching farther into rural areas

To supply increased volumes, supply chains have to reach out geographically, penetrating further into rural areas and deeply affecting farmers and other rural enterprises in the food system—including wholesalers, transporters, processors, and input suppliers—as well as the millions of rural wage earners working for them.

For example, supplying Beijing with rice requires a supply chain that is 1,200 kilometers long; fish supply chains into Beijing average between 1,000 to 1,400 kilometers in length, while potato supply chains into the city can be up to 1,300 kilometers long, depending on the season. Similar patterns on a somewhat more moderate scale prevail in India and across Southeast Asia and are emerging on national and regional scales in Africa. In general, supply chains for major dry grains and pulses are longer and those for fresh fruits, vegetables, dairy, and eggs are shorter because of perishability.

The length of these supply chains depends on several factors, including the size of the city, with large cities having long supply chains drawing from far away and close-by zones in the country. Small cities and towns draw mainly from surrounding rural areas. The availability of infrastructure to "pave the way" to cities also plays a role, as do local policies and technological change along the supply chain. These factors help determine who can take advantage of the opportunities supply chains offer and who cannot. These challenges are discussed further starting on page 32.

Diet changes play to the advantage of small-scale farmers

The rapid rise in urban consumption of fruits, vegetables, meat, fish, and dairy is an especially positive opportunity for small farmers and also creates higher incomes, more rural employment, and many new SMEs. These perishable products require a large increase in services such as cold chains, logistics, wholesale collection, sorting and bulking, loading and unloading, warehousing, and retailing. The needs in these areas are typically far more labor-intensive per ton than for grains.

In addition, growing fruit, vegetables, fish, chickens, and dairy all pay far more per hectare than do basic grains. Nonstaples also usually require much more labor than basic grains and often pay much more per day of labor. This means a rise in demand for farm workers, who are typically the poorest rural residents. Some of these higher-value products, such as dairy, eggs, or vegetables, are especially helpful in providing jobs and incomes to women, who in many regions have greater control over income from these products compared to major staple crops.

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For small-scale farmers, issues such as vulnerability, economic inefficiencies, and inclusiveness are all important as food systems continue to develop. Many small-scale farmers are already in a position to take advantage of the opportunities, especially those in proximity to city markets and feeder roads and with access to a consistent source of water. As cities expand, farmers in peri-urban areas may also get better access to power than their more remote counterparts, giving them an advantage in areas such as water filtration, irrigation, and processing. For farmers in more remote areas with fewer geographic assets, or those who lack the assets or capacity to respond to urban demand, attention from policymakers and private-sector actors can help ensure broader participation by farmers as urban demand grows.

Food systems are changing

In response to changing demands, food systems are undergoing structural change, from who participates to how they function. Unlike urbanization and diet changes, which are happening throughout LMICs, food system transformation varies greatly by region, country, and by product (see box 7). Thus, the solutions or approaches policymakers might use to create a supportive, enabling environment for this change, inclusive of small farmers, will also vary.

Supply chain transformation

Supply chains in LMICs have undergone significant transformation over the past 25 to 35 years, although this transformation varies greatly by region and country and even within countries. Supply chains encompass the services and activities involved in bringing an agricultural product from the farm to the consumer. These activities include

Box 6 – Urban agriculture

Urban agriculture refers to the process of cultivating food and raising livestock within city limits. Activities can range from household production in backyards, on rooftops, and in community plots to indoor commercial production in spaces as small as shipping containers or as large as acres-long warehouse facilities. While the scale of urban agricultural production is insufficient to meet growing urban food demand, urban agriculture has a modest and emerging role to play in feeding cities.

In high-income countries major innovations are under way to increase commercial urban agriculture production. In a suburb 15 miles south of Chicago, Illinois, for example, FarmedHere employs vertical farming to grow crops like herbs and microgreens in a 90,000 square-foot warehouse space—the largest indoor farm in the United States. The plants are layered in rows that extend to the ceiling of the warehouse and are sustained with LED lighting and hydroponics. Vertical farms generate larger yields in less space than traditional methods and are not subject to weather conditions to grow. Similar operations are under way in Singapore, where vegetables grow in a skyscraper known as Sky Green Farms, and in Japan, where a vertical farm in a former Sony factory produces an average of 10,000 heads of lettuce per day.

LMICs are also employing urban agriculture for food production. The Food and Agriculture Organization of the United Nations (FAO) has found that about 22 million people in Africa consume food grown within cities. Urban farming such as rooftop and community farming is a growing trend among middle-class Indian households. Urban agriculture is also being deployed to help households living in slums improve their food security. In Kibera, one of Africa's largest slums located in Nairobi, Kenya, farmers are growing kale, spinach, onions, and other vegetables from "sack gardens" supported through an initiative of the Kenyan Ministry of Agriculture's Urban and Peri-Urban Agriculture Project.

Sources: FAO; FarmedHere; The Guardian, 2015; SkyGreens; Washington Post, 2014; WorldWatch Institute.

Claro Cortes/Reuters

Box 7 – Structural transformation and food systems

Structural transformation and poverty reduction

Structural transformation is a broad, economy-wide process that refers to the transition of labor from agricultural to nonagricultural activities and the movement of people from rural to urban areas.

The role of structural transformation in reducing poverty varies widely. For example, Ethiopia has experienced little structural transformation, but poverty rates fell from 44 percent in 2000 to 30 percent in 2011. In fact, Ethiopian policy has aimed to limit urbanization, focusing on agricultural transformation and poverty reduction, while maintaining tight controls on markets and private-sector activity, particularly by outside investors. In addition, the Ethiopian economy has grown 8.3 percent per capita over the past decade, primarily driven by agricultural productivity and service-sector growth. While some structural transformation has occurred, it has not contributed significantly to poverty reduction.

In comparison, Ghana has witnessed significant poverty reduction driven in large part by structural transformation. Between 1991 and 2012 poverty fell from 53 percent to 21 percent in Ghana, less than half the African poverty rate of 43 percent. While the Ghanaian government has also invested in agricultural development, often at rates of 9 or 10 percent in recent years, the growth that drove their poverty reduction was due to structural transformation in the labor force and geographic trends, not primarily from agriculture.

Food system transformation

Structural transformation of the food system includes both structural changes and conduct changes within the segments of the food system. Structural changes include spatial lengthening, consolidation, disintermediation, and vertical integration. Conduct changes include technological advances, use of purchasing standards and contracts, the rise of procurement networks, and increased horizontal coordination such as cooperatives.

Structural transformation of food systems varies widely and is not a "one size fits all" process. Within LMICs, structural transformation of food systems first began in Latin America, South Africa, and with some exceptions, in East and Southeast Asia as markets liberalized and populations became more urban. South Asian countries such as India and Bangladesh followed.

Food system transformation began much more recently in Sub-Saharan Africa and Asian countries such as Laos and Cambodia, with great differences between countries and slower modernization of food systems. For example, supermarkets are emerging rapidly in countries like Tanzania, Kenya, Nigeria, Senegal, and Ghana. But low-income or conflict-ridden countries such as Sierra Leone, Chad, and Zaire have seen very few supermarkets, and it will likely take decades before structural changes in food systems take place.

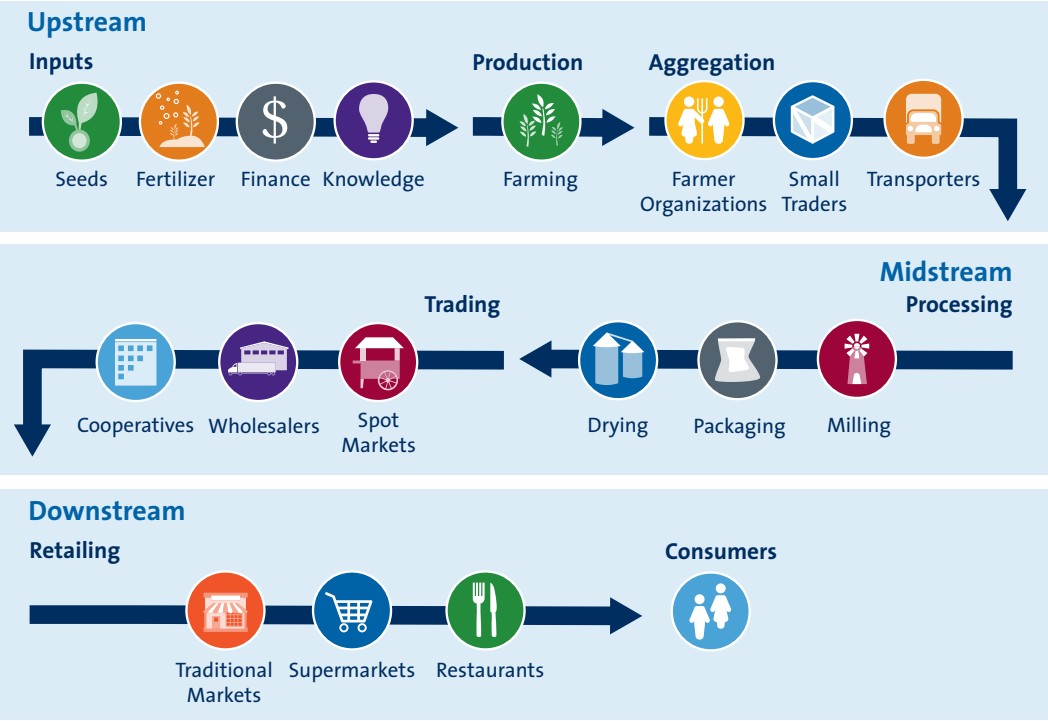
Transformation varies by region and agricultural product

Structural food system change also varies within countries—most notably between urban and rural areas, but also among urban areas. Change begins first in large cities, then moves to small cities, followed finally by rural towns. The differences between urban and rural areas, especially remote rural areas, are often extreme.

Changes within food systems also vary depending on the agricultural product. Across regions changes have occurred earliest and most rapidly for grains given their caloric importance and economies of scale. Changes in the systems of semiprocessed, perishable products like milk and poultry have followed grains. Fruit and vegetable supply chain transformation is typically the last to occur within food systems since perishable products have lower economies of scale in production, packing, and processing and require cold storage when supply chains are longer.

Source: World Bank, 2015.

Figure 3 – Food supply chains



everything from planting, growing, and harvesting food to storing, processing, transporting, and marketing.

From fragmented systems to concentrated organizations

From a fragmented system involving simple transactions over short distances to feed local populations, supply chains in the 1960s and 1970s became largely concentrated in the hands of government-owned parastatal organizations that assumed the role of procuring and selling food. Parastatals were mainly involved in the domestic market for grains, the main foodstuff at the time. A traditional fragmented system of SMEs competed with the parastatals in the grain market, but continued to dominate in the markets for nonstaples.

Liberalization of supply chains and the proliferation of SMEs

Since the early 1980s, following implementation of Structural Adjustment Policies in many LMICs, the direct government role in supply chains has been reduced. The liberalization and privatization of supply chains resulted initially in refragmentation of the system, with the proliferation of SMEs that took advantage of rapidly growing urban demand from the 1980s through the 2000s as well as the gaps left by the privatized parastatals. These SMEs have formed the backbone of expanding rural-urban supply chains.

First, they filled the vacuum left by the dismantling of state services in crop procurement, marketing, and storage. As food markets have grown, so has the volume and diversity of SME activities, including the move into nongrains along with value-added activities. SMEs also proliferated in the farm input sector—with the appearance of

thousands of seed, fertilizer, and pesticide dealers in LMICs as well as tractor rental services—and in the service sector. SMEs are a key source of rural nonfarm employment and service-sector jobs, especially for youth and women in small and medium cities, rural towns, and villages. They provide jobs in everything from transport and mills to tractor services, warehouses, and retail shops.

The challenge is that most of the SMEs are informal and unregulated. As a result, they are often challenged by food safety issues, are poorly served by business development services, and are usually bereft of access to extension services. Because of these disadvantages they may be excluded when pursuing supplier contracts with supermarkets due to their inability to meet the greater food safety rigor demanded in urban areas.

Consolidation and multinationalization

Following this rapid proliferation of SMEs has been the more recent trend of consolidation of small businesses into larger ones. Liberalization of the market and privatization of parastatals drew in a huge amount of foreign direct investment (FDI) in the 1990s and 2000s in retail (supermarkets, fast food chains) and processing (first and second stage

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processing) and to a lesser degree in logistics and wholesale services. Liberalization also induced a large amount of competitive activity by large-scale, domestic private companies, including mergers and acquisitions. As a result, there has been significant consolidation—and multinationalization—of the retail and processing sectors, which has also recently started in the wholesale and logistics sectors. This greater concentration of services allows for increased economies of scale and reduced transaction costs that can drive SMEs out of business over time. How this will play out across geographies remains to be seen given the varied investment and policy environments across countries.

Increasing role of foreign firms

In middle-income countries, the processing sector was rapidly transformed after liberalization. The avalanche of FDI that propelled this change came first mainly from western Europe and the United States among global firms like Nestlé, Kraft, and Danone, which were seeking less saturated markets with higher profit margins than their domestic markets could provide.[42] Japan followed and was eventually joined by regional multinationals such as Mexico's Bimbo, expanding into Central America, and Thailand's Charoen Pokphand Group, entering China and other Southeast Asian countries.

By the 2000s foreign firms formed a major share of the large processing sector in a number of the "early transformer" countries such as Argentina, Thailand, and South Africa. In "late transformer" countries like China and India in the 2000s, consolidation by foreign firms was just starting.

FDI by multinationals from middle-income country powerhouses, with Chinese and Indian firms at the forefront, is already becoming evident. Notably, China's President Xi Jinping committed $60 billion to African states in 2015, most of which was in the

form of increasing production (including agricultural production), incenting exports to China through export credits, and concessional lending to both African SMEs and Chinese companies interested in expanding to Africa. This is a new addition to the traditional support for infrastructure that China has offered across the continent, which is extensive.

Over time, the sources of foreign investment may continue to evolve, indicating the new importance of rising regional multinationals in what is now being called "south-south FDI."[43] The question of whether economies that are still transforming will also be primarily driven by FDI from North American and western European companies, by Indian and Chinese companies making "south-south" investments, or whether by domestic private-sector actors, is still being answered.

Retail transformation

The retail sector in all developing regions has undergone a "supermarket revolution" to varying degrees, starting in the early 1990s and continuing to the present.[44] This revolution was often assumed to be impossible in low-income countries, yet its takeoff in the 1990s is now clearly documented in many LMICs.[45]

Modern food retail in the developing world began in the early 1990s in East Asia (outside Japan and China), South America, South Africa, and Central Europe, where the share of modern retail in total food retail went from roughly 5 to 10 percent in 1990 to some 50 to 60 percent by the late 1990s. Modern retail came to Southeast Asia (outside transition countries like Vietnam), Central America, and Mexico in the mid-to-late 1990s, where the share of total retail reached some 20 to 50 percent by the late 1990s.

Large-scale retail and processing firms in developing regions have modernized their marketing and procurement systems not just to cut costs and increase efficiency, but to meet the quality, food safety, and phytosanitary standards demanded in today's markets.

Then in the late 1990s and 2000s retail transformation came mainly to China, Vietnam, India, and Russia, where the share climbed rapidly to some 5 to 20 percent by the end of the 2000s. In some countries of Africa, mainly in Eastern and Southern Africa outside South Africa, modern retail is just beginning.

Estimates suggest that modern retail's share of the retail pie continues to expand. Within these countries modern retail has rolled out first in large cities then in small cities and finally in rural towns in adapted forms. It has moved from upper to middle to poorer classes and from processed foods to semiprocessed foods to fresh produce, assisted by cold chain development. These paths are essentially the same as occurred in the twentieth century in high-income countries.

Changing systems for sourcing food

Large-scale retail and processing firms in developing regions have modernized their marketing and procurement systems not just to cut costs and increase efficiency, but to meet the quality, food safety, and phytosanitary standards demanded in today's mar-

kets. Such standards, which were once mainly for international trade, are now emerging for domestic supply chains.

To achieve their goals, the trend among multinational firms is to buy or sell more directly, foregoing intermediaries. Food industry firms have also centralized distribution networks through distribution centers, implemented hub and spoke systems to collect from farmers, and used specialized/dedicated wholesalers who coordinate suppliers and enforce contract specifications or the private standards of their food industry clients.

There has also been some vertical integration, including farming by large processors, logistics undertaken by large supermarket chains, and wholesalers opening supermarket chains. "Follow sourcing," which has been common in the automotive industry, is now becoming common in the food industry, where service suppliers from the home market "follow" their clients into developing regions and "fast track" the development of food systems, acquiring and/or upgrading local suppliers.

Technological changes throughout the food system

Rapid technological change has accompanied the structural transformation of food systems. Growing demand and fierce competition to meet it has driven firms to invest, where possible, in bigger, more efficient, labor-saving machines, biotechnology, and

Cell phones have given even poor farmers in remote rural areas access to market, technology, and weather information.

skilled labor to meet new volumes and keep costs competitive. This includes investments in practices and equipment that can meet new quality and food safety standards. These technological investments are changing the performance of the food system and play a critical role in helping to feed the world's cities.

Improvements in technology have come in several areas:

- **Mobile technologies.** The rise in the use of cell phones in Africa, Asia, and Latin America has been meteoric. Cell phones have proliferated in all segments of the food industry—among farmers; agricultural input and services firms; rural and urban wholesalers, truckers, and retailers; and urban and rural consumers. Cell phones have given even poor farmers in remote rural areas access to market, technology, and weather information.
- **Dairy processing, freezing, and packaging technologies.** These have allowed, for example, the shift of dairy farming from small-scale, peri-urban operations to larger-scale production far away from cities, leading to increased milk consumption (and protein intake) and lower consumer prices.[46] Freezing technology is greatly increasing the length of the supply chain for fish in Asia and has led to a massive increase in fish consumption, including year-round availability.[47]
- **Storage technology.** These technologies can help farmers and rural SMEs prevent losses and therefore garner greater return on their harvests, enhance supply chain efficiency, and improve food safety for consumers by protecting food from contamination.

Box 8 – A technological revolution—mobile money

Mobile banking, commonly referred to as mobile money, involves the transfer, storage, or use of electronic funds transmitted through a mobile phone. In practice users can send and receive funds between phones via SMS (text messaging). To deliver this service, telecoms partner with banks and together a network of agents across a country act as "cash-in/cash-out" points where users can both redeem stored mobile money or convert cash into a mobile credit.

M-Pesa, a mobile money platform that revolutionized banking in Kenya, initially began with an investment of 1 million pounds by Vodafone, which was matched by funds from the UK Department for International Development (DFID). This initial investment has offered enormous returns. By 2015, 19 million people in Kenya, more than 90 percent of the adult population, were using M-Pesa, and 42 percent of the Kenyan GDP was handled through M-Pesa.

Today, there are over 255 formal mobile money services in 89 countries. It is now available to 61 percent of developing markets. From 2013 to 2014 alone, active account users increased by 40 percent to over 100 million users worldwide. Mobile money continues to transform the way people access financial services. In three-quarters of the markets where mobile money is available, agent outlets outnumber bank branches, and in 25 markets there are more than 10 times as many mobile money agents as bank branches.

Mobile money solves a major problem that has been invisible in marginalized communities. Using cash is actually expensive and has many hidden costs, especially for those who are "unbanked" like the vast majority of the world's poor. For example, without access to formal banking, people "save"' in assets that are easily lost like livestock—that die—or jewelry—that can be stolen. Rural residents in particular have to travel long distances to borrow money or pay for services, which can result in lost days of work and the risk of bodily harm or theft. Mobile money eliminates these risks. An added and fairly new benefit of the mobile money revolution is that financial institutions can better understand customers, design products that fit their needs, and even assess "creditworthiness"—often a major barrier to increased lending—through new methodologies.

Challenges remain regarding policy and regulatory frameworks associated with mobile banking and interoperability across telecom networks. For example, users on one platform may not be able to easily pay family members who use another platform. However, it seems that the use of mobile money will continue to expand across the developing world, yielding better access to savings, insurance, lending, and payment products. Small-scale farmers and rural entrepreneurs will reap a number of benefits from the use of this technology, which will allow them to engage in new markets, make better production decisions, and access financial services.

Sources: Agence France-Presse, 2014; CBS, 2015; GSMA, 2014; Techweez, 2015; US National Advisory Board on Impact Investing, 2014; Wired, 2015.

Box 9 – Storage innovation: Blumberg Grain

For small farmers and rural SMEs, poor storage capacity and technology can lead to product losses and, as a result, income losses. Blumberg Grain is a company that provides food security warehousing and systems globally. Blumberg developed modular systems for grain and for the refrigerated storage of agricultural produce and other perishables in either dry or cold storage conditions. The modules are lightweight and easily transportable, improving accessibility of the technology. They are also energy efficient and adaptable to their environments, specifically designed to use various sources of energy, from generators to solar to wind. Blumberg's storage modules have been found to reduce postharvest loss by up to 50 percent.

Source: Blumberg Grain.

- **Feed milling technology.** These technologies have enabled, for example, intensive fish production far from cities where water resources are good for fish, poultry production at medium distance from cities due to odor diseconomies, and hog production closer to cities where grazing is not available for other livestock.
- **Retail technologies.** These include store layout, accounting, labeling, inventory of warehousing, logistics of procurement distribution centers, and sales tracking. These techniques have all been crucial to cutting costs and improving quality and consistency in retail chains. Much of this technology has been transferred by multinational retail chains to their chains in developing regions and from there to domestic chains competing with them.

Opportunities and challenges of food systems transformation

Challenges

While the transformation of food systems provides opportunities for small-scale farmers and for the rural poor through off-farm employment, the scale and pace of transformation can create unique challenges. The food system faces numerous challenges in the effort to increase food production while building safe, efficient, and sustainable supply chains to deliver this food to cities.

Food waste

Food waste ranges from on-farm losses from harvesting and home storage practices to losses during threshing and transport to spoilage and contamination all along the supply chain (by pests, various mycotoxins such as aflatoxins, or exposure to the elements). Food waste is also an issue for retailers and consumers, which is more prevalent in high-income countries. Calls to reduce waste throughout the global food system have intensified, especially in response to the 2008 global food crisis when food prices temporarily spiked.[48] At the global level, food losses and waste were estimated at 32 percent of all food produced in 2011.[49]

New research is beginning to call the conventional wisdom on waste in emerging economies into question. For example, new studies in Bangladesh, India, and China demonstrated that wastage rates for potato supply chains were as low as 5 percent, and around 1 percent for rice value chains from farm harvest through retail sale.[50] These and other findings demonstrate that better and more data collection and analysis on food waste are necessary to fully understand the scope and solutions. Armed with this information, more accurate, tailored approaches to the global food waste challenge can be deployed. At the same time, consumers, retailers, and policymakers in high-income countries are also developing innovative efforts to reduce waste at the end of the supply chain.

Observers who posit that losses are more modest than previously thought emphasize that public and private investments in logistics have already been successful in reducing the sheer size of the food waste challenge.[51] Regardless of this debate, it is clear that public and private investments in safe storage technologies and infrastructure must continue and increase if they are to keep pace with the exponentially growing supply chain, especially for perishables.

Food safety

Related to food waste is the issue of food safety. Long, complex supply chains and logistics systems raise the risks that contaminated or spoiled foods remain in the supply

Box 10 – ColdHubs: Refrigeration to preserve products and incomes

The increased urban demand for perishable foods such as fruits, vegetables, dairy, and meat increase the need for refrigeration and cold storage in developing supply chains. Without cold storage, perishables spoil more quickly, increasing food waste and risk of contamination. Small farmers, however, often lack access to the electricity or refrigeration technologies necessary to produce and deliver perishables to urban areas.

Innovative methods to improve access to cold storage in LMICs can make a tremendous difference for farmers and consumers alike. ColdHubs, a solar-powered cold storage hub created by a Nigerian start-up company, gives small farmers and entrepreneurs access to refrigeration technology. ColdHubs are pay-to-store facilities set up in food production and consumption centers such as farms and markets. Solar panels on the hub's roof provide the energy to keep the space inside cold, refrigerating perishables 24 hours a day. Farmers pay a small fee per crate only when they are storing goods—such as at the end of a market day—to preserve unsold goods rather than lose their products and incomes to spoilage. ColdHubs are currently in operation in Ghana, Kenya, Nigeria, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe, with expansion planned throughout Sub-Saharan Africa, Asia, and Latin America.

Source: ColdHubs.

Box 11 – Innovation to reduce aflatoxins: Aflasafe

As much as one-fourth of the world's harvests are contaminated by mycotoxins, toxic substances produced by fungi. Contamination is often the result of poor storage practices, and LMICs are often especially vulnerable. Aflatoxin, a type of mycotoxin known to be a carcinogen, can often afflict maize and peanut harvests, leading to increased food safety risks for consumers and limiting farmers' ability to meet demand.

Aflasafe is one technology that can help control aflatoxins in maize production. The result of collaborative research among the International Institute of Tropical Agriculture; the USDA; the University of Bonn, Germany; and the University of Ibadan, Nigeria, Aflasafe contains spores of isolated, toxin-free strains of Aspergillus, the bacteria that generates aflatoxins. Farmers can spread small pellets of Aflasafe throughout a field prior to planting maize. The spores from the nontoxic Aspergillus strains contained in the pellets then dissipate in the growing environment and biologically outcompete the naturally occurring Aspergillus. Aflasafe shifts the genetics of the bacterial population to create an environment that is less toxic overall, which produces fewer aflatoxins. Some variations of Aflasafe can protect crops for several growing seasons and carry over from field to storage, providing protection from aflatoxins throughout the value chain.

Source: Aflasafe; Smith and Solomons, 1994.

chain if food safety mechanisms are not adequate. Poor food storage and preparation in centralized food catering companies, for instance, has also been linked to large-scale foodborne illness outbreaks and fatalities in some extreme cases. Lax food processing protocols can also lead to safety concerns.

With animal-sourced foods there can be a lack of pasteurization, animal control/slaughter regulations, and disease surveillance programs for common foodborne illness threats like brucellosis, which is transmitted through unpasteurized milk to consumers. Urbanization is presenting additional challenges in this area. As cities spread into peri-urban and rural areas, livestock are often in far closer proximity to human settlements, leading to both food safety and hygiene challenges and, increasingly, acceleration in zoonotic disease spread. Building national governments' capacity to monitor food safety threats and trace products through the supply chain to their source will take time, as the more immediate tasks of increasing production and improving logistics take precedence.

Environmental impacts and sustainability concerns

Longer supply chains can create higher greenhouse gas emissions per ton of food. Important debates are under way on how best to balance the need for longer supply chains with the need to reduce energy usage and environmental effects. While this will remain a critical issue, there is emerging evidence that with the right improvements in transport technology, long supply chains can sometimes lower transport costs and emissions per ton of final received produce.[52] For example, a relatively short trip on an old, small truck may have higher costs and emissions than bulk shipment in a modern

container ship, train, or modern truck coming from afar. Good road infrastructure can further reduce emissions. Thus, polices that support the updating of transport equipment alongside investments in new roads and road maintenance can reduce the cost of transport per ton and also minimize the potential climate impacts.

Other concerns include groundwater pollution and pesticide risks associated with the intensification of cropping, aquaculture, and livestock production. Increased production will depend on healthy soil, but soils too often become depleted or contaminated. Water requirements will increase as diversifying diets—including meat as well as fruits and vegetables—will also require farmers to increase their water usage, straining existing supplies.

Water usage in particular is a pressing issue as cities grow. With urbanization has come increasing conflict over water, including water scarcity and lack of reclaimed water infrastructure in urban areas as well as competition for water usage between urban areas and rural farmers. Today, an estimated 4 billion people worldwide are impacted by water scarcity.[53] Given that over 70 percent of the world's freshwater usage is currently devoted to agricultural production, conflict over water could significantly undermine the global food system.

In addition, as the pressure to increase production grows, the risks of converting nonagricultural land to agricultural production are high. Similarly, excessive use of inputs can lead to environmental damage. In many low-income countries, fertilizer usage is far too low, but the tide can quickly shift with rising demand and the conversion to horticultural crops. Governments and the private sector have a role to play to avoid this by ensuring good agronomic information and knowledge of climate-smart practices reach farmers as they intensify production. Radically increased data availability, along with corresponding technology platforms, will be key to assisting policymakers in tracking and optimizing these natural resource constraints.

With urbanization has come increasing conflict over water, including water scarcity and lack of reclaimed water infrastructure in urban areas as well as competition for water usage between urban areas and rural farmers.

Infrastructure, energy, and vulnerability

Poor physical infrastructure such as poor-quality roads or lack of roads and highways in LMICs make transport and logistics difficult and costly. Likewise, the lack of extensive and reliable energy infrastructure in many countries impedes the productivity of farmers and SMEs. In Sub-Saharan Africa two out of three people lack access to electricity.[54] This vulnerability is exacerbated as farm production and supply chains become increasingly machine-intensive. Without access to energy, crucial components of the food system such as technology and cold storage are limited. Solar energy technology and other innovations in power can play a major role in reducing this vulnerability.

The longer the supply chain, the more it is vulnerable to "shocks" of climate, energy costs, food safety, phytosanitary problems, corruption, and sociopolitical unrest as well as policy constraints such as interstate and international tariff and nontariff trade bar-

riers. Some of these challenges, like food safety and energy costs, are magnified as the share of perishable foods in total food grows. All these issues can add to uncertainty and increase transaction costs in supply chains and are key challenges to address.

Risk of exclusion of asset-poor farmers and SMEs

The exclusion of asset-poor, small-scale farmers and rural SMEs from growing food supply chains is a real problem. Because cities can source food widely, small farmers must be cost competitive, both in production and transaction costs. This can be difficult to achieve for small farmers who often lack access to credit and sufficient investable surplus from off-farm jobs and crop sales. Moving from staple grain production to non-starchy staple food production such as fruits, vegetables, dairy, and meat requires more water and a need to irrigate, animal husbandry and aquaculture skills, a new or wider range of pest control tools, and the equipment and knowledge to properly harvest and store perishable products. These changes can be costly and difficult for inexperienced, subsistence farmers. Access to needed resources from extension services and rural credit programs may be seldom available.

Urban food demand puts other pressures on farmers beyond costs. Urban consumers increasingly expect year-round availability as well as a consistent, high-level of food quality and safety. Large food companies often establish even higher private standards when sourcing from small farmers. Farmers, therefore, need information about these standards and need to invest in methods to meet them.

Moreover, in many low-income countries there is fragmentation of farms, with the average size of farms decreasing or staying the same size. This means that access to markets for labor-intensive products such as dairy and horticulture become increasingly important to small-scale farmers who have to earn more from decreasing holdings. The role and impact of urban residents' ownership of rural agricultural land as an investment opportunity is another avenue for further exploration.[55]

It is critical that food system policies and investments ensure that small farmers and rural entrepreneurs are included in food system development.

Rural SMEs also face resource challenges. Rural wholesalers and food processors, for example, must also make investments in processing equipment or trucks. Farmers and SMEs alike also need access to infrastructure like roads and energy grids to participate in urban markets.

In addition, modern food firms use regional and global networks and distribution centers for purchasing, which can lead to more competition for small farmers. It is therefore critical that food system policies and investments ensure that small farmers and rural entrepreneurs are included in food system development.

The benefits and opportunities of food systems transformation

In spite of the challenges, the transformation of food systems also provides a range of benefits to urban consumers, small farmers, rural SMEs and rural workers.

Box 12 – About Power Africa

In June 2013 the Obama administration launched the Power Africa initiative to increase the number of people who have access to power in Sub-Saharan Africa. Combining the expertise of 12 US government agencies, Power Africa taps into the region's wind, solar, hydro, natural gas, biomass, and geothermal resources to enhance energy security, promote economic growth, and reduce poverty. Power Africa collaborates with African governments, over 100 private-sector partners, and other organizations with the goals of adding more than 30,000 megawatts of cleaner, more efficient electrical power and 60 million new home and business connections in Sub-Saharan Africa.

The initiative capitalizes on a new development model by leveraging the private sector. Through local and international project development partnerships, Power Africa has leveraged more than $20 billion in private-sector investment for new on- and off-grid projects in Sub-Saharan Africa through its initial $7 billion investment. That's almost three dollars in private-sector commitments for each US government dollar.

US efforts to increase access to electricity also have bipartisan support in Congress. In 2016 Congress passed the Electrify Africa Act, which directs the president to establish a multiyear strategy to assist countries in Sub-Saharan Africa in implementing national power strategies with a mix of energy solutions, including renewable energy sources.

Source: Christian Science Monitor, 2016; USAID.

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For farmers

Opportunity to move beyond self-supplying production and out of poverty

For farmers, increasing demand in cities transmits demand—and incentives—to supply zones further and further away from them. A rural zone that moves from self-supplying (mainly low-value grain and seasonal vegetables) to being linked to a rural-urban supply chain has the potential to massively increase agricultural output and incomes and a chance to climb the "value ladder" from primarily staple crop production to higher-value products.

This link to urban markets often induces small farmers to adopt technologies that improve productivity and sustainability. For example, African farmers producing for urban markets were 10 times more likely to use soil fertility and soil conservation technologies compared to farmers producing for themselves and the local rural market.[56]

African farmers producing for urban markets were 10 times more likely to use soil fertility and soil conservation technologies compared to farmers producing for themselves and the local rural market.

Since the urban market is year-round, farmers who can move beyond rainfed agriculture have an incentive to grow crops in multiple seasons.

Reduced risks and quality upgrades through productive, stable supplier relationships

When large companies offer resource provision contracts and other assistance to suppliers, they enable small-scale farmers and SMEs to make the upgrades needed to supply the quantity and quality of food demanded. Often, the producer is rewarded for higher quality with a premium price, which helps farmers "climb the quality ladder." These contracts can also reduce risk to farmers through guaranteed price range agreements that ensure profitability, inducing even more investments in productivity and food safety.[57]

For SMEs and rural labor markets

Job creation

As noted earlier, in the initial stages of supply chain transformation there is a proliferation of SMEs, which leads to new opportunities for off-farm employment in rural areas and small cities in logistics such as transport, cold chains, and warehousing. In these early stages, the volumes of food moving along the supply chain are increasing, value is being added through processing and packaging, and all ships are "rising with the tide." These opportunities are especially important for youth, given high unemployment among this demographic group in many LMICs.

As the technology transformation goes on, however, machinery that improves efficiency and economies of scale can displace labor. History has shown that as urban and rural wages rise, there is an inevitable incentive to adopt modern machinery and

increase scale with less labor.[58] But policymakers can encourage both SMEs and large firms, as Singapore has done, to upgrade to the best equipment, educate workers, and differentiate themselves with unique products and services for the market. This seems to be an attractive, medium-term approach for LMICs working to maximize technology modernization while being as inclusive as possible of SMEs and workers.

For consumers

Increased food safety

Transformation of the supply chain increases food safety for urban consumers in several ways, especially in the long term. Supermarket chains and large processors have a strong incentive to make sure their retail practices and technology minimize food safety problems. Large food industry firms, therefore, impose food safety standards on suppliers. They have the buying and bargaining power to make this part of the contract, requiring farmers to make the needed investments and changes or forego lucrative market opportunities. In the short- and medium-term, however, as food supply chains are developing and lengthening, the transformation can lead to increased food safety risks.

Lower costs from economies of scale

Large companies that have entered food markets have access to capital to upgrade technology, centralize procurement, and increase economies of scale. This can increase efficiencies and reduce transaction costs in supply chains. Longer supply chains also help reduce food costs by allowing sourcing from productive zones and those with the greatest comparative advantages. Due to competition, companies can pass on savings to consumers in the form of lower food prices compared to traditional food systems.[59] Supermarket chains using distribution centers can reduce transaction costs by 30 to 40 percent, thereby reducing food prices to consumers.[60] The diversification of sourcing also reduces supply risk for cities.

Supermarket chains using distribution centers can reduce transaction costs by 30 to 40 percent, thereby reducing food prices to consumers.

Year-round food supplies, reduction of food waste, and lowering of risks from climate change

Food system modernization has been central to the diversification of the food supply to cities and brought massive increases in volume. Longer supply chains have also resulted in increases in year-round supplies of food as climatically diverse rural zones are brought into the food system. Many upgrades such as cold storage and refrigerated trucks and train cars increase resilience and reduce postharvest losses.

Moreover, modern firms have made investments in redundancies in their supply chains to reduce risk of climate shock. For example, the Charoen Pokphand Group in Thailand introduced duplicate private port facilities at progressive distances inland in Thailand to reduce shutdown risk of their ports due to typhoons.

Ensuring that small-scale farmers are included

The transformation of food systems can and should benefit small farmers as well as rural SMEs and rural workers. For small farmers to be included and benefit, it is important that they have the capacity to increase their grain yields, to diversify into products beyond grains, and to intensify their technology with more use of irrigation, fertilizer, manure, greenhouses, and sustainable use of pest control tools where needed.

Intensification, commercialization, and product diversification have proceeded at very different speeds and reached different levels in various regions and zones within them. Generally, farms in Latin America, Southeast and East Asia, and parts of South Asia have gone much further and faster than African farms. There is, however, large variation by zone, with significant intensification and commercialization of some crops in certain zones.

Help farmers seize the market opportunity of diversifying consumer demands

Helping small-scale farmers compete as markets continue to grow and supply chains expand will be critical in allowing them to share in the benefits. There is a major role for helping small-scale farmers to be productive in grains, especially those still in semisubsistence and those unable to diversify into higher-paying crops. But the evidence points to diversification beyond grains as a path out of poverty for small-scale farmers. A study

Helping small-scale farmers compete as markets continue to grow and supply chains expand will be critical in allowing them to share in the benefits.

of farmers over decades in Zambia is persuasive: farmers who stayed in grain farming stayed in poverty, while those who shifted to cotton and horticulture rose above it.[61]

The challenge is that the demand for quality, safety, and volume, especially for non-grains, will increasingly play to asset-rich farmers, whether small or large. This can spur concentration in farming over time. The development of land markets (for purchase and rental) accelerates this. There is evidence of this occurring in Africa, Asia, and Latin America, especially in commercial regions close to cities. Policies such as land titling that protect small-scale farmers' access and control of land over time will be important for promoting equitable growth.

Farmer cooperatives and associations that allow farmers to pool their resources are one way small farmers can meet new requirements. Food companies can also establish resource provision contracts to help farmers meet demand.[62] Support services from governments or from nongovernmental organizations (NGOs) can also be crucial to building farmers' capacity to meet new and growing urban demand. These investments and programs are critical to ensuring that small farmers as well as rural enterprises are not excluded as food systems respond to urban demand.

Action is needed now

The process of food system transformation does not, by its nature, have to include small-scale farmers. Scenarios abound, especially for remote rural areas far from cities, for small-scale farmers to remain as semisubsistence farmers of staple foods alone.

Even with new technologies, these small-scale farmers may have little incentive or ability to make needed investments. It is therefore critical that policies and investments ensure that as food systems develop to feed cities this growth and development is inclusive. Since rural employment can also supplement farming to increase household incomes, the emergence of strong SMEs in rural economies is key. As incomes rise, farm families may look to move beyond the farm, and rural employment is a key to enabling that decision.

Improving farmers' access to urban markets involves reducing transaction costs of markets and developing supply chains to increase their access. It's a win-win—for small-scale farmers and other rural residents who benefit from robust food production systems and supply chains that deliver their goods to those who need it, and for city dwellers, who can enjoy safe, healthy, and diverse food choices produced and delivered from their rural counterparts.

Moreover, strategies and policies that seek to address issues of farmers' marginality, geographically or otherwise, exposure to risk (associated with weather or price fluctuation, for instance), and low overall asset base will become important to ensure these small-scale populations do not become the "lagging regions" of tomorrow, persisting in poverty decades after their compatriots have climbed the economic ladder to greater health and well-being.

Hailey Tucker/One Acre Fund

PART II

Public-Sector Action and Private-Sector Investment: Building Blocks for an Inclusive, Resilient Food System

Thierry Gouegnon/Reuters

The public and private sectors both have a crucial role to play in ensuring that the transformation of the food system lifts all boats. Governments must help set the stage with enabling policies, regulatory and safety protocols, and investments in necessary infrastructure. But the private sector must complement this work by investing capital to capture the market opportunity.

In some cases, profitability and inclusion may happen naturally to create win-win solutions. In others, new business models and partnerships may be required to address market failures. Action by bilateral and multilateral donors as well as civil society will be important to demonstrate new models and take risks that may not make sense for those operating against a bottom line. But the scale of investment needed makes it evident that action, innovation, and investment across all sectors is needed. Part II looks at the opportunities for private-sector investment, the role of government to enable these investments, and the importance of civil society in food system transformation.

The opportunity for private-sector investment

Feeding the world's cities is a significant investment opportunity for the private sector. The size of the food and agribusiness sectors in LMICs is rapidly growing. In Africa alone, the agriculture and food sector is expected to reach $1 trillion by 2030.[63] As stated already, the vast majority of market opportunity is in domestic markets for small-scale farmers, and the backbone of this system is SMEs. The force and full power of this economic engine will depend on government support. Even so, many governments recognize the need and benefit of outside investors in the agrifood sector given the scale of the development challenge.

This section looks at opportunities for private-sector actors considering investment or already investing in LMICs. It identifies the broad investment opportunities and

In Africa alone, the agriculture and food sector is expected to reach $1 trillion by 2030.

business models as well as principles that will result in greater inclusion and poverty reduction. Attention to equity and inclusion is not just an important development goal. Analysts have found that harnessing the productivity of small-scale farmers is essential for the $7 trillion global food and beverage industry to meet exploding demand.[64] The overarching principle of investment—addressing poverty, hunger, and inequity while maintaining necessary attention to the bottom line—is the basis for this section's analysis.

Key principles for investment

In light of the trends outlined in Part I, guiding principles for responsible and inclusive private-sector investment in emerging food systems are outlined below.

Increase the efficiency and resilience of food systems

As urban demand grows, managing the cost of food will be critical for both the urban and rural poor who depend on food purchases. Investments in agricultural intensification are therefore essential alongside investments that reduce transaction costs and improve overall efficiency of the supply chain.

Focus on inclusion and returns to the local economy

Responsible investors and private-sector actors should enter into new business deals with eyes wide open. Choice of location, value chain, and ways of engaging with local communities matter when companies desire to reduce poverty alongside making profits. Investing in host communities should be a priority to ensure communities are left better no matter the length of engagement. Examples range from community infrastructure development to training and capacity development for employees, SME business partners, and farmers. Ideally, investors will support local competitiveness and innovation capacity through their business practices.

Respond to increasing consumer demand for diversity and ensure food safety

While continued investments in the productivity and resilience of staple crops will be critical to meeting the urban demand for food, emerging economies' consumers are increasingly demanding diverse, nutritious foods as incomes rise and will be looking to the private sector to supply them. Doing this while ensuring that food is safe and healthy in uncertain environments will be a challenge, yet a clear guiding principle of responsible investment.

Ground profitability in sustainability

Since the 2015 United Nations Climate Change Conference (COP21) discussions, new goals are emerging in a range of sectors to achieve environmental sustainability. Agriculture is mentioned in 80 percent of all countries' mitigation strategies and 64 percent of all adaptation strategies across the 160 countries with national plans.[65] In addition, sectors like transport, energy, and forestry are also targeted for improvement in national plans. This could mean new restrictions to meet goals, but in low-income countries it also could mean new incentives as the Green Climate Change Fund and other mechanisms begin to reward efforts to help low-income countries meet their nationally determined plans. Companies that have already placed sustainability at the center of their business models, which are many, stand to benefit as the food system scales up amid new environmental commitments globally.

Since the COP21 discussions in 2015, new goals are emerging in a range of sectors to achieve environmental sustainability.

Modes of investment: Opportunities in the emerging food system

There are three primary modes of supporting food security in emerging economies. The first is through trade with developing economies that require food imports to meet demand. The second is through direct business investment in emerging economies, which can take many forms. And the third is through procurement arrangements in emerging economies that contribute to small-scale agriculture and food system development.

Emerging economies are export markets

There is a complex relationship between commercial and development objectives when it comes to trade, but they do not have to be at odds. Rather than focus on issues of trade policy, this section encourages companies to consider countries that welcome food imports.

Agrifood products

A major role for the private sector is to take advantage of the opportunity to export finished or semifinished agrifood products. These products, like dried milk, can be sold

Box 13 – World Initiative for Soy in Human Health

In 2000 state soybean grower organizations in the United States created the World Initiative for Soy in Human Health (WISHH), a program of the American Soybean Association. WISHH focuses on value chain development by improving trade and developing long-term markets for US soybean farmers. Through market development, education, and research, WISHH seeks to grow the protein supply available to low-income countries while expanding the market for US-grown soy. WISHH develops agricultural value chains in emerging markets to improve health, nutrition, and food security through a bolstered US soy trade, and its core programs focus on technical transfer to strengthen weak links in global value chains. Doing so improves the economies of regions currently lacking in robust value chain infrastructure and provides improved nutrition to both people and animals in low-income countries.

Source: WISHH.

RyanFaas/iStock

both in growing city markets or as inputs to a growing processing sector. In fact, US exports to developing markets can help domestic farmers and even induce domestic supply chain development in some cases.

For example, US seasonal fruit and vegetable exports to cities in the southern hemisphere can provide counterseasonal availability and develop internal markets and consumer demand for horticulture products. By building these markets, firms can also help improve access to nutritious foods and lay the building blocks for food safety mechanisms. Similarly, US poultry and meat exports to cities in LMICs can help build a critical mass and support domestic cold chain and retail development that can also serve domestic farmers in those countries.

Services to support supply chains

US export market opportunities are not limited to food products. US exports of services and inputs that are crucial along supply chains include cell phone networks, detection equipment for food safety and phytosanitary problems, cold chain services and equipment, and storage and packaging equipment. These useful inputs and services build local capacity to feed cities.

However, it is important to note the risks. US exports can compete with and potentially forestall medium-term development of domestic supply chain capacity to feed their own cities, even while fulfilling short-term objectives of feeding the urban hungry or supplying products of quality and safety levels beyond what domestic supply

US seasonal fruit and vegetable exports to cities in the southern hemisphere can provide counterseasonal availability and develop internal markets and consumer demand for horticulture products.

capacity can provide. For this reason, it is essential that investments in export markets are made with long-term strategies in mind. Good examples of partnership exist where commodity associations and the USDA Foreign Agricultural Service have found ways to collaborate for the benefit of local communities and American industries (see box 13).

Many options exist for investing directly in emerging economies

FDI will be crucial to increase production, develop supply chains, and supply consumers. FDI can include a variety of investments, including "greenfield," or new investments in which firms are established locally through mergers and acquisitions or independently. Other types of investments include the development of international cooperatives, export/import platforms, or joint ventures, where an international firm partners with a local company under a combined brand, while maintaining its individual legal status. Each comes with risks and benefits.

US agribusiness are familiar with such arrangements, as so many food firms already operate internationally. US processed food firms sell about six times more internationally from their FDI subsidiaries than they physically export from the United States to foreign markets.[66] Successful firms adapt to local needs and regulations and vie to be preferred suppliers for supermarket chains and other critical buyers that increasingly

Box 14 – Multiplier effects of foreign direct investment

FDI is not just an opportunity for the businesses who invest in foreign countries, but a powerful mechanism for local economic development through multiplier effects. Besides jobs and economic opportunities, FDI results in spillovers of technology and organizational know-how to local suppliers, joint venture partners, or even those just "looking over the fence." Foreign firms can establish preferred supplier relationships with second-stage processors in the country or work closer to the farm, which could in principal support SME development and small-scale agricultural development, though benefits are not automatic and relationships should be carefully designed.

The most intensive and direct spillover effects come from joint ventures, which support local firms in the supply chains. The local partner can also help the FDI firm navigate the complex local environment. FDI in general, and joint ventures in particular, which can be risky, are far more successful when good policy and infrastructure are in place locally. This includes clear FDI policy and clear joint venture regulations and protections such as intellectual property rights.

 Prashanth Vishwanathan/CCAFS

dominate developing economies. Efficient firms can often operate with lower transaction costs while also serving local markets.

FDI is a powerful tool not just to increase a business's profits, but to potentially support economic development. FDI can impact local economies through direct employment and through multiplier effects that induce, for example, local investments in transport, cold storage, and warehouse development (see box 14). A foreign firm's FDI can be a conduit or leverage for credit flows to domestic firms in the supply chains. In some cases the foreign firm might provide direct credit or at least inputs and services to suppliers to increase production and quality. Public-private arrangements between companies and development partners have in many cases also proven successful in including local suppliers.

Some types of FDI, however, do not contribute to reducing poverty. FDI that puts fledgling domestic firms out of business or that results in a high net outflow of resources are examples. To avoid this, host governments increasingly have investment promotion plans and priority areas of investment—often paired with incentives—to guide companies toward sectors where they invite support. US government agencies such as the US Chamber of Commerce and the US Commercial Service could play an important role in helping companies identify opportunities and better understand areas ripe for investment. The US Agency for International Development (USAID) and USDA could also guide interested firms toward development partnerships (see Part III).

Procurement systems are a key component of private-sector investment, including the extent to which firms source locally from small farms and help suppliers improve quality.

Smart and inclusive procurement strategies

Procurement systems are a key component of private-sector investment, including the extent to which firms source locally from small farms and SMEs and how much help they provide to suppliers to improve quality and consistency. Follow sourcing, where companies ask large suppliers in mature markets to follow their company to a developing region to rapidly upgrade the supply chain, is one example. To achieve this aim, arrangements are often made with financial institutions to help local suppliers secure assets to make upgrades, which can have lasting development effects.

Firms may find that small-scale farmers are too disorganized and unproductive to meet requirements, which is why rural SMEs play such a key role. However, many NGOs also have a strong business orientation and aim to assist farmers in increasing their capacities and finding sustainable private-sector relationships. Great examples of partnerships between NGOs and sourcing companies abound. Increasingly, traditional NGOs and emerging organizations are reinventing themselves as "social enterprises," which have a dual focus on social benefit and financial return, with the former as the priority. Successful partnerships can significantly improve the inclusion of small-scale farmers in emerging supply chains.

Box 15 – Walmart's direct farm sourcing strategies in Nicaragua

Rising demand from city dwellers for safe, high-value, and ethically produced food is changing the way that food moves from farms to markets. One promising trend emerging from this transformation has been the rise of direct sourcing on the part of retailers from farmers in many countries across the developing world.

Whereas traditional supply chains work through decentralized webs of buyers and wholesalers, supermarkets practicing direct sourcing work through one or a few professional intermediaries—generally NGOs or specialized firms—to procure food directly from farmers.

Among the most prominent supermarket companies to have adopted the direct purchasing model in several countries across Latin America and Asia is Walmart. Recent research in Nicaragua suggests that although small farmers selling to Walmart do not necessarily see an increase in the prices they receive, they do operate with a consistent price for their product, which protects farmers from the volatility that can be common to more traditional marketing systems. As a result, farmers in Nicaragua were able to increase their investments in agricultural production and in productive household assets. These assets can improve households' well-being and in the long term may offer a pathway out of poverty. While there is much to discover about the conditions under which direct sourcing benefits farmers and consumers, this model offers the potential to improve the livelihoods of urban and rural communities alike.

Source: Michelson, 2016.

Paulo Whitaker/Reuters

Growth sectors for investment

This section identifies broad segments that are well positioned for growth and could also support development objectives.

Agricultural production and inputs

Increasing the productivity of small-scale farms and livestock in Africa and South Asia is a huge area of opportunity. Access to improved seeds and fertilizers are a natural starting point. While the seed industry is improving in developing regions, solutions still need to be found. With increasing demand for meat and animal products, businesses can expect growth in the feed, animal health, and animal genetics industries. Programs like BAIF Development Research Foundation in India has tapped into demand for improved dairy productivity through improved genetics, and they now serve over 5 million families with door-to-door artificial insemination to improve otherwise low dairy productivity.

Financial services are critical to enabling farmers and rural SMEs to participate in growing market opportunities, yet these services are frequently lacking, even with the proliferation of microfinance.

In addition to the inputs sector, growth should be expected in small mechanization and mechanization services such as tractors, irrigation equipment, pumps, shellers, and threshers. Business models that address the financing constraints facing small-scale farmers are most needed.

Financial services, insurance, and risk management

Financial services are critical to enabling farmers and rural SMEs to participate in growing market opportunities, yet these services are frequently lacking, even with the proliferation of microfinance. Tailored products and services for farmers and rural entrepreneurs in savings, credit, and insurance can better enable their participation.

Asset financing is one promising example. Given the high capital costs of equipment and high costs of finance, the speed of mechanization uptake can be slow. Models that allow farmers to finance equipment differently can improve access. For example, the social enterprise Juhudi Kilimo finances specific agricultural assets rather than working capital, which is traditional in microfinance. Juhudi Kilimo's assets are insured to protect clients from harsh business losses, which reduces the farmer's risk of further indebtedness by using the assets as a form of collateral in case of default.[67]

Small-scale farmer insurance is another product that many argue would transform small-scale farming. New models are addressing the challenges of scaling small-scale agricultural insurance. For example, Acre Africa, which was launched by the Syngenta Foundation, acts as a broker between insurers and aggregators of farmers, including cooperatives, SMEs, and NGOs. They help aggregators cover the cost of financing insurance for small-scale farmer groups and connect them to appropriate insurance providers. Through approaches like these, insurers begin to reach scale, which drives down

costs and allows farmers to get the protection they need. Acre Africa has helped over 233,000 small-scale farmers access insurance.[68]

As discussed in box 8, mobile money is changing the face of all of these products rapidly. Understanding how to best use this rapidly growing platform for farmers will help improve the potential for success.

Transportation, logistics, cold chain, and storage

The logistics sector is also a significant investment opportunity. Logistics firms have the opportunity to leverage their expertise from high-income country markets and identify innovative ways to solve challenges unique to underdeveloped emerging markets. In China, for example, the cold storage and transportation market currently generates between $12 and $18 billion in revenues and is expected to continue growing by 10 to 15 percent annually to meet growing consumer demand for fresh vegetables, dairy products, and meat.[69] Globally, the cold chain market is forecasted to grow at a rate of 16 percent annually.[70]

Food and beverage markets

Food and beverage markets in emerging economies are growing rapidly. In Africa food and beverage consumption is projected to reach $544 billion by 2020 as consumers buy both greater quantities of food and higher quality items.[71] In India urban food consumption is growing nearly twice as fast as rural food consumption as consumers increasingly purchase high-value foods like fruits, vegetables, and complex proteins.[72]

The global fruit and vegetable market is projected to be worth $2.3 trillion by 2017, an increase of nearly 52 percent from its value in 2012.

The global fruit and vegetable market is projected to be valued at $2.3 trillion by 2017, an increase of nearly 52 percent from its value in 2012.[73]

Given known environmental effects, growing demand for animal protein will be both a challenge environmentally and a huge business opportunity for livestock keepers and the livestock industry. Innovations to improve sustainability and meet this demand are desperately needed. China's current total meat consumption is greater than the entire global consumption of meat in 1950.[74] Populations in meat-consuming countries like Kenya and Nigeria may see similar demand, though supply strategies may look different.

For both urban and rural consumers in LMICs, the development of nutritionally fortified products is another opportunity for investment that contributes to nutrition security. Unilever's Knorr brand, for example, has developed iron-fortified bouillon cubes to reduce anemia in Nigeria.[75] Examples like these prove firms can tap into a new market demand while also helping to alleviate global malnutrition.

Box 16 – Small-scale farmer insurance

It is risky for small-scale farmers to change production practices generally. Therefore, transitioning toward the high-value crops demanded by urban consumers is not as simple as making the decision. The threat of huge losses from fluctuations in weather, prices, and other factors drives many small-scale farmers to stick with low-risk crops that yield low returns. But small-scale farmers who do not diversify into higher-value products may remain caught within poverty traps, never able to generate the returns needed to take their enterprise to the next level.

One promising financial tool that can address this problem is index-based insurance. While transaction costs are generally too high for traditional agricultural insurance to be viable for small-scale farmers, index-based insurance schemes circumvent transaction costs by tying insurance payouts to easily observable indices like rainfall or commodity prices. If the rains fail or if the price of a product crashes, farmers will be compensated by a predetermined amount. This allows farmers to take the risks they must take in order to expand into higher-value markets. Recent studies in Ghana and India have confirmed that insured small-scale farmers readily switch their investments to crops that are high risk and high returns. However, challenges remain. Perhaps most importantly, small-scale farmers rarely decide to invest in insurance unless it is heavily subsidized. Nonetheless, the importance of insurance in helping small-scale farmers to expand into higher-value production warrants continued investment by NGOs, donors, and social enterprises.

Source: J-PAL, 2016.

C. Shubert/CCAFS

Box 17 – Direct sourcing case study: Carrefour in Indonesia

In the early 2000s, Carrefour, a French multinational food company, sought out producers to supply them with small watermelons to meet growing demand from middle-class urban consumers in Southeast Asia. To meet this market opportunity, Carrefour collaborated with several stakeholders. Carrefour turned to Bimandiri, a specialized wholesaler in Indonesia, who in turn collaborated with a farmer cooperative that cultivated large watermelons, called Mekar Buah. Bimandiri and the head of the farmer cooperative first experimented with small watermelon cultivation and launched an outgrower scheme for the small variety with 50 farmers from the cooperative. Bimandiri also solicited input credit and technical assistance from Syngenta, the multinational agribusiness firm, which educated farmers on low-pesticide use to optimize melon cultivation.

Through this collaborative effort to enable farmers to meet Carrefour's demand, farmers began producing small, personal-sized watermelons known as "baby black watermelons" and sold them to Carrefour. For these melons, the farmers in the Mekar Buah cooperative received a price that was twice as much per kilogram than that of the traditional, large watermelons.

Source: World Bank, 2007.

 F. Hogue/iStock

Packaging and retail distribution

Consumers increasingly want convenient food, which means portability and shelf stability, among other qualities, are rising in importance. While developing regions do not hold a large share of this market, in many cases growth in emerging economies outpaces more developed regions, showcasing a potentially attractive investment opportunity. Interestingly, tougher environmental regulations in many countries and consumer demand for environmentally friendly products may spur the emergence of new products in the packaging industry. For example, Rwanda has a total ban on plastic packaging, so creative paper-based products have been the focus of that sector's development.

There is clear growth potential on the retail side, but challenges as well in some of the biggest markets. For instance, Indian retail food sales are estimated at $360 billion, or about 60 percent of total retail sales.[76] However, the Indian government's restrictions on FDI have limited outside investment. Despite this, restrictions have been gradually decreasing and many investors continue to look for the right opportunity to enter this

Tougher environmental regulations in many countries and consumer demand for environmentally friendly products may spur the emergence of new products in the packaging industry.

market. And while growth is slower in Sub-Saharan Africa, countries like Nigeria, Kenya, and Botswana also have growing middle class populations and growing food retail sectors that can generate employment opportunities for urban and rural workers.

Promising business models

Franchises

Quality and consistency are important and elusive factors in growing markets, both for farmers and consumers. Powerful, recognizable branding, a high quality of service, and qualified staff can set businesses apart and is an appealing strategy in emerging markets. In Nigeria alone, food franchises have grown 10 percent annually for the past decade. Western brands like KFC and Coldstone Creamery are popping up alongside home-grown franchises like Kilimanjaro, which sources foods locally and serves traditional foods like pounded yam in a "fast food" format. A more farmer-focused example can be found in Kenya, where a group called Sidai has set up dozens of branded, quality agro-vet shops across the country to provide on-farm artificial insemination, vaccines, and medications, setting them apart amid a sea of products of varying quality. [77]

Bundled services

Building supply chains that reach the farm can be expensive and risky for firms since maintaining loyalty among farmers and other key supply chain actors is difficult. In some areas businesses are bundling services to farmers and SMEs, such as providing inputs along with extension, financial, and marketing services. This can help businesses build loyalty, diversify products, reduce risk, and increase profit margins while sup-

porting farmers. Commission-based models can also provide incentives for frontline workers, rewarding strong employees and improving farmer engagement and support.

Hub and spoke

Hub and spoke models, mentioned in Part I, are another means to reduce the costs of reaching disparate farmers. They allow businesses to cluster collection points for suppliers so that aggregation, storage, and transport can be made more efficient. These models often include bundled services as well, but farmers receive the bundle at a "hub" instead of on the farm. For example, dairy collection hubs will often have a chilling plant, but they may also have an on-site extension services, quality feed for sale, or artificial insemination services. Such a model is what allows companies like Amul, one of the world's largest dairy cooperatives based in Gujarat, India, to only have 750 employees but a remarkable 3.6 million small dairy producers.

Technology platforms

The rapid proliferation of mobile technology across LMICs has set the stage for new avenues of investment in and along the value chain. These new technology platforms can reduce transaction costs and improve food system transparency. For example, MFarm is a mobile tool that improves farmers' access to information about buyer options and

The rapid proliferation of mobile technology across LMICs has set the stage for new avenues of investment in and along the value chain. These new technology platforms can reduce transaction costs and improve food system transparency.

price information by sending information via SMS (text messaging).[78] Other technological innovations impossible only years ago are also scaling up, like video-enabled extension. Similarly, new technologies abound to improve supply chain traceability and automation from production to processing. While these are most evident in developed economies, it is only a matter of time before applications also emerge in developing economies.

The opportunity for national and local governments to enable positive food system change

National and local governments in LMICs are immensely important in the development of an inclusive, diverse, sustainable, and efficient food system. There are two primary areas for their attention: (1) facilitating public infrastructure development and (2) creating an enabling policy and regulatory environment. Progress in these areas promotes private-sector investment, safety in the food system, and inclusion of vulnerable populations in economic development and food system transformation. To be sure, governments can set policies that enable—or inhibit—private investment, farmer investment, and SME development. While what constitutes "good policy" can vary greatly by country and context, this section outlines those policy actions at the national, state and provincial, and municipal levels that are most positive for creating an enabling environment for the development of food systems.

Box 18 – Leapfrog technologies

It is well known that LMICs largely "leapfrogged" landline telephone systems because mobile phones became available much more readily and cheaply before landline systems could develop. As food systems transform, there may also be opportunities to make "leapfrog" advancements in key underdeveloped areas of the supply chain.

Skip the truck and train?

While the coming decades will see extended supply chains that reach into the interiors of low-income countries with promise of market access for small-scale farmers, significant infrastructure challenges remain. Road and rail networks in many low-income countries are either scarce or of poor quality, and the construction of more effective networks would be both time-consuming and costly, preventing supply chains from reaching small-scale farmers in remote areas.

One solution to these infrastructure problems would be as revolutionary as it would be historic: airships, also known as blimps. Although best known as a transportation option from the Hindenburg era, airship technology has undergone a renaissance in recent years, and engineers are now producing models that could transport goods deep into roadless regions like northern Canada. Means to power these airships with solar, wind, and hydrogen power are in development, with the aim to drastically reduce the cost and environmental impact of shipping and moving goods from cities to and from the deep countryside.

Although current models are costly, there might be a moment when they begin to look more attractive to investors. With the tagline, "No Roads? No Problem," Lockheed Martin is one such investor aiming to become the cargo solution for remote parts of Africa with hybrid airships. As technology advances and pressures intensify to connect productive rural areas to urban population centers, there may be cause to look beyond roads and rails and look up.

Cryogenic cold chains

Cold chain improvements are critical to support functional, expanded supply chains. However, cold chains are one of the biggest contributors to greenhouse gas emissions, particularly in economies where the majority of electricity is derived from fossil fuel and where supply chains are heavily dependent on diesel-powered, refrigerated trucks.

This challenge presents an enormous possibility for a clean technology, leapfrog solution. By harnessing cryogenic energy storage technologies in lieu of traditional refrigerants, developing countries may be able to expand cold chain capacities while minimizing the carbon footprint of expanding supply chains. Cryogenic energy storage harnesses the potential energy of liquefaction of atmospheric air, providing both a source of stored energy and of dense cold. Using reusable energy sources like solar and wind power—both of which can produce energy locally, independent of an electricity grid—air can be liquefied and stored in cryogenic storage tanks, a mature and preexisting technology commonly used in Western industrial practices. These storage tanks not only provide a fossil fuel–free means to store energy and refrigeration at scale, but the technology could also be scaled down to power and cool the refrigeration units on trucks, trains, and warehouses.

Source: CleanLeap; CNBC.

National policy and regulatory frameworks for food transformation

Developing physical infrastructure

Too often, missing or poor-quality infrastructure prevents the connectivity needed for well-functioning modern supply chains. Support for the construction of rural roads is particularly critical to connecting marginalized rural populations, especially farmers, to urban markets. Road maintenance is an equally important investment to secure long-term benefits. Physical market infrastructure improvements and storage improvements can improve the quality of commodities flowing through supply chains.

Investments in natural resource management, especially in water, could also support small-scale farmer participation in growing sectors like horticultural production and dairy that require more reliable water resources. But because of water scarcity, infrastructure must go hand in hand with good policy. Take Kenya, for example, where

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a single watershed supplies 90 percent of Nairobi's water and 70 percent of the city's hydropower. But surrounding small-scale farmers also use the same river and its ecosystem services.[79] Making smart infrastructure decisions with such a limited natural resource base and competing interests will be an increasing challenge.

Sustaining or increasing agricultural investment

Sustaining or increasing investment across the agricultural sector will be critical to ensure that domestic production, driven by small-scale farmers, can rise to meet growing demand. In 2003 African governments committed 10 percent of their national budgets to agriculture, but as of 2014 only 20 percent of countries had met this commitment.[80] Despite this, many national budgets have been increasing and productivity gains are beginning to show across those countries.

Investments in everything from agricultural extension to research and development are important. Taking a commodity specific, whole-of-value-chain approach can be particularly effective, helping governments identify key opportunities for growth. For example, in India the National Agricultural Research System (NARS) developed a disease-resistant potato with a long shelf life that was important to the rapid shift from grains to potatoes in western Uttar Pradesh. This led to the rapid growth of the potato cold storage sector and a vast increase in supply to New Delhi and the surrounding region.

Enabling a climate for investment

Macro-level policies such as reasonable base interest rates, supportive regional trade regimes, and general sectoral policies from grades and standards to transport tariffs can incentivize private-sector investment. Such policies and regulations set the conditions

for investment, whether by domestic private companies or potential foreign investors. Governments may decide to focus on SME development, on attracting FDI, or on pursuing the two in tandem.

Regardless of strategy, public investments and policies should be coordinated and integrated. This can be a challenge when policies for the sector cut across so many different ministries. Coordination among ministries such as agriculture, commerce, industry, environment, water, and energy is crucial for maximizing the effectiveness of policies, but is often lacking in LMICs.

Moreover, changes must also take place in small cities and towns, including changes in municipal regulations, cooperation in road building, establishment and maintenance of wholesale markets, and so on. Yet the government ministries needed to facilitate these investments often lack the political incentive or the ability to regulate or even coordinate with state, district, and municipal governments. Lack of coordination and countervailing activities and confusion in these relations is common and detrimental to building food systems.

Governments can, however, provide incentives for such coordination. For example, in 2015 Peru launched a rural development initiative in which the central government provided funding to the ministry of rural development to incentivize coordination

Box 19 – The ease of doing business index

Each year the World Bank releases findings on the state of national economies in its *Doing Business* report, one of the most respected barometers on the health of global business environments. The report examines business reforms, regulations, governance, and macroeconomic factors that impact economic long-term health, performance, and growth.

The 2016 report evaluated 189 countries and found significant improvements in the business environments of many countries in Sub-Saharan Africa. Improvements measured included making it easier to start a business, issuing construction permits, and improving access to credit. Access to credit was an area where Africa showed particular improvement, with half the world's 32 improved credit regulations happening in Africa. The report found continued improvements in countries like Mozambique, where regulatory reforms have shrunk the time needed to start a business from 168 days in 2003 to 19 days today. Overall, Uganda, Kenya, Mauritania, Senegal, and Benin showed the most improvement within the region.

In addition to assessing the general business environment, agriculture companies can also reference the Benchmarking the Business of Agriculture index, which assesses the specific ease or difficulty in agricultural sectors, from seed to machinery. This greater specificity can help the private sector better understand where conditions may be best for new investment based on their business area.

Source: World Bank.

Box 20 – 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 corporations 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 the capacity of food processors, create sustainable linkages throughout the value chain, build local environments for sustained processor growth, and promote a learning agenda.

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

Source: Partners in Food Solutions.

Ollivier Girard/CIFOR

across ministries and local governments for specific goals. The central government backed the funding with requirements for each government entity.

Governments in developing regions often view supply chains and commerce through an export lens, with a focus on high-value commodities. This neglects the importance of internal commerce and inter-regional investment environments. Since food demand is mainly met by domestic supply chains, the development of intranational supply chains and regional trade opportunities should not be overlooked. In Africa groups like the Economic Community of Western African States (ECOWAS) and the Common Market for Eastern & Southern Africa (COMESA) outline common trade standards by region. These groups also collaborate on infrastructure upgrades at borders that track and reduce time spent at borders and help combat systemwide problems like corruption in transport.

Food safety grades, standards, and enforcement

To identify food safety challenges and prevent disastrous consequences, governments should establish food safety bodies, providing training and testing equipment. They should work to ensure industry understanding and compliance with regulations. Food processing is a key point along the supply chain on which to focus. Creative public-private partnerships can help improve knowledge and compliance.

Land tenure and land use

As demand for increased production grows, agricultural land will become increasingly valuable. Governments should ensure their policies support access to and control over land by small-scale farmers. This is critically important for women, who often find themselves heading households in rural areas due to the migration, divorce, or death

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of their husbands. In many regions this puts women at risk of losing control of their land. Studies show that farmers who believe their land is secure are more likely to make investments that improve production and are more likely to be food secure than their counterparts with weaker control over land.[81]

Because of the increasing demand for agricultural land from public and private, foreign and domestic interests—which can affect both small-scale farmers and potentially the use of nonagricultural land—land use policies must be carefully considered. These decisions will have long-term effects on the sustainability of production.

Local and provincial governments

City, district, provincial, and state governments have important roles to play in encouraging and facilitating supply chain development from farms to final markets in towns and cities large and small.

Box 21 – Women in agriculture

Forty-three percent of the agricultural labor in low-income countries is supplied by women—but women farmers in low-income countries often lack access to land, credit, inputs, and information compared with their male counterparts. This gender gap means that women farmers are underproducing, and that inhibits farmers' abilities to meet demand. FAO found that if women farmers had the same access to productive resources as men, women farmers could increase their yields by 20 to 30 percent, which could reduce the number of undernourished people worldwide by 150 million. Closing the gender gap in agriculture can play a major role in enabling farmers' participation in growing food systems and meeting urban demand.

In India, for example, agriculture is the single largest production endeavor, contributing 25 percent of annual GDP, and it is increasingly led by female farmers. Agriculture currently employs four-fifths of all economically active women in the country, and nearly half of India's self-employed farmers are women. There are 75 million women engaged in dairy as compared to 15 million men, and 20 million in animal husbandry as compared to 1.5 million men.

In addition to farming, however, women are also responsible for childcare and the well-being of the household, which often means their workdays are far longer than men. And they are generally either poorly remunerated or not remunerated at all. These time constraints, in addition to the generally low status of women in India and low levels of female land ownership (less than 10 percent), contributes to a large productivity gap between men and women in agriculture. A range of programs that support women's empowerment, from basic literacy to support for greater control of assets like livestock and land, is needed and can improve their overall well-being as well as their ability to close the yield gap.

Source: FAO, 2011; IOSR Journal of Humanities and Social Science, 2014.

Neil Palmer/CIAT

Policy, regulation, and infrastructure

Prime actions include:

- systematic city infrastructure development that efficiently connects highways, water routes, and railways to wholesale markets;
- designation of certain high-potential regions as special growth corridors to help accelerate progress across the supply chain;
- municipal regulations, including wholesale market regulations and anticorruption measures, that facilitate competitive, cost-efficient commerce and reduce risk.

Training for local and provincial officials

While many policy and budgetary decisions are made at the national level, spending and implementation increasingly rest with states, districts, and city governments. However, balancing the many competing demands can be challenging. Support and training for these officials are needed. Without strong capacity to assess trade-offs and remove obstacles to trade, these officials may find themselves inadvertently constraining progress. Programs like USAID's Capacity to Improve Agriculture and Food Security

Support and training for these officials are needed. Without strong capacity to assess trade-offs and remove obstacles to trade, these officials may find themselves inadvertently constraining progress.

(CIAFS) in Ethiopia, for example, are designed to help strengthen capacity all the way down to the district level. The program is also integrating training into the curricula of local universities to ensure sustainability.[82]

The critical role of civil society

Civil society is frequently an important player in the success of public- and private-sector initiatives. Examples of civil society action include the following.

Demonstrating successful models

NGOs and a growing number of social enterprises are increasingly on the leading edge of experimentation and demonstration of new models to encourage development. One Acre Fund, an NGO in East Africa, is addressing the challenge of access to inputs among farmers through a model of bundled services. This model has scaled to 280,000 farmers since initiation in 2007 and is pointing to a potentially attractive business model that could be used by the private sector.[83]

Since risks and costs can often be too high for the private sector to engage with farmers or other local stakeholders, NGOs and social enterprises can "buy down the risks" of entry for companies who otherwise would not have the time or capacity to do things like aggregate, train, and prepare farmers for business opportunities. The examples in this section are just a few of many examples in which an NGO has demonstrated how

small-scale farmers and other vulnerable populations can be included in income-generating economic activities.

Advocacy

Civil society groups play a critical role in advocating for vulnerable populations like small-scale farmers as systems evolve. They can provide critical feedback on both government and private-sector activities on behalf of these populations. Civil society can also help national and local governments make policy changes and establish good governance practices. Local think tanks can play a critical role in evaluating the effects of policies on different populations and posing alternatives to policymakers.

Accountability

Civil society can also hold both the private and public sector accountable for programs and policies aimed at building inclusive food systems. Oxfam, for example, has taken an active role in holding businesses accountable for their investments in supply chains within LMICs. In 2005 Oxfam and Unilever agreed to examine Unilever's supply chain in Indonesia. The study explored the impact of Unilever's business activities on poverty reduction.[84] Civil society action is also important for ensuring that corruption is identified and prevented at all levels of government and within the private sector.

Building capacity and brokering relationships

In order to facilitate public-private partnerships, civil society organizations can play a key role in facilitating engagements between private- and public-sector actors. NGOs can also help enable relationships between food companies and farmers. For a company seeking to source their products from small-scale farmers, an NGO can make this sourcing strategy more feasible by bringing farmers together in a cooperative or building farmers' capacity to meet required standards. NGOs also train farmers and rural entrepreneurs on negotiation, numeracy, and other skills that help small-scale farmers

NGOs and a growing number of social enterprises are increasingly on the leading edge of experimentation and demonstration of new models to encourage development.

and SMEs thrive within evolving food systems, while also helping to create a reliable pool of suppliers for agrifood companies.[85] These solutions often involve forming farmers' organizations to disseminate skills, increase small-scale farmers' bargaining power, and leverage economies of scale.[86] The World Food Programme's Purchase for Progress program, for example, has supported over a thousand farmers' organizations across 20 African, Asian, and Latin American countries.[87]

Isabel Tiessen Pastor/iStock

PART III

Recommendations for US action

Micky Wiswedel/iStock

US leadership will be essential to meet the challenge of feeding an increasingly urban world. While growing cities—especially those in Africa, Asia, and Latin America—put new pressures on the global food system, the world must also increase agricultural production to feed 9 billion people by 2050, build resilience to a changing climate, and meet the growing demand for diverse, nutritious food. Since World War II the United States has led global efforts to mitigate hunger and malnutrition. Today, US policymakers must continue this legacy.

To improve the world's food systems and meet exploding demand, the United States must enable and leverage private-sector investments. US expertise is imperative to ensure that small-scale farmers and rural SMEs can fully participate in and benefit from burgeoning urban markets. Investments in scientific research and innovation will also be needed for food systems to successfully meet demand.

Meeting these challenges is in the interest of the United States. Growing markets create demand for US exports and offer enormous new investment opportunities for the private sector. Strong global food systems will contribute to affordable, nutritious, and safe food for consumers around the globe, including in the United States. Stable food supplies and food prices are also critical to political and economic stability and are therefore soundly in the US national security interest. Indeed, other nations such as China are already seeking to ensure their future food security and trading relationships by accelerating the pace and scale of their investments in food systems.

Building on the recommendations of previous Council global food security reports, Part III outlines policy actions that the US government can undertake in collaboration with researchers, policymakers, civil society, practitioners, and the private sector to invest in food systems that can feed the world's cities, support the livelihoods of small-scale farmers and rural residents, and reduce hunger and poverty.

Leadership from both the current and the next presidential administration can drive agencies to implement many of the recommendations in this report. Many US government agencies have a great deal of expertise on food security, agricultural development, and food systems. This expertise will be more critical than ever to addressing increasingly complex food system challenges.

Leadership from Congress is also imperative to support implementation, coordination, and appropriations for many of the recommendations. Numerous members of Congress from both parties and both houses have championed global food security issues. Continued bipartisan leadership from members of Congress is essential to ensuring that the United States continues to lead global efforts to advance global food security.

RECOMMENDATION 1

Develop, implement, and strengthen policies for global food security

Action 1a. Pass legislation committing the United States to a long-term global food and nutrition security strategy

This has been the top recommendation in previous Council reports and remains the most important action the US government can take to move the United States and the world toward a food-secure future. 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 through the Feed the Future program. The program has made numerous gains, such as improved agricultural production and nutrition status in Feed the Future countries, and enjoyed bipartisan support in Congress. Without a long-term commitment, the gains that have already been made will be in jeopardy and the challenges of meeting global food demand more difficult if not impossible to achieve.

Authorizing legislation has been introduced in a bipartisan fashion in every session of Congress since it was first introduced by former Senator Richard Lugar (R-IN) and Senator Robert Casey (D-PA) in 2008. Although this authorizing legislation has not yet been passed, Congress has continued to appropriate support for the Feed the Future program.

The urgency of the food and nutrition security challenge cannot be overstated. Exploding populations are increasing food demand in cities at unprecedented rates. Investments in agriculture and food systems often take years if not decades to come to fruition and need to be sustained and predictable over the long term in order to yield lasting results. In the absence of a food crisis, agricultural investment often dips, only to leave the world vulnerable to crisis. Long-term leadership by the United States will ensure the global community also stays the course in its commitment to this issue.

The urgency of the food and nutrition security challenge cannot be overstated. Exploding populations are increasing food demand in cities at unprecedented rates. Investments in agriculture and food systems often take years if not decades to come to fruition and need to be sustained and predictable over the long term in order to yield lasting results.

Passing authorizing legislation for a long-term strategy for advancing food security and nutrition through agricultural development would be similar to the passage of and continued bipartisan support for the President's Emergency Plan for AIDS Relief (PEPFAR) or for Power Africa, which is now authorized through 2020 due to bipartisan support in Congress and passage of the Electrify Africa Act in early 2016. Particularly in the face of the growing demand from cities for a secure and sustainable domestic food supply over the next several decades, long-term investments are critical.

A long-term strategy should include a focus on raising the incomes of small-scale farmers, and rural households more generally, through increases in productivity and market access. It should also focus on food system efficiency and sustainability, 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

Box 22 – About Feed the Future

In June 2009 at the G8 Summit in L'Aquila, Italy, President Obama pledged $3.5 billion over three years (FY2010 to FY2012) to a food security initiative to address hunger and poverty worldwide. The US commitment was made as part of a pledge of more than $22 billion by G8 and G20 countries and others to address global food security. The L'Aquila declaration called for donors to increase their contributions to agricultural development assistance and to provide the assistance in a new way—one that supports comprehensive investments through country-owned plans.

In May 2010 the United States officially launched its global hunger and food security initiative called Feed the Future. The US Department of State lead the development of Feed the Future's strategy, and the USAID became the primary agency responsible for coordinating its implementation. Nine other agencies contribute to Feed the Future, which was intended as a "whole-of-government" effort.

Feed the Future builds on the five principles for sustainable food security articulated in the L'Aquila declaration and subsequently endorsed at the 2009 World Summit on Food Security in Rome. The two primary objectives of Feed the Future are (1) to accelerate inclusive agricultural sector growth and (2) to improve nutrition in developing countries, particularly for women and children. Feed the Future is focusing activities in 19 developing countries in Sub-Saharan Africa, Asia, and Latin America and the Caribbean. It integrates three cross-cutting priorities—gender, environment, and climate change—into its investment activities in focus countries. To promote inclusive economic growth, Feed the Future investments target agricultural research and extension, agricultural production/productivity enhancement, and linkages between producers and value chains that incorporate sustainability, gender equality, and women's empowerment. Nutrition assistance in focus countries concentrates on nutrition interventions, especially during the 1,000-day period from pregnancy to a child's second birthday.

Source: Hanrahan, 2015.

the time needed to shift deeply engrained practices, norms, and priorities that can only be overcome with long-term investments and incremental progress.

Continued congressional engagement and oversight is also critical to the success of a long-term global food security strategy. Each relevant committee in Congress should continue to hold at least one hearing per year within their jurisdiction on the state of the world's food systems and global food security and on the effectiveness of US government actions to address these issues. Discussions should include agricultural productivity in low-income countries, urbanization and its implications, agricultural research, and other related key areas. Joint hearings in each chamber are opportunities to bring the expertise of several committees together on a challenge that cuts across jurisdictions and disciplines to build support among various interest groups.

Action 1b. Increase support for capacity strengthening of national and subnational policy in low-income countries

As a result of urbanization, food systems are changing rapidly, with significant impacts on nutrition and health, national economies, and the environment. National, regional, and local governments' policies in low-income countries can significantly improve—or hinder—inclusive and sustainable food system development. Greater sophistication of both the available data and analytical skills are required to respond to such seismic system shifts.

The US government should increase support for capacity strengthening of national and subnational policymakers and implementers in low-income countries to cope

Capacity building in infrastructure development, land rights, food safety protections and gender equality will be critical to helping food systems meet the growing urban demand for food while also ensuring that small farmers and rural entrepreneurs are included in food system development.

with the increasing complexity and trade-offs in urbanizing food systems. In particular, capacity building in infrastructure development, land rights, food safety protections, and gender equality will be critical to helping food systems meet the growing urban demand for food, while also ensuring that small farmers and rural entrepreneurs are included in food system development.

USAID, for example, in partnership with the FAO, supports a program called the Monitoring and Analyzing Food and Agricultural Policies (MAFAP). Under this program countries receive assistance in analyzing quality data to form policy, monitoring the effects of decisions, and ultimately, reviewing alternatives and adjusting. This type of hands-on training will result in more effective national and subnational policies over time. This could not only help small-scale farmers, but would-be investors and neighboring countries that would be affected by poorly designed or erratic policy changes. USAID should expand MAFAP across all Feed the Future priority countries and increase support for similar programs.

Action 1c. Lead action in the G7 and G20 to keep food security high on the global agenda

For years, the United States has led global food security and agricultural development efforts. In 2009 President Obama led world leaders in launching a global food security initiative at the G8 Summit in L'Aquila, Italy, leading to over $20 billion in pledges for agricultural development and global food security.

With the announcement of the SDGs in November 2015 comes renewed global focus on the need to end hunger and poverty and the opportunity for the United States to continue to lead action on these goals.[88] The G7 and G20 Summits provide the platform for the United States to ask global leaders to build on their strong commitments, incorporating new dimensions that reflect urbanization trends and take a food systems view of these challenges.

Discussions of global food security should recognize the growing importance of supply chain development and ensure that increasing production translates to feeding cities and achieving global food security broadly. US leadership is essential to outlining a broad agenda that incorporates critical features such as environmental sustainability and nutritional diversity. Small-scale farmers must also remain at the center if these discussions are to achieve the most progress on ending poverty.

Leading a small farmer–centered food systems agenda beginning in 2017 would be a tremendous contribution to the legacy begun at L'Aquila in 2009, catalyzed by US action. To effectively prepare for the 2017 G7 Summit to be held again in Italy, the United States should lead a review of progress on global food security since pledges were made in L'Aquila. These findings should then inform a recommitment among G7 countries to fulfill their pledges by 2030, the new timeline set by the SDGs. A new agenda should draw on this broader view and could anchor contributions to achievement of the SDGs.

Additionally, as momentum for international cooperation and effort on climate change continues following the historic COP21 meetings in Paris in December 2015,

With the announcement of the SDGs in November 2015 comes renewed global focus on the need to end hunger and poverty and the opportunity for the United States to continue to lead action on these goals.

now is a critical time to highlight the crucial role of climate-smart agriculture for resilient food systems, especially in low-income countries. The United States should lead efforts to incorporate climate-smart agriculture and food system resilience into global food security discussions and commitments.

Action 1d. Leverage US expertise and invest in early warning and surveillance systems to track and respond to food system threats

Exploding food demand in cities necessitates increased agricultural productivity, longer supply chains, and the movement of massive amounts of food through the food system. At the same time, "threatening" events related to weather and the spread of pests and

diseases are becoming more frequent. All of this elevates the importance of surveillance and early warning systems to monitor threats and accelerate effective response. When diseases and pests hit major staple crops, the results can be rapid and serious for poor farmers and urban consumers alike and leave farmers and scientists without an easy or quick solution.

With livestock production, the need for increased investment is even clearer as urbanization puts more people and animals in contact and at risk. Sanitary conditions and the high density of humans in proximity to livestock increase the risk of foodborne

Important US contributions can be made in cutting-edge data collection (including satellite imagery), early identification, and control strategies for both animal and plant threats. The US government should make greater investments in these areas.

illness and zoonotic disease. Similarly, as supply chains lengthen and diversify to meet consumer demand, foodborne illnesses and contamination pose a significant threat to public health. The increasing interconnectedness of the global food system demands greater investments in this area.

Important US public- and private-sector contributions can be made in the areas of cutting-edge data collection (including satellite imagery), early identification, and control strategies for both animal and plant threats. Predictive modeling can support a range of emerging issues. The US government should make greater investments in these areas. Given the global scope of data collection and surveillance, multilateral partnerships will be essential. The United States should also participate in multilateral surveillance efforts such as FAO's Global Animal Disease Information System (EMPRES-i), which provides up-to-date information on global animal diseases and current national, regional, and global threats.[89]

Technological expertise and knowledge sharing should be made available alongside capacity strengthening investments such as USAID's PREDICT program, which strengthens national capacity to track and respond to threats. In addition, investments and capacity building to help city governments in low-income countries understand and better control factors that contribute to the spread of zoonotic disease would also be valuable.

Similarly, public- and private-sector expertise and innovation can lead to better standards and techniques for ensuring food safety from farm to fork. Better coordination between agencies could best leverage this expertise. Numerous agencies, including USDA's Animal and Plant Health Inspection Service (APHIS), USAID, the Food and Drug Administration (FDA), and the Centers for Disease Control and Prevention (CDC) operate food safety programs. An interagency global food safety program could lead efforts to develop and harmonize regulations, establish best practices, and build the capacity of small farmers and rural small enterprises to meet the standards needed to prevent contamination. These efforts would also protect US consumers from foodborne illnesses and other food safety risks from imports from these regions.

Box 23 – About Millennium Challenge Corporation

Created in 2004 under President George W. Bush with strong bipartisan support, the Millennium Challenge Corporation (MCC) has approved more than $10 billion in large-scale grants to fund country-led solutions for reducing poverty through sustainable economic growth. MCC grants focus on transport, agriculture, health, education, and community service, water supply and sanitation, energy, governance, and financial services.

MCC has a unique set of criteria for its grants:

- Competitive selection: Before a country can become eligible to receive assistance, MCC's board examines its performance on independent, transparent, and rigorous policy indicators and selects compact-eligible countries based on policy performance.
- Country-led solutions: MCC requires selected countries to identify their priorities for achieving sustainable economic growth and poverty reduction. Countries develop their MCC proposals in broad consultation within their societies. MCC teams then work in close partnership to help countries refine programs.
- Country-led implementation: When a country is awarded a compact, it sets up its own local entity accountable to the MCC to manage and oversee all aspects of implementation. Monitoring of funds is rigorous and transparent, often through independent fiscal agents.

There are two types of grants MCC awards:

- Compacts are large, five-year grants for countries that meet MCC's eligibility criteria.
- Threshold Programs are smaller grants awarded to countries that come close to meeting criteria and are firmly committed to improving their policy performance.

After more than a decade, MCC has announced a new strategic plan. "MCC NEXT" considers the current poverty and development landscape in low- and middle-income countries and identifies a more dynamic role for the agency. The strategy is far-reaching, focusing on five goals, 20 new strategic directions, and 38 actions.

Source: MCC.

 Khaled Abdullah Ali Al Mahdi/Reuters

Action 1e. Authorize the Millennium Challenge Corporation to make regional compacts to develop supply chains beyond national borders

In 2004 the Bush administration created the MCC as an independent US foreign aid agency to complement other US development programs. MCC provides well-performing countries with large-scale grants to fund country-led solutions for reducing poverty through sustainable economic growth.[90] MCC makes bilateral compacts, or large, five-year grants, with countries that pass the MCC eligibility criteria. To date MCC has signed compacts totaling roughly $10 billion with 25 countries.[91]

MCC is well positioned to facilitate the kinds of investments needed to develop food systems in Africa, Asia, and Latin America. Thirty-one percent of MCC compact funding is devoted to transit and 18 percent to agriculture, with significant funding for other sectors related to value chains such as energy, water supply, and sanitation.[92]

Developing and investing in the supply chains needed to connect farmers with cities is often an effort that is regional in scope. But MCC is unable to make regional compacts. Attempting to develop infrastructure with two separate country compacts, for example, is difficult due to differences such as the timetable of each country's compacts and other factors.

MCC has already identified opportunities for regional compacts in West Africa and in South Asia. In December 2015 the House Committee on Foreign Affairs passed legislation that would authorize MCC to make regional compacts, and a parallel effort is currently under way in the Senate. This legislation has received bipartisan support in both chambers of Congress.[93]

MCC is well positioned to facilitate the kinds of investments needed to develop food systems in Africa, Asia, and Latin America.

Congress should authorize MCC to make multination, regional compacts. Regional compacts would allow MCC to leverage its expertise in developing supply chains and facilitating trade across national borders and take a regional approach to developing food systems.

RECOMMENDATION 2

Enable and leverage private-sector investment that includes small-scale farmers and rural SMEs in the food system

S. Kilungu/CCAFS

Given the scale of the challenge of feeding cities, private-sector investment will be critical. The United States and other donors can and should play a significant role, but the sector is well positioned to deliver solutions to ensure that food systems can meet the demand of growing urban markets. As urban markets grow and small-scale farmers' capacity and production improves in Africa and Asia, supply chain investment is a significant and growing market opportunity for the private sector, with the potential for high returns.

For US companies to make such investments, however, the US government must play a role in helping to reduce the risks of investing in low-income countries, even in areas that welcome investments. The US government has several support services and partnership programs across several agencies to enable successful investment. Bilateral engagement to alert US companies to such opportunities, enabling national policies, and incentives can help US companies make investments with financial and social returns.

In the same way that Feed the Future takes a whole-of-government approach toward a common goal, US government programs that support and incentivize responsible private-sector engagement should be scaled up as well as made more transparent and coordinated. To ensure that private-sector investment can have the biggest effect possible on reducing rural poverty, the US government should incentivize investments that are inclusive of small-scale farmers and rural entrepreneurs. Inclusive private-sector investment would, over time, lead to "triple wins"—expanded and more resilient supply chains, increased societal food security, and reduced poverty.

To ensure that private-sector investment can have the biggest effect possible on reducing rural poverty, the US government should incentivize investments that are inclusive of small-scale farmers and rural entrepreneurs.

At the same time, the US government also has the ability to invest in programs that support local and regional small enterprises along the supply chain in low-income countries. As outlined in Part I, SMEs are critical to supply chain development in order to feed cities, the generation of rural employment opportunities, and ultimately, poverty alleviation. A dual investment strategy of supporting local SMEs and leveraging and encouraging US-based expertise and investment potential can make sizable contributions to the development of the food system and the reduction of poverty.

Action 2a. Review, leverage, expand, and coordinate programs supporting private investment

The opportunity for US investors to tap into these emerging markets is great. In 2013 FDI reached a new high of $759 billion, well above official development assistance of $150 billion in 2012.[94] Yet FDI to Sub-Saharan Africa, South Asia, the Middle East, and North Africa together represented only 6 percent of the world's total FDI.[95] US agencies facilitate US private investments in low-income countries through multiple agencies and with a myriad of services. Several have robust programs, and the Overseas Private Investment Corporation (OPIC) has a particularly relevant set of products and services. OPIC facilitates investments in emerging markets by providing debt financing, guaran-

tees, political risk insurance, and support for private equity funds. In 2013 OPIC generated a return of $436 million on its investments. Risk mitigation products like these are especially important given that food system investments can be riskier even as they can deliver high returns.

In addition to the financial supports available through OPIC, the US Commercial Service also sponsors trade missions, market analysis, and business matchmaking services that may help companies get started. USAID's Development Credit Authority (DCA) uses partial loan guarantees to demonstrate that underserved businesses in the developing world are commercially viable and creditworthy borrowers. In the past two years DCA has used its $8 million annual budget to leverage over $1 billion in private investments.[96]

US agencies such as USDA and USAID with a presence in many low-income countries can help identify profitable joint venture opportunities that maximize development impact. USDA and USAID's programs are ideally placed to help assess the suitability of investment partners and address key barriers. For example, the Livelihoods and Food Security Trust Fund (LIFT) in Myanmar is a partnership between the US firm PrimeAgri and a local agrifood firm with support from USAID.[97]

The next presidential administration should establish an interagency policy working group that establishes a holistic and coordinated approach to US government development finance tools available to private-sector investors.

The strengths of OPIC, USAID, USDA, and other agencies should be further leveraged. Activities that invest in the food systems of low-income countries should be prioritized and expanded. The State Department, the Treasury Department's Office of Technical Assistance, and the Department of Defense also have important programs. These programs should be reviewed to determine which are most effective and should be scaled up and expanded upon. This review should also identify the barriers to scaling up effective models for partnership and identify each agency's strengths and assets.

With these strengths identified, an interagency program that could draw these tools into a single entity would allow companies interested in investing in low-income countries to much more easily draw from available US government resources. The next presidential administration should establish an interagency policy working group that establishes a holistic and coordinated approach to development finance tools available to private-sector investors.

Action 2b: Establish and incentivize public-private partnerships with SMEs to facilitate supply chain development

US government agencies work with and support local and regional enterprises as a means of extending their development programs, leveraging local knowledge, and supporting the development of businesses along the value chain. Public-private partnership is a major component of USAID programs like Feed the Future, where partnerships with small local businesses can improve rural incomes and increase efficiency along the supply chain.

Box 24 – Impact investment

Impact investments are investments made in companies, organizations, and funds to generate a social impact along with a financial return. The popularity of this new type of investment is growing rapidly, and impact investing by US firms could have a substantial effect on food systems. Investments that facilitate entrepreneurship and innovation throughout the food system—from on-farm activities to delivery of food within cities and every point in between—will help ensure that farmers and rural entrepreneurs can feed cities.

US investors have an opportunity to tap into these emerging markets, and the US government has a critical role to play in incentivizing, supporting, and enabling impact investment in low-income countries. OPIC, for example, supports impact investment by US investors. In FY2015 OPIC committed $1.9 billion—43 percent of its development finance support—to impact investment projects. OPIC's Portfolio for Impact is a $200 million experimental pilot program that supports selective, small but risky projects with the potential for high impact. Portfolio for Impact facilitates the financing of highly innovative, early stage projects, which are supported with loans between $1 million and $5 million for up to 10 years. Among its investments, Portfolio for Impact supports the Africa-focused microfinance group Participatory Microfinance Group for Africa (PAMIGA), which provides financial access to low-income households, farms, and businesses in rural Sub-Saharan Africa.

Sources: Global Impact Investing Network; OPIC.

V. Atakos/CCAFS

Box 25 – USAID Food and Enterprise Development Program

While half of Liberians earn their income through agriculture, it is often not seen as a business opportunity. But in Liberia, Feed the Future is working to build incentives that help local stakeholders adopt a commercial approach to agriculture. The Liberian Food and Enterprise Development (FED) program, a flagship Feed the Future initiative, embodies a new generation of rural development interventions that operate across value chains. The FED program brings together stakeholders from business, the Liberian government, and civil society to leverage these emerging commerce opportunities by strengthening existing supply chains and building new ones through a multifaceted five-year aid package.

Focusing on youth and on women, FED supports small-scale farmers in adopting productive and profitable technologies, practices, and inputs. But FED also simultaneously trains processors to build small enterprises that add value to agricultural products and assists traders in moving local produce into emerging urban and rural markets. FED has successfully developed chains in Liberia for both lower-value staples like rice and cassava and higher-value goods like vegetables and goats. The idea is to stimulate entrepreneurial activity at mutually synergistic points in the food system so that rural households come to envision food production and marketing as a set of business opportunities to be cultivated and invested in rather than as a set of subsistence practices to simply be maintained. Given the results it has achieved in Liberia, the FED model may have the potential to substantially improve rural livelihood and food security across low-income countries.

Sources: DAI; IFDC.

 Rupak De Chowdhuri/Reuters

For example, in Senegal USAID works with a local enterprise, Son Brahim Fall, that provides harvesting services to rice farmers with equipment leased from a local leasing institution, Locafrique. Feed the Future Senegal and Locafrique developed the equipment leasing program together, and Feed the Future also provides Son Brahim Fall with business counseling and technical support. Partnerships between agencies and local and regional enterprises are an effective strategy, and agencies should prioritize these partnerships. US agencies can play a pivotal role in building SMEs' capacity to meet

US government agencies work with and support local and regional enterprises as a means of extending their development programs, leveraging local knowledge, and supporting the development of businesses along the value chain.

quality and sanitary standards for procurement systems and participate in retail markets and regional exports.

US agencies should put particular emphasis on enterprises led by women entrepreneurs when partnering with and supporting small enterprises. USAID invests in and supports local enterprises with programs such as the Microenterprise and Private Enterprise Promotion program. More than 60 percent of the beneficiaries of this program are women.[98] These kinds of investments by US agencies can play a crucial role in enabling women to participate in supply chains and should be a priority for the United States.

Action 2c. Lead multilateral efforts to spur private-sector investment

The US government should continue to leverage its leadership through multilateral efforts to promote, innovate, and scale responsible and inclusive private-sector investment. The Agriculture Fast Track Fund is an example of such a multilateral effort. The fund was established in 2013 with support from USAID and the Swedish and Danish governments and is managed by the African Development Bank. It spurs greater private investment in agriculture infrastructure projects in Sub-Saharan Africa. Launched at the Grow Africa Investment Forum with initial funds of $23.8 million, the fund provides project preparation grants to countries that are members of the New Alliance for Food Security and Nutrition: Burkina Faso, Cote d'Ivoire, Ethiopia, Ghana, Mozambique, and Tanzania.

Supporting up to $1.5 million per project, the fund finances project design, including feasibility studies, market analyses, site surveys, business plans, financial modeling, and other activities necessary to ensure project quality and bankability. These project preparation grants will ultimately facilitate access to more funding for agriculture infrastructure because banks and other investors require this documentation to issue commercial loans.

USAID should encourage the Agricultural Fast Track Fund to reach additional countries in Sub-Saharan Africa. The US government should also lead efforts to collaborate with other G20 governments and multilateral institutions to facilitate global private-sector investment.

RECOMMENDATION 3

Improve regional trade capacity to build efficient and sustainable food systems across national borders through trade policy

P. Kimeli/CCAFS

If farmers are to feed cities in Africa, Asia, and Latin America, efficient regional trade of agricultural products will be essential. But too often, food staples and perishable goods are delayed at national borders or are barred from crossing entirely.

These barriers to trade prevent small-scale farmers from fully participating in the market for their goods. Such barriers likewise inhibit US companies from making investments in the agriculture and food sector and impede growth of businesses. Even as US food companies build their production capacity in Africa and Asia to meet growing demand for products from urban consumers, their ability to source their products within the region can be impeded or prevented entirely due to the costs of moving food across regional borders.

The expansion of cross-border trade creates opportunities for small-scale farmers to become small commercial growers, moving from informal production to formal value chains and markets where economies of scale can be achieved. When combined with access to information about markets such as the spot price for their crops, increased profitability can fuel a virtuous cycle. Profitability creates incentives for small commercial farmers to maximize production for market and provides the means to invest in quality inputs and care for their soil, further improving productivity.[99]

Farmers and traders must be able to move food staples and perishable foods across borders cheaply, safely, and efficiently. US agribusiness and food companies must be able to work within regional contexts if investment is to be a possibility. The United States must leverage its trade relationships and expertise to facilitate better regional trade.

The United States can build countries' regional trade capacity through its trade policies. Such leadership is already under way through a myriad of efforts. The US Trade Representative (USTR), USDA, and the Department of Commerce all play significant and important roles in US trade policies with low-income countries. USAID operates three regional trade hubs in Africa.[100] And in 2013 the administration launched Trade Africa, a partnership between the United States and Sub-Saharan Africa to increase internal and regional trade within Africa and expand trade and economic ties among Africa, the United States, and other global markets.[101]

But much more must be done. Farmers and traders must be able to move food staples and perishable foods across borders cheaply, safely, and efficiently. US agribusiness and food companies must be able to work within regional contexts if investment is to be a possibility. The United States must leverage its trade relationships and expertise to facilitate better regional trade.

Box 26 – The African Growth and Opportunity Act

The African Growth and Opportunity Act (AGOA) is a preferential trade agreement between the United States and nearly 40 Sub-Saharan countries. Originally passed as part of the Trade and Development Act of 2000, the agreement reinforces African reform efforts, provides improved access to US credit and technical expertise, and establishes a high-level dialogue on trade and investment in the form of a US–Sub-Saharan Africa Trade and Economic Forum.

Renewed in June 2015, AGOA has been extended an additional 10 years. But despite its crucial role for sectors such as natural resources, AGOA does not offer nearly as much benefit to Africa's agricultural sector. Of Africa's $52 billion in food and agriculture exports in 2012, less than 1 percent were destined for the United States. In that same year only 5 percent of the trade facilitated by AGOA was related to agriculture and food.

Following its renewal, Congress took an important step to correct this imbalance with an amendment to AGOA introduced by Senate Agriculture Committee Chairman Pat Roberts (R-KS) and Ranking Member Debbie Stabenow (D-MI). The Roberts-Stabenow amendment expands US technical assistance to businesses that engage women farmers by lifting the cap on the number of countries that can receive trade capacity support and broadening the type of technical assistance available to AGOA countries. The amendment empowers the US president to coordinate within the executive branch on trade capacity-building efforts across federal agencies.

Despite this vast improvement to the legislation, the share of African agricultural exports to the United States could still be increased. From 2001 to 2013 petroleum products accounted for over 80 percent of US imports under AGOA. While the share of nonpetroleum products increased from 9 to 14 percent during the same period, the top three products were machinery and transportation equipment, textiles and apparel, and minerals and resources. Support for export and trade capacity is needed to engage Africa's agricultural sector more significantly in US markets.

SOURCES: GAO; US Department of Commerce; USTR; World Bank; WTO.

 Ollivier Girard/CIFOR

Action 3a. Incentivize and build capacity to improve regional trade of agricultural goods, standardize and improve border crossing procedures, and support efforts to make corruption more difficult

In addition to the physical infrastructure and logistics challenges of moving food across borders, many countries have multiple roadblocks along their internal transportation routes. Research from 2008 on maize prices in Kenya, Tanzania, and Uganda documented four to ten roadblocks between farms and secondary wholesale markets, the equivalent of a stoppage every 30 to 50 kilometers. These stoppages are compounded by the solicitation of bribes at each checkpoint, ranging from US$2.40 to US$16.80.[102] Once

US trade policy can and should promote transparent legal and customs infrastructure and help accelerate regional economic integration.

food arrives at the border, unpredictable costs and long wait times are also common due to bureaucratic delays and regulatory red tape. This can greatly diminish the benefits of investments in roads and other hard infrastructure.

Corruption at the borders is not only costly—it can be dangerous. Hundreds of thousands of Africans cross borders every day to move food from surplus areas to markets where they command higher prices. The majority of these traders are women. They are vulnerable due to long waits in insecure environments and lack knowledge about the fees they may be legally charged. In surveys they report regular occurrence of bribes, confiscated goods, acts of violence, and sexual harassment.[103]

Long delays at the border and redundant inspections that require on- and off-loading of food result in postharvest food loss in the form of spoilage and damage. Further, officials inspecting and testing for health and food safety requirements can be lacking in number and level of professional skill. Inspectors often do not know basic protocols or lack appropriate test equipment. While recent years have seen improvements in regional harmonization rules on grades and standards in many regions, especially in Africa, capacities to enforce agreements still require more support.

US trade policy can and should promote transparent legal and customs infrastructure and help accelerate regional economic integration. US agencies are well equipped to lead capacity-building efforts to enforce existing regulations, improve border crossing procedures, and tackle pervasive corruption.

Action 3b. Encourage regional trade policies that reduce protectionism

Regional trade can often be inhibited by protectionist policies such as export or import restrictions or bans. In 2008 protectionist policies in some Asian countries caused already high food prices to move even higher. But at a regional level such policies occur with some frequency without such attention. While intended to protect national food security, often, poorly designed protectionist policies can have devastating and destruc-

tive consequences, especially for small farmers who lose access to regional market opportunities, and can inadvertently exacerbate food insecurity. These policies are often built upon incomplete information about both domestic and regional food surpluses and deficits.

Regional food balance sheets can help national leaders set trade policies that reflect and account for both national and regional food availability during times of crisis. The United States should encourage national government leaders to adopt and rely on regional food balance sheets when establishing trade policies. Such practices will ensure improved flow of agricultural goods across regional borders, enable small farmers to participate in markets beyond their national borders, and improve emergency relief response efforts, where needed, toward better food security for all.

Action 3c. Establish and designate the position of USDA undersecretary of trade and foreign agricultural affairs

As food systems in emerging economies transform, the opportunities and challenges for US agricultural trade are transforming as well. Growing export markets come alongside increasing complexity as food systems evolve. The Agricultural Act of 2014, more commonly known as the 2014 Farm Bill, directed USDA to submit a proposal on how to reorganize itself to create a new undersecretary who would focus on trade and enhance multiagency departmental coordination in addressing trade issues.[104] Trade issues are currently under the jurisdiction of the undersecretary for farm and foreign agricultural services, and a number of USDA mission areas also have substantial trade components to them. An undersecretary position could enable high-level attention to these issues and facilitate interagency coordination.

The United States should encourage national government leaders to adopt and rely on regional food balance sheets when establishing trade policies.

But the USDA has yet to establish this position. With the creation of the position, the agency was required to report to Congress how the trade functions would be reorganized within 180 days after the signing of the Farm Bill. Implementation of this plan, including establishing the undersecretary position, was required to occur within a year of submission. Yet with over two years since the signature of the bill in February 2014, the USDA has not reported on their reorganization plans.[105] In October 2015 the National Panel of Public Administration released their report to USDA as mandated by Congress, with an assessment of options for the creation of this office. They concluded that "the changing nature of agricultural trade provides a compelling rationale for a reorganization of USDA's trade-related functions and the creation of [an undersecretary] for trade. The panel finds that USDA's organizational structure has become obsolete, and [an undersecretary] position focused on trade issues, by design, will help enable consistent high-level focus and enhanced interagency coordination on trade issues."[106]

The report went on to note: "The panel recommends that the reorganization be implemented after the next president takes office, but emphasizes the need to begin

Viveak Prakash/Reuters

planning for the reorganization now to help ensure a smooth and timely implementation early in the next administration. In addition, the panel recommends formalizing important interagency coordination mechanisms before the transition to minimize disruption from the change in leadership."[107]

Before the end of the current presidential administration, the USDA should submit its report to Congress regarding plans for reorganizing the agency's trade functions to establish the office of a new undersecretary and implement this new position at the beginning of the next administration. Congress, having created this role through the 2014 Farm Bill, supports designating the new undersecretary as the lead coordinator for US government policy on trade and food security.

RECOMMENDATION 4

Strengthen research support and expand the research agenda to build food systems

P. Kimeli/CCAFS

The entire agriculture research enterprise in the United States and around the world needs to focus on solving the future challenges of the global food system. Research and development (R&D) is essential to sparking the innovations and approaches needed for today's growers and food farmers to increase productivity, produce more nutritious food, use fewer resources, reduce food waste, and adapt to climate change. These efforts will help build a sustainable global food system. With strong leadership the world has the ability to prepare the global food system for the coming challenges and help farmers engage in burgeoning urban markets. With unparalleled expertise, historical experience, and leadership potential at its disposal, the United States can and must rise to this challenge.

Action 4a. Increase investment in food and agricultural science research to advance the components of productive, sustainable, and efficient food systems

The United States needs to double investments in agricultural and food research over the next 10 years to help meet food system challenges. Public agencies—such as USDA, the new Foundation for Food and Agricultural Research, and National Science Foundation—the US Congress, and research universities will be game-changing players in increasing the investment in agricultural research and reshaping national priorities. Given the lag time between the research funding and the eventual uptake of technologies, R&D investment decisions need to be taken with a long-term perspective and a funding horizon of at least a decade.

US land grant universities and other public institutions must lead global efforts to advance the research agenda on the key components of improved food systems. Such components include:

- inputs for increased productivity and resilience;
- crops with improved shelf life, especially horticulture products;
- improved transportability of perishable foods;
- improved harvesting and storage technologies, refrigeration/cold storage technologies, and methods to reduce loss and waste on the farm and along the supply chain and improve food safety—such as reduction of aflatoxins and other mycotoxins;
- climate resilience along the value chain;
- soil health and restoration of depleted soils;
- water utilization and conservation technology and innovation, development of low-water-use crops and livestock;
- leapfrog technologies such as solar energy and mobile phones and other information and communications technology that enhance farmers' production, access to markets, and efficiency along the supply chain.

In addition, US land grant universities should take coordinated action to call for the federal funding appropriation levels needed to make these research advancements. Research institutions are best equipped to convey the value of their research findings

Box 27 – Multilateral research institutions

CGIAR Consortium

The CGIAR Consortium is a global partnership that unites organizations engaged in research for a food-secure future. As a consortium of 15 agriculture research centers and nearly 100,000 scientists working in 96 countries, CGIAR researches sustainable agricultural practices, policies, and technologies that support enhanced global food security and poverty alleviation. CGIAR consults with governments, civil society organizations, development agencies, and the private sector to offer robust food security solutions with actionable stakeholder engagement.

Agricultural Model Intercomparison and Improvement Project (AgMIP)

With a focus on improved and sustainable global food security in light of climate change, the US-based Agricultural Model Intercomparison and Improvement Project (AgMIP) works internationally on climate, crop, and economic modeling to develop the next generation of climate impact projections for the agricultural community. AgMIP's projections provide the agriculture sector in LMICs and high-income countries with the information they need to adapt and react to climate change.

Inter-American Institute for Cooperation on Agriculture (IICA)

Founded in 1942, IICA is the specialized agency for the agricultural sector within the Inter-American System. IICA supports its 34 member states' agricultural development and rural well-being. Through capacity-building, improved public policy, and intraregional cooperation, IICA helps reduce hunger and poverty among farmers and rural communities throughout the region. Its technical support aims to help countries achieve four strategic objectives: improve the productivity and competitiveness of the agricultural sector; strengthen agriculture's contribution to rural development and well-being; improve agriculture's capacity to mitigate and adapt to climate change; and improve agriculture's contribution to food security.

Sources: AgMIP; CGIAR; IICA.

 Georgina Smith/CIAT

and should work with their congressional representatives to make the case for research investment.

Stagnation in public-sector investment in research has left a huge deficit in "basic" research, much of which focuses on building knowledge that feeds into future innovations without specific applications in mind. Basic research provides the building blocks for solutions to challenges in the food system. While the private sector has picked up some of the slack in R&D in recent decades, there is no substitute for public-sector research investments. Around 43 percent of private-sector R&D in the United States over the past two decades involved "applied" research in the areas of food processing, beverages, and tobacco, where there is more immediate commercial potential.[108]

Continued investment in multilateral research institutions such as the CGIAR Consortium, the Agricultural Model Intercomparison and Improvement Project

Basic research provides the building blocks for solutions to challenges in the food system. While the private sector has picked up some of the slack in R&D in recent decades, there is no substitute for public-sector research investments.

(AgMIP), and the Inter-American Institute for Cooperation on Agriculture (IICA) is also important. These investments have received bipartisan support in Congress. In 2015 when the Treasury Department announced plans to reduce US funding to CGIAR, Senators Pat Roberts (R-KS) and Debbie Stabenow (R-CA), chair and ranking member of the Senate Agriculture Committee, co-wrote a letter to the secretary urging him not to.

Action 4b. Launch an additional Feed the Future Innovation Lab focused on food system logistics and supply chains

Feed the Future Innovation Labs draw from the expertise of the nation's top research institutions to research, develop, and scale solutions for agricultural development and global food security. The 24 Feed the Future Innovation Labs focus on specific solutions such as climate-resilient strains of staple food crops, better market access for small-scale farmers, aquaculture and fisheries, postharvest loss prevention, and small-sale irrigation.

USAID should establish a new Feed the Future Innovation Lab to focus on food safety, food logistics, and processing. The research should focus on food chain efficiency, delivering safe and nutritious foods for consumers, and increased profits for small-scale farmers.

Action 4c. Invest in the next generation of scientists, entrepreneurs, and leaders

To meet the challenges of the food system, the next generation must be made up of the scientists, farmers, entrepreneurs, and political leaders who are ready and able to find solutions for these challenges. The United States should increase investment in the next generation of agricultural scientists, innovators, and leaders in Africa, Asia, and Latin America. Successful programs such as the Cochran Fellowship Program, the Norman E.

Borlaug International Agricultural Science and Technology Fellowship Program, and the John Ogonowski and Doug Bereuter Farmer-to-Farmer Program should have increased funding to train a greater number of future leaders.

Investments should prioritize programs that invest in women scientists and entrepreneurs. For example, the African Women in Agricultural Research and Development (AWARD) program supports African women agricultural scientists by strengthening their research and leadership skills through mentorship and formal training.[109]

Innovations and new partnerships have broadened the ways in which the United States can support the next generation of expertise needed to advance food security. First, the United States should increase funding for students from Africa, Asia, and Latin America to study agricultural and food science at American universities, which not only improves their skills, but increases long-term ties between the next generation of scientists and entrepreneurs in emerging economies and our own.

Second, the United States should promote and support US partnerships with universities in Africa and Asia. For example, the Innovative Agricultural Research Initiative (iAGRI) is a partnership program between Ohio State University and Sokoine

Investments should prioritize programs that invest in women scientists and entrepreneurs.

University in Tanzania supported by USAID. It aims to strengthen training and collaborative research capacities within Sokoine University and the Tanzanian Ministry of Agriculture, Food Security, and Cooperatives through collaborative research, training, and organizational transformation activities, all with the goal of improving food security and agricultural productivity in Tanzania.[110] These partnerships can increase the amount of in-country expertise at low cost.

Third, the US government should support university-led and private-sector efforts to scale Open CourseWare (OCW), particularly in disciplines needed to address the challenges outlined in this report. OCW, also known as Massive Open Online Classes, are lessons created by universities that are published free via the Internet. Numerous US universities now have OCW platforms in place. For example, MIT's OCW publishes virtually all MIT course content and is available worldwide. Similarly, private companies like Coursera also offer aggregated course offerings across multiple universities. Scaling up particular agriculture, supply chain, and other coursework and ensuring their availability in low-income countries would greatly contribute to training the next generation, potentially at a very low cost.

Box 28 – Feed the Future Innovation Labs

Applied Wheat Genomics Innovation Lab
Kansas State University

Aquaculture and 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

Livestock Systems Innovation Lab
University of Florida

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

Source: USAID.

Ajay Verma/Reuters

Conclusion

The world is at a critical inflection point. By 2050 the world's population will reach 9 billion, two-thirds of whom will live in cities. This seismic demographic shift puts enormous pressure on emerging food systems to meet this demand, even in the midst of the ongoing challenges of a changing climate, the growing triple burden of malnutrition, and global population growth that will require increases of 50 to 60 percent in agricultural production to meet global demand.

But feeding cities presents a major opportunity to improve the plight of millions of small-scale farmers and rural residents trapped in subsistence agriculture and joblessness as well as a major market opportunity for the private sector. Up to 90 percent of the food consumed in LMICs is produced domestically, much of the time by small-scale farmers. Farmers also comprise the vast majority of the people living in extreme poverty around the world. Urbanization offers an opportunity for farmers and rural entrepreneurs to improve their lot by supplying cities as long as rapid transformation does not leave them behind.

The years that will pass from now until 2050 will test the world's collective ability to rise to this monumental task. Feeding the world's cities will require all of the of innovation that can be collectively summoned, coordinated effort across the public and private sectors, and sustained investment—even when food price spikes or catastrophic weather events fail to remind us of the urgency of the challenge. History has shown that inspiring global action by example is where the United States shines, and the nation is well placed to lead.

Since the 2008 global food price crisis, Feed the Future has emerged as a model for what the strength and collective wisdom, generosity, creativity, and commitment of the American people can do. In partnership with host governments, civil society, and

the private sector, Feed the Future countries are seeing progress. Food productivity is increasing in many countries, with visible reductions in poverty and improvements in health and nutritional status mirroring that shift. In this same period, other bilateral donors have also been re-energized to fund agriculture, nutrition, and food security programs, often following or joining US announcements of support with their own. Many national governments have also substantially increased their funding for agriculture and nutrition programs.

But history has also shown that it is far too easy to lose focus or shift priorities. During the 1960s and 1970s, agriculture enjoyed strong support globally. But in the 1980s interest in other sectors prompted the steady decline of agriculture funding until the early 2000s, and the impact of this decline reverberated worldwide with the global food price crisis in 2008. The United States must continue to press forward and show visionary leadership to avert future crises.

Small-scale agricultural development is proven to be more than twice as effective at reducing poverty than development investments in other sectors. It is essential that the global community stays committed to ensuring that today's small-scale farmers and rural economies are included in and benefit from the transformation of food systems. If not, the world may face large populations of urban poor struggling to feed themselves, while pockets of small-scale farmers remain locked in subsistence.

The United States and the global community must act because the health, productivity, and well-being of swelling urban populations and the rural economies that will feed them matters for the United States' own food, economic, and national security. And the United States is poised to lead. Feed the Future has built a strong foundation upon which progress can be consolidated and scaled. While development aid for agriculture is higher now than in 2008, it is still far below the levels seen in the early 1980s. Funding must be increased, or at a minimum, maintained in coming years.

The United States can further leverage its development agenda by encouraging other bilateral donors and national governments to stay the course and support priorities such as agricultural research and training for the next generation of leaders and invest in the infrastructure that enables their farmers to feed cities. Equally promising, US companies, investors, and innovators are gearing up to meet the global food security challenge, and the US government can and should align with them even more in the coming years to achieve global food security.

Ultimately, leadership in the US administration and Congress is vital to bringing people and nations together to confront this task of feeding the world's growing cities. The recommendations in this report aim to assist the United States in reaching for new heights in the fight for global food security.

About the Principal Author

Thomas Reardon has been professor of agricultural, food, and resource economics at Michigan State University (MSU) since 1992 and at the International Food Policy Research Institute (IFPRI) since receiving his PhD at UC Berkeley in 1984. From 2012 to 2014 Reardon was also a 1,000 Talents Program Scholar at Renmin University in Beijing. From 2007 to 2011 he was resident in New Delhi in a joint program with the IFPRI South Asia Office. Reardon is a global leader on research on urbanization, diet change, and transformation of agrifood value chains, including the rapid rise of supermarkets; modern processing, wholesale, and logistics companies and their effect on food security; agricultural technology intensification (he coined the term "sustainable intensification" in 1995); and rural nonfarm employment. Most recently he has become a leader in a new wave of research on developing country food system transformation, this time on the "Quiet Revolution" in food supply chains in Asia and Africa, emphasizing the rapid development of small- and medium-sized enterprises (SMEs) along rural-urban food value chains. He has 12 years of experience in Asia, 10 in Latin America, and 13 in Africa, with 19 years of in-country residence on these continents. He is listed in *Who's Who in Economics,* is a fellow of the Agricultural and Applied Economics Association (AAEA, formerly called American Association of Agricultural Economics), has over 20,000 citations in Google Scholar, was a personal invitee of the World Economic Forum in Davos, and was featured on the front page of *The New York Times* and in the UK Parliament. He has been a featured speaker at agribusiness and food industry conferences and conventions in a number of countries, including the US-based Produce Marketing Association.

About the Chicago Council on Global Affairs

The Chicago Council on Global Affairs is an independent, nonpartisan organization that provides insight—and influences the public discourse—on critical global issues. We convene leading global voices and conduct independent research to bring clarity and offer solutions to challenges and opportunities across the globe. Ranked the #1 Think Tank to Watch worldwide, the Council on Global Affairs is committed to engaging the public and raising global awareness of issues that transcend borders and transform how people, business, and governments engage the world. Learn more at thechicagocouncil.org and follow @ChicagoCouncil.

The Global Food and Agriculture Program, launched in 2008 and expanded in 2010, aims to build support and provide 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 program is led by Douglas Bereuter, president emeritus of The Asia Foundation, and Dan Glickman, former secretary of US Department of Agriculture, and is overseen by an advisory group comprised of leaders from the government, business, civic, academic, and NGO sectors. For further information, please visit thechicagocouncil.org/globalagdevelopment.

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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. He 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 both 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 also serves on the boards of the Arbor Day Foundation and the Nebraska Community Foundation.

Dan Glickman

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Dan Glickman is a cochair of the Council's Global Food and Agriculture Program. 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. He chairs the Foundation for Food and Agriculture Research, created in the 2014 Farm Bill to fund new and innovative research projects in the areas of food and agriculture. Prior to joining the Aspen Institute, 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 very 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

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 George Washington University. He is a member of the Kansas and District of Columbia bars.

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Catherine Bertini is a distinguished 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 also 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). Ms. Bertini also chaired the UN System Standing Committee on Nutrition. 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.

Ms. Bertini is the 2003 World Food Prize Laureate. She was a presidential appointee to the Board for International Food and Agricultural Development and is a Stuart Family Foundation board member. She is a board member of the Tupperware Brands Corporation and on the Leadership Council for IFPRI's Compact 2025.

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 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 Food and Agriculture Program, 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. He 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. Dr. Bouton speaks and writes on India, Asia and US-Asia relations.

Dr. Bouton came to the Council from the 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

Lecturer in International and Public Affairs, Columbia University

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 distributes over $100 million annually to strengthen 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. For his work he received 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 partnerships strategy.

Mr. Buffett earned his BA from Northwestern University and his MPA in advanced management and finance from Columbia University. He is a term member of the Council on Foreign Relations and serves on corporate advisory boards for Toyota Motor North America Inc. and FarmLink Inc. Mr. Buffett coauthored *The New York Times* best-selling book *40 Chances: Finding Hope in a Hungry World,* which examines global hunger and food systems challenges from around the world. He is from Omaha, Nebraska, where he and his father operate their conservation-based family farm.

John Carlin

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Former Governor, Kansas

John Carlin is currently a visiting professor/executive in resident at Kansas State University in the School for Leadership Studies, where he has taught executive leadership and practical politics since 2005. During this period he also served as member, then chair of the Kansas Bioscience Authority. This authority was created in 2004 for the purpose of advancing the biosciences in Kansas. Mr. Carlin also chaired the Pew Trust Commission on Industrial Farm Animal Production. The commission's final report was issued in 2008, and it continues to help inform policymakers in Washington on key issues facing agriculture and our food supply. Mr. Carlin served 10 years as archivist of the United States after 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. 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 degree in dairy husbandry from Kansas State University.

Jason Clay

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Jason Clay is senior vice president of markets and executive director of the Markets Institute for the World Wildlife Fund (WWF). His focus is on spotting global issues and trends that affect WWF's conservation mission and strategies, with a particular focus on soft commodities, e.g., agriculture (plant-based and livestock), seafood (aquaculture and wild caught), 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 35 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 co-creating Rainforest Crunch and more than 200 other products with combined retail sales of $100 million. Since then he has co-convened (with the IFC and others) multistakeholder roundtables of producers, investors, buyers, researchers, and NGOs to identify and reduce the social and environmental impacts of such products as salmon, soy, sugarcane, cotton, and tilapia. Dr. Clay created WWF's aquaculture, agriculture, and livestock strategies and built that work out globally. He created WWF's Market Transformation program to work with private-sector companies to improve their supply chain management. He also pioneered precompetitive approaches in WWF and beyond to convince companies to work together to address sustainability issues.

Dr. Clay is the author of more than 20 books, 500 articles and 1,000 invited presentations. He was the first ever National Geographic Food and Agriculture Fellow. In 2012, he won the James Beard Award for his work on global food sustainability. 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

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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.

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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 Food and Agriculture Program, 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 UN Secretary General Ban Ki Moon to the first UN Scientific Advisory Board.

Cutberto Garza

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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 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, Institute of Medicine's (IOM) Food and Nutrition Board, and the National Research Council's Board on International Scientific Organizations. He is a member of the National Academy of Medicine and the recipient of the Alan Shawn Feinstein World Hunger Prize for Education and Research, awarded by Brown University in 1996. He delivered the first Found-

ers' 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 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.

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 nonprofit that is developing innovative and sustainable collaborations for 21st century agriculture. He serves on several boards and committees, including the Ag Advisory Committee for the AGree Initiative; the Board on Agriculture and Natural Resources, a policy arm of the National Academy of Sciences' Natural Resource Council; American Farmland Trust board member; Farm Foundation Round Table member; Western Growers Association board member and former chair. Mr. Kawamura serves on the boards of the Delta Vision Foundation and the Southern California Water Committee. 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, receiving a doctorate in agricultural economics in 1988, 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.

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.

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. Dr. 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 (HIID) and a lecturer on economics and public policy. He is author of *The Great Surge: The Ascent of the Developing World, 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 as 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 & CEO, 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 10,000 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 Agency for International Development (USAID), working on behalf of children in emergency situations and conflict zones. Since production began in March 2010, Edesia has reached over 4 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.

Barbara A. Schaal

Dean of the Faculty of Arts & Sciences, Mary-Dell Chilton Distinguished Professor, Washington University in St. Louis

Barbara Schaal is the Mary-Dell Chilton Distinguished Professor in Arts and Sciences and dean of the Faculty of Arts & Sciences at Washington University. She is a plant evolutionary biologist who uses DNA sequences and genomics to understand evolutionary processes such as gene flow, geographical differentiation, and the domestication of crop species. Her most recent work focuses on the evolutionary genomics of rice.

Dr. Schaal graduated from the University of Illinois, Chicago, with a degree in biology and received a PhD from Yale University. She was on the faculty of the University of Houston and Ohio State University before joining Washington University in 1980, where she has served as chair of the biology department. She has been president of the Botanical Society of America and president of the Society for the Study of Evolution. She was the vice president of the US National Academy of Sciences from 2005 to 2013. She received a Guggenheim Fellowship, the Wilbur Cross Medal from Yale University, the Key award from the American Genetics Association, an honorary degree from the University of Illinois, and is an elected member of the US National Academy of Sciences and the American Academy of Arts and Sciences. She was selected in 2012 by then secretary of state Hillary Clinton as the US science ambassador to Latin America. She currently serves on President Obama's Council of Advisors for Science and Technology

(PCAST) and is president of the American Association for the Advancement of Science (AAAS), the publisher of *Science Magazine*.

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 Agriculture Decision Board and he is a member of the DuPont Operating Team. Mr. Schickler is a graduate of Drake University, where he received bachelor of science and master of arts degrees in business administration. He currently serves on the Chicago Council on Global Affairs board of directors, the Chicago Council's Global Food and Agriculture Program advisory group, the Greater Des Moines Partnership board of directors, the Grand View University board of directors, 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, and Meals from the Heartland.

Lindiwe Majele Sibanda

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

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. She has served as trustee and adviser to numerous international food security-related initiatives and institutions. Currently, she is a serving member of the United Nations (UN) Committee for Policy Development (CPD), a subsidiary body of the Economic and Social Council Committee (ECOSOC). She is a member of the African Union Commission (AUC) Leadership Council representing African civil society organizations.

Robert L. Thompson

Professor Emeritus, University of Illinois

Robert L. Thompson is professor emeritus at the University of Illinois at Urbana-Champaign, where he held the Gardner Endowed Chair in Agricultural Policy. He is also senior fellow at the Chicago Council on Global Affairs and chairman emeritus of the International Food and Agricultural Trade Policy Council. From 2011 to 2015 he was a visiting

scholar at Johns Hopkins University's School of Advanced International Studies. 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 1987), and senior staff economist for food and agriculture at the President's Council of Economic Advisers (1983 to 1985).

Dr. 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 (2005-2010)
United States Secretary of Agriculture (2001-2005)

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 the US secretary of agriculture from 2001 to 2005. 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 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), Veneman directed one of the 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 the 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 Veneman advanced an expanded trade agenda, food protection, progressive farm policy, responsible forest policy, and stronger nutrition programs.

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.

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 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, 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 Council's Global Food and Agriculture Program, 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, Veneman has practiced law in both California and in Washington, DC. Early in her career she was a deputy public defender. Veneman 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 juris doctor 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

Chief Health Officer, The Vitality Group

Derek Yach has focused his career on advancing global health. He is chief health officer of the Vitality Group, part of Discovery Holdings Ltd. 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 at 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 250 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, and the Wellcome Trust. 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 — Agricultural Model Intercomparison and Improvement Project

AGOA — African Growth and Opportunity Act

APHIS — Animal and Plant Health Inspection Service

AWARD — African Women in Agricultural Research and Development

COMESA — Common Market for Eastern & Southern Africa

CDC — Centers for Disease Control and Prevention

CIAFS — USAID's Capacity to Improve Agriculture and Food Security

COP21 — 2015 United Nations Climate Change Conference

DCA — Development Credit Authority

DFID — UK Department for International Development

ECOWAS – Economic Community of West African States

FAO — Food and Agriculture Organization of the United Nations

FDA — Food and Drug Administration

FDI – Foreign Direct Investment

FED- Food and Enterprise Development Program

iAGRI — Innovative Agricultural Research Initiative

IICA — Inter-American Institute for Cooperation and Agriculture

MAFAP — Monitoring and Analyzing Food and Agricultural Policies

MCC — Millennium Challenge Corporation

NCD — Non-Communicable Disease

NGO — Nongovernmental Organization

LIFT — Livelihoods and Food Security Trust Fund

LMICs— Low- and Middle-Income Countries

OCW — Open CourseWare

OPIC — Overseas Private Investment Corporation

PAMIGA — Participatory Microfinance Group for Africa

PEPFAR — President's Emergency Plan for AIDS Relief

R&D — Research and Development

SDGs — Sustainable Development Goals

SMEs — Small- and Medium-Sized Enterprises

UHT — Ultra-High Temperature Processing

USAID — United States Agency for International Development

USDA — United States Department of Agriculture

USTR — United States Trade Representative

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