2013 GLOBAL FOOD POLICY REPORT

IFPRI

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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The International Food Policy Research Institute (IFPRI), established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. The Institute conducts research, communicates results, optimizes partnerships, and builds capacity to ensure sustainable food production, promote healthy food systems, improve markets and trade, transform agriculture, build resilience, and strengthen institutions and governance. Gender is considered in all of the Institute's work. IFPRI collaborates with partners around the world, including development implementers, public institutions, the private sector, and farmers' organizations.

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A Peer-Reviewed Publication

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ISBN 978-0-89629-562-9
DOI: 10.2499/9780896295629

Cataloging-in-Publication Data is available from the Library of Congress

PHOTO CREDITS

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Preface

This *2013 Global Food Policy Report* is the third in an annual series that provides an in-depth look at major food policy developments and events. Initiated in response to resurgent interest in food and nutrition security, the series offers a yearly overview of the food policy developments that have contributed to or hindered progress in achieving food and nutrition security. It reviews what happened in food policy and why, examines key challenges and opportunities, shares new evidence and knowledge, and highlights emerging issues.

In 2013, staple food prices were relatively stable, lacking the spikes that often dominated headlines in previous years. But prices of important dietary components, such as vegetables and fruits and nutrient-intensive crops, increased and fluctuated in many countries, particularly China and India. Nutrition captured the international spotlight in an unprecedented way. For instance, the high-level Nutrition for Growth summit in June resulted in commitments of US$4.15 billion to tackle global undernutrition, the New Alliance for Food Security and Nutrition and the Scaling Up Nutrition Movement both gained momentum, and India passed major food security legislation.

Yet the world continues to face serious hunger and undernutrition challenges: one in eight people around the world suffers from hunger, and more than double that number are victims of hidden hunger (deficiencies in essential micronutrients). With the Millennium Development Goals set to conclude in 2015, the global community is already working to define future efforts to eradicate hunger and undernutrition under a post-2015 agenda.

The anchor of this new agenda is the formulation of sustainable development goals. Extending beyond traditional investments in increasing food production, this new agenda should embrace a comprehensive, long-term approach that promotes increased agricultural productivity for all farmers, links smallholder farmers' production to markets, and ensures that their products are safe and nutritious. It is important that the post-2015 development agenda does not pursue environmental sustainability goals at the expense of the well-being of poor and hungry people. Based on the successful experiences of several developing countries, we see the clear potential for ending hunger and undernutrition by 2025 if the necessary policies and investments are adopted. Among other things, reaching this goal will require a more inclusive global partnership, one that includes regional and country levels and spans government, civil society, and the private sector. Eliminating hunger and undernutrition sustainably by 2025 will be challenging, but it is doable.

The topics covered in the *2013 Global Food Policy Report* were selected following a number of consultations designed to capture the depth, relevance, and breadth of food policy issues in 2013. For inclusion in the report, a topic had to represent a new development in a food policy issue, or a new way of looking at it; it had to be international in scope (by affecting several countries or stakeholders); and high-quality research results or expert judgment had to be available to allow for authoritative and evidence-based discussion of the topic. To add perspectives and deepen discussion, we supplemented chapters with shorter contributions from experts and stakeholders.

I hope that this report is met with interest, informs stakeholders and decisionmakers the world over, helps set the food policy research agenda for 2014 and beyond, and contributes to improving food policies so they benefit the world's poorest and most vulnerable people. I welcome your feedback, comments, and suggestions at ifpri@cgiar.org.

SHENGGEN FAN
Director General

Acknowledgments

The *2013 Global Food Policy Report* was prepared under the overall leadership of Shenggen Fan and a core team comprising Rajul Pandya-Lorch, Gwendolyn Stansbury, Alexander J. Stein, and Klaus von Grebmer. The report greatly benefited from the strategic insights of IFPRI's Board of Trustees and members of the IFPRI 2020 and Strategic Advisory Council.

Text and data contributions were made by Yemi Akinbamijo, Kamiljon Akramov, Perrihan Al-Riffai, Suresh Babu, Ousmane Badiane, Nienke Beintema, Lars Bergström, Clemens Breisinger, Nicola Cenacchi, Kevin Chen, Noah Cohen-Cline, Julia Collins, Cindy Cox, Kristin Davis, Eugenio Díaz-Bonilla, Mariella Di Ciommo, Paul Dorosh, Olivier Ecker, Shenggen Fan, Myles Fisher, Carsten Friedland, Karen Garrett, Haris Gazdar, Sinafikeh Gemessa, Stuart Gillespie, Daniel Gilligan, Lawrence Haddad, Melissa Hidrobo, John Hoddinott, P. K. Joshi, Holger Kirchmann, Avinash Kishore, Jawoo Koo, Nancy E. Lindborg, Tsitsi Makombe, Amy Margolies, Edith Mkawa, David Nabarro, Latha Nagarajan, Alejandro Nin-Pratt, Tolulope Olofinbiyi, Felix Pensulo Phiri, Nicostrato Perez, Paul Polman, Carl E. Pray, Claudia Ringler, Richard Robertson, Mark Rosegrant, Shalini Roy, Marie Ruel, Maurice Saade, Nidhi S. Sabharwal, Benjamin Schwab, David J. Spielman, Gert-Jan Stads, Alexander J. Stein, Sukhadeo Thorat, Peter Timmer, Maximo Torero, Klaus von Grebmer, Bingxin Yu, and Francis Bruno Zotor.

Production of the report was led by IFPRI's Publications Unit under the guidance of Andrea Pedolsky; the overall production of the report was made possible through the dedicated work of Patricia Fowlkes, Heidi Fritschel, Corinne Garber, Michael Go, Andrew Marble, Lucy McCoy, David Popham, Julia Vivalo, and John Whitehead. In addition, Chapter 1, which draws partially on other chapters in this book, benefited from research and writing assistance from Joanna Brzeska and Heidi Fritschel. Tolulope Olofinbiyi and Sinafikeh Gemessa contributed to the writing of Chapter 2. The report benefited from a thorough review by IFPRI's Publications Review Committee, chaired by Gershon Feder, as well as from the anonymous external scholars and experts who peer-reviewed the research and provided insightful comments on the preliminary drafts.

FOOD POLICY IN 2013

Nutrition Grabs the Spotlight as Hunger Persists

Shenggen Fan

SUMMARY The challenge of ensuring future food and nutrition security received widespread attention in 2013. This chapter describes discussions on the direction of the global development agenda as the world approaches the 2015 deadline of the Millennium Development Goals and reviews major 2013 food policy events and decisions around the world.

The world has arrived at a critical crossroads in the effort to promote food and nutrition security. The year 2014 will be a crucial period and a last chance for working to achieve the Millennium Development Goals, which conclude in 2015. But 2014 will also define future efforts to eradicate hunger and undernutrition as the process to cement the post-2015 agenda moves into full swing. This global debate is happening in a rapidly changing geopolitical and environmental landscape that makes it difficult to plan based solely on past experience. In addition to traditional development donors, the center of gravity of food- and nutrition-security decisionmaking is shifting toward new actors on the global and country-level development stage: for example, food and nutrition policies in a handful of developing countries, such as China and India, and actions by the private sector have increasing potential to affect global food and nutrition security.

Volatile food prices have often dominated headlines in recent years, but 2013 was relatively stable, with no spikes in global food prices. According to the food price index of the Food and Agriculture Organization of the United Nations (FAO), the average annual price of food in 2013 was at its lowest level in three years. IFPRI's early warning system for excessive food price variability shows that prices of basic staples, such as maize, rice, and wheat, have exhibited minimal volatility during the past 450–650 days.[1] This is no cause for complacency, however, because many fundamental factors behind the 2008 crisis—including strong demand for biofuels, extreme weather events, and panicky trade behaviors—are still present or have the potential to reemerge. Moreover, global food price indicators do not always reflect country-level

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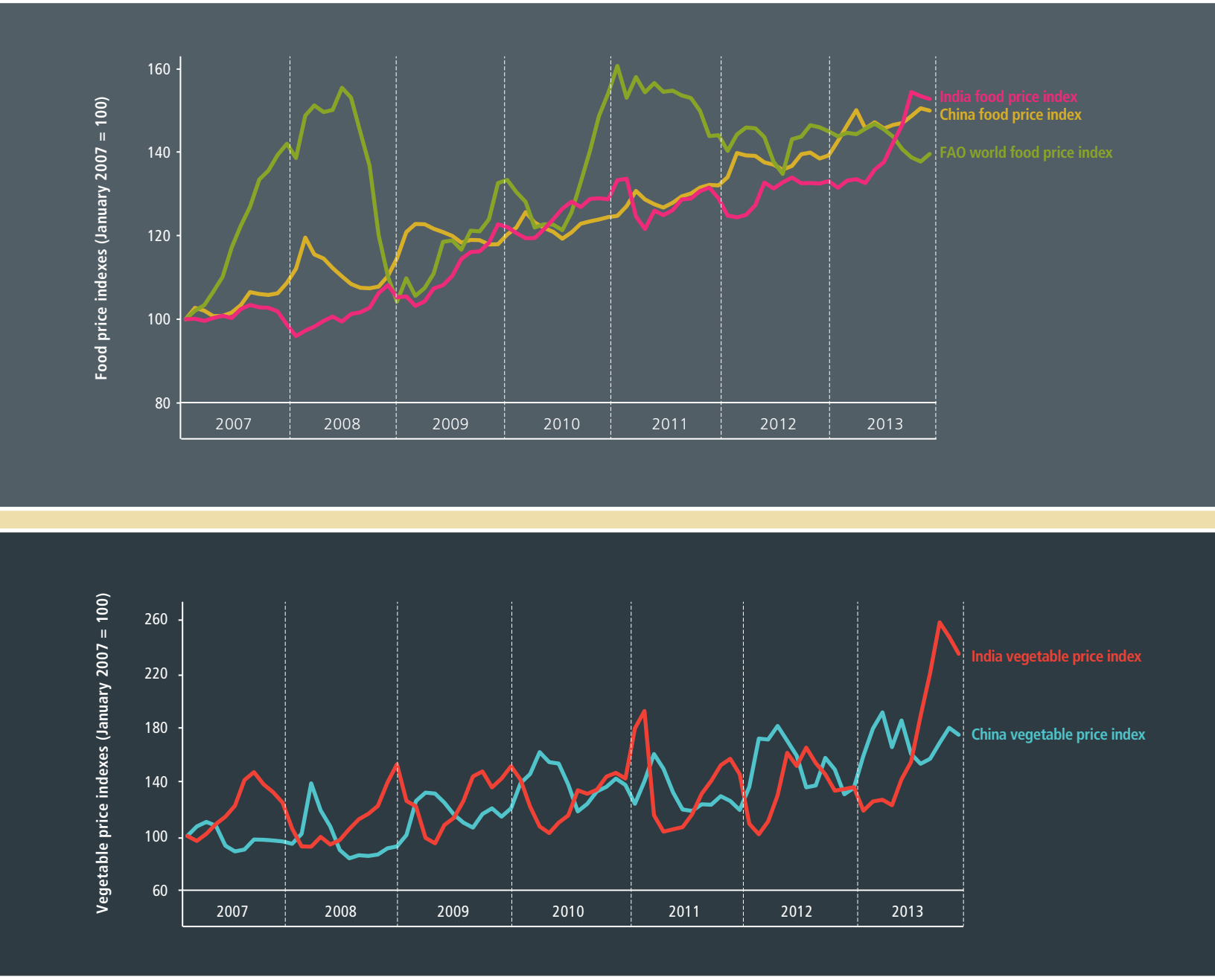
FIGURE 1 FOOD PRICES IN CHINA, INDIA, AND THE WORLD, 2007–2013



Sources: Real FAO global food price index is from FAO, Food Price Index, www.fao.org/worldfoodsituation/foodpricesindex/en/. Nominal China food price index and China vegetable price index are from National Bureau of Statistics China. Nominal India food price index and India vegetable price index are from India, Ministry of Commerce and Industry, Office of the Economic Adviser, www.eaindustry.nic.in/. Additional data were obtained through Kevin Chen (IFPRI), Yumei Zhang (Chinese Academy of Agricultural Sciences), and Devesh Roy (IFPRI).

Notes: FAO = Food and Agriculture Organization of the United Nations. Price indexes are adjusted for inflation. Figures are consumer price indexes for China and wholesale price indexes for India. For China, the industrial producer price index (from China's National Bureau of Statistics, through Kevin Chen and Yumei Zhang) was used to convert nominal prices to real prices. For India, the manufactured products price index (from the Office of the Economic Adviser to the Government of India, Ministry of Commerce and Industry; www.eaindustry.nic.in/) was used to convert nominal prices to real prices.

realities. For example, in China and India, where a large share of the world's poor and undernourished people live, food prices rose significantly in 2013, especially for high-nutrient foods such as vegetables (Figure 1).

The world continues to face serious challenges of hunger and undernutrition. The number of chronically hungry people gradually declined from almost 1 billion three decades ago to 842 million in 2013, according to recent estimates by FAO.[2] This means that about one in eight people in the world suffers from hunger today. The problem is especially urgent in South Asia and Africa south of the Sahara, which together are home to almost two-thirds of the world's hungry people. At the same time, more than 2 billion people are affected by hidden hunger—that is, deficiencies in essential micronutrients, such as iron, vitamin A, and zinc.

Hunger and undernutrition[3] can be eliminated sustainably by 2025. But to achieve this goal, governments and donors must devote sufficient resources and implement appropriate policies and investments. This aspirational target is an immense, but not insurmountable, challenge. Evidence from countries such as Brazil, China, Thailand, and Vietnam, which have substantially reduced hunger and undernutrition, suggests that it is realistic to strive for this goal by accelerating the pace of progress (see Chapter 2). Given the detrimental consequences of hunger and undernutrition for human development and for economic growth, their elimination needs to be made a top priority.

Within this context, the *2013 Global Food Policy Report* aims to provide insight into the major developments in food policy during 2013 and their implications for future food and nutrition security. This chapter is an overview of these developments, with special attention to the debate surrounding the post-2015 agenda as it applies to food and nutrition security. This overview also provides recommendations for the agenda that can effectively address challenges to food and nutrition security.

SUSTAINABLE DEVELOPMENT GOALS AND THE POST-2015 AGENDA

The Millennium Development Goals (MDGs) have served as an effective call to action for the international community to come together around a set of common objectives; as such, they have influenced political discourse and helped frame development issues. Several MDG targets have already been met at the global level or are within close reach, including halving poverty, increasing access to improved drinking water, and reducing the incidence of malaria and tuberculosis. However, significant concerns remain about the unevenness of achievements in the MDGs across targets and regions,[4] as highlighted during a 2013 special session of the UN General Assembly on progress toward the MDGs.[5] Progress has stalled or is lacking with regard to addressing hunger; child mortality; and access to primary education, reproductive healthcare, and sanitation. The goals themselves have also been criticized from several angles. Given the MDGs' focus on achieving certain development outcomes, an important criticism has been their lack of mechanisms for tracking inputs and ensuring accountability, as well as the lack of a theory of change linking drivers with outcomes.[6] At the same time, whereas some critics deemed the MDGs too ambitious, others claimed the goals were not ambitious enough. When all is said and done, even if we achieve all of the intended targets under the MDGs, the world will still be home to millions of people facing poverty, hunger, disease, lack of education, and other challenges, which is why the next set of goals must achieve more in a shorter timeframe.

A Broader Agenda

Building on the foundations established by the 2012 UN Conference on Sustainable Development in Rio de Janeiro, attention is now shifting toward the development of sustainable development goals (SDGs) as an anchor for the post-2015 development agenda.[7] The push for SDGs is grounded in a recognition of the interdependence among social, economic, and environmental outcomes. Current discussions on the post-2015

agenda emphasize the need to expand beyond the MDGs by incorporating climate change, urbanization, conflict, and sustainable consumption and production patterns into the development framework. This approach is particularly relevant for food and nutrition security, given the many synergies between achieving environmental sustainability and food and nutrition security—each is critical to achieve the other. Increased food production must be achieved by increasing yields while using fewer resources, such as land and water, and minimizing or reversing negative environmental impacts.

A vital step is to provide agricultural producers with a favorable policy environment that will make agricultural growth more sustainable.

One approach to increasing sustainable growth in agricultural productivity is known as sustainable agricultural intensification (see Chapter 4). This approach has played a central role in the agricultural debate surrounding the post-2015 development agenda, with significant emphasis placed on the need to make current food production systems more efficient. However, sustainable growth in agricultural productivity often requires transformative and possibly radical interventions along different segments of the food chain, including changes by both producers and consumers.[8] A vital step is to provide agricultural producers with a favorable policy environment that will make agricultural growth more sustainable, including the reversal of water and energy subsidies that encourage unsustainable resource use. Equally important is encouraging farmers to apply specific agricultural technologies that increase agricultural productivity and enhance environmental sustainability. Large-scale adoption of these technologies should lead to increased food production, reduced food prices, and improved food security.

The Search for Consensus

Work on the post-2015 agenda is well under way along several interrelated tracks, with a number of high-level meetings, consultations, and reports produced in 2013. Food- and nutrition-security issues have received significant attention at several forums. As part of the broad-based consultation process that was launched around the post-2015 agenda, the High Level Consultation on Hunger, Food Security, and Nutrition[9] presented food and nutrition security as a basic human right that can be achieved within a generation. Participants emphasized the need for development efforts that focus on sustainable and resilient food production and consumption patterns, reduced postharvest losses and food waste, and improved agricultural productivity among smallholders, especially women farmers.[10] The results of this consultation were channeled into the report "A Million Voices: The World We Want," which is the United Nations Development Group's synthesis report of the 11 global thematic consultations and public surveys that have thus far engaged approximately 1.3 million people.

One of the eight sessions of the newly launched Open Working Group on Sustainable Development Goals (made up of 30 member states of the UN General Assembly) also addressed food security, nutrition, and sustainable agriculture issues (as well as desertification, land degradation, drought, water, and sanitation).[11] During this meeting, participants highlighted the importance—and difficulty—of designing goals that reflect the multidimensionality of food and nutrition, including the linkages among food, land, and water resources. In 2014, the Open Working Group will use these deliberations as inputs into the sustainable development goals it proposes to the 68th session of the UN General Assembly for consideration and action.

In the same vein, two prominent reports released in 2013 contained preliminary visions for the post-2015 agenda: one by the UN Secretary-General's High-Level Panel of Eminent Persons on the Post-2015 Development Agenda and the other by the Sustainable Development Solutions Network, a global network of research centers, universities, and technical institutions. Both reports

emphasize a vision for sustainable development that revolves around four dimensions: economic development, social inclusion, environmental sustainability, and good governance.[12] The proposed goals—for both developed and developing countries—include targets pertaining to climate change, governance, land and water management, health, and more sustainable and equitable urbanization. The High-Level Panel proposes a standalone goal for food security and nutrition security and includes indicators related to stunting, anemia, agricultural productivity, and postharvest losses. The Sustainable Development Solutions Network proposal gives hunger a lower profile by situating it under the poverty goal, and it includes more general targets related to improving food security, promoting good nutrition, and ending child stunting. The report also proposes another goal to improve agricultural systems and raise rural prosperity.

These divergent views on agriculture, food, and nutrition goals in the post-2015 framework show that despite good information for debate, we are still far from consensus on a final decision. The proposal of the High-Level Panel, for example, left about half of its targets blank. Many questions remain regarding what should be included as goals, what kind of targets should be set, and how they can be measured. For example, postharvest food losses are particularly difficult to measure accurately. In addition, during the two-day European Development Days 2013, discussions among European development practitioners and their partners centered on building a vision for the post-2015 agenda. In the high-level closing panel, the participants emphasized the need for an international development agenda that addresses "unfinished business" with a clear link to national and individual interests and that finds the optimal balance of goals that are neither too ambitious nor too modest.

GLOBAL DEVELOPMENTS IN 2013

The intensive debate on the future direction of the global development agenda comes at the same time as a great push for policies related to food and nutrition across different global platforms. Politicians are finally taking undernutrition seriously as a major development challenge. One of the most notable initiatives was the June 2013 high-level Nutrition for Growth summit, which brought together representatives from developed and developing countries, the private sector, civil society, and scientific organizations in the lead up to the Group of Eight (G8) Summit in Northern Ireland. The resulting Global Nutrition for Growth Compact made new commitments of US$4.15 billion to tackle global undernutrition and promote nutrition-sensitive investments between now and 2020.

Politicians are finally taking undernutrition seriously as a major development challenge.

The Nutrition for Growth summit was also a follow-up to the New Alliance for Food Security and Nutrition, which was launched at the 2012 G8 Summit to strengthen the global commitment to food and nutrition security. As a joint initiative of African leaders, the private sector, and the G8 countries, the New Alliance is designed to bring these groups together to mobilize private investments and align aid to recipient countries for agricultural and rural development and food and nutrition security. In 2013, the New Alliance expanded its reach with the membership of Benin, Malawi, Nigeria, and Senegal, which joined existing members Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Mozambique, and Tanzania. Participation in the New Alliance reflects stakeholders' commitment to mobilize private investment in agricultural development and food and nutrition security and to encourage innovation for sustainable development of the agricultural sector.

At the same time, the Scaling Up Nutrition (SUN) Movement has increased its momentum to help developing countries prioritize nutrition-related commitments and integrate these commitments into programs. As of December 2013, the number of member countries stood at 45 (up from 33 in December 2012). During the 68th UN General Assembly in September 2013, representatives from most SUN member countries and networks (including stakeholders from governments, the

private sector, and multilateral organizations) came together for the Global Gathering of the SUN Movement. This event provided a platform for stakeholders to share news about progress and challenges. Participants noted increased political will and institutional arrangements for aligning nutrition-related policies and legal frameworks and mobilizing partners, capacity, and resources. Emphasis was also placed on the challenges facing multisectoral efforts to design and implement policies for nutrition. Such events are important tools for sharing best practices and challenges.

Food security in developing countries emerged as a thorny topic in global trade negotiations at the end of 2013.

These meetings and discussions have been supported by the release of numerous background papers and reports. In particular, the release of the most recent *Lancet* series of papers on maternal and child nutrition helped put the spotlight on the importance of nutrition for broader development outcomes in 2013.[13] Building on *The Lancet*'s 2008 landmark series of papers, the new series outlined the latest research findings on maternal and childhood malnutrition, including reviews of nutrition-sensitive programs, the political economy of malnutrition, and the growing threat posed by the double burden of undernutrition and overweight/obesity in many developing countries.

The development community has made significant commitments to promoting food- and nutrition-security efforts. We now have a better understanding of what needs to be done and what it will cost, and resources are being generated to make it happen. An important step in realizing these commitments is developing governance and accountability systems at the global and national level to hold stakeholders accountable for their commitments and measure the level of implementation. These efforts require sufficient capacity and resources. The implementation of multisectoral efforts to improve nutrition is especially affected by political and governance constraints (see Chapter 7). Overcoming these constraints requires an enabling environment that uses high-quality, well-communicated information and evidence; raises the profile of undernutrition as a development challenge; and strengthens the strategic and operational capacity at all levels of government.

Many stakeholders are now engaged in food-security and nutrition efforts—a positive development that is nonetheless challenging to coordinate. To facilitate international cooperation, new integrated approaches across sectors, disciplines, and actors will be crucial. The private sector, for example, has been actively involved in consultations on the post-2015 agenda. This includes a private-sector outreach program led by Unilever that consists of consultations and roundtable meetings with businesses in developing and developed countries, the results of which were summarized in a report for the High-Level Panel.[14] In particular, thematic consultations on food and nutrition emphasized the need for locally relevant targets that reflect efforts to improve market access, empower smallholder farmers, integrate solutions across the food-water-energy nexus, and build long-term resilience into food chains. The private sector is also engaged in ways that go beyond the post-2015 agenda. For example, the company Royal DSM has been working with the World Food Programme to increase the micronutrients in that agency's food supplies.[15] In the aftermath of the destructive Typhoon Haiyan in the Philippines, the World Food Programme received an outpouring of supplies alongside financial, telecommunication, and logistical support from private companies, demonstrating the private sector's increasing engagement in relief efforts.[16] Such collaboration among stakeholders is crucial, especially given the increased likelihood of more intense and frequent extreme weather events,[17] and it should be accompanied by clearly defined roles and responsibilities in order to increase accountability and avoid duplication of effort.

Food security in developing countries emerged as a thorny topic in global trade negotiations at the end of 2013. After more than a decade of relatively little progress in the World Trade Organization

(WTO) trade talks, participants at the Ninth Ministerial Conference reached a monumental, long-sought agreement that promises to ease trade barriers and costs for all types of trade, including trade in agricultural and food commodities, by simplifying customs procedures and regulations. The agreement also assured developing countries that they will receive support in building capacities to meet these trade facilitation commitments. Estimates suggest that this agreement could boost global trade by US$666 billion to US$1 trillion over the long term.[18] Negotiations were almost sidelined when India stood firm on its demand that the purchase (and stockholding) of crops by developing countries to support poor farmers and feed the poor and food insecure should not be considered a trade-distorting subsidy. India argued that its food security would be compromised if such food-security schemes were not permanently exempted from caps on subsidy spending. In the end, WTO members agreed to give developing countries a temporary exemption from subsidy limits, deferring the issue to future negotiations. Failure to reach an agreement would have had significant negative ramifications not only for the future of the Doha round of trade negotiations, but also for the credibility of the WTO as a forum for trade talks.

REGIONAL AND NATIONAL DEVELOPMENTS IN 2013

Food and nonfood policies at the country and regional level continue to be relevant for both global food security and environmental sustainability. In 2013, countries introduced a range of policies with significant implications for future national and global food supply and demand. Commitments to agricultural development and food security continued at the country and regional level. Although global initiatives to promote food and nutrition security are rife, the greatest potential for promoting food and nutrition probably lies within developing countries and depends on their capacity and willingness to take the required actions effectively and efficiently. National ownership of strategies, policies, and mechanisms of accountability are necessary conditions for eradicating hunger and undernutrition, but they need to be supported by national investment priorities. The experiences of successful developing countries, such as Brazil, China, Thailand, and Vietnam, in reducing hunger suggest that development strategies have the greatest chance of success when they are country led, context specific, and evidence based (see Chapter 2).

India's Food Security Act

Home to the largest share of the world's hungry and poor, India recently signed into law the National Food Security Act (also known as the Right to Food Act), which entitles approximately two-thirds of India's 1.2 billion people to fixed rations of subsidized food grains. This law, discussed in Chapter 3, could be a game changer for national food security if the resulting large-scale program is effectively designed, targeted, and implemented. But many issues remain. The law is expected to increase India's already strained food-security budget to about US$21 billion, which equals an estimated 1.2 percent of gross domestic product in 2013–2014. Although the law focuses on food subsidies, it leaves the door open for the government to introduce other types of transfers, such as direct cash transfers and vouchers, for which the outcomes will vary among different modalities of transfers, market conditions, and the ability of institutions to deliver services. The new law also raises several questions: How can India sustainably develop the program to guarantee access to cheap nutritious food to the poor without overwhelming its already strained national funding and food-procurement channels? How will it overcome the diversion and mistargeting that afflicted India's earlier subsidized food programs? How will this ambitious food scheme affect—and potentially distort—national grain markets and, during times of drought or flood, international grain markets? What effect will it have on maternal and child nutrition and the livelihood opportunities of smallholder farmers in India?

Challenges in Food Safety and Proposed New Reform in China

Food-safety issues have grown in importance in the food-security debate. In China, concerns about

2013 FOOD POLICY TIMELINE: ISSUES, ACTIONS, AND EVENTS

March 22

CHINA REVAMPS FOOD-SAFETY CONTROL

China rebranded and restructured its food-safety agency, elevating the China Food and Drug Administration to a ministerial-level agency after numerous food-safety incidents.

May 30

HIGH-LEVEL PANEL PROPOSES NEW DEVELOPMENT GOALS

A report was issued by a panel of eminent persons charged by UN Secretary-General Ban Ki-moon to make recommendations on the development agenda in the wake of the Millennium Development Goals, which end in 2015. The panel's report called for eradicating poverty by 2030 and transforming economies through sustainable development.

June 8

SUMMIT GENERATES NEW PLEDGES FOR NUTRITION

The Nutrition for Growth summit in London brought together a wide range of stakeholders to generate commitments to investments in nutrition. It established the Global Nutrition for Growth Compact, which has committed US$4.15 billion to tackle global undernutrition.

J F M A M J

July 11

CAADP TURNS 10

The Comprehensive Africa Agricultural Development Programme (CAADP), an Africa-wide framework for generating agriculture-led growth, marked 10 years in operation. While many countries have made progress, Africa as a whole has not achieved the CAADP goals of spending 10 percent of government budgets on agriculture and reaching a 6 percent annual growth rate for agriculture.

September 12

INDIA ADOPTS A NATIONAL FOOD SECURITY ACT

India's new National Food Security Act extends the coverage of the existing Public Distribution System, one of the largest social safety net programs in the world, to provide subsidized food to 65 percent of the country's population. It remains to be seen whether the program can avoid overwhelming the country's already strained finances and food-procurement channels.

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September 23–24

SUN COUNTRIES COME TOGETHER

One of the roles of the Scaling Up Nutrition (SUN) Movement—a country-led movement to promote national actions to improve nutrition—is to allow countries to share their experiences and insights. At the SUN Movement Global Gathering in New York, country participants reflected on progress so far and suggested future actions.

September 23–27

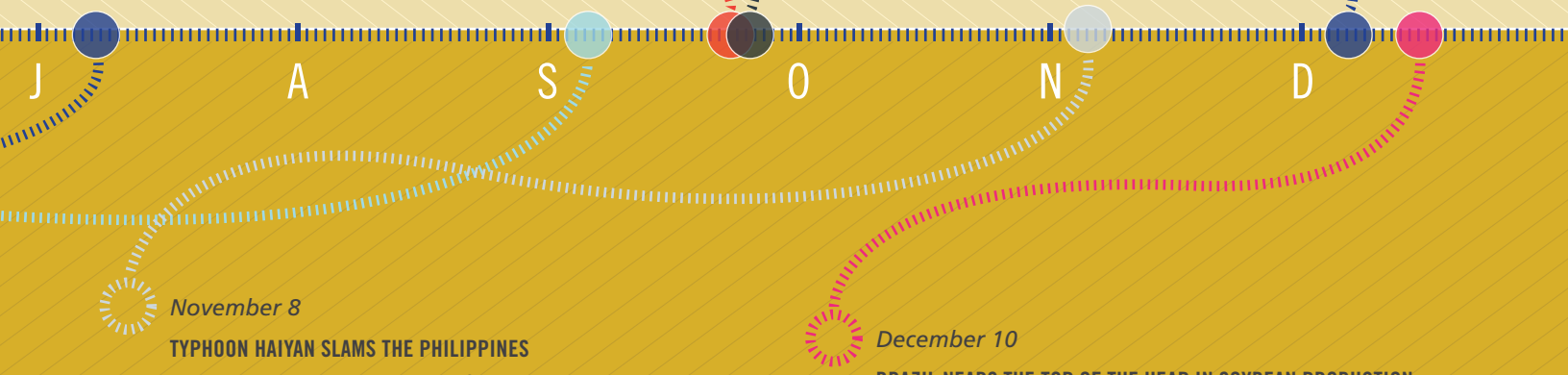
UN ASSESSES PROGRESS ON THE MILLENNIUM DEVELOPMENT GOALS

At the UN General Assembly meetings in New York, global leaders recognized the important but uneven success of the MDGs, reaffirmed their commitment to ending hunger, and deliberated on how to accelerate progress.

December 3–6

TRADE TALKS MAKE A COMEBACK

After years of little progress in global trade talks, participants at the World Trade Organization (WTO) conference in Bali, Indonesia, agreed to simplify customs procedures and regulations for all types of trade, including agricultural and food commodities. Talks were nearly sidelined over subsidies in developing countries, but WTO members agreed to temporarily exempt developing countries from subsidy limits.



November 8

TYPHOON HAIYAN SLAMS THE PHILIPPINES

Typhoon Haiyan, the most powerful storm ever recorded, hit the Philippines, causing widespread damage to lives and livelihoods. Large swaths of housing, crops, and infrastructure were destroyed, and damage to agriculture and aquaculture was extensive. Shortages of food and other essential goods arose following the storm.

December 10

BRAZIL NEARS THE TOP OF THE HEAP IN SOYBEAN PRODUCTION

In 2013, Brazil was estimated to attain broad parity with the United States in global soybean production at 89 million tons. More broadly, Latin America has become a powerhouse of agricultural production, with Brazil and Argentina now among the world's leading exporters of many agricultural commodities.

article-view/article/3073/chinas-sfda-becomes-cfda-amidst-consolidation-of-power-and-new-leadership.aspx; High-level panel proposes new development goals: United Nations, "Report of the Secretary-General's High-Level Beating Hunger through Business and Science," press release, June 8, 2013, https://www.gov.uk/government/news/nutrition-for-growth-beating-hunger-through-business-and-science; CAADP turns 10: IFPRI, "CAADP 10 Years National Food Security Act: Chapter 3 of this report; SUN countries come together: Scaling Up Nutrition, SUN Movement Global Gathering, 2013, http://scalingupnutrition.org/sun-movement-global-gathering; UN assesses mgoals/specialevent.shtml; Typhoon Haiyan slams the Philippines: Food and Agriculture Organization of the United Nations, "Severe Damage to Agriculture and Fisheries after Typhoon Haiyan," press release, November 12, 2013, e-talks-yield-deal-first-time-almost-20-years-unaccustomed; Brazil near the top of the heap in soybean production: P. Hollis, "Brazil climbing to top of global soybean ladder," *Southeast Farm Press*, November 6, 2013,

food safety were again in the headlines in 2013, with reports that some of China's rice supplies contained excessive levels of cadmium, a carcinogenic heavy metal that could induce multiple organ damage. In response, the government centralized its food-safety system by elevating the power of the General Food and Drug Administration in 2013 to set standards and monitor production, distribution, and consumption.[19] This ministry-level institution replaces a system of overlapping and scattered food-safety agencies and regulators, thereby streamlining regulation processes for food and drug safety. This is an important step because a shift in demand among Chinese consumers from domestic- to foreign-produced food supplies as a result of food-safety concerns could have significant impacts on international markets by, for example, raising global food prices.

In the face of industrialization and urbanization, China is in need of a new approach to agricultural development. An important step in this direction occurred at the third plenary meeting of the Central Committee of the Chinese Communist Party, which is a major gathering of China's top government officials to set new policy directions every five years. Among the government's proposals were sweeping policies and investments designed to reverse China's slowing economic growth by increasing consumption and integrating rural and urban areas. China's government leaders seek to use urbanization as an engine of growth for the Chinese economy by introducing more flexible land-use rights and increasing migrants' access to social services in cities.[20] This urbanization-focused strategy and its associated investments could lead to higher agricultural productivity through land consolidation, but they could also have an impact on national and global food demand and supply, both by raising demand for high-value foods and by threatening food supplies through population and environmental pressures on natural resources.

Comprehensive Africa Agriculture Development Programme in Africa

In Africa, 2013 marked the 10th anniversary of the Comprehensive Africa Agriculture Development Programme (CAADP) and the Maputo Declaration, through which African heads of state and government pledged to allocate at least 10 percent of their national budgets to agriculture. Since its inauguration, CAADP has successfully guided country and regional actions designed to stimulate economic growth and reduce hunger and poverty through increased investment in agriculture. Africa as a whole, however, has not met the CAADP targets of raising annual agricultural growth by at least 6 percent and committing at least 10 percent of national budgets to agricultural development. Investments in agricultural research and development (R&D) can be an especially effective tool to develop and adapt new technologies that enhance the quantity and quality of agricultural outputs, leading to greater food security. According to evidence presented in Chapter 5, increased public spending on agricultural R&D in Africa south of the Sahara was driven by a relatively limited set of countries, especially Nigeria, Tanzania, and Uganda. Other often small and donor-dependent countries are stuck in a vicious cycle of underinvestment and serious capacity constraints in agricultural R&D. These national governments need to step up efforts to devote sufficient and stable financial resources to agricultural R&D, thereby helping to generate high-value research outputs that could be used to fuel future growth.

Increased Investment and Policy Reforms in Central Asia and Russia

The countries of Central Asia and Russia placed a strong emphasis on food security in 2013. Most notably, Kazakhstan and Russia, which are major producers and exporters of wheat, adopted multi-year state programs to expand agriculture's share of the economy. These programs, which entail heavy subsidization of agriculture, aim to improve the long-term efficiency of agriculture by promoting the adoption of efficient technologies and inputs, increasing investments in market and production infrastructure, and improving land. Although heavy subsidies for agriculture are generally not a sustainable or efficient way to bring about long-term agricultural growth, fiscal constraints are less serious in resource-rich Kazakhstan and Russia

than they might be in other countries. A number of countries made large advances in regional and international trade cooperation, which will help the region attain more efficient trade structures and, as a result, increased incomes and improved nutritional outcomes.

Food Price Inflation in Emerging Countries

Although global food prices continued to fall in late 2013 and are some of the lowest in three years, they are still not much lower than the all-time highs in 2011.[21] Furthermore, spikes in food prices did occur in India and China. For five straight months in 2013, India experienced double-digit food inflation, with year-on-year food price inflation jumping from about 10 percent in June to more than 18 percent in October; inflation for vegetables, especially onions, was even higher, with prices increasing by 78 percent over the past year.[22] In China, food prices rose in late 2013, and the 6 percent increase in food prices in October was the highest since April 2012.[23] Food inflation continued to outpace general inflation throughout the Asia-Pacific region, albeit on a smaller scale than in China and India. Food and general inflation issues will require careful monitoring in 2014.

Debate over Policies on Genetically Modified Organisms

Genetically modified (GM) foods have continued to be a source of scrutiny and heated debate, and in 2013 countries continued to adopt different approaches to GM foods and the related issue of biosafety. For example, Mexico introduced an indefinite ban on genetically engineered corn, whereas Bangladesh approved the commercial cultivation of GM eggplant that is resistant to insect damage.[24] In the Philippines, field trials of GM vitamin A–enriched rice (often dubbed golden rice) were vandalized.[25]

At the same time, there has been a definitive push toward science-based policymaking in the field. The European Union's (EU's) chief scientist, alongside the national science academies of all EU member states plus Norway and Switzerland, gave support to a report by the European Academies Science Advisory Council that urges the EU to rethink its widespread rejection of GM technologies.[26] The report argues that there is no scientific evidence that GM technologies are any riskier than their conventional breeding counterparts.[27] On the contrary, the report asserts that European policymakers are doing their economies and global food security a disservice by limiting agricultural innovations that can improve agricultural productivity and efficiency, environmental quality, and human health. Along the same lines, the United Kingdom's environment secretary stated that opposition to GM crops has been dominated by emotions rather than scientific evidence, resulting in policies in many countries that hinder the potential of GM foods to improve the health and food security of millions of people.[28]

Rapidly Increasing Role of Latin America in Food Exports

Countries in Latin America and the Caribbean (LAC) continued to be major exporters of food. This region remains the world's main net exporter of agricultural products and is responsible for a large share of global exports of sugar, oilseed meal cakes, coffee, corn, poultry, and bovine meat. Because LAC supplies 18–20 percent of calories imported by Africa and Asia, production changes in the region can have implications for global food availability and prices. In 2012–2013, Brazil surpassed the United States to become the world's largest exporter of soybeans, which are mostly genetically engineered and produced for export (in particular to China and Europe), with Argentina a distant third and Paraguay taking fourth place. During the same period, poor weather in the United States pushed Brazil and Argentina to become the two largest exporters of coarse grains. Brazil continues to be the second largest beef and veal producer (after the United States).

Lack of Progress in Reforming Industrial-Country Farm Policies

Negotiations around the renewal of the US farm bill continued to be at a stalemate well into 2013 as a result of bipartisan division in the US Congress. The bill is a significant contributor to the global food and nutrition landscape not only because it

offers farmers price and income support that can distort world markets, but also because it governs US food aid. The current practice of transporting US-grown food supplies to developing countries using US ships has been the source of much debate because it is a more expensive, less efficient, and slower system of food aid delivery. In 2013, President Barack Obama pushed for reforms to untie food aid from domestic procurement and delivery requirements, but the US House of Representatives rejected an amendment to the farm bill that would have promoted the use of more locally grown food supplies in developing countries.

The EU was also in the midst of substantial reforms to agricultural and biofuel policies, the impacts of which will be felt throughout the developing and developed world. Extensive debate and negotiations on the future of the EU's biofuel policies took place amid claims that biofuels from food crops push up global grain prices and are a greater source of emissions than fossil fuels.[29] Efforts to fast-track a proposal to limit the use of food crop–based biofuels have failed, making it unlikely that negotiations on the draft biofuels law will start before 2015. This delay has created uncertainty regarding the future of EU biofuel policies, jeopardizing the long-term development of alternative renewable energy technologies, such as advanced biofuels derived from algae and biomass.

Another significant development is that after two years of negotiations, EU policymakers reached an agreement on reforms to the Common Agricultural Policy (CAP). The agreed-upon reforms emphasize shifting direct payments toward more environmentally focused practices and increased support for young and small farmers. Critics argue, however, that the final reform package is watered down and riddled with exemptions.[30] Although support to European farmers is decoupled from production, such support mechanisms have the potential to distort patterns of global agricultural production by giving European farmers a competitive advantage compared with farmers in other parts of the world. The CAP reforms made some progress in removing these distortions by limiting the use of export subsidies to times of market disturbance. However, calls to introduce detailed and systematic monitoring of how the EU's agricultural policies, especially income support mechanisms, affect farmers and food production systems in developing countries were rejected.[31]

LOOKING TO THE FUTURE

On the path to ending hunger and undernutrition by 2025, environmental sustainability is a must, but it is also crucial to remember the people whom the goals are intended to help. The post-2015 development agenda should not pursue the achievement of environmental sustainability goals at the expense of food and nutrition security and the well-being of poor and hungry people. To the contrary, discussions in the coming year should focus on developing sustainable people-focused goals with clear targets and timelines for ending hunger and undernutrition by 2025. There is still much ground to cover before we reach a coherent and holistic post-2015 framework that adequately incorporates the goal of eliminating hunger and undernutrition. The post-2015 agenda needs to be grounded in a multisectoral approach that (1) focuses on clear goals and targets, (2) uses comprehensive data and indicators that can be monitored and measured accurately, (3) supports partnerships among all stakeholders, and (4) promotes accountability. At the same time, this approach should include scaled-up social protection to ensure that everyone—especially the most vulnerable population groups, such as women and children—has access to high-quality diets, improved nutrition, and better human capital outcomes.

Traditional investments in increasing food production are important but not enough. Efforts should focus on a comprehensive, long-term approach that promotes increased agricultural productivity for all farmers, effectively links viable smallholder farmers' production to markets (and includes steps to reduce food waste), and ensures that their products are safe and nutritious. For example, information and communication technologies, such as mobile phones, can offer poor and food-insecure populations a wealth of tools and information to improve their resilience and

livelihood opportunities and become more food secure (see Chapter 6). Smallholder farmers, who are often poor and undernourished, can use these technologies to acquire real-time market information—on prices, demand, quality standards, and weather—that they can then use to make better-informed production and marketing decisions and to participate more actively in agricultural value chains. Accelerating the adoption of these technologies requires strategies and policies that encourage both people's access to these tools and the provision of useful information.

In addition, good data and metrics are needed to monitor the progress and impact of agriculture, food, and nutrition programs and policies and to formulate and target future development strategies more effectively. Food- and nutrition-security goals, and the data to support them, must cover all important dimensions of hunger and undernutrition. This includes not just access to adequate calories but also access to diverse and balanced diets that help prevent childhood stunting and micronutrient deficiencies and that reduce the risks of obesity and chronic disease. Efforts should also be stepped up to improve monitoring of short-term and seasonal food-security shocks, including more frequent data collection on wasting in hotspots such as South Asia, the Horn of Africa, and the Sahel. Developing countries can learn, for example, from Bangladesh's experience with the Food Security and Nutrition Surveillance Project.[32] The food- and nutrition-security goals should also be designed to allow for monitoring progress and to include mutual accountability systems at the global and national level. And when the SDGs are fully developed, high-quality, timely, and consistent data will be essential to monitor progress on all of the goals and to develop relevant policies and strategies.

Moving forward with the post-2015 agenda to eliminate hunger and undernutrition sustainably by 2025 requires a more inclusive partnership at the global, regional, and country level. This global partnership includes civil society and the private sector, as well as the commitments of national governments to reduce hunger and undernutrition through the adoption of appropriate measures and allocation of adequate budgets. An important avenue for partnerships is mutually beneficial South-South cooperation. Countries such as Brazil, China, and Vietnam have made significant strides in reducing hunger and undernutrition, and they can share both successful and failed technological, policy, and institutional innovations. By drawing on the experiences of these countries, other developing countries have the opportunity to design and implement a successful toolkit of context-specific strategies as they chart their own pathways for eliminating hunger and undernutrition. Brazil and China have both placed an emphasis on South-South knowledge sharing.

Discussions in the coming year should focus on developing sustainable people-focused goals with clear targets and timelines for ending hunger and undernutrition by 2025.

The deadline for meeting the Millennium Development Goals is less than two years away. As we continue to work toward meeting them, we need to set our sights on a new target: ending hunger and undernutrition by 2025. This target can be achieved, but it will require adequate resources, a clear accountability system, and a transparent framework for partnership. It will also demand action at the national and local level; thus, it will be important to improve countries' capacity to advance sustainable food and nutrition security. With these conditions solidly in place and all relevant stakeholders working together, we can achieve a world of sustainable food and nutrition security. ■

AN AMBITIOUS DEVELOPMENT GOAL

Ending Hunger and Undernutrition by 2025

Shenggen Fan and Paul Polman

SUMMARY Much attention in 2013 was devoted to considering what should follow the Millennium Development Goals, which will come to an end in 2015. This chapter calls for prioritizing the elimination of hunger and undernutrition globally by 2025 and discusses what it will take to achieve that goal.

In 2000, the global community adopted the Millennium Development Goals, which called for halving both the proportion of people living in extreme poverty and the proportion of people suffering from hunger. At a global scale, the poverty goal has been achieved, but progress toward halving hunger is not on track. Close to 850 million people worldwide still suffer from chronic hunger, according to recent estimates by the Food and Agriculture Organization of the United Nations (FAO).[1]

The 2015 deadline for achieving the Millennium Development Goals is fast approaching. As a result, deliberations on how to accelerate progress toward meeting the goals by 2015 and beyond have intensified. Now underway is a discussion of a post-2015 development agenda that will advance what began with the Millennium Development Goals. The UN secretary-general appointed a High-Level Panel of Eminent Persons on the Post-2015 Development Agenda, which proposed potential new goals and targets that will guide the agenda and culminate in a set of sustainable development goals.[2] Central to the discussions of the post-2015 agenda is the goal of eliminating extreme poverty by 2030. Though ambitious and laudable, this goal is not enough: we argue that it is equally important to eliminate hunger and undernutrition and that we should aim to do so by 2025.

There are both economic and moral reasons for striving to end hunger and undernutrition. In countries where large numbers of people lack the food and nutrition security they need to lead healthy and productive lives, it is difficult to break out of poverty or sustain economic development.[3] Research shows that undernutrition limits people's educational achievements and productivity, which in turn leads to large global economic losses.[4] In addition to

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these economic considerations, ending hunger and undernutrition implies ending an important dimension of human suffering. It is thus a global ethical task that must be given top priority.

The goal of ending hunger and undernutrition by 2025 is colossal, but not unattainable. To achieve this goal, governments and donors must allocate sufficient resources and pursue appropriate policies and investments. The experiences of countries such as Brazil, China, Thailand, and Vietnam in reducing hunger and undernutrition suggest that it is realistic to strive for this goal if the pace of reduction is accelerated. Their achievements also offer lessons for charting pathways to even greater success. Moreover, recent technological, policy, and institutional innovations put us in a better position to spur faster progress in reducing hunger and undernutrition. Such progress can be achieved when ideas are broadly disseminated, when countries learn from each other, and when cooperation in pursuit of ever better solutions sets in—in other words, when a snowball effect triggers avalanches in innovations. It is important to note, however, that achieving the goal may still leave 5–8 percent of the population suffering from residual hunger and undernutrition.[5]

The recent attention to food security and nutrition and the pledged increases in nutrition investments are monumental. It is crucial to follow through on this momentum and develop a global and inclusive partnership for ending hunger and undernutrition that goes beyond rhetoric.

WHY IT PAYS TO END HUNGER AND UNDERNUTRITION

Hunger here means food intake that is insufficient to meet the dietary energy requirements of an active and healthy life.[6] According to the FAO, the term *hunger* refers specifically to the consumption of fewer than about 1,800 kilocalories per day. Hunger can lead to undernutrition, which refers to the outcome of prolonged inadequate intake of macronutrients (such as calories, proteins, and fats) and micronutrients (such as vitamins and minerals).[7] The World Health Organization estimates that more than 2 billion people suffer from micronutrient deficiencies, often referred to as hidden hunger.[8] Deficiencies of vitamin A, iron, iodine, and zinc are the most common.[9]

Undernutrition typically takes the form of micronutrient deficiencies, child stunting (low height-for-age), child underweight (low weight-for-age), or child wasting (low weight-for-height). This chapter focuses on stunting, because this form of undernutrition has been recognized as the most critical.[10] Stunting is associated with adverse outcomes related to slow physical and cognitive development.[11] It results from inhibited skeletal growth and low accumulation of muscle mass and fat and is linked to negative neurological outcomes because of the damage it causes to the chemical processes associated with spatial navigation, memory formation, and memory consolidation.[12] This neurological damage leads to low cognitive development with both short- and long-term consequences, such as low school attainment and low lifetime earning potential.[13] Worldwide, it is estimated that 25 percent of children under five years of age—162 million children—are stunted.[14] In both Africa south of the Sahara and South Asia, the prevalence of stunting remains particularly high—approximately 38 percent in both regions.

Poverty, hunger, and undernutrition are linked in a vicious cycle. To break this cycle, it is important to prioritize the elimination of hunger and undernutrition, which cause and perpetuate poverty, have detrimental effects on human health,[15] and impose huge social and economic costs. These costs and burdens can be felt at the individual, household, and societal levels. Growth failure in early life is likely to be passed to the next generation. Women affected by stunting are more likely to have their first child at younger ages, have more children, and live in poor households as adults.[16] Productivity losses and direct healthcare costs caused by hunger and undernutrition also have adverse economywide effects. According to the FAO, hunger and undernutrition reduce global gross domestic product (GDP) by 2–3 percent, equivalent to US$1.4–2.1 trillion a year.[17] Another study estimates this loss to be 8 percent of world GDP over the 20th century and projects it to be 6 percent in the first half of the 21st century.[18] Recent country-level cost estimates range from

Concerted Action against Hunger and Malnutrition beyond 2015

DAVID NABARRO

In 2013 the vision of ending hunger and malnutrition rose higher on the agenda of governments, development agencies, foundations, civil society groups, businesses, and the research community, with increasing support for the Scaling Up Nutrition (SUN) Movement and the Zero Hunger Challenge. At the same time, the international community is looking beyond the 2015 deadline for the Millennium Development Goals to discuss the post-2015 development agenda. In March 2013, the Open Working Group, established at the 2012 Rio+20 Conference, began deliberating how to formulate a set of sustainable development goals. At its third meeting in May 2013, the group discussed issues of food security and nutrition, sustainable agriculture and desertification, and land degradation and drought.[1] Meanwhile, the United Nations system and its partners have been engaged in an unprecedented process of country, regional, and global consultation as a contribution to this post-2015 development agenda. This process included the High-level Consultation on Hunger, Food Security, and Nutrition hosted by Spain and Colombia in Madrid in April 2013.[2] The promotion of food security, nutrition, and sustainable agriculture in the post-2015 development agenda was also discussed at the 40th session of the Committee on World Food Security in Rome in October 2013.[3]

Many reports delivered to the UN secretary-general during this process put food security, nutrition, and sustainable agricultural and food systems high on the agenda. The High-Level Panel of Eminent Persons (appointed by the secretary-general) and the UN Global Compact propose a specific stand-alone goal for ending hunger and malnutrition.[4] The Sustainable Development Solutions Network adds a specific goal of improving agricultural systems and raising rural prosperity to the overall goal of ending poverty and hunger.[5] All the reports call for a focus on ending stunting (low height-for-age).

The UN secretary-general's report, *A Life of Dignity for All,*[6] summarizes the vision emerging from these discussions: a universal and transformative post-2015 development agenda for eradicating poverty through sustainable development. Member states and other stakeholders concur that ending hunger and malnutrition through inclusive and sustainable agricultural, rural, and food systems is an essential part of the overall post-2015 vision. In his report, the UN secretary-general included ending hunger and malnutrition in the set of transformative and mutually reinforcing actions that apply to all countries and that are required to bring the overall post-2015 vision to life. In his words, "Addressing hunger, malnutrition, stunting and food insecurity…will require a combination of stable and adequate incomes for all, improvements in agricultural productivity and sustainability, child and maternal care and strengthened social protection for vulnerable populations."[7] Taking action in a comprehensive way will bring multiple benefits, including stronger economic growth, social inclusion, and sustainable rural development. One of the most important determinants of success for the post-2015 development agenda will be its means of implementation, particularly adequate financing. In this respect, the funds pledged at the June 2013 Nutrition for Growth summit in London are an important first step.[8]

International stakeholders are supporting this discussion and developing proposals for global goals and rights. They recognize the importance of underpinning these goals and rights with incentives and policies that are kept coherent, and then legislated and implemented, at the country level. This process requires the involvement, ownership, and accountability of all stakeholders. The United Nations system supports member states and partners as they advance this work in ways that take account of people's voices.

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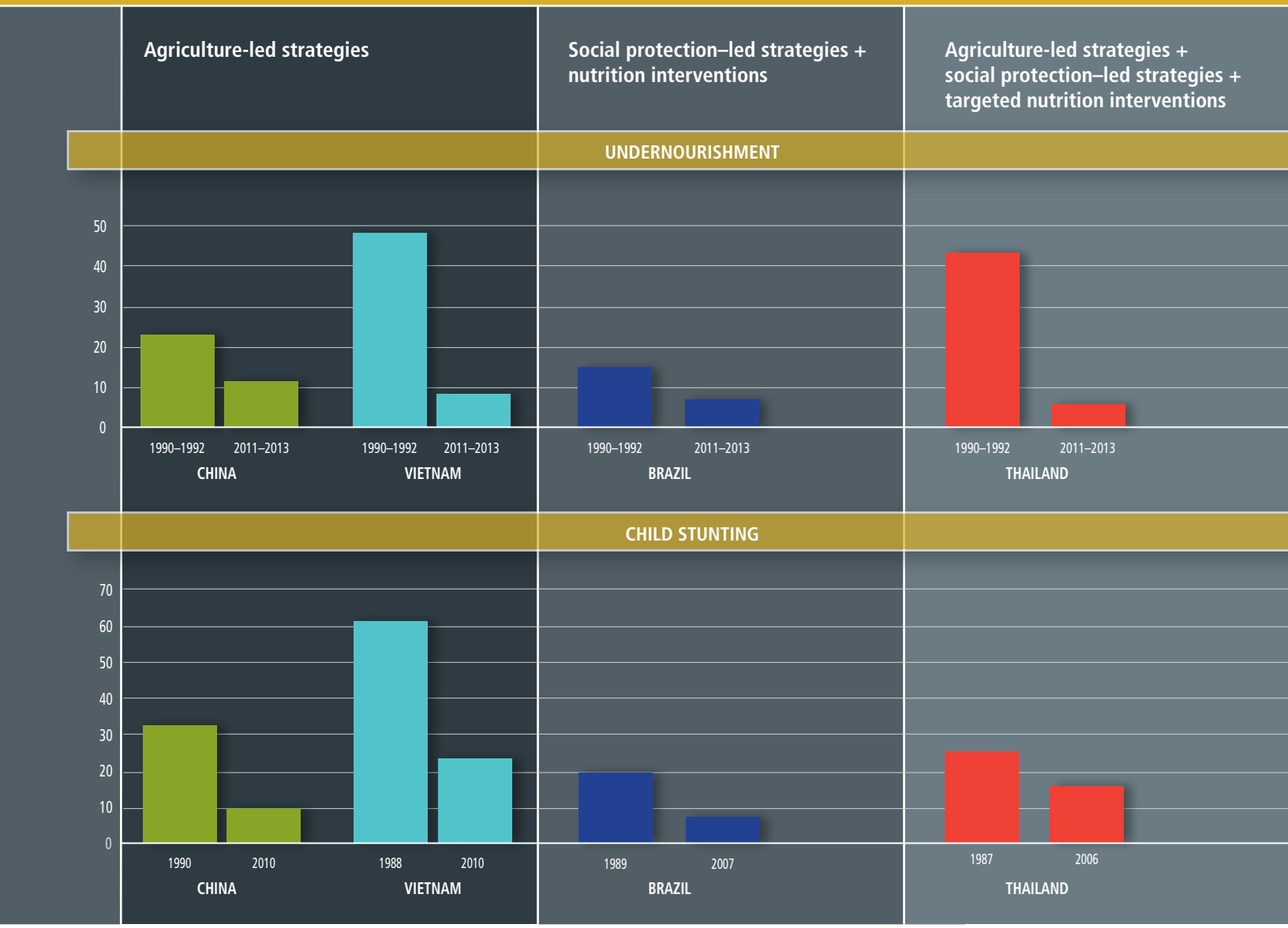
2 percent of GDP in Egypt and Panama to more than 10 percent in Ethiopia and Guatemala.[19]

The economic returns to eliminating hunger and undernutrition can be very high (see the box "Addressing Hunger Has High Returns on Investment" on page 20). It may be possible to cut the deaths of children younger than five years by 15 percent by adopting ten core nutrition

FIGURE 1 PATHWAYS TO REDUCING UNDERNOURISHMENT AND CHILD STUNTING



Sources: Data on undernourishment are from the database underlying Food and Agriculture Organization of the United Nations, *The State of Food Insecurity in the World 2013* (Rome: 2013). Data on child stunting are from World Bank, World Development Indicators 2013 databank (Washington, DC: 2013), http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators.

Note: Data on undernourishment are reported as three-year averages, and data on child stunting are reported yearly.

interventions at a cost of about $10 billion a year.[20] This is less than 1 percent of the cost of hunger and undernutrition. Country-level evidence also shows large economic returns. Under conservative assumptions, every dollar spent on interventions to reduce stunting is estimated to generate about US$30 in economic returns, even in poor countries such as Ethiopia.[21]

WHY WE ASPIRE TO END HUNGER AND UNDERNUTRITION BY 2025

The experiences of Brazil, China, Thailand, and Vietnam suggest that we should aspire to end hunger and undernutrition on a global scale by 2025. The strategies implemented by these countries can be broadly classified as agriculture-led, social protection– and nutrition intervention–led, or a combination of both of these approaches (Figure 1). Successes in China and Vietnam, for example, may

be seen as resulting mainly from an agriculture-led strategy. In Brazil, success has likely been primarily driven by social protection programs and targeted nutrition interventions for those most in need. Success in Thailand has likely been catalyzed by a combination of these strategies.

By drawing on the experiences of these countries, other developing countries have the opportunity to design and implement successful context-specific strategies to address hunger and undernutrition. In this chapter we discuss trends of relevant indicators in countries that have had successes in reducing hunger and undernutrition. We also provide a brief overview of the main elements of the strategies employed. As an indicator of hunger, we use FAO data on the prevalence of undernourishment (which occurs when a person's daily food intake is less than his or her minimum energy requirement, typically around 1,800 kilocalories). As an indicator of undernutrition, we use World Bank figures on the prevalence of child stunting.[22] Because a 5–8 percent rate of hunger or undernutrition may be unavoidable, we use 8 percent as a cutoff below which we consider hunger and undernutrition to be "eliminated."

Agriculture-Led Strategies: China and Vietnam

If China continues its current rate of reduction, it can eliminate hunger and undernutrition by 2025.[23] Between 1990 and 2013, China was able to halve the prevalence of undernourishment from roughly 23 to 11 percent. More impressively, between 1987 and 2010, China reduced the prevalence of child stunting by more than two-thirds, from 32 to 9 percent.

China's agricultural and economic success was catalyzed through the decollectivization of agriculture (through the introduction of the Household Responsibility System for securing land rights), pro-market reforms and the dismantling of state planning and monopolies, and the implementation of policies that supported human capital development and rural nonfarm economic growth.[24] These reforms, which began in the late 1970s, had a strong initial emphasis on agricultural growth—stimulated by improved incentives in smallholder agriculture—and rural development. These changes resulted in significantly higher incomes among rural residents, where levels of poverty and hunger were initially the highest, and in increased availability of food at affordable prices.[25] In addition, nutrition, health, and family-planning interventions were implemented on a large scale.[26] To complement these interventions, investments in education, clean water, and good sanitation were also expanded.

The experiences of Brazil, China, Thailand, and Vietnam suggest that we should aspire to end hunger and undernutrition on a global scale by 2025.

Even though social protection policies have the potential to promote inclusive growth, such policies were not at the forefront of China's strategies during the reform period. China could probably have achieved much greater progress if it had launched and scaled up well-targeted social protection programs earlier. Instead, it relied on social welfare benefits provided by individual firms to their employees, even when major economic transformation, including rising unemployment and labor mobility, meant that this approach led to inequality in social welfare provision.[27] In recent years, the government of China launched its main social protection program, the Minimum Livelihood Guarantee Scheme (widely known as Dibao).[28]

Overall, careful experimentation was vital to the design, sequencing, and implementation of successful reforms in China.[29] A strong monitoring and evaluation system, including an effective data-collection strategy, facilitated the flow of information for policymaking. The reforms also profited from other factors, such as good initial conditions in rural infrastructure, agricultural research and extension services, and institutional capacity.[30]

Like China, Vietnam has the potential to eliminate hunger by 2025 if it continues its current rate

of reduction. Between 1990 and 2013, the prevalence of undernourishment fell remarkably from about 48 to 8 percent. The prevalence of child stunting was reduced from a high of 61 percent in 1988 to 23 percent in 2010. Although Vietnam is not likely to eliminate stunting by 2025, with the right policies and strategies in place it could come close to achieving this goal.

As in China, initial progress in Vietnam was likely driven largely by growth in agriculture, supplemented by targeted nutrition and health programs.[31] The Doi Moi reforms, introduced in the late 1980s by the Vietnamese government,

Addressing Hunger Has High Returns on Investment

ALEXANDER J. STEIN

Estimates of the number of undernourished people have traditionally sought to shed light on the human and ethical dimensions of hunger. In 2013, however, a flurry of studies sought to do something different: to approximate the economic cost of hunger.

Two studies tallied the global cost of undernourishment and micronutrient malnutrition. One linked estimates of the global burden of disease to undernutrition and tentatively converted them into dollar terms, suggesting that hunger in all its forms causes economic losses of US$0.8–1.9 trillion a year.[1] This estimate was similar to that offered by the Food and Agriculture Organization of the United Nations (FAO). Using a bottom-up approach to aggregate information on economic productivity losses due to undernutrition, FAO estimated a cost of US$1.4–2.1 trillion a year, the equivalent of 2–3 percent of global gross domestic product (GDP).[2]

Three other studies focused on country-level costs—in Egypt, Ethiopia, and Uganda[3]—supplementing an earlier study of Central American countries.[4] These country studies generated preliminary estimates based on healthcare and educational costs and on lower productivity due to undernutrition. Their estimates of the cost of hunger ranged from 2 percent of GDP (in Egypt and Panama) to well over 10 percent (in Ethiopia and Guatemala), suggesting that the cost of hunger may be high even in relatively better-off countries, such as those in Central America. This is because as the share of nonmanual work increases in an economy, education often becomes a prerequisite for better-paying jobs, and by reducing educational achievement, undernutrition threatens higher income-earning opportunities.

Although reducing human suffering to a simple number is a limited approach to understanding hunger, it is a pragmatic one: it expresses the problem in monetary units, which are familiar and comparable. And although these figures are only rough estimates, their magnitude cannot be ignored. Such high sums send a strong signal: cost-effective programs that eliminate hunger should lead to large economic gains—globally and particularly in countries where undernutrition is worst.

Feasible solutions to eliminate undernutrition in cost-effective ways do exist.[5] With the annual cost of hunger perhaps in the trillion-dollar range—which is as much as the GDP of Indonesia or Mexico—the bill for addressing hunger may be only a fraction of that cost. For instance, reaching more than 80 percent of the world's undernourished children with key nutrition interventions may require as little as $10 billion a year[6]—at most one-hundredth the cost of hunger.

Alas, the commitments made so far by the international community are much lower. At the London Nutrition for Growth summit in June 2013, for instance, international donors made a commitment to spend about US$10 billion on nutrition programs—an amount to be distributed over eight years, however, not one.[7] This is unfortunate because, as has been suggested here, hunger is costly—not only for the individuals concerned but also for society, given the productivity losses and public health burden it imposes on countries worldwide. Thus, in addition to meeting a moral obligation, eliminating hunger could offer high economic returns for humanity.

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consisted of four main elements: (1) equitable land reform, (2) liberalization of agricultural markets and trade, (3) pragmatic and sequenced liberalization for attracting and benefiting from foreign direct investment, and (4) sustained investment in human development.[32] The 1988 implementation of Resolution 10, which recognizes that the household is the basic production unit of the rural economy, drastically improved agricultural incentives. Both Resolution 10 and the 1993 Land Law played a critical role in spurring agricultural growth in the 1990s, enabling Vietnam to become one of the world's major rice-exporting countries. Rapid agricultural growth contributed to higher rural incomes and the movement of labor into nonagricultural sectors.[33]

Vietnam also targeted significant public spending toward improving nutrition and health outcomes. It implemented a comprehensive nutrition policy to improve dietary diversity and programs to increase micronutrient supplementation.[34] Furthermore, Vietnam established child-health and family-planning programs, maintained national health coverage, and provided health subsidies to the poor. Notably, these reforms were implemented with a focus on promoting equity while improving living standards.

In recent years, however, inequality has been rising—for example, between the North and the South and between urban and rural areas—as it has become more difficult to reach poor and vulnerable groups.[35] Given that a majority of Vietnam's poor earn 75 percent of their income from agriculture and related activities, this sector is likely to continue to play a critical role in stimulating more pro-poor growth.[36] Measures such as improved access to markets, rural infrastructure, and basic services, as well as further development of the private sector (both within and outside of agriculture), will be important to promote more inclusive growth.[37] The implementation of the Enterprise Law in 2000, for example, which streamlined the registration process for business, set in motion a move toward private-sector growth. Effective social protection policies will also be crucial as Vietnam continues to experience economic transformation.[38]

Social Protection–Led Strategies and Targeted Nutrition Interventions: Brazil

Based on our cutoff point of 8 percent, Brazil has eliminated both hunger and undernutrition. Between 1990 and 2013, the prevalence of undernourishment declined from 15 to 7 percent, and between 1989 and 2007, the prevalence of child stunting fell from about 19 to 7 percent.

This success was arguably spurred by Brazil's macroeconomic and trade policy reforms, introduced in the mid-1990s, accompanied by pro-poor social spending.[39] Social protection reforms, which played an important role starting in the late 1990s, involved expanding and better targeting the country's social assistance and social security programs. Existing transfer programs were consolidated under Brazil's flagship social program, popularly known as *Bolsa Família*.[40] The program, which promotes improved education and healthcare for beneficiaries, is the largest conditional cash transfer program in the world to date. Key to the success of *Bolsa Família* is its integration with other social programs and social policies for food and nutrition security.[41]

To support these programs, the government put in place key social legislation and policies—in particular, the 1988 statutory right of every citizen to social security, the 2003 Zero Hunger strategy, and the 2004 basic income law.[42] It also scaled up investments in education, healthcare, clean water, and sanitation.[43]

Despite these advances, Brazil began with a high initial level of inequality that, coupled with inequality-promoting policy distortions, seems to have hampered progress.[44] In more recent years, however, inequality has declined in the face of higher macroeconomic stability and more progressive social policies, creating room for accelerated progress.

Agriculture-Led Strategies Plus Social Protection–Led Strategies and Targeted Nutrition Interventions: Thailand

At the current rate of reduction, Thailand has already eliminated hunger based on our cutoff point of 8 percent prevalence. However, it will only come close to eliminating stunting by 2025. Between 1990 and 2013, the country dramatically

Measuring Hunger and Undernutrition Precisely and In Time

TOLULOPE OLOFINBIYI AND SINAFIKEH GEMESSA

In measuring progress toward ending hunger and undernutrition, no single indicator can capture all the dimensions of these two conditions. Therefore, it is important to use multiple indicators that together can capture the multidimensional nature of both phenomena. A comprehensive assessment of hunger and undernutrition needs to include indicators of both inputs to food and nutrition security (such as calories and dietary diversity) and outcomes (such as stunting, underweight, and wasting).[1] It is also crucial to collect and report data for these indicators, as well as for the household and institutional factors that drive them, in a timely fashion. Data are already collected for many of these indicators, but not in a regular, comprehensive, and timely way.

The prevalence of undernourishment—computed by the Food and Agriculture Organization of the United Nations (FAO)—is the most widely used measure of global and national hunger. For a country, the prevalence of undernourishment is a function of food availability (dietary energy requirements and supply) and access (the likely distribution of these calories within the country). To estimate the distribution of calories, FAO does not make direct observations; instead, it simulates the distribution using data from occasional household surveys. In 2012, FAO made some important revisions to the methodology and data it uses to construct the undernourishment indicator. Among other things, FAO revised its estimations of food losses and updated its parameters for dietary energy requirements and access to food.[2] Although these are steps in the right direction, important information gaps remain. The indicator does not consider imbalances in people's consumption of macro- and micronutrients, variation within countries, and short-term or within-year variations.[3] Encouragingly, FAO's *2013 State of Food Insecurity in the World* report includes discussions of the different dimensions of hunger and undernutrition, with a suite of proposed indicators to measure each of them.[4]

Research evidence suggests that indicators of dietary diversity are better measures of hunger, in a broad sense, than indicators of calorie deficiency.[5] Dietary diversity indicators are sensitive to people's nutrition intakes, shocks that affect their food consumption, and seasonal shortages. Household survey–based indicators, such as the World Food Programme's Food Consumption Score and the US Agency for International Development's Household Dietary Diversity Score, are examples of indicators that can be used to better assess nutrient adequacy.[6] It should be noted, however, that dietary diversity indicators still require improvements to allow for more frequent measurement and cross-country comparisons.

On the outcome side, anthropometric indicators that measure consequences of undernutrition, such as stunting (low height-for-age), should also be tracked frequently. Stunting is increasingly recognized as the most useful indicator of chronic undernutrition because of its greater specificity compared with other indicators such as underweight (low weight-for-age).[7] However, frequent measurement of underweight and wasting (low weight-for-height) is still needed to capture relatively short-term impacts of undernutrition. When using anthropometric indicators, researchers must control for other confounding factors, such as lack of access to safe drinking water and sanitation, which directly affect these undernutrition outcomes.[8]

Dietary diversity indicators and anthropometric measures often rely on expensive surveys of households or individuals that are challenging to update regularly. This problem is compounded by many developing countries' lack of capacity to collect reliable and timely data due to shortages of statistical infrastructure and human capital. To design and implement evidence-based policies and programs, it is essential to invest in building developing countries' capacity for data collection. Investments in innovative tools, such as information and communication technologies, should also be accelerated to reduce the cost and time needed to collect data and publish findings, as well as to improve the quality of data collected.[9]

reduced the prevalence of undernourishment from about 43 to 6 percent. Child stunting has also fallen significantly, though more slowly, declining from about 25 to 16 percent between 1987 and 2006. If Thailand accelerates the implementation of appropriate strategies, it could likely eliminate stunting.

Agriculture was the driving force of pro-poor growth in Thailand in the 1960s and 1970s.[4,5] Growth benefited from macroeconomic stability, more secure land rights, strong public spending on rural infrastructure, and a 1972–1974 world commodity boom. Fast-paced agricultural growth

Proposed measures of global hunger and undernutrition

Measure	Description	Source	Proposed improvements
Input-side indicators			
Prevalence of undernourishment	The proportion of the population experiencing inadequate calorie intake lasting more than one year	Food and Agriculture Organization of the United Nations	• Increase use of representative household surveys • Regularly update distribution framework of calories
Dietary diversity indicators (for example, Food Consumption Score)	Frequency-weighted consumption of different food groups by a household in the past 7 days before the survey	World Food Programme	• Compute at individual level and make comparable over time and space • Report yearly at national and subnational levels
Outcome-side indicators			
Prevalence of stunting	The proportion of children under 5 who are stunted (low height-for-age)	World Health Organization	Report yearly at national and subnational levels
Prevalence of underweight	The proportion of children under 5 who are underweight (low weight-for-age)	World Health Organization	Increase frequency of data collection, especially in hunger hotspot areas
Prevalence of wasting	The proportion of children under 5 who are wasted (low weight-for-height)	World Health Organization	Determine frequency of data collection by extent of food crisis

Source: Authors' compilation.
Note: Data for all the measures should be collected collaboratively by international organizations and national and regional governments.

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in this period contributed to higher rural incomes and reduced poverty. Starting in the mid-1980s, pro-poor growth was led by the development of the nonfarm sector and a structural shift of household income from farm to nonfarm activity.[46] In the 1990s, however, government policies refocused on agriculture.[47] Thailand's agricultural sector became characterized by a market-oriented approach with well-developed marketing chains and interaction between smallholders and private companies, as well as high diversification and specialization of products, as encouraged by public expenditures on

agricultural research and extension. This situation contributed to increased incentives for agricultural production, which enabled Thailand to become one of the largest global exporters of rice.[48]

Beginning in the early 1980s, Thailand adopted an integrated, community-based approach to improving nutrition and health outcomes.[49] In the early to mid-1980s, Thailand's Second National Health and Nutrition Policy focused on targeted nutrition interventions to tackle undernutrition.[50] Nutrition programs, which were included in the National Economic and Social Development Plan, focused on underdeveloped areas, targeting mainly children and pregnant and lactating women.

Accelerating progress in improving nutrition demands well-targeted nutrition interventions that address both the immediate cause of undernutrition and the underlying causes.

These nutrition programs were not implemented in isolation; rather, they had clear linkages with agriculture to help ensure that their impacts were sustainable.[51] Intersectoral approaches and local participation continued to improve in the 1990s. In 2002, the government introduced the Universal Health Coverage Scheme.[52] Fully financed by the government of Thailand, this scheme entitles every citizen to free basic healthcare. More recently, the government has extended social protection programs that go beyond healthcare to cover, among other things, death and old-age benefits to workers in both the formal and informal sectors.[53]

WHAT WE CAN LEARN FROM THESE EXPERIENCES AND OTHERS

In many countries, ending hunger and undernutrition will require a mix of agricultural, social protection, and nutrition strategies. Agricultural growth contributes directly to reducing hunger and undernutrition by increasing farm households' ability to produce and purchase more nutritious foods, lowering food prices for poor consumers, and raising demand for rural labor.[54] Evidence from a study of multiple countries suggests that in food-insecure countries, agricultural growth is associated with reductions in underweight and stunting.[55] The experiences of China and Vietnam show that in agriculture-based economies where smallholders predominate, growth strategies focused on these smallholders may do the most to reduce poverty and hunger. Within agriculture, investments should be directed toward the subsectors with heavy participation of poor and hungry people.[56]

Because growth alone is not sufficient to eliminate hunger and undernutrition, well-designed and well-implemented social protection strategies are also important. As Brazil's success shows, social safety nets, such as conditional cash transfers, can contribute to more inclusive growth by helping people build assets and protecting these assets from shocks, reducing inequality, facilitating structural reform of the economy, and increasing the effective allocation of resources.[57] Effective social safety nets should have a clear objective, a feasible means of targeting beneficiaries, a reliable mode of transferring resources, a sound monitoring and evaluation system, and transparent operations.[58]

Accelerating progress in improving nutrition also demands well-targeted nutrition interventions that address both the immediate causes of undernutrition (through nutrition-specific programs) and the underlying causes (through nutrition-sensitive programs in areas such as agriculture and early childhood development). Thailand's experience is instructive: Thailand was one of the few countries to prioritize nutrition in the early 1980s by targeting healthcare and nutritious food supplements to people affected by hunger and undernutrition.[59] The effectiveness, coverage, and scale of nutrition-specific interventions (such as micronutrient supplementation and optimum breastfeeding practices) can be improved immensely when nutrition-sensitive programs (such as agricultural and early childhood development programs) are leveraged as delivery platforms.[60] The nutrition

sensitivity of programs can be increased by, for example, improving the targeting of interventions, using nutrition-related conditions, integrating nutrition goals and actions, and focusing on the empowerment of women.

The relative importance of these strategies in different countries depends on the structure of the economy and where the vulnerable groups reside. In agriculture-based economies (mostly in Africa south of the Sahara), agriculture will play an important role in bringing about pro-poor growth and reducing hunger and undernutrition. In transforming economies (mostly in Asia, North Africa, and the Middle East), growth originates less from agriculture, but poverty, hunger, and undernutrition remain largely rural phenomena. In these economies, growth in agriculture and the rural nonfarm economy is important for poverty reduction. In urbanized economies (mostly in Eastern Europe and Latin America), agriculture makes a smaller contribution to growth, and urban poverty is starting to exceed rural poverty. In these economies, agriculture functions much like other competitive sectors, such as manufacturing, even though it may predominate in some areas.[61] Eliminating hunger and undernutrition in these urbanized countries will depend more heavily on targeted nutrition and social protection programs. In large countries such as India and Mexico, different states may exhibit different economic structures, further emphasizing the need for strategies tailored to local circumstances.

HOW WE CAN MOVE FORWARD

Concerted actions by all stakeholders, including national governments, donors, civil society, and the private sector, are needed to eliminate hunger and undernutrition by 2025. The positive experiences of successful countries suggest that we can aspire to achieve this goal if sufficient resources are allocated and appropriate policies and investments are pursued. The sustainable development goals that will eventually be agreed upon must be ambitious, pragmatic, and time-bound; have clear objectives; and be facilitated by a global and inclusive partnership. This partnership should be characterized by clearly defined roles and responsibilities in order to increase accountability and avoid duplication of effort.

The positive experiences of successful countries suggest that we can aspire to achieve this goal if sufficient resources are allocated and appropriate policies and investments are pursued.

Approaches to accelerating the pace of hunger and undernutrition reduction include the following:

- **Country-led strategies and investments.** As the country experiences show, national ownership of strategies and policies is important. Policies aimed at ending hunger and undernutrition should be country led in order to be well adapted to the local context, highly effective, and sustainable, as shown by China's partial and sequenced liberalization of markets. Beyond setting the direction of strategies for ending hunger and undernutrition, national governments must allocate adequate budgets to strategies that support more inclusive growth, including growth in viable smallholder agriculture; well-targeted social protection programs linked to improved food and nutrition outcomes; and specialized nutrition interventions. One global initiative that promotes country-led actions is the Scaling Up Nutrition Movement, which brings together governments, civil society, the United Nations, donors, businesses, and researchers to make improving nutrition a priority in countries' policy actions. Countries that join the Scaling Up Nutrition Movement are expected to create a coherent policy and legal framework for nutrition policies, work in partnership with stakeholders, agree on common objectives, and mobilize resources for scaling up nutrition.
- **Evidence-based policies and policy experiments.** National strategies should be guided by evidence. Pilot projects and policy experiments

are important to provide decisionmakers with information on what investments and processes work before they scale up successful policies and programs. Experimentation contributes to proper design, sequencing, and implementation of country strategies.

- **Knowledge sharing and transfer.** Insights on policy, institutional, and technological innovations carried out by successful countries can provide some guidance in designing national strategies to reduce hunger and undernutrition. Successful countries should engage in knowledge sharing with other developing countries.
- **Data revolution.** Reliable and timely data on relevant indicators of hunger and undernutrition at the global, national, and subnational levels are

Ending Hunger and Malnutrition: Holding Those in Charge Accountable

LAWRENCE HADDAD

Despite significant global progress in reducing the number of hungry and malnourished people,[1] in Africa south of the Sahara and South Asia high levels of hunger and malnutrition remain a stubborn and tragic stain on the fabric of a thriving and vibrant world. The goal of eliminating hunger and malnutrition sustainably by 2025 is an inspirational one because it stretches us, and yet, as several country experiences have shown—most notably in Brazil and China—we can get close to it. Meeting this ambitious goal will require the right policies and programs, the right investments, and a supporting legal framework. In addition, these commitments need to be monitored to guide action and to hold duty bearers to account. The world's hungry and malnourished people cannot solve their plight on their own; they need support from their own governments and from the international community. Who can they count on, and how do they know whether those actors have delivered? Who should they hold accountable, and how should they do this?

Improving accountability will require measuring outcomes using credible data on hunger and malnutrition. Currently, the data on hunger are abundant, but their quality needs to improve. The data on malnutrition are more reliable but too infrequent. Yet it is not enough just to measure outcomes, because outcomes are determined by a range of more controllable and less controllable factors. The ones that governments (and other key actors) can control should be made transparent and monitored carefully.

The Hunger and Nutrition Commitment Index,[2] from the Institute of Development Studies in the United Kingdom, is one way of comparing the commitment of different governments in terms of policies, spending, and legislation designed to reduce hunger and malnutrition, and thereby of improving these governments' accountability to their populations.[3] The index ranks 45 countries that have high levels of hunger and malnutrition and for which data on commitments are available. It finds that the countries with the highest burden of hunger and malnutrition are often, but not always, the ones with the highest commitment to doing something about that burden. It also ranks donor countries and finds that some of the best donor performers (in terms of official development assistance as a share of gross national income) are some of the least committed to hunger and malnutrition reduction. It is important to collect data on these commitments as well as their outcomes.

Equally important, accountability at the subnational level in countries affected by hunger and malnutrition needs to be improved—in this way, the relationship between the state and civil society around these issues can be strengthened. New methods and tools of accountability are being developed. These include real-time monitoring of program coverage using mobile technologies, subnational Hunger and Nutrition Commitment Index scores, social accountability mechanisms such as community scorecards, and better ways of diagnosing constraints on national strategies for reducing hunger and malnutrition to help clarify how programs should be sequenced and prioritized.[4] We often hear the food and nutrition community lament that hunger and malnutrition are everyone's business but no one's responsibility. Through stronger accountability mechanisms we can promote everyone's responsibility for ending these twin scourges.

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urgently needed for evidence-based policymaking. Providing these data should be a collaborative effort by international organizations and national and regional governments. To support this effort, data collection and analytical capacity in developing countries (particularly in terms of statistical infrastructure and human capital) need to be improved significantly.

- **Enhanced role of the private sector.** The private sector has the potential to bring to bear sustainable solutions to ending hunger and undernutrition, provided the right conditions and incentive structures exist. Recently, the private sector has stepped up its actions and commitments to improve food and nutrition security in a number of ways. Through the New Vision for Agriculture, the private sector is engaging in public-private partnership programs (such as the Grow Africa Initiative) in 11 countries. Clear monitoring and evaluation systems and regulatory mechanisms are needed to ensure that the private sector can take an even larger role in ending hunger and undernutrition.

Ending hunger and undernutrition by 2025 should be a top priority in the post-2015 development agenda.

Ending hunger and undernutrition by 2025 should be a top priority in the post-2015 development agenda. This not only makes economic sense but should also be considered a global ethical duty. To achieve this goal, it is crucial to promote country-driven strategies, build on evidence and past experiences, allow for the sharing of ideas, enhance and expand partnerships, and employ integrated approaches. ■


दिल्ली खाद्य सुरक्षा कानून लागू करने वाला पहला राज्य

A Novel Approach to Food Security

Avinash Kishore, P. K. Joshi, and John Hoddinott

SUMMARY In 2013, the government of India passed the National Food Security Act, designed to ensure access to adequate food at affordable prices. How well will it work? This chapter examines the strengths and weaknesses of India's existing food-grain procurement and distribution system that will be used to implement the act and draws lessons from the food safety net and food subsidy experiences of other countries.

In 2013, the government of India put in place a massive food safety net program. Beginning as an ordinance passed in July and then as an act of Parliament in September, the National Food Security Act seeks, according to its preamble, to "provide for food and nutritional security…by ensuring access to adequate quantity of quality food at affordable prices to people."

Despite rapid economic growth and gains in reducing its poverty rate, India is saddled with among the highest levels of hunger and malnutrition in the world. More than half of Indian women between 15 and 49 years old are anemic, and more than one-third have a low body mass index. Among children younger than age five, 48 percent have low height-for-age, and 42.5 percent have low weight-for-age. In addition, 43.1 percent of children aged 6–59 months have moderate to severe anemia.[1] Not only does India have high levels of hunger and malnutrition but it has also reduced hunger only marginally over the past two decades despite having made progress in economic growth and poverty reduction.[2]

To address the problem, the act entitles two-thirds of India's total population of 1.25 billion to 5 kilograms (kg) of rice, wheat, or coarse cereals per person per month, at the highly subsidized price of 1–3 rupees (Rs) per kg (US$0.016–$0.050 per kg).[3]

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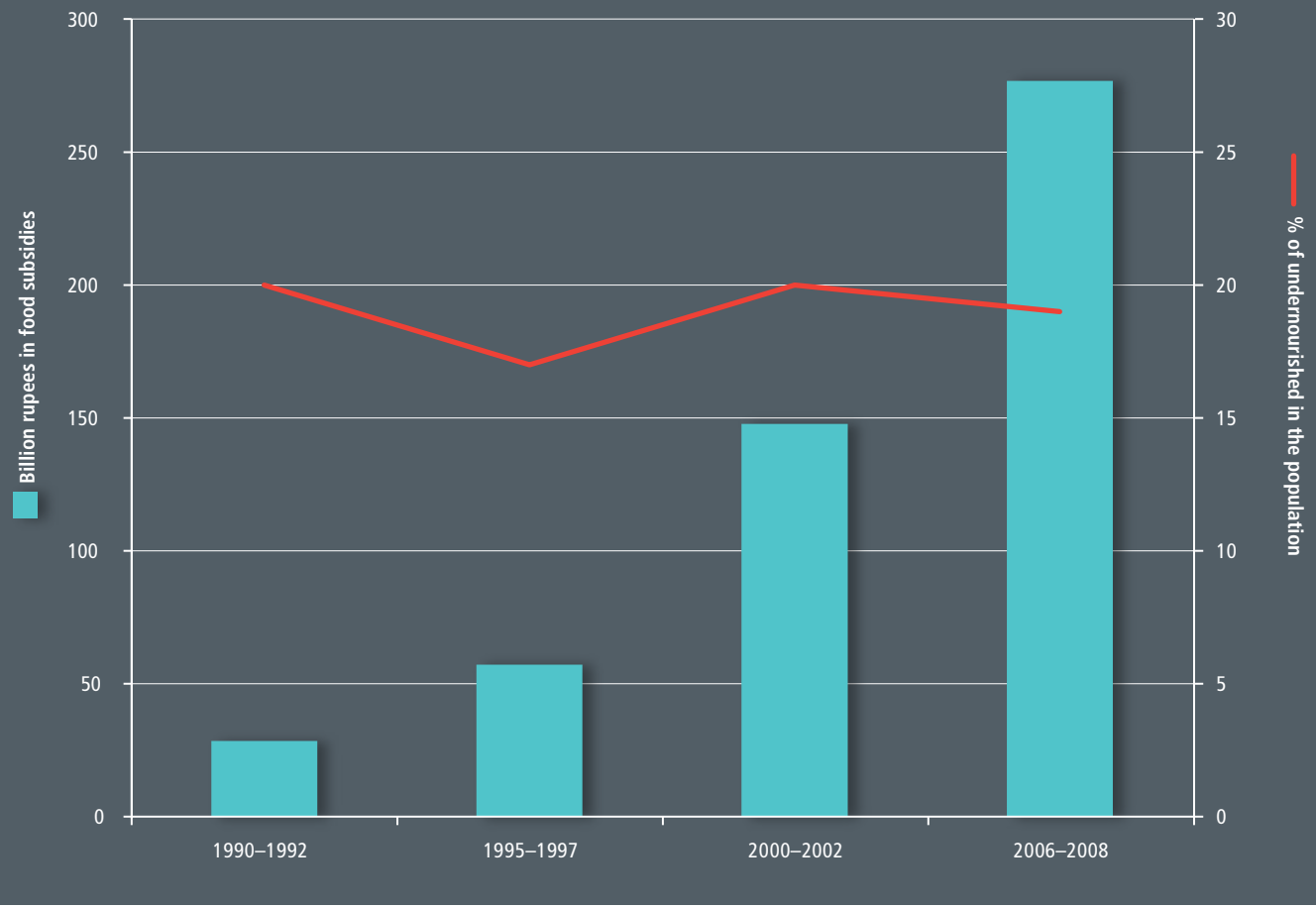
Although there is a consensus on the need to address the alarming levels of hunger and malnutrition in India, it remains an open question whether providing subsidized cereals to two-thirds of the population through a public distribution system is the right policy response.[4] This debate is hamstrung, however, by a lack of credible data on health indicators—including those measuring hunger and malnutrition—of India's population.

This chapter reviews the performance of India's existing food-grain procurement and distribution system, which will be used to implement the National Food Security Act. It highlights the system's inefficiencies and recent achievements and draws lessons from the experiences of other countries in implementing food safety net programs. The conclusion argues both for the need to try alternative modes of delivering food subsidies that have worked well in other developing countries and for the importance of informing the policy process with better evidence.

THE SUBSIDY BURDEN OF INDIA'S EXISTING FOOD SAFETY NET PROGRAM

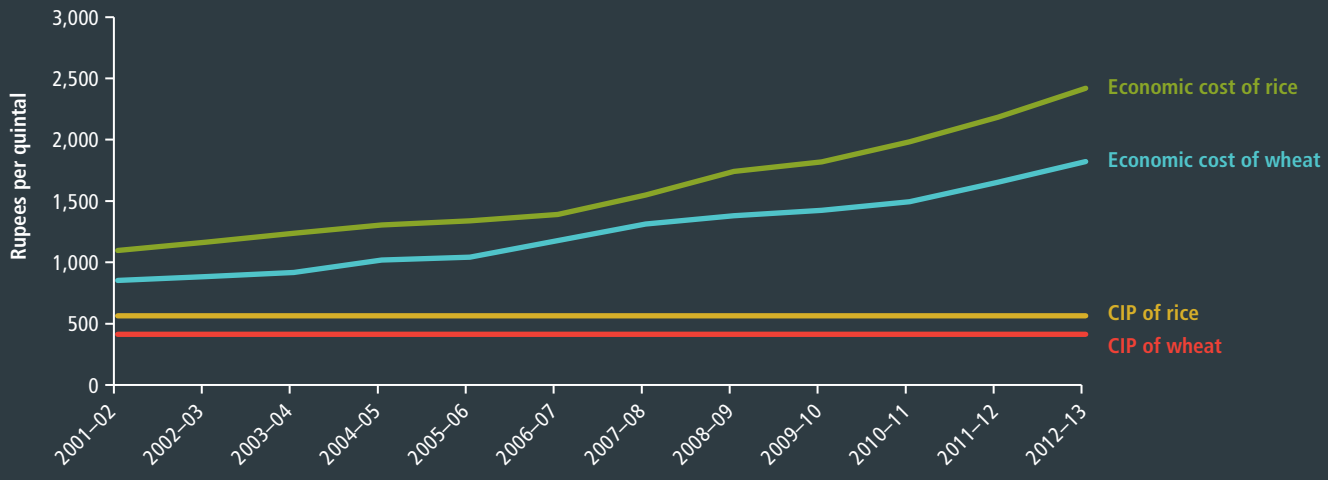
India already runs the largest food safety net program in the world. In 2011–2012, the Food Corporation of India procured 63.4 million metric

FIGURE 1 RISING FOOD SUBSIDIES AND STAGNANT LEVELS OF UNDERNOURISHMENT IN INDIA



Sources: Food subsidies: V. P. Sharma, *Food Subsidy in India: Trends, Causes, and Policy Reform Options,* Working Paper 2012-08-02 (Ahmedabad, India: Indian Institute of Management, 2012); undernourishment: Food and Agriculture Organization of the United Nations, *The State of Food Insecurity in the World 2011* (Rome, 2011).

FIGURE 2 ECONOMIC COST AND CENTRAL ISSUE PRICES (CIP) OF WHEAT AND PADDY RICE, 2001–2002 TO 2012–2013



Source: Compiled from V. P. Sharma, *Food Subsidy in India: Trends, Causes, and Policy Reform Options,* Working Paper 2012-08-02 (Ahmedabad, India: Indian Institute of Management, 2012).

tons of rice and wheat,[5] and the country's public distribution system delivered 51.3 million tons of grains at subsidized prices to 530 million people.[6] The act envisages a significant expansion of this food safety net. According to the government's own projections, after implementation of the act, 61.2 million tons of cereals,[7] procured from farmers at a minimum support price,[8] will be delivered every year to nearly 820 million people at Rs 1–3 per kg through the existing retail network of 480,000 fair price shops. The estimated cost to the exchequer in 2013–2014 is Rs 1,247.24 billion (US$21 billion).[9]

The annual cost of India's food subsidy has grown more than 25-fold over the past two decades, from US$0.62 billion in 1992 to US$16.67 billion in 2012, without any perceptible reduction in the proportion of the population that is undernourished (Figure 1).[10] This increase has been driven mainly by the widening gap between the economic cost of cereals and the central issue price at which they are provided to households (Figure 2). The economic cost includes the minimum support price at which the Food Corporation of India buys grains from farmers and rice mills as well as the cost of storage and distribution.

India has not increased the central issue prices of rice and wheat since July 2002. Once the act is implemented, moreover, these prices will drop. The minimum support price of both rice and wheat, on the other hand, has more than doubled over the past 10 years and will presumably continue to rise to cover the increasing cost of production and to incentivize farmers to produce the additional rice and wheat that may be needed to fulfill the act's requirements.[11] The cost of handling grains (including procurement, storage, and distribution) has also been rising rapidly due to India's increasing buffer stocks and growing diseconomies of scale in handling costs.[12] The overall cost of the food subsidy, therefore, is projected to increase rapidly from its current estimate of almost Rs 1,250 billion to Rs 1,401.92 billion in 2014–2015 and then to Rs 1,577.01 billion in 2015–2016.[13]

The actual cost of implementing the act may be even higher. The estimates given do not include the costs of setting up new institutions stipulated by the law (such as state- and district-level mechanisms for redressing grievances), of strengthening the existing institutions that manage food procurement and civil supplies, or of carrying

Food Security for India's Poorest of the Poor

SUKHADEO THORAT AND NIDHI S. SABHARWAL

In September 2013, the government of India took the bold step of enacting the National Food Security Act, which will provide poor households with 5 kilograms of food grain per person per month at an affordable price. In 2005, the government had adopted a similar act designed to legally guarantee minimum wage employment. These minimum food and employment guarantees supplement India's growth strategy by reducing poverty and hunger, which economic growth alone may not do. Although the National Food Security Act is crucial for the poor, it is especially critical for the persistently excluded and the indigenous groups of Scheduled Castes and Scheduled Tribes. These groups depend heavily on casual wage labor in rural areas, and their poverty rates are high. In 2010, 58 percent of rural Scheduled Caste households and 44 percent of rural Scheduled Tribe households were engaged in casual farm and nonfarm wage labor; the rest were self-employed farmers and nonfarm producers. Among the rural casual farm wage laborers, poverty rates were 37 percent for the Scheduled Caste households and 45 percent for the Scheduled Tribe households. Similarly, among the rural casual nonfarm wage laborers, poverty rates were 31 percent for the Scheduled Caste households and 38 percent for the Scheduled Tribe households.[1]

Although food and employment security for poor people is in place in India, the poor people in the Scheduled Castes and Scheduled Tribes need additional safeguards against the discrimination they face in obtaining food and employment, in contrast to the poor from nonexcluded groups. This discrimination affects their quantity and quality of food and their wage earnings. For example, the Scheduled Castes receive less food and other services from food security programs.[2] In the kindergarten centers, discrimination takes the form of provision of less food and less frequent visits to lower-caste neighborhoods for counseling on child feeding and other topics.[3] In the Mid Day Meal program in schools, Scheduled Caste children are seated separately, served last, served insufficient quantities, selectively denied meals, and not allowed to be employed as cooks and helpers.[4] In the employment guarantee scheme, the average wage earnings of the Scheduled Caste workers was lower than that of higher-caste labor workers, though in some cases the Scheduled Caste workers had slightly more employment days than the higher-caste workers.[5] These forms of discrimination are not uniformly practiced nationwide, and the practices vary considerably across states, but their incidence is enough to affect people's access to food and employment.

It is imperative, therefore, that India's general food security strategy be supplemented by safeguards against discrimination-induced low access, which we believe is the reason for more persistent poverty among the excluded groups. The need for safeguards against discrimination in market and nonmarket exchange has not yet been sufficiently recognized by national and international policy bodies. In the case of India, food security policies should include legal safeguards against discrimination and positive steps to ensure equal and fair shares in food and employment. Such an approach would improve excluded groups' access to food and employment and help reduce poverty at an accelerated rate.

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out new household surveys to identify the new beneficiaries.

Even before passage of the act, India had been spending nearly 1 percent of its gross domestic product (GDP) and at least 4–5 percent of its agricultural GDP every year on food subsidies, price supports, and price-stabilization programs. In comparison, during the past decade, public-sector spending on agricultural research and development (R&D) in India has remained in the range of 0.50 to 0.59 percent of agricultural GDP, and gross capital formation in agriculture from public sources has been less than 2 percent of agricultural GDP.[14] India's food subsidy allocation also exceeds what is

TABLE 1 Government of India's budget allocation to social-sector programs, 2011–2012

Sector	Allocation (billions of rupees)
Integrated Child Development Services	92.94
Mid Day Meal Scheme	103.8
Health and family welfare	456.23
Food subsidy	605.73
Education	633.63
Rural development	878.55

Source: Collated by authors from Accountability Initiative, www.accountabilityindia.in/expenditure_track.

budgeted for most social-sector services (Table 1). After implementation of the act, food subsidies will increase further. The increment is estimated to be Rs 239.51 billion, or 0.2 percent of GDP, in 2013–2014. If nonfood subsidy costs are also included, the total incremental cost of implementation is estimated at Rs 447.11 billion for 2013–2014, which is expected to increase to Rs 473.92 billion in 2014–2015 and then to Rs 505.91 billion in 2015–2016.[15] The increase in allocation of resources to the National Food Security Act may affect long-term agricultural growth if subsidies crowd out investment in agriculture and agricultural R&D.

FOOD SUBSIDIES: MODEST ACHIEVEMENTS AT HIGH COSTS

Food subsidies already account for more than one-third of total central government subsidies under nonplan expenditure.[16] This large expenditure on food subsidies is meant to ensure (1) a price floor for producers of rice and wheat, (2) stable rice and wheat prices for consumers through buffer stock management and open-market sales operations, and (3) food security for poor households through the public distribution system. As shown in a number of studies, the existing system has achieved only modest success on all three counts, all while bleeding resources due to enormous leakages and spiraling administrative costs.[17] This glaring inefficiency deserves serious attention given that this is the system to which the act will dedicate additional resources to get food from farms to the plates of the poor.

Price Support to Farmers

The Food Corporation of India buys nearly one-third of all rice and wheat produced in the country at the minimum support price. Until recently, however, much of the grain (about 90 percent in 2000–2001) was procured from only the four states of Andhra Pradesh, Haryana, Punjab, and western Uttar Pradesh (Table 2); farmers in other

TABLE 2 Percentage share of selected states in total cultivated area, production, and procurement of rice and wheat in India, 2011–2012

	Rice			Wheat		
	CULTIVATED AREA	PRODUCTION	PROCUREMENT	CULTIVATED AREA	PRODUCTION	PROCUREMENT
Andhra Pradesh	4.10	12.36	21.53	negligible	negligible	negligible
Haryana	2.81	3.60	5.72	8.43	13.51	24.45
Punjab	6.41	10.1	22.05	11.75	18.32	38.67
Uttar Pradesh	13.53	13.43	9.58	32.54	32.26	12.21

Sources: *Agricultural Statistics at a Glance 2012* (Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Government of India). For area and production data, see http://fciweb.nic.in//upload/Procurement/Procurement%20of%20rice%20from%2099-00%20onwards_3.pdf. For data on procurement of rice and wheat, see http://fciweb.nic.in//upload/Procurement/Statewise%20Procurement%20from%202000-01%20onwards.pdf.

states of India often did not benefit from the minimum support price. More recently, the interstate imbalance in procurement has lessened to some extent, with large-scale procurement of cereals beginning in Bihar, Chhattisgarh, Odisha, and Madhya Pradesh.[18]

Price Stabilization for Consumers

In the past few years, buffer stocks of rice and wheat have risen sharply to the unsustainable level of 80.5 million tons, compared with the estimated requirement of 31.9 million tons.[19] The overstocking of grains distorts food-grain markets

Safety Nets with Impact: Cash, Food, or Vouchers?

JOHN HODDINOTT, DANIEL GILLIGAN, MELISSA HIDROBO, AMY MARGOLIES, SHALINI ROY, AND BENJAMIN SCHWAB

The debate over whether to provide food assistance and the form that assistance should take has a long history in economics. Although many studies look at the impact of providing either food or providing cash, there is remarkably little rigorous evidence directly comparing the impact of in-kind food assistance with cash transfers. Between 2010 and 2013 the International Food Policy Research Institute, in partnership with the World Food Programme, undertook a study to compare the impact of cash, food, and vouchers on household food security in Ecuador, Niger, Uganda, and Yemen.[1] For the study, we used an experimental design and randomly assigned cash, food, or vouchers to different localities in all four countries. To the extent possible, we equalized the timing, frequency, and value of the transfers to help ensure that differences in outcomes were attributable to the form of the transfer and not to other confounding factors.

Our preliminary findings suggest that there is no one "right" form of food-assistance transfer. The relative effectiveness of cash, food, or vouchers seems to depend heavily on context, such as the severity of food insecurity and the strength of markets for grains and other foods. In assessing alternative forms of transfer, it is important to explicitly consider trade-offs between the quantity of food available and the quality of people's diets. In three of the four countries studied (Ecuador, Uganda, and Yemen), the findings suggest that cash had a larger impact than food on improving dietary diversity; in the case of Ecuador, we found that vouchers also did more than food to improve diet diversity. In the fourth country (Niger), food had a larger impact on dietary diversity. By contrast, in two countries (Ecuador and Yemen), food did more than cash or vouchers to increase the quantity of calories available for households' consumption.

Impact, however, is only part of the story. Excluding the cost of procuring food, the results suggest that cash transfers are cheaper to deliver than food. These differences can be large. For each transfer delivered, cash is less expensive by US$2.91 in Uganda, US$6.28 in Yemen, US$8.47 in Ecuador, and US$8.91 in Niger. In cases where it is cheaper to procure food for transfers than it is for beneficiaries to buy food in local markets, this cost differential tends to narrow. Our data suggest, however, that as implementers gain further experience with cash, the cost of delivering it can be significantly reduced.

Other notable preliminary findings include the following:

- We found no evidence that beneficiaries always prefer one type of modality. Instead, beneficiaries' preferences depended on context.
- We found virtually no evidence that beneficiaries sell their food transfers.
- We found no meaningful evidence that cash transfers are used for undesirable purposes such as buying beer (Uganda) or qat (Yemen).
- We found that cash transfers can reduce the prevalence of anemia and improve cognitive development in preschool-age children (Uganda).
- We found no evidence that any of the different transfer modalities have adverse impacts on women's decisionmaking in the household (Ecuador and Yemen) or on social tensions between host and refugee communities (Ecuador).

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and imposes huge storage costs (approximately US$1 billion in 2010–2011). Ironically, between 2004 and 2013, even as government buffer stocks surged, the retail prices of rice and wheat increased by 137 percent and 117 percent, respectively.[20] Although there is no rigorous analysis attributing the high food price inflation in recent years to poor or worsening food management, the increase in procurement of grains from farmers, combined with the slow release of those grains into the market by the Food Corporation of India, is thought to have contributed to a rise in the average price of grain in the domestic market.[21]

Household Food Security: The Targeted Public Distribution System

The Nutritional Impact of the Cereals Subsidy. India's targeted public distribution system (hereafter referred to as TPDS to distinguish it from the general public distribution system or PDS), which the Indian government considers one of its primary nutrition programs, is the world's largest food safety net program.[22] Yet there are few rigorous studies on the impact of this system on calorie intake, food security, nutrition, or household welfare. The few studies that do exist show that it has had little impact on total calorie consumption and malnutrition.

In a 2005 study, Kochar found that the TPDS subsidy has only a marginal impact on the calorie intake of rural households, mainly because a small proportion of households bought a small share of their monthly rice and wheat requirements from the fair price shops.[23] More recently, Kaushal and Muchomba have suggested that increases in food subsidies following the expansion of the system in 2002 had "a negligible to negative effect on calorie and protein intake and no statistically significant effect on fat intake."[24]

In part because of a lack of data, the effect of the TPDS on hunger or food security has also not been analyzed; only tentative evidence is available.[25] For example, Khera found that 70 percent of households below the poverty line in Bihar had to skip meals sometime during the three months preceding the survey, whereas in Chhattisgarh only 17 percent of households below the poverty line had to do so, even though the rate of rural poverty is almost the same in both states (55 percent and 56 percent, respectively).[26] Drèze and Khera have conjectured that the lower incidence of skipping meals in Chhattisgarh is due to its well-functioning TPDS.[27]

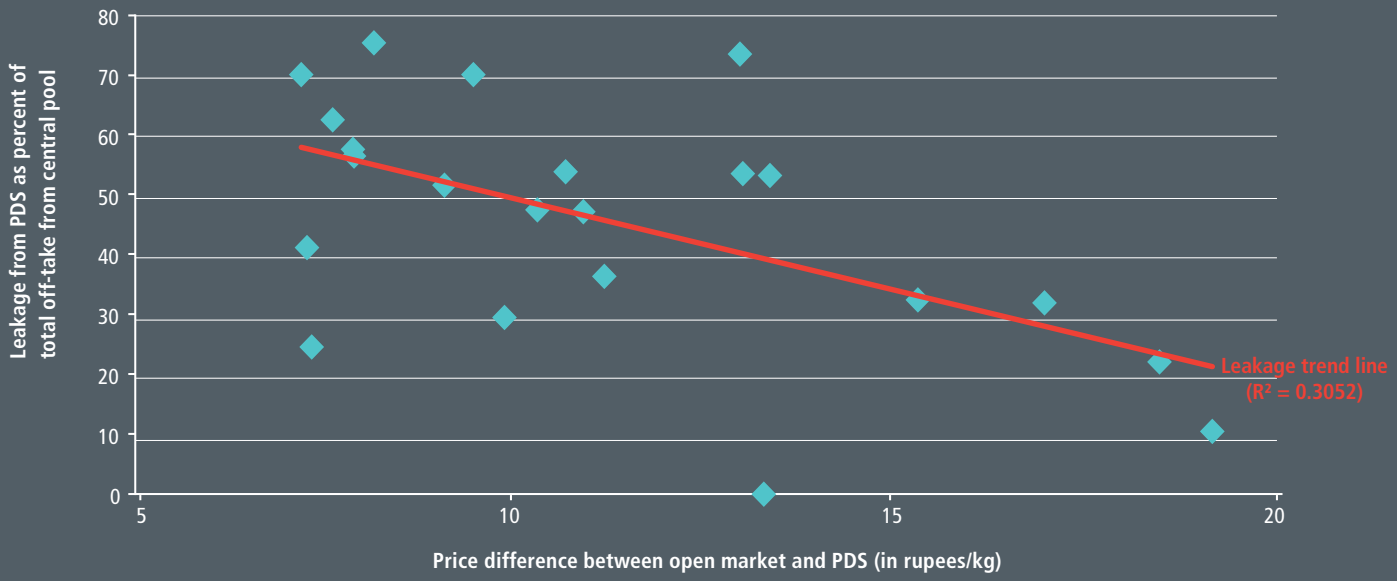
The actual contribution and cost-effectiveness of the act will depend on the extent to which its implementation can overcome the deficiences of the current public food distribution system.

In terms of nutrition, Tarozzi found that in 1992, a sudden doubling of the price of the rice provided through the PDS in Andhra Pradesh in 1992 did not have an adverse impact on children's weight-for-age in the state, suggesting the possibility that even large changes in food subsidies may not have a significant effect on child nutrition.[28] Studies on the nutritional impact of subsidized food prices have found mixed evidence in other developing countries as well. For example, in China, Jensen and Miller did not find any overall improvement in nutrition due to food price subsidies.[29] Similarly, in Malawi, Ecker and Qaim found that demand for food is sensitive to price changes, whereas demand for nutrients generally is not.[30]

The outcome of the National Food Security Act may, however, be different from the studies cited here, as the act offers much higher subsidies than the ones examined in studies by Jensen and Miller, Kochar, and Kaushal and Muchomba.[31] Thus, the actual contribution and cost-effectiveness of the act will obviously depend on the extent to which its implementation can overcome the deficiencies of the current PDS, as described in the next section.

Leakage and Corruption in the TPDS. The low impact of India's TPDS is not surprising given three problems—poor targeting, high leakage, and inefficiency. These problems make it one of

FIGURE 3 LEAKAGE OF RICE AND WHEAT FROM PUBLIC DISTRIBUTION SYSTEMS (PDS) IN DIFFERENT STATES OF INDIA AND AGAINST PRICE DIFFERENCE, 2009–2010



Source: Graph plotted by authors. The price difference was calculated using data from the 66th round of the National Sample Survey (NSS) consumption survey. The leakage from the public distribution system has been estimated using rice and wheat off-take data from the Food Bulletins of the Ministry of Food and Civil Supplies, http://dfpd.nic.in/?q=node/1058.

Note: Leakage is the difference between central allocation of grains and the household off-take as estimated from NSS consumption surveys.

the most inefficient social safety net programs in the world.

In terms of targeting, the TPDS seems plagued by large exclusion and inclusion errors; that is, it excludes many people who meet the program's requirements and includes many people who do not. Preliminary analysis of the 68th round of the National Sample Survey (NSS) data on consumption suggests that in 2011–2012, more than half of all households in the poorest three consumption classes did not have *Antyodaya*—or below the poverty line (BPL)— cards, whereas nearly 16 percent of the richest households (in the top consumption decile) did. Furthermore, only about half of the poor households in the bottom three deciles of monthly per capita consumption expenditure in India received rice or wheat from fair price shops in 2011–2012, and even those households bought only a small fraction of their total entitlement of subsidized grains from fair price shops.[32] A recent study on allotment of BPL cards in Karnataka, a state in southern India, found that rule breaking was common and that nearly half of all sample households were misclassified.[33]

The second problem is high leakage. Recent estimates suggest that 40 percent of grain channeled through the TPDS gets diverted to the open market and thus does not reach its intended consumers.[34] The diversion of subsidized grain increased from 23.9 percent in 1999–2000[35] to 54 percent in 2004–2005[36]—a time period in which the difference between the market price and the central issue price, and thus the incentive to divert, increased.[37] Some estimates suggest, however, that the diversion decreased to 40 percent in 2009–2010 despite a further increase in the price gap (and thus in the incentive to divert).[38] Interstate comparisons also suggest that the leakage of grains from TPDS is lower in states where the difference between the open market price and the central issue price is higher (Figure 3).[39] Seeking to explain this trend, Drèze and Sen have conjectured that the rising

market price of food increased the value of TPDS entitlements, thereby increasing people's interest in securing them and thus providing state governments with an incentive to reform the TPDS in response to its rising popularity.[40]

Third and finally, the TPDS suffers from high costs and high inefficiency. According to one preliminary estimate, it costs Rs 8.5 for the system to transfer one rupee to poor households.[41] Only 10.5 percent of a given subsidy reaches the poor.[42]

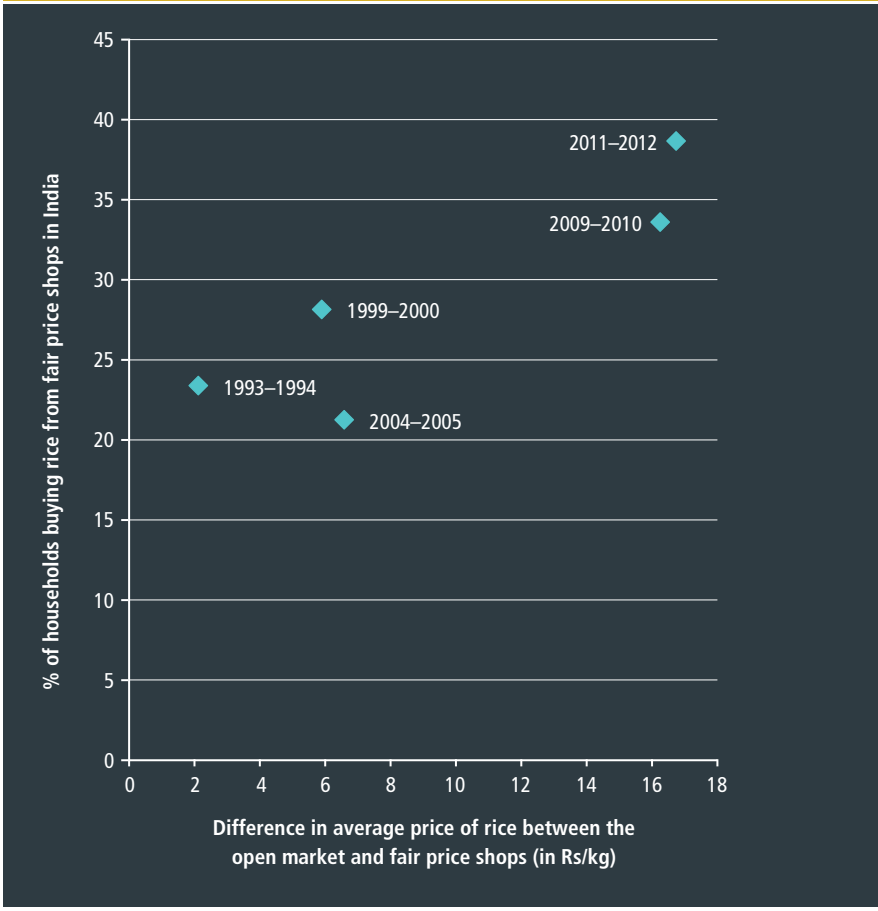
Revival of TPDS and Emergence of the "New PDS." The high inefficiency, poor reach, and low impact of TPDS have forced policymakers at both the state and national levels to revisit the issue of how to design and deliver social transfers effectively and efficiently. As this discussion has progressed in recent years, India's TPDS has shown some improvement. States now collect a higher share of their allocation of rice and wheat from the central pool.[43] Although still high (at 40 percent), the level of food diverted from reaching its intended consumers has been decreasing.[44] As the gap between the open-market and central issue prices of rice and wheat has risen sharply, more households have come to rely on the TPDS. Households' total purchase of cereals through the PDS rose from 13.5 million tons in 2004–2005 to 25.3 million tons in 2009–2010, and the average quantity of cereals purchased by each household from fair price shops also increased significantly (Figure 4).

Chhattisgarh and Tamil Nadu. The PDS experiences of Chhattisgarh and Tamil Nadu stand out. The Tamil Nadu government has implemented a universal public distribution system with no targeting, whereas Chhattisgarh has relaxed targeting to include 90 percent of the state's population. Tamil Nadu provides all households with 12–20 kg of rice per month free of cost.[45] In Chhattisgarh, rice is sold at Rs. 2 per kg. Through the use of technology-enabled administrative measures, the governments of both states have managed to control the diversion of free or cheap grain from the public distribution system.

In Tamil Nadu, the movement of grain from warehouses to fair price shops, which are owned and operated by the government or its agencies, is tightly controlled through fixed-route charts and mobile phone–based tracking (stocks in all 32,000 fair price shops are monitored daily by way of SMS text messages). The state government spends approximately Rs 3 billion every year to run these shops.

In Chhattisgarh, the government has also deprivatized the fair price shops, increased the shopkeeper commission on grain from Rs 8 to Rs 35 per quintal, and arranged delivery of subsidized goods directly to the shops via a special fleet of trucks monitored using global positioning satellite technology. It is important to note that no robust evidence exists to demonstrate either how these different mechanisms used by Tamil Nadu and

FIGURE 4 INCREASE IN USE OF FAIR PRICE SHOPS WITH RISING PRICE DIFFERENCE BETWEEN OPEN-MARKET AND CENTRAL-ISSUE PRICES



Source: Data from National Sample Survey Office (NSSO) consumption surveys, rounds 50, 55, 61, 66, and 68.

Chhattisgarh actually reduce leakages or at what administrative and financial cost.

By matching data on consumption expenditures from the NSS with data on food allocation by the central government, we can see that these measures to reform the system are associated with positive results in both states. Preliminary analysis suggests that in 2009–2010, the diversion of food grains from the TPDS was much lower in Tamil Nadu (10–11 percent) than the national average of about 40 percent, despite the large gap between the open-market price and the central issue price of rice in the state. Of the rural households in the state, 91 percent bought 53 percent of the total rice they consumed from the TPDS, compared with a national average of 39.2 percent of rural households buying 23.5 percent of their total rice from the public distribution system.[46] Similarly, a survey of 900 households in eight districts of Chhattisgarh showed that 92 percent of respondents received their full quota of food grains and that

Policymakers should consider the trade-offs between increasing the quantity of food available and improving the quality of people's diets.

97 percent of the respondents were satisfied with the food quality.[47] The 66th consumption survey by the NSS in 2009–2010 also revealed that 9 out of 10 households in the bottom three consumption deciles of Chhattisgarh used the TPDS to buy rice—the staple grain; their average off-take level was close to their entitlement of 35 kg per month. Overall, nearly 75 percent of rural households in the state receive 35 kg of rice from the TPDS every month at highly subsidized rates.[48]

Although the improvement in the reach of the PDS in Chhattisgarh and Tamil Nadu is impressive, it has come at a high fiscal cost. Tamil Nadu allocated Rs 49 billion to food subsidies in 2013–2014 (of which Rs 37 billion will be used to distribute free rice), and Chhattisgarh's food subsidy bill is close to Rs 25 billion a year. The costs of increased monitoring and supervision and of running state-owned shops are unknown. The budgetary allocations by these states are in addition to the support they receive from the central government in the form of subsidized rice and wheat. Unfortunately, we do not know if the welfare gains from the increase in household consumption of subsidized rice from the TPDS and the reduction in the diversion of the system's supplies exceed the additional cost in both states. Nor do we know whether increased resource allocation to the TPDS in these states has reduced poverty or led to any increase in calorie intake, dietary diversity, or better nutritional outcomes.

The National Food Safety Act has also adopted the first two elements of the Chhattisgarh–Tamil Nadu reform strategy—that is, it has expanded the list of targeted households to cover the bottom two-thirds of Indian households and made grain cheaper for those households. It remains to be seen whether other state governments will follow the lead of Chhattisgarh and Tamil Nadu to invest in administrative efforts to control diversion and monitor performance. If they do not, leakage may increase even further due to the higher gap between market and subsidized prices.

Food Security through Direct Cash Transfer: Lessons from International Experience. The reforms in Chhattisgarh and Tamil Nadu have shown that the existing system of transferring grain to the poor can be made to work. Yet because the existing system is highly inefficient and distortionary, other more targeted delivery mechanisms—such as direct cash transfers or food stamps—may be more cost-effective and are thus worth exploring. India has declared its intent to eventually replace the distribution of subsidized food with unconditional direct cash payments to beneficiaries.[49] The act also allows the use of such alternative delivery mechanisms.

Unconditional cash transfers may provide recipients with greater choice and create less risk of distortion.[50] In rural areas, cash distribution may stimulate agricultural production and

nonagricultural activities by facilitating investment in agriculture and allied activities and by relieving credit constraints.[51] In rural Bolivia, for example, landowners who received pension benefits from BONOSOL (Bono Solidario), the unconditional cash transfer program, increased their consumption by twice the amount of the benefit because of improved household production. Similarly, in Mexico, cash transfer programs like PROGRESA (now called Oportunidades) and PROCAMPO (Programa de Apoyos Directos al Campo) helped increase investment and income; and in Bangladesh and Brazil, such programs have improved households' access to credit.[52] Furthermore, experience from a range of countries demonstrates that distributing cash can be cheaper than distributing food or other commodities. Food-based programs in Bangladesh, for example, cost 0.20 taka to transfer 1 taka worth of food, whereas the cost of delivering cash was virtually zero.[53]

Taken as a whole, however, current international experience suggests that the choice between food and cash transfers is context specific. First, some argue that the capacity to deliver cash transfers regularly is a prerequisite for implementing a successful cash transfer system.[54] India, for example, has only one bank branch per 14,000 people and only 33,495 rural branches for 600,000 villages (that is, one bank branch for every 17 villages). More than 145 million households do not have bank accounts. Limited access to financial institutions thus makes it difficult to institute a direct cash transfer system in India.

A second prerequisite for the provision of cash is well-functioning local food markets. Cash is less effective when markets are weak and food prices are volatile.[55] Cash transfers can even push prices up in food-deficit areas that have underdeveloped markets.[56] Although much of India is well served by markets, this is not true everywhere, especially in rural areas where most of the beneficiaries of the public distribution system live. In such areas, the purchasing power of cash transfers will likely be diminished by higher food prices. Linking the transfer amount to the inflation index is one possible solution to this problem; however, the global food price crisis of 2007–2008 drew attention to the fact that cash transfers are rarely index linked.[57] Index-linked cash transfer schemes do exist—the Dowa Emergency Cash Transfer project in Malawi, for example—but we do not know whether such projects can be feasibly implemented on a large scale.[58]

Third, it is conceivable that transfer programs can be improved by directly considering the views of program beneficiaries regarding the type of assistance they receive. A pilot experiment in New Delhi had some interesting findings: women from many households at the poverty level who had opted for direct cash transfers for a year reported that they would prefer to get rations from the fair price shops rather than cash deposits to their bank. This was true even for those who had a mostly positive experience with direct cash transfers under the experiment.[59] In other countries, poor people's preferences for commodity or cash depend on their recent experiences with price changes. The poorest beneficiaries tend to prefer food transfers, though this preference is less pronounced among those in this group who are relatively better off.[60]

Additional insights come from a recent study by the International Food Policy Research Institute, working with the World Food Programme, conducted in Ecuador, Niger, Uganda, and Yemen.[61] Beneficiaries, selected across localities, received either a food basket (containing grains, pulses, and oils), cash equivalent in value to the food basket, or (in one country, Ecuador) a voucher. Several preliminary findings relevant to India emerge:

1. There is no one "right" transfer modality. The relative effectiveness of different modalities depends on context, such as the severity of food insecurity and the competitiveness of markets for grains and other foods.
2. In assessing alternative modalities, policymakers should consider the trade-offs between increasing the quantity of food available and improving the quality of people's diets. In Ecuador, Uganda, and Yemen, cash had a larger impact on improving dietary diversity, whereas in Niger, food had a larger impact on diet diversity.

The Reform of US Food Aid

NANCY E. LINDBORG

Over the past 60 years, the United States has reached more than 3 billion people with its food assistance, both saving lives and helping the most vulnerable break the cycle of poverty and hunger through agriculture and livelihoods support. However, the world has changed over the past 60 years, and the US Agency for International Development (USAID) has the opportunity to increase its reach and effectiveness in tackling hunger. In the 2014 budget request, President Barack Obama included a food-aid reform proposal that would provide the USAID with much-needed flexibility in how it responds to food needs.

Currently, the US Food for Peace Act requires the United States to purchase agricultural commodities domestically and ship them abroad. Since 1954, these in-kind food aid programs have helped feed billions of people and may have been the best available response in many scenarios. For example, in a country where local markets do not have enough food on hand, in-kind food aid may be the best option.

Certain complex environments, however, call for different approaches. To respond to the growing need for more flexible, market-sensitive, timely, and cost-effective approaches, USAID created the Emergency Food Security Program in 2010. This program enables USAID and its partners to expand their food-assistance toolbox to cash transfers, food vouchers, and locally or regionally purchased commodities. A recent study showed that when local markets have adequate supplies, we can purchase large amounts of food locally and reach more people sooner, with valuable cost and time savings.[1] A 2009 study showed that local and regional purchases allowed partners to buy food closer to the site of an emergency, getting it to those in need an average of 15–16 weeks faster and at a cost up to 34 percent less than traditional in-kind food aid.[2] Even if purchasing locally or regionally is not always more cost-effective than US in-kind food aid, it is always faster.[3]

In addition, a preliminary four-country study has suggested that across programs, cash transfers are generally—but not always—more effective than food in improving food consumption scores while costing significantly less.[4] These studies do not mean that cash-based programs are better than food in every case; rather, they underscore that food-assistance responses must have flexible tools so the right response can be tailored to a specific country context.

The Philippines typhoon in November 2013 was a vivid example of how we need all of our tools to meet emergency needs. Within five days of the superstorm, USAID had purchased 2,400 metric tons of rice locally and airlifted 40 metric tons of high-energy biscuits from Dubai, providing immediate support to the World Food Programme's (WFP's) emergency operation in Tacloban. These resources were supplemented with 55 metric tons of Title II emergency food products airlifted from a warehouse in Miami, which reached the island of Cebu on the same day food distributions through the Philippines' Department of Social Welfare and Development began; within three weeks 1,020 metric tons of prepositioned Title II rice had arrived from Colombo, Sri Lanka, by ship.

Additionally, in communities where markets were functioning and adequately stocked, WFP began unconditional cash transfers for food to the most food-insecure people. Unconditional cash transfers for food reached more than 111,000 people by the end of December and targeted more than 500,000 people in January 2014, while cash-for-assets activities will begin in support of early recovery.

USAID was the first and remains the largest contributor to WFP's operation. A full portfolio of tools allows USAID to respond quickly in times of crisis, while ensuring that enough food remains available in the weeks following a crisis.

President Obama has prioritized reforming USAID food-aid programs as part of a commitment to modernizing our assistance, stretching our existing budget, and reaching more hungry people. In early 2014, the President signed into law a new Farm Bill, which made significant reforms to food aid. We remain committed to our longstanding partnership with America's farmers and shippers in helping to feed hungry people around the world. Finally, we seek to modernize our food assistance at a time when disasters and emergencies are growing in number and complexity.

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3. There was virtually no evidence of beneficiaries selling their food rations or using cash transfers for undesirable purposes (including buying alcohol).

WAYS FORWARD

India's newly launched National Food Security Act has been characterized as the world's largest and most ambitious food safety net program. Such a scale is appropriate for a country with the highest number of malnourished people in the world. The program is ambitious in its reach and resource commitment yet it relies on existing problematic institutions and channels for delivering food subsidies. Although the act has created several mechanisms to reduce leakage and ensure effective monitoring, it remains to be seen how transparent and cost-effective the proposed institutional frameworks will be. Going forward, it would be prudent for the state and central governments of India to experiment with other mechanisms (such as direct cash transfers or food stamps), wherever appropriate.

There is a fear that the bulk procurement, stocking, and distribution of rice, wheat, and coarse cereals will distort markets and lead to higher prices for grain sold in the open market. This suggests a need to ensure that distorted markets do not adversely affect farmers. Moreover, India's neighbors, such as Bangladesh and Nepal, fear that India's food subsidies may encourage illegal border trade that could affect their own domestic grain markets. Appropriate mechanisms need to be developed to check such illegal border trade.

As it is currently configured, the act provides only rice, wheat, and coarse cereals to beneficiaries. Experimentation and analysis are needed to assess whether providing pulses instead of these cereals would lead to better nutrition outcomes. Pulses, which have recently increased steeply in price, are presently beyond the reach of many poor consumers. Furthermore, protein consumption by poor consumers is declining.[62] Because of the increasing preference for meat in India, demand for coarse cereals for livestock feed is increasing.[63] Some state governments have included pulses in their public distribution system. After evaluation of such programs, India may see the wisdom of institutionalizing the practice.

In 2011, the government of India declared its intent to eventually replace distribution of subsidized food with direct cash payments.[64] The act leaves the choice of delivery mechanism, however, to the state governments. Most states—including Karnataka, Madhya Pradesh, Odisha, and Rajasthan—are following the example of Chhattisgarh in reforming their public distribution system. The option of cash transfers, however, should not be taken off the table. Rather, it should be tested, especially in cities, large towns, and peri-urban areas, where grain markets are well developed and where people have easy access to banks or banking services. In such areas of the country, cash entitlements that are indexed to inflation and transferred directly to beneficiaries' bank accounts will reduce not only the overall buffer stock requirements necessitated by large-scale food transfers but also the government's food subsidy cost. ■

SUSTAINABLE AGRICULTURAL INTENSIFICATION

The Promise of Innovative Farming Practices

Claudia Ringler, Nicola Cenacchi, Jawoo Koo, Richard Robertson, Myles Fisher, Cindy Cox, Nicostrato Perez, Karen Garrett, and Mark Rosegrant

SUMMARY Sustainable agricultural intensification holds promise to play a role in the broader effort to ensure food security while protecting our natural resource base. But what would such a sustainable intensification look like in practice? This chapter presents the results of an ex ante assessment of the yield and food security potential of 11 technologies for the sustainable intensification of the key staple crops of maize, rice, and wheat.

Growth in the agriculture sector is shown to reduce poverty three times faster than growth in any other sector—manufacturing, industry, or services.[1] By sustainably increasing agricultural production, we can enhance food availability, which is a necessary condition to combat hunger. Experts agree that greater production must be achieved by increasing yields while using fewer resources and minimizing or reversing negative environmental impacts. This sustainable agricultural intensification approach is fundamentally about making the current agricultural system more efficient through the use of new technologies or by improving current production systems. Importantly, sustainable intensification is only one pillar of food security; others include interventions to improve food access, utilization, and stability.

Sustainable agricultural intensification is central to the agricultural debate surrounding the post-2015 development agenda, which focuses on the formulation of the United Nations (UN) Sustainable Development Goals. In 2012, the UN Conference on Sustainable Development, known as Rio+20, issued a declaration entitled "The Future We Want,"

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Evaluating the "New Agronomy"

DAVID J. SPIELMAN

In 2013, there was much discussion about record crop yields in some unlikely places in the developing world.[1] Many stories share a common refrain: better crop and resource management practices have driven impressive yield improvements. This message is a break from the common narrative in which yield gains are attributed primarily to high-yielding cultivars and synthetic fertilizers.[2] Although cultivars and fertilizers are by no means passé, attention may be turning to technologies that are less discrete or harder to identify, observe, or define. Such technologies include those classified under the umbrella of "climate-smart agriculture," "sustainable intensification," or "new agronomy" and are designed to simultaneously increase productivity, conserve natural resources, and adapt to weather shocks associated with climate change.[3]

Examples of such technologies include practices as varied as integrated soil fertility management, agroecology, agroforestry, systems of crop intensification, integrated pest management, minimum tillage systems, and conservation agriculture. Many are fundamentally different propositions from the technologies promoted during the past five decades. Some are even radical changes in how farmers cultivate their crops and manage livestock, water, land, soil, trees, residues, and waste. What to an outsider may seem like innocuous recommendations on planting dates, tillage practices, plant spacing, irrigation timing, or residue disposal are, for many farmers, controversial and counterintuitive after generations of collective experience.[4]

Yet there are relatively few rigorous assessments of the social and economic impacts of these practices across multiple dimensions—not only of yields, but also of social and economic returns on investment, farm-level efficiency, household consumption, or national food security.[5] One reason for this may simply be that these practices are difficult to measure because they look different from farmer to farmer. These practices are often contingent on high levels of site- and context-specificity, so successful application relies heavily on farmers' ability to adapt complex cultivation and resource management techniques to the specific attributes of their own farms. This farmer adaptation renders every technology slightly different when put into practice, leaving the evaluator without a consistent intervention to measure. Arguably, impact evaluations will have to somehow account for these adaptation and learning processes, particularly where learning relates to farmers' unobservable innovative capabilities.

Forecasting the impact of these practices also requires a rethinking. The attributes and specificity of these practices may make them difficult to transfer between farmers through standard research and extension approaches. If this is the case, then proven agronomic or economic performance may not lead to widespread or durable change. This suggests that promotion efforts built around "scaling up and out" or "bridging the last mile" may yield poor results. Instead, policymakers and donors might have to diversify away from the search for large-scale solutions to appreciate more incremental successes that accumulate over longer time horizons.

These challenges call for new and better approaches to measuring technological change and evaluating the impact of farmers' management practices. Further development of the evaluation toolkit used by different disciplines is needed to demonstrate where new practices might work, where they might falter, and what the trade-offs might be for individuals and society.

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which adopted a voluntary 10-year framework of programs on sustainable consumption and production in support of sustainable production increases.[2] Furthermore, a technical report for the post-2015 development agenda—*Solutions for Sustainable Agriculture and Food Systems*—suggests that "Sustainable Agricultural Intensification (SAI) offers workable options to eradicate poverty and hunger while improving the environmental performance of agriculture, but requires transformative, simultaneous interventions along the whole food chain, from production to consumption. It also requires unprecedented, large-scale behavior change by consumers as well as producers of food."[3] For the purposes of this chapter, we focus on the sustainable production component of sustainable agricultural intensification.

Although the basic premise of sustainable intensification is clear, some experts consider it a contradiction in terms. Others disagree, seeing it as one of several tools necessary for achieving the broader goal of sustainable food security.[4] Sustainable intensification does not specify which agricultural technologies and practices should be deployed, because these are context specific.[5] Experts have suggested that the adoption of incremental changes—such as expanded fertilizer use, improved varieties, use of mulches, optimal spacing, and adoption of precision agriculture in both high- and low-tech systems—could have important positive effects on yields in many parts of the world, while also limiting environmental impacts.[6] As Juma et al. stated succinctly: "We know that innovation can come from a variety of sources—international organizations, the private sector, National Agricultural Research Systems (NARS), Non-Governmental Organizations (NGOs) and farmers themselves. But which of these and/or their combinations are most likely to deliver not only multiple benefits but resilience and sustainability?"[7]

ANALYSIS OF SUSTAINABLE AGRICULTURAL INTENSIFICATION SCENARIOS

We use a new modeling approach to assess the yield and food security impacts of 11 agricultural technologies for the three key staple crops of maize, rice, and wheat. The approach combines comprehensive process-based modeling of agricultural technologies globally[8] across a 60-square-kilometer grid of global crop areas with sophisticated modeling of global food demand, supply, and trade (using the International Model for Policy Analysis of Agricultural Commodities and Trade or IMPACT).[9] The technologies assessed in the study are presented in Table 1.

Experts have suggested that the adoption of incremental changes…could have important positive effects on yields in many parts of the world, while limiting environmental impacts.

Several of these technologies (such as crop protection, advanced irrigation, and no-till) can be found in the field, whereas others (including nitrogen-use efficiency and heat-tolerant varieties) are still under development. Covering a broad range of traditional, conventional, and advanced practices recognized as having wide geographic applicability, these technologies illustrate the key strands of research and development that are necessary in order to respond effectively to growing natural resource scarcity, climate change, and higher food demands.

Any complex and multidimensional modeling effort, including the present one, is subject to a series of assumptions and limitations. Consequently, simulated outcomes are not intended to be taken at face value but rather to demonstrate

TABLE 1 Agricultural technologies included in the simulation

Technology	Description
No-till	Minimum or no soil disturbance, often in combination with residue retention, crop rotation, and use of cover crops
Integrated soil-fertility management	Combination of chemical fertilizers, crop residues, and manure or compost
Precision agriculture	GPS-assisted delivery of agricultural inputs in combination with low-tech management practices that aim to control all field parameters, from input delivery to plant spacing to water level
Organic agriculture	Cultivation with exclusion or strict limits on use of manufactured fertilizers, pesticides, growth regulators, and genetically modified organisms (GMOs)
Water harvesting	Water channeled toward crop fields from macro- or micro-catchment systems or through the use of earth dams, ridges, or graded contours
Drip irrigation	Water application via a small discharge directly around each plant or to the root zone, often using microtubing
Sprinkler irrigation	Water distributed under pressure through a pipe network and delivered to the crop via overhead spraying by sprinkler nozzles
Heat tolerance	Improved varieties that maintain yields at higher temperatures
Drought tolerance	Improved varieties that have better yields compared to regular varieties due to enhanced soil-moisture-uptake capabilities and reduced vulnerability to water deficiency
Nitrogen-use efficiency	Varieties with enhanced nitrogen-use efficiency (either same yield with lower nitrogen input or higher yield without additional nitrogen input)
Crop protection	Chemical treatment that, based on the collected data, protects against diseases (fungal pathogens), insects (arthropod pests), and weeds

Source: Authors' compilation.

possible orders of magnitudes that suggest areas of focus, which can then be studied further as additional data and more advanced analytical models are developed. One key assumption that underlies our model, and thus our results, is that our agricultural technology characterizations in the process-based crop model adequately reflect how the technologies play out in the field under the different biophysical conditions that exist globally. We also assume that, to date, the agricultural technologies assessed have not been widely adopted, with the exception of no-till. Other important limitations include the following: (1) Because crop models cannot simulate the dynamic behavior of pest populations and their interactions with crops, we characterize both crop protection and organic farming implicitly based on our regional disaggregation of published literature; (2) We do not explicitly model the costs of these technologies; (3) We use simple, coarse, technology-adoption profiles to differentiate the adoption ceilings of these technologies; and (4) We assess the yield impacts of long-term climate change but not of climate-extreme events.

In agreement with sustainable agricultural intensification, many of the selected technologies and practices have the potential to improve or restore soil fertility, thereby establishing conditions for increased productivity while making better use of resources, helping farmers adapt to a changing climate, and reducing adverse environmental impacts of agricultural production.[10]

SIMULATION RESULTS

Our simulation found that almost all technologies studied have great potential to sustainably increase agricultural production compared with our baseline scenario. (Note that we found no regional yield benefits for organic agriculture.) We project that yields under the agricultural technologies by 2050 would be higher than under a baseline without widespread adoption

TABLE 2 **Projected impact of alternative agricultural technologies on global yields in 2050 (% change from baseline)**

Technology	Maize	Rice	Wheat
Nitrogen-use efficiency	11.3	20.2	6.2
No-till	15.8	NA	16.4
Heat tolerance	16.2	3.0	9.3
Precision agriculture	3.7	8.5	9.7
Integrated soil fertility management	1.8	6.7	3.8
Crop protection: diseases	2.2	2.8	4.2
Crop protection: weeds	3.1	2.5	3.4
Crop protection: insects	2.6	2.5	3.3
Drought tolerance	1.1	0.2	1.4
Drip irrigation	0.1	NA	0.7
Water harvesting	0.5	NA	0.1
Sprinkler irrigation	0.1	NA	0.4

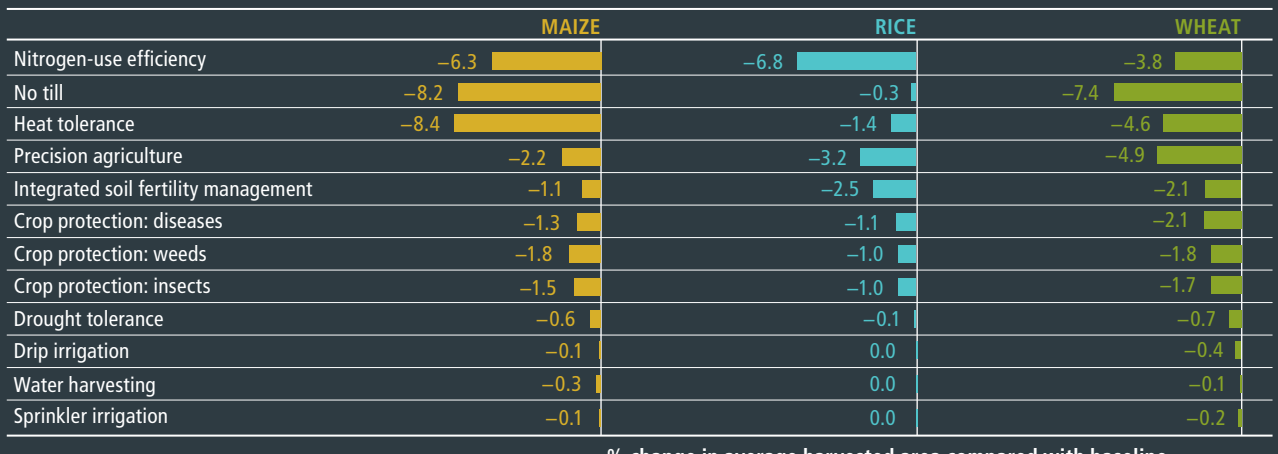
Source: Results are based on authors' International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) simulations with adoption profiles and the Model for Interdisciplinary Research on Climate (MIROC) A1B climate scenario.
Notes: NA = technology is not applicable. Yield impacts are not additive.

of sustainable agricultural intensification technologies under both the relatively hotter, wetter Model for Interdisciplinary Research on Climate (MIROC) A1B and the relatively cooler, drier Commonwealth Scientific and Industrial Research Organisation (CSIRO) A1B climate scenarios simulated.[11] In particular, the simulations for maize predict yield increases of about 16 percent for heat-tolerant varieties and no-till; for rice, 20 percent yield increases for nitrogen-use efficiency and 9 percent for precision agriculture; and for wheat, 16 percent yield improvement for no-till, 10 percent for precision agriculture, and 9 percent for heat-tolerant varieties under the Model for Interdisciplinary Research on Climate scenario (Table 2). The largest difference found with the Commonwealth Scientific and Industrial Research Organisation climate change scenario is a reduced benefit for heat-tolerant varieties under this relatively cooler and drier scenario.

Higher crop yields from sustainable agricultural intensification adoption results in reduced commodity prices and lower crop harvested areas. As expected, the technologies with highest yield impacts also lead to the largest reductions in harvested area expansion (Figure 1).

The sustainable agricultural intensification debate on producing "more with less" does not only relate to higher output per unit of area but also to reduced agricultural inputs, particularly those inputs that are becoming more scarce (such as water) or can damage the environment (such as nitrogen). We find that no-till, nitrogen-use efficiency, and heat-tolerant varieties are promising technologies for reducing nitrogen loss in maize. For rice, nitrogen-use efficiency, integrated soil-fertility management (ISFM), and precision agriculture show substantial reductions in nitrogen losses; and for wheat, no-till, integrated soil-fertility management, and precision agriculture reduce nitrogen losses significantly. Unsurprisingly, we find that the largest projected water savings are associated with drip and sprinkler irrigation (as compared with furrow irrigation in the baseline). Compared with furrow irrigation,

FIGURE 1 PROJECTED IMPACT OF ALTERNATIVE AGRICULTURAL TECHNOLOGIES ON GLOBAL HARVESTED AREAS FOR MAIZE, RICE, AND WHEAT IN 2050



Source: Results are based on authors' IMPACT simulations with adoption profiles and the MIROC A1B climate scenario.

The Limits of Organic Food Production

HOLGER KIRCHMANN AND LARS BERGSTRÖM

The potential of organic agriculture to feed the world sustainably was a point of discussion in 2013.[1] Notwithstanding individual success stories, the question remains whether organic agriculture would be feasible and sustainable if it were practiced at a global scale.

Organic yields are between 25 and 50 percent lower than conventional yields, depending on whether the organic system has access to animal manure. The amount of animal manure available on organic farms is usually not sufficient to produce crop yields similar to those in conventional systems, even when green manures, such as legumes, are used. When organic yields reach levels similar to those in conventional production, they usually involve high nutrient inputs that are, to a large extent, transferred from conventional production. The rules that define organic agriculture—exclusive use of manures and untreated minerals as well as the avoidance of synthetic pesticides—greatly limit the potential to increase yields. Thus, the only way for organic agriculture to achieve the same level of aggregate output as conventional agriculture is to compensate for lower yields by expanding cropland.[2] However, accelerated conversion of natural ecosystems into cropland would cause significant loss of natural habitats.

Extensive organic production would also affect the type of crops that are grown and the food that is supplied to the market. For example, in Sweden organic crop rotations use a higher proportion of forage and legumes and thereby reduce the supply of cereals, potato, and oilseed rape.[3] These shifts affect human diets away from pork, poultry, and eggs and toward more red meat and dairy products.

Moreover, the demand for organic products is limited and mainly concentrated in North America and Europe—which account for 96 percent of global revenues in the sector—and in some rich countries in Asia, such as Japan, Singapore, South Korea, and Taiwan. Currently most consumers in poor countries are not willing to pay a premium price for organic products.[4] Organic production in developing countries in Africa, Asia, and Latin America is mainly export driven.[5] If the agroecological, infrastructure, and market conditions are favorable, organic farming can be profitable for some of these export-oriented farmers in developing countries, but it cannot feed the world at a global scale.

Combining expected population growth and projected land use reveals that low-yielding agriculture is an unrealistic option for producing sufficient food in the future. Organic agriculture is subject to severe supply-side constraints, not least because of the lack of plant-available nutrients, and thus cannot be a major food source for the world. Further improvement of conventional agriculture based on innovations, enhanced efficiency, and improved agronomic practices seems to be the only way to produce sufficient and affordable food for a growing world population while minimizing negative environmental impacts.[6]

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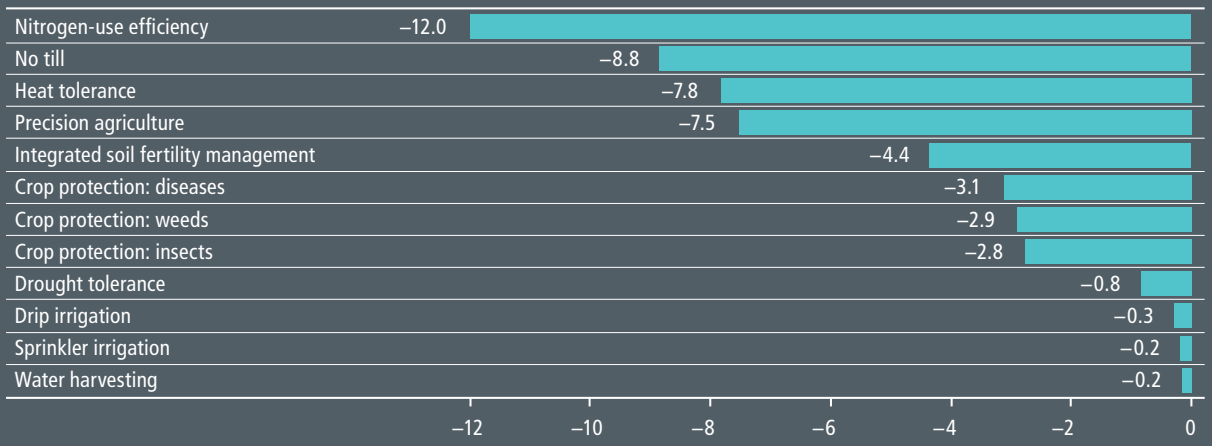
water savings in the field under drip irrigation are projected to be in the range of 24–27 percent, depending on crop and climate change scenario, whereas water savings for sprinklers are 11–12 percent.

Furthermore, positive impacts on food security could be substantial. The number of people at risk of hunger in developing countries in 2050 could be 12 percent lower if nitrogen-use efficiency technologies were rolled out, reduced by 9 percent if no-till were adopted more widely, and reduced by 8 percent if heat-tolerant varieties and precision agriculture were widely adopted (Figure 2). Nitrogen-use efficiency has the largest food security impact across all technologies studied due to its exceptionally large impact on yield of rice, a staple among developing-country consumers. Moreover, this

FIGURE 2 PROJECTED IMPACT OF ALTERNATIVE AGRICULTURAL TECHNOLOGIES ON THE NUMBER OF PEOPLE AT RISK OF HUNGER IN 2050



Source: Results are based on authors' IMPACT simulations with adoption profiles and the MIROC A1B climate scenario.

technology ranks third and fourth, respectively, for maize and wheat.

The largest yield gains for the three crops, in percentage terms, are projected in Africa, South Asia, and parts of Latin America and the Caribbean. First, we find a particularly large range of technologies with high potential for the breadbaskets of South Asia. However, given the heterogeneity in yield response across regions as well as within regions, it is important to target specific technologies to specific regions and countries.

Second, we also find that the impacts of agricultural technologies are amplified with irrigation. Although the direct impacts on yield caused by substituting furrow irrigation with drip and sprinkler irrigation are small for maize and wheat, water savings are substantial. Moreover, because the yield impacts of other technologies tend to be larger with irrigation, continued investment in efficient irrigation should go hand in hand with technology rollout.

Third, technologies are important to addressing abiotic stresses, which are expected to increase as a result of climate change. Drought-tolerant varieties performed well in the simulations—as well as susceptible varieties under conditions in which no drought was present—and can have substantial yield benefits under drought conditions. Heat-tolerant varieties can help reduce the projected negative impacts of climate change. In addition to biotic stresses, further rollout and continued development of crop protection options against weeds, insects, and diseases can achieve large benefits in developing countries.

Fourth, improved land management can have large yield impacts in many regions. Key land management practices with simulated high impacts include no-till (particularly for maize), precision agriculture, and integrated soil-fertility management. On the other hand, the simulations suggest that organic agriculture is not a preferred strategy for maize, wheat, or rice because yields achieved under organic agriculture are lower than conventional yields, though this technology might have a role in niche high-value markets.

Fifth, given growing natural resource scarcity and concern about environmental deterioration, technologies that reduce environmental impacts (such as water use and nitrogen runoff) are particularly important. These technologies

include advanced irrigation (such as drip and sprinkler as opposed to furrow irrigation), particularly if renewable energy sources are used for application. Other important technologies that can address growing resource scarcity include no-till, which conserves soil moisture and reduces erosion; integrated soil-fertility management, which can provide important nutrients for farms in Africa south of the Sahara; and nitrogen-use efficiency in new varieties, which has strong yield impacts and reduces negative environmental impacts from fertilization. A final technology that is gaining wider acceptance and that furthers resource conservation is precision agriculture, which we project will result in particularly strong yield gains for wheat.

CONCLUSIONS

The simulations in our study suggest that adoption of most of the technologies examined here could substantially increase food production, reduce food prices, and improve food security under climate change. Across the three crops, the largest yield gains, in percentage terms, are in Africa south of the Sahara, South Asia, and parts of Latin America and the Caribbean, suggesting growing yield convergence through adoption of appropriate technologies.

We believe that the objectives of sustainable agricultural intensification can be further advanced by accelerated development and rollout of several of the agricultural technologies and management practices examined here. Doing so would not only stem increases in total global harvested area but also reduce nitrogen losses and lead to savings in water, depending on the technology. However, some technologies, such as some forms of crop protection, can also have negative environmental impacts, and others, such as no-till, could increase (rather than reduce) greenhouse gas emissions, depending on the biophysical situation and how the management practice is implemented.

Moreover, inducing wider adoption of these technologies will require institutional, policy, and investment advances in many areas. For sustainable agricultural intensification practices to become a building block of the sustainable development agenda, they must do more than just increase yields—they must also improve smallholder income and livelihoods as well as avoid not only losses of natural capital but also negative social and cultural impacts.[12] A further key concern in adoption will be the cost of these technologies, for which global datasets are currently not available.

Most of the technologies assessed can improve important outcomes across many sustainable agricultural intensification indicators.

Is sustainable agricultural intensification a silver bullet or an empty promise? Our work has shown that the balance of evidence tilts toward sustainable agricultural intensification being not only possible and plausible, but also the way forward. We find that most of the technologies assessed can improve important outcomes across many sustainable agricultural intensification indicators, particularly in developing regions, where yield gains would be largest. Although getting there will not be easy or quick, we must move ahead. The cost of not taking any action could be dramatic for the world's food-insecure. ■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AGRICULTURAL R&D

Is Africa Investing Enough?

Nienke Beintema and Gert-Jan Stads

SUMMARY Given the goals of economic growth and poverty reduction, as well as the challenges of rapid population growth, climate change, and food price volatility, Africa south of the Sahara must invest in research and development (R&D) to boost agricultural productivity. This chapter provides a data-driven analysis of the region's recent progress in investing in financial resources and human resource capacity related to agricultural R&D.

Despite both unprecedented economic growth since the turn of the millennium and a steady decline in poverty rates in recent years, Africa south of the Sahara (SSA) remains the poorest region on the planet.[1] Agriculture is the mainstay in many SSA countries, serving as a significant source of employment. Although recent growth in gross domestic product (GDP) has brought some improvements to rural populations, many people living in rural areas remain in a state of poverty. Furthermore, the region will need to feed an additional 900 million people by 2050, according to estimates by the United Nations (UN).[2] To respond effectively not just to this rapid population growth but also to other pressing challenges—including climate change and rising and volatile food prices—SSA needs to accelerate its agricultural productivity without delay.

There is much evidence to show that over the past five decades investments in agricultural research and development (R&D) have tremendously enhanced agricultural productivity around the world.[3] By raising the quantity and quality of agricultural outputs, new technologies and varieties resulting from R&D investments have led to higher incomes, greater food security, better nutrition, and, ultimately, economic growth and poverty reduction. Little wonder that at their 2012 meeting in Mexico, the heads of state of the Group of 20 (G20) countries highlighted the importance of R&D in promoting agricultural productivity and food security and that the UN's post-2015 development agenda stresses the key role of R&D in increasing food production while protecting natural resources.[4]

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Private Investments on the Rise in Africa

CARL E. PRAY AND LATHA NAGARAJAN

Private investment in agricultural research and development (R&D) in Africa south of the Sahara has been limited to date—particularly compared with Asia and Latin America—but it is growing rapidly. We observe this increase especially in the seed industry. A recent study of five African countries—Kenya, Senegal, South Africa, Tanzania, and Zambia—estimated that about US$62 million was spent on private R&D.[1] Of this $62 million, $50 million was spent in South Africa.[2] About half of the private research is conducted by African firms, some of which are regional multinational corporations, such as Seedco based in Zimbabwe and Illovo based in South Africa. The other half was spent by multinational firms headquartered outside Africa, such as DuPont and Monsanto. The seed industry accounted for the largest share of R&D expenditure in all of the countries, followed by the plantation and processing industries, such as the sugar industry.

Among these five countries, private investment in agricultural R&D grew fastest in South Africa, doubling between 2001 and 2008. Two major reasons for this growth in South Africa were (1) the liberalization and privatization of the agricultural input and output markets and (2) the growing demand for modern agricultural inputs and food due to trade liberalization and economic growth elsewhere in Africa.[3]

Private agricultural R&D has led to increased yields of several important crops in Africa. The adoption of proprietary hybrids of maize increased yields in Tanzania.[4] Private sugarcane research in South Africa increased productivity there[5] and elsewhere in southern Africa. Many studies show that proprietary genetically modified maize and cotton improved the yields, incomes, and health of smallholder farmers in South Africa[6] and Burkina Faso.[7]

Private agricultural R&D in Africa is likely to grow faster than public sector R&D, which grew by one-third from 2000 to 2011.[8] The basis for this predicted private growth includes several factors:

1. Demand for agricultural products and processed goods will increase due to rapid economic growth.
2. The growth of public-sector research by national programs and international institutes in Africa provides opportunities for firms to create proprietary maize hybrids and other innovations.
3. Tariffs and technical barriers to trade in agricultural inputs are declining, and foreign investment is increasing.
4. The options for protecting intellectual property (such as hybrid plant varieties) and legal protection of intellectual property (such as patents) are growing stronger.

The key policies for African governments that want to encourage private-sector R&D and maximize its impact are support for public research, removal of barriers to trade in technology, continued liberalization and privatization of agribusiness, and strengthening of intellectual property rights.

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Global investment in agricultural R&D, once heavily weighted toward the developed world, has shifted dramatically in recent years toward the developing world. Whereas spending growth in high-income countries as a group has stalled to near-zero levels since the turn of the millennium, the developing world has accelerated its agricultural R&D investments at a rapid pace.[5] China and India alone accounted for about half the growth in global agricultural R&D spending during 2000–2008, and a number of other large middle-income countries (in particular, Argentina, Brazil, Iran, Nigeria, and Russia) significantly increased their spending levels.[6] R&D spending in low-income countries as a group also rose during this period, driven primarily by a number of larger East African countries.

Some encouraging signs indicate that African countries are increasingly focused on investing in agriculture for economic growth, evidenced by a number of influential initiatives and regional and subregional processes that have put agriculture and agricultural R&D firmly back on the political and donor agendas. Many countries have

developed solid agricultural development and financing plans to strengthen agricultural production and food security as part of the Comprehensive Africa Agriculture Development Programme (CAADP) of the New Partnership for Africa's Development (NEPAD). Another important move toward a stronger agricultural sector is the Science Agenda for Agriculture in Africa (S3A), which was initiated in early 2013 and is scheduled to be finalized and endorsed at the African Heads of State Summit in mid-2014.[7]

To achieve future growth targets, national governments in SSA will need to provide sufficient and stable financial and human resources adequate in both numbers and quality. Government support is required because research on agricultural commodities that have a large impact on smallholder income, food security, and poverty reduction generates knowledge, technologies, and other outputs that are considered public goods.[8] These public goods, by definition, have social benefits that are higher than the private benefits to individuals; they thus justify public intervention. Research conducted by the private sector, in contrast, is largely dictated by the profitability of investments and the appropriability of research returns. The private sector tends to ignore research areas that do not fulfill these two conditions.

Governments and donors in SSA need to allocate sufficient funds to the right types of agricultural R&D within not only a national but also a regional and subregional context. They must also ensure that farmers adopt the resulting innovations. National agricultural research systems cannot bring about success all alone, however; the CGIAR consortium, regional organizations, commodity networks, and the private sector also have an important role to play in releasing better varieties and technologies and ensuring their adoption.

This chapter takes stock of recent progress made in agricultural R&D investments and human capacity in SSA by using comprehensive datasets collected through primary surveys by IFPRI's Agricultural Science and Technology Indicators (ASTI) initiative and a network of national partners.[9]

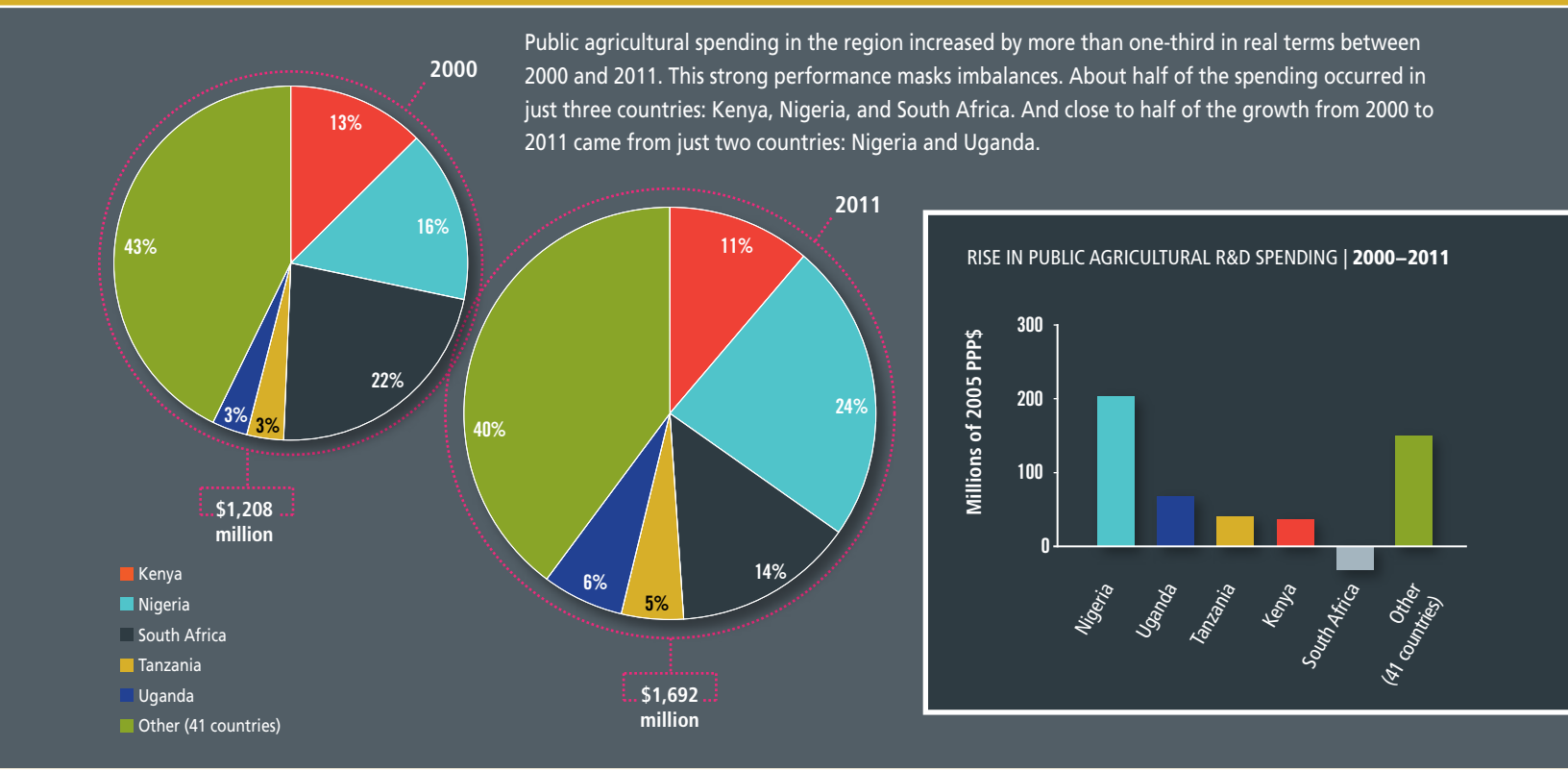
SPENDING INCREASED, BUT DONOR DEPENDENCY AND VOLATILITY REMAIN CRITICAL

Following a decade of stagnation during the 1990s, public agricultural R&D spending in SSA increased by more than one-third in real terms during 2000–2011, rising from $1.2 billion to $1.7 billion in 2005 constant purchasing power parity (PPP) dollars[10] or from $0.6 billion to $0.8 billion in 2005 constant US dollars (Figure 1).[11] Absolute spending levels varied considerably across countries. In 2011, Kenya, Nigeria, South Africa, and Uganda were the only countries that spent more than $100 million 2005 constant PPP dollars in agricultural R&D. On the other hand, roughly half the countries in the region reported investment levels below the $10 million mark.

The 2000–2011 growth in public agricultural R&D spending in SSA was driven mainly by a handful of larger countries. Close to half of this growth was attributable to increased spending in just two countries: Nigeria and Uganda. Ghana, Kenya, and Tanzania also recorded relatively high increases in total spending, each accounting for between 5 and 9 percent of total growth during 2000–2011. Growth was relatively consistent over time in Ghana, Kenya, Tanzania, and Uganda and resulted mostly from increased government funding combined, in some cases, with substantial additional resources provided by development banks (mostly the World Bank) and donors. In Nigeria, on the other hand, spending was erratic over time, as it was in many other countries in the region. Nigeria's public agricultural R&D spending, for example, more than doubled during 2000–2008 as a result of renewed government commitment to boosting scientist salary levels and investments in infrastructure and equipment. Government support has leveled off since then, however, resulting in an estimated drop in overall R&D spending of 3 percent during 2008–2011.[12]

Although increases and decreases in the absolute levels of agricultural R&D spending of a few countries in the region overshadow those of the others, a closer look at relative shifts in investment levels over time reveals some important cross-country differences. During 2000–2011,

FIGURE 1 PUBLIC AGRICULTURAL R&D SPENDING IN AFRICA SOUTH OF THE SAHARA, 2000 AND 2011 (IN 2005 PPP DOLLARS)



Source: Agricultural Science and Technology Indicators (ASTI) Database, www.asti.cgiar.org/data-graphics, forthcoming.

Notes: Regional total includes 45 of the 48 countries in Africa south of the Sahara: Equatorial Guinea, a high-income country, is excluded as are South Sudan and Somalia. For countries where data is unavailable—Angola, Cameroon, Comoros, São Tomé, and Príncipe—research spending and researcher capacity trends were estimated based on share of total agricultural output.

7 of 28 SSA countries for which a full set of time-series data was available experienced negative annual growth in public agricultural R&D spending, ranging from –1.2 to –13.6 percent a year. An additional 7 countries experienced near-zero growth rates (of between –0.9 and 0.2 percent a year).[13] This is a sizable number of countries given that spending in SSA as a whole actually increased substantially over this period. Some of the region's smallest, often francophone, countries have very low, volatile, and often declining long-term levels of investment and human resource capacity, which calls into question the effectiveness of their national agricultural R&D output. Nonetheless, some initial signs indicate that in more recent years, this negative cycle has been broken in an increasing number of smaller countries. Just looking at the 2008–2011 period (rather than the 2000–2011 period), 23 of the 33 countries for which full time-series data were available saw a rise in agricultural R&D spending. The 2007–2008 global food crisis and a number of influential initiatives, including the 2008 L'Aquila Food Security Initiative and CAADP, have put agriculture and agricultural research back firmly on the political and donor agendas and may be at the basis for this shift. In addition, starting in 2008, the World Bank–funded West Africa Agricultural Productivity Program, followed by the Eastern Africa Agricultural Productivity Project shortly afterward, injected significant funds into agricultural R&D in a number of countries throughout the region and contributed to overall R&D investment increases.

In addition to looking at absolute levels of agricultural R&D investment, another way of comparing commitment to public agricultural R&D investment across countries is to measure intensity—that is, total public agricultural R&D spending as a percentage of agricultural output (AgGDP).

A New Regional Push for Agricultural R&D in Africa

YEMI AKINBAMIJO

Will Africa achieve the first United Nations Millennium Development Goal (MDG1) of halving poverty by 2015? Success will depend largely on how agriculture affects national economies directly and on how it stimulates growth in other sectors. As Africa's population grows, continues to urbanize, and becomes more affluent, agriculture and its related value chains must grow even faster. Agriculture needs to chart Africa's path to sustainable economic growth and development, but this path requires increased investment.

Nowhere is this truer than in Africa's agricultural R&D systems, which have the most potential to effectively generate and disseminate technologies to transform agriculture. The agricultural success of Brazil, China, and India has been predicated in large part on their increased investments in agricultural R&D. Africa's current intensity of agricultural R&D investment (agricultural R&D spending as a share of agricultural gross domestic product) is 0.51—well below the target of 1 percent set by the New Partnership for Africa's Development. Africa needs higher levels of R&D investment to transform agriculture.

Overall, investment in Africa's agricultural R&D is rising. A few countries (Ethiopia, Ghana, Kenya, Nigeria, South Africa, Sudan, Tanzania, and Uganda) have relatively high levels of investment in agricultural R&D compared with other African countries; in others, however, investment remains low. *The Framework for African Agricultural Productivity*, a reference document for implementing the tenet on R&D spending set out by the Comprehensive Africa Agriculture Development Programme (CAADP), challenges African governments to invest prudently in R&D and to address problems of fragmentation and alignment. Many governments and development partners are now making long-term commitments through regional R&D initiatives and creating supportive policy environments for agricultural R&D. Global, regional, and national institutions and development partners are also playing a larger role in addressing agricultural R&D issues in ways that support CAADP targets.[1]

Key developments in 2013 involved consolidating these institutions' efforts to promote investments in regional and subregional agricultural R&D initiatives. For example, the Science Agenda for Agriculture in Africa (S3A), an initiative of several stakeholders,[2] is one of five work streams of the Dublin Process, currently being led by the Forum for Agricultural Research in Africa (FARA). The Science Agenda for Agriculture in Africa provides guidance on funding levels and priority areas of investment in science and makes the case for strengthening the people, institutions, and infrastructure required to transform Africa's agriculture. Contributing to this agenda is the regional agricultural productivity work stream, led by FARA, which seeks to align CGIAR Research Programs with the CAADP country process by developing agricultural R&D investment programs. Other R&D investment initiatives include the West Africa Agricultural Productivity Program, the Eastern Africa Agricultural Productivity Project, and the Agricultural Productivity Program for Southern Africa. These initiatives are led by subregional organizations and regional economic communities. They provide innovative and sustainable models by (1) focusing investments on priority agricultural sectors that have the greatest potential to stimulate growth, (2) establishing mechanisms for dissemination and adoption of technologies, and (3) leveraging spillover effects for a faster and wider impact on regional economic growth.

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Overall investment levels in most countries are still well below the levels required to sustain agricultural R&D needs. In 2011, SSA as a whole invested $0.51 for every $100 of agricultural output on average, which is well below NEPAD's 1 percent national R&D investment target. The 2011 intensity was comparable to the value recorded in 2000 but considerably lower than values recorded in more recent years, which indicates that growth in agricultural R&D spending, though substantial, has not kept pace over the past few years with growth in agricultural output. In 2011, just 10 of the 39 countries for which agricultural R&D intensity ratios were available met the 1 percent target (Figure 2). In contrast, 18 countries recorded intensity ratios lower than 0.5. While intensity ratios

do provide useful insights into relative investment levels across countries and over time, they do not take into account the policy and institutional environment within which agricultural research occurs, the broader size and structure of a country's agricultural sector and economy, or the qualitative differences in research performance across countries. Small countries, for example, may require relatively

The New Face of Agricultural Extension Services

KRISTIN DAVIS

Agricultural extension services are back on the development agenda. Extension provides information and services required by farmers and other actors in rural settings for developing their own technical, organizational, and management skills.[1] Extension services had a heyday in the 1980s and early 1990s, when money was poured into systems that promoted agricultural technologies, mainly in a top-down, one-size-fits-all fashion. In the late 1990s, when many of these systems were shown to be ineffective, spending on extension declined.[2] Now, however, extension services are being viewed from a broader systems perspective. New tools for providing information and services are available, and new roles and capacities are required for extension services to meet the challenges facing rural people and systems.

These new aspects of extension were subjects of international meetings and reports in late 2012 and in 2013.[3] Several of these were direct outgrowths of a position paper called *The New Extensionist* that was published in 2012 by the Global Forum for Rural Advisory Services (GFRAS), an international group involved in advocacy and leadership on extension services.[4] This work described the new roles to be played by extension services and called for improving not only individual capacity but also the capacity of extension organizations and systems. It noted the increasingly important role of the private sector and civil society organizations, together with the public sector. In addition to promoting agricultural innovations, extension services are now being asked to contribute to improving nutrition, reducing risk and enhancing the resilience of rural livelihoods, and peacebuilding, among other things. Extension systems must make use of new information and communication technologies.[5]

In the face of these new demands and realities, a number of national governments have renewed their focus on extension policies and programs. For example, Kenya, Liberia, South Africa, and South Sudan have recently drafted extension policies.[6] These policies, which were all developed through participatory consultation, focus on strengthening farmers' voices. Most take a systems approach, promote pluralism, and rely on the public sector to play the necessary role of coordinating and regulating. Bangladesh and Ethiopia are training staff and developing new programs for extension.[7] A 2013 study of 15 countries in Latin America and the Caribbean showed that public funding for extension has rebounded in the region and that extension services have become increasingly driven by demand, based on a business model, reliant on information and communication technologies, and cofinanced.[8]

A coalition of actors recently completed a worldwide study of extension system programs and human and financial resources.[9] The study showed that there is a huge number of public, private, and civil society actors providing services globally, but that it is difficult to continuously update the data because of the pluralism and decentralization of government services.

As extension services seek to meet new demands, more research is needed to shed light on how extension can contribute most effectively to rural development. Currently, research on extension is fragmented and inadequate to support evidence-based policymaking. The IFPRI-led CGIAR Research Program on Policies, Institutions, and Markets is seeking to deepen understanding of how to strengthen extension systems.[10] The program will start with a historic overview of reforms of extension systems and frameworks, a study on operationalizing the "best fit approach,"[11] and a contribution on monitoring and evaluating extension.

Extension services are back. But they run the risk of being viewed once again as ineffective if they are stretched too thin by the great expectations of the development community. With the recognition of the systemic nature of rural development and the use of tailored best-fit approaches for different client groups and policy contexts, there is tremendous potential for extension services. However, we need to better understand and document the impact that extension services have on rural development outcomes.

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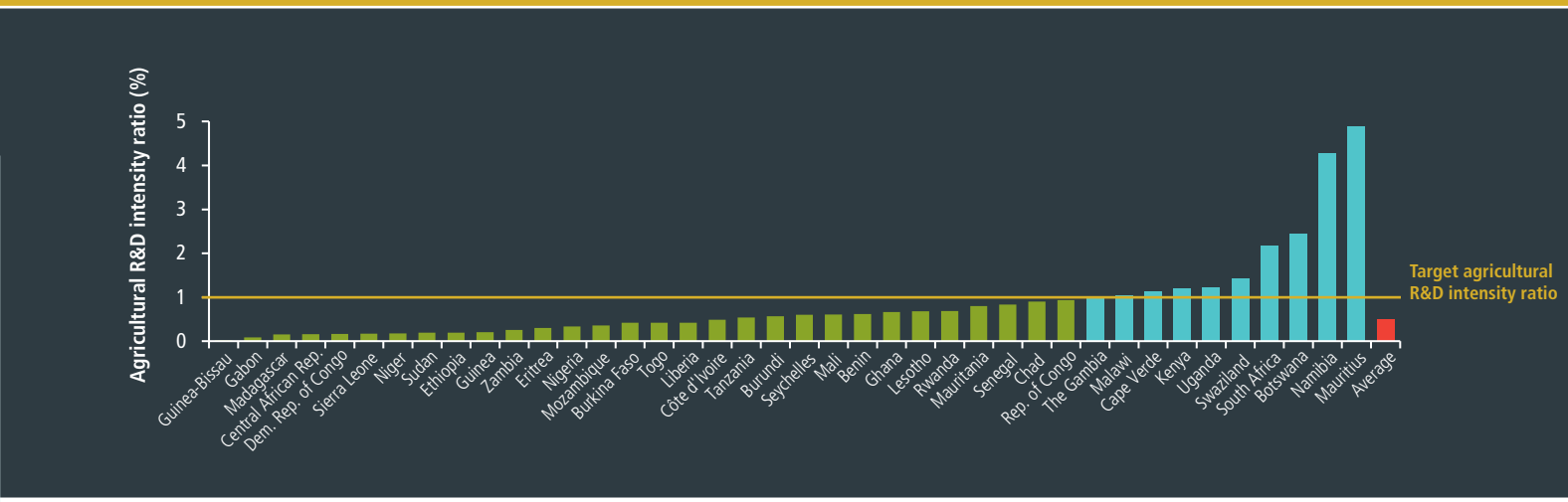
FIGURE 2 AGRICULTURAL R&D INTENSITY RATIOS BY COUNTRY, 2011



Source: ASTI Database, www.asti.cgiar.org/data-graphics, forthcoming.

more human resource and capital investments because they are unable to benefit from the economies of scale available to larger countries. Equally, countries with greater agricultural diversity may have more complex research needs, requiring higher funding levels.

Agricultural R&D investment is positively associated with high returns, but these returns take time—commonly decades—to develop. Consequently, the inherent lag from the inception of research to the adoption of a new technology or the introduction of a new crop variety calls for sustained and stable R&D funding. As Nigeria's experience shows, agricultural R&D funding in many SSA countries has been far from stable over time, and agricultural R&D spending in the region overall has been more volatile than in other developing regions. Research agencies in SSA, particularly those in low-income countries, are highly dependent on funding from donors and development banks, and this type of funding has been considerably more volatile than government funding over the past decade. These agencies thus often fall into financial crisis upon the completion of large donor-funded projects, forcing them to cut research programs and lay off staff. In addition, too much of the critical decisionmaking about research priorities is sometimes devolved to donors and development banks. As a result the research agendas of many agricultural research agencies across SSA—particularly in smaller, low-income countries—are skewed toward short-term goals that are not necessarily aligned with national and regional or subregional priorities.[14]

INCREASE IN RESEARCHER QUANTITY BUT NOT QUALITY

SSA needs talented, well-trained, and highly motivated research staff to generate the high-quality research outputs that are necessary to accelerate growth in the agricultural sector.[15] During 2000–2011, researcher capacity in SSA increased by roughly 50 percent to an estimated 14,300 agricultural researchers, in full-time equivalents (FTEs).[16] The participation of female scientists has increased in many countries; the number of researchers with doctorate (PhD) and master of science (MSc) degrees has also risen considerably in absolute numbers, though average researcher qualifications varied across countries (Table 1). PhD holders in only 5 of the 36 countries for which a complete set of degree-level data are available (Botswana, Benin, Burkina Faso, Madagascar, and Senegal) exceeded 40 percent of the total number of researchers, whereas another 56 countries reported PhD shares of 10 percent or lower.[17]

The lack of a critical mass of PhD-qualified scientists poses significant constraints to conducting high-quality research and attracting external funding. No researchers with PhD or MSc degrees

TABLE 1 Share and age distribution of researchers with doctorate (PhD) degrees by country, 2011

Country	Share of PhD holders in total number of researchers (%)	Share of PhD holders older than 50 (%)
Senegal	70	38
Benin	55	57
Burkina Faso	47	29
Swaziland	43	75
Madagascar	42	65
Ghana	36	60
Sudan	35	48
Mali	33	82
Kenya	32	55
Republic of Congo	31	74
Togo	31	71
Uganda	31	45
Nigeria	25	54
Mauritania	25	23
Gabon	20	37
Tanzania	20	49
Botswana	20	45
Malawi	20	31
Burundi	18	18
Sierra Leone	17	74
Chad	17	56
Guinea	16	95
Central African Republic	14	50
Mauritius	13	45
Namibia	13	61
Democratic Republic of Congo	13	61
Zimbabwe	12	28
Rwanda	12	28
Eritrea	11	75
Liberia	11	71
Cape Verde	10	0
Ethiopia	9	43
Lesotho	9	76
The Gambia	9	47
Mozambique	8	27
Guinea-Bissau	0	0

Source: ASTI Database, www.asti.cgiar.org/data-graphics, forthcoming.

Notes: Data for Nigeria include the national agricultural research institutes under the Agricultural Research Council of Nigeria only; age data for Burkina Faso, Malawi, Senegal, Sudan, and Tanzania exclude the higher-education sector.

are active in Guinea-Bissau, for example, and in 2011, the national agricultural research institutes in Burundi and The Gambia employed just one and two PhD-level scientists, respectively.[18] This finding highlights the necessity of regional initiatives focusing on the needs and vulnerabilities of small countries. A recent expert panel report, produced as part of the S3A process, calls on African leaders to, among other things, ensure minimal agricultural R&D capacity in all SSA countries, support regional centers of excellence to share knowledge and research facilities, and contribute to a regional science fund.[19]

Despite rapid growth in the total number of agricultural researchers in SSA, many countries continue to face serious capacity constraints. Long-term public-sector recruitment restrictions have resulted in an aging pool of researchers in a number of countries. This trend has left agencies in these countries highly vulnerable. As many senior staff approach retirement, midlevel researchers who can take on seniority roles and mentor the next generation of junior scientists are often lacking. In addition, low salary levels, poor conditions of service, and subpar facilities have led to high staff turnover in many countries.[20] Evidence on the exact nature and scope of staff turnover, however, is sketchy. To help address this information gap, ASTI collected detailed information on the age distribution of researchers by degree for 36 countries (Table 1). In 17 countries more than half of the researchers holding a PhD degree were older than 50, whereas in 9 countries the share of PhD holders older than 50 was higher than 70 percent. The situation is particularly severe in West Africa. These findings highlight the acute need to recruit and train the next generation of scientists.

Given high staff turnover, large numbers of retiring senior researchers, and various recruitment restrictions, the rapid R&D capacity growth over the past decade has largely been driven by the recruitment of junior researchers (often having only a bachelor's degree, BSc), particularly during 2000–2008. In fact, although the number of PhDs increased in absolute terms from 2008 to 2011, the overall share of PhD holders in total agricultural R&D staff for a sample of 28 countries for which

long-term data on researchers by degree were available (excluding, among others, South Africa) fell from 31 percent in 2008 to 29 percent in 2011.[21] A worrisome trend is that 12 of the 28 sample countries reported a decline in the absolute number of researchers with PhD degrees during the same period.[22]

Notwithstanding the numerous human resource challenges that many SSA countries continue to face, there have also been many positive developments in recent years. In an attempt to halt staff turnover, some countries have put in place new measures, including large-scale recruitment after years of neglect, the boosting of scientist and support staff salaries to more competitive levels, increases in retirement age, improved benefits packages, and the establishment of performance appraisal systems and promotion opportunities based on merit rather than seniority. New donor-funded capacity-building initiatives have also arisen in recent years (these had been a major source of funding for staff training during the 1970s and 1980s but had been cut or reduced by many donors in the 1990s). Many donors acknowledge the need to not only increase funding for agricultural research but also invest in human capital. Such initiatives include the capacity-strengthening components of the West Africa Agricultural Productivity Program, the Eastern Africa Agricultural Productivity Project, the Alliance for a Green Revolution in Africa, and the Regional Universities Forum for Capacity Building in Agriculture.

CONCLUSION

Given the challenges that SSA is facing in terms of rapid population growth, climate change, and food price volatility, it is crucial that agricultural productivity in the region be further increased. Agricultural R&D in SSA is at a critical crossroads. Although the past few years have been characterized by positive developments and ambitious goals and processes, these advances will need to be further accelerated and scaled up. The 2013 high-level report on agriculture and food systems by the UN Sustainable Development Solutions Network has put forward a number of goals to replace the Millennium Development Goals.[23] Specifically, the group has called for a minimum of 5 percent annual growth in agricultural R&D spending in low- and middle-income countries over the next decade and allocation of at least 1 percent of agricultural GDP to public agricultural R&D.[24] Given SSA's annual spending growth rate of 2.7 percent in 2000–2011 and its agricultural R&D intensity ratio of 0.51 percent in 2011, investments in agricultural R&D would need to double over the next decade if these ambitious targets are to be achieved.

As many senior staff approach retirement, midlevel researchers who can take on seniority roles and mentor the next generation of junior scientists are often lacking.

Success in building on recent progress and in achieving future growth targets is profoundly dependent on sufficient and stable financial resources and on human resource capacity of adequate quantity and quality. Researchers also need appropriate incentives to pursue productive research careers in SSA, including attractive salaries, good research facilities and support services, and management systems that reward high-quality work. Public research institutions across the region will need to be further transformed by attracting, maintaining, and effectively using expertise and by securing more diverse funding sources, including relatively untapped sources in the private sector. National governments need to identify their long-term national R&D priorities more clearly and design relevant, focused, and coherent R&D programs accordingly. Donors will need to align their funding strategies more closely with national R&D priorities; countries' CAADP investment plans can be used to expedite this process. Finally, stronger partnerships linking national agricultural research actors with each other, with subregional organizations, and with CGIAR will help maximize opportunities for cross-country synergies. ■

INFORMATION AND COMMUNICATION TECHNOLOGIES

Farmers, Markets, and the Power of Connectivity

Maximo Torero

SUMMARY Roughly three-fourths of the world's poor live in rural areas. What role can information and communication technologies play in empowering them? This chapter explores the potential for these technologies, especially mobile phones, to stimulate agricultural and rural development through the provision of information and capacity-building opportunities.

Addressing global poverty is not possible without considering rural populations in developing countries, especially smallholders. Roughly three-fourths of the world's poor live in rural areas.[1] In South Asia, Africa south of the Sahara, and East Asia and the Pacific, the rural population represents more than half of the total population of each region. These three heavily rural regions are home to about 1.1 billion poor people who live on less than US$1.25 a day—the international poverty line—and who account for roughly 90 percent of the world's poor.[2]

What major challenges do rural populations face? High on the list is lack of access to physical products as well as to new technologies and ideas. This lack of access may limit agricultural output and impede improvements to health and education outcomes. In addition, by leading to unsustainable agricultural practices and resource use, it could arguably be related to environmental degradation.

A growing body of evidence suggests that in many circumstances, information and communication technologies (ICTs), specifically mobile phones, can help address these problems. Such technologies are thought to increase access to both information and capacity-building opportunities for rural populations in developing countries. Policymakers, in turn, can also benefit from increased information sharing, which allows them to gather a more complete overview of the situation on the ground in their country. These technologies may play a key role in improving many sectors—from agriculture and food security to health care, education, and financial institutions.

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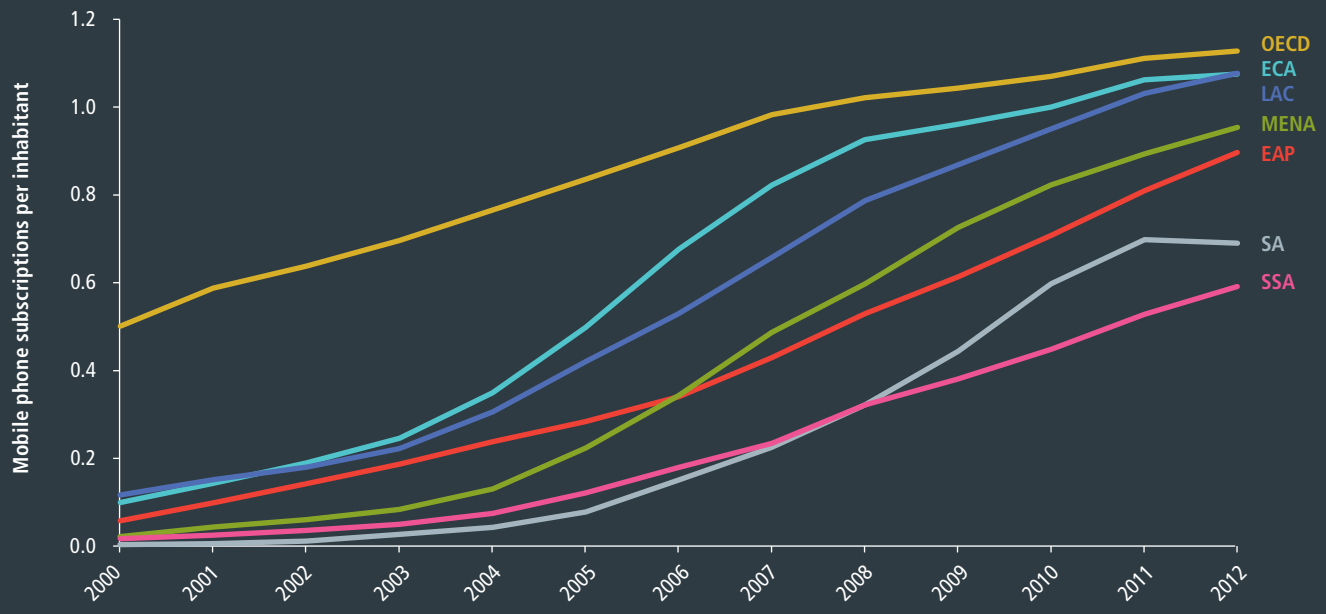
FIGURE 1 MOBILE PHONE SUBSCRIPTIONS PER INHABITANT, BY REGION, 2000–2012



Source: Adapted from Figure 1 of E. Nakasone, M. Torero, and B. Minten, "The Power of Information: The ICT Revolution in Agricultural Development," *Annual Review of Resource Economics* 6 (forthcoming 2014). Mobile phone subscriptions are from the International Telecommunication Union, and country categories are from the World Bank.

Notes: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA= Middle East and North Africa; SA = South Asia; SSA = Africa south of the Sahara; and OECD = high-income countries only. Developing world = ECA, LAC, MENA, SA, and SSA.

This chapter assesses the potential of such technologies, including mobile phones, to help break the poverty trap faced by smallholders in developing countries.

THE SPREAD OF INFORMATION AND COMMUNICATION TECHNOLOGIES

The exponential increase in access to mobile phones in the past decade has clearly reduced the digital divide between developed and developing countries (Figure 1). In fact, several developing countries currently have higher rates of penetration per inhabitant than developed countries. In 2012, Europe, Central Asia, and Latin America and the Caribbean were home to more mobile phone connections than people. By 2013, the number of mobile phone subscriptions worldwide had approached the global population (Figure 2). Phone subscriptions have also increased dramatically in Africa south of the Sahara. This huge jump in accessibility, if combined with a supply of high-quality information, could open a significant window for the use of these technologies in development. In particular, information and communication technologies could help lift smallholders out of poverty by giving them a better understanding of lucrative markets, leading them to enter these markets, and allowing them to realize increased gains from trade.

Although many information and communication technologies undoubtedly have potential to enhance rural livelihoods, most are not as widespread as mobile phones. For example, as of 2012, there were only 0.11 landlines per inhabitant in developing countries (Figure 3).[3] Although increasing, access to the Internet is still far from extensive: only 27 percent of the population in developing countries uses the Internet, and there are only 0.05 broadband subscriptions per inhabitant. In contrast, by 2012, there were 0.82 mobile phone subscriptions per capita in the same group of

countries, many of which have more subscriptions than people.

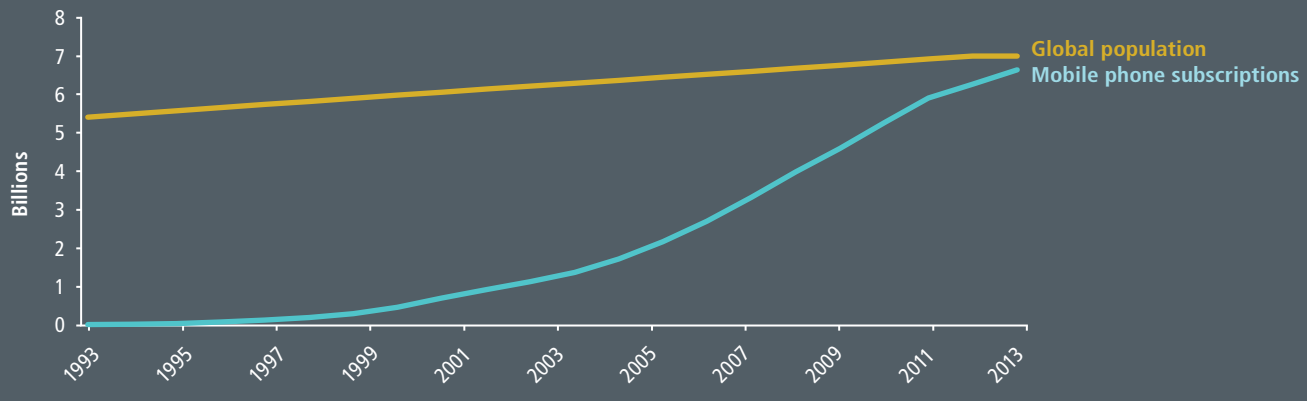
HOW INFORMATION AND COMMUNICATION TECHNOLOGIES MIGHT HELP SMALLHOLDERS AND IMPROVE FOOD SECURITY

An increasing body of evidence highlights the potential for information and communication technologies to improve the lives of the poor. Increased access to and adoption of new technologies can address the challenges of food insecurity on multiple fronts, including increasing households' access to nonfarm income and enabling households to better gauge the safety, quality, and nutritional value of their food.

Information and communication technologies can make poor populations more resilient in several ways. First, access to technology can increase the amount, timeliness, and quality of information available to the poor. Preliminary research suggests that this in turn can translate into better job opportunities (as the poor establish better contacts) and higher crop yields (as they get access to timelier and better-quality information on products and inputs as well as environmental and market conditions).[4] Second, these technologies may promote learning, which itself can enhance technology adoption among farmers.[5] Lastly, though no evidence is available, it is conceivable that improved access to health and nutritional information through these technologies could help reduce the prevalence of hunger among the poor.

There are many reasons to believe that these technologies may have a large impact on agricultural markets. For example, they can allow different market agents to communicate more efficiently, thus enhancing information flows. This impact can be critically important for rural areas in developing countries, where inadequate infrastructure tends to make markets less integrated. Mobile phones are particularly good at spreading information (Figure 4). As of October 2013, 98 mobile phone projects were being implemented in the agricultural sector of developing countries.[6] Arguably because of their wide availability, mobile phones are used in most of these projects. Delivery of information is mainly through short message service (SMS), although voice messages, interactive voice response systems, or mobile applications are also used. Most projects deliver information regarding market prices (48 percent) and agricultural extension (39 percent), combined with weather advisory information in a number of important cases.

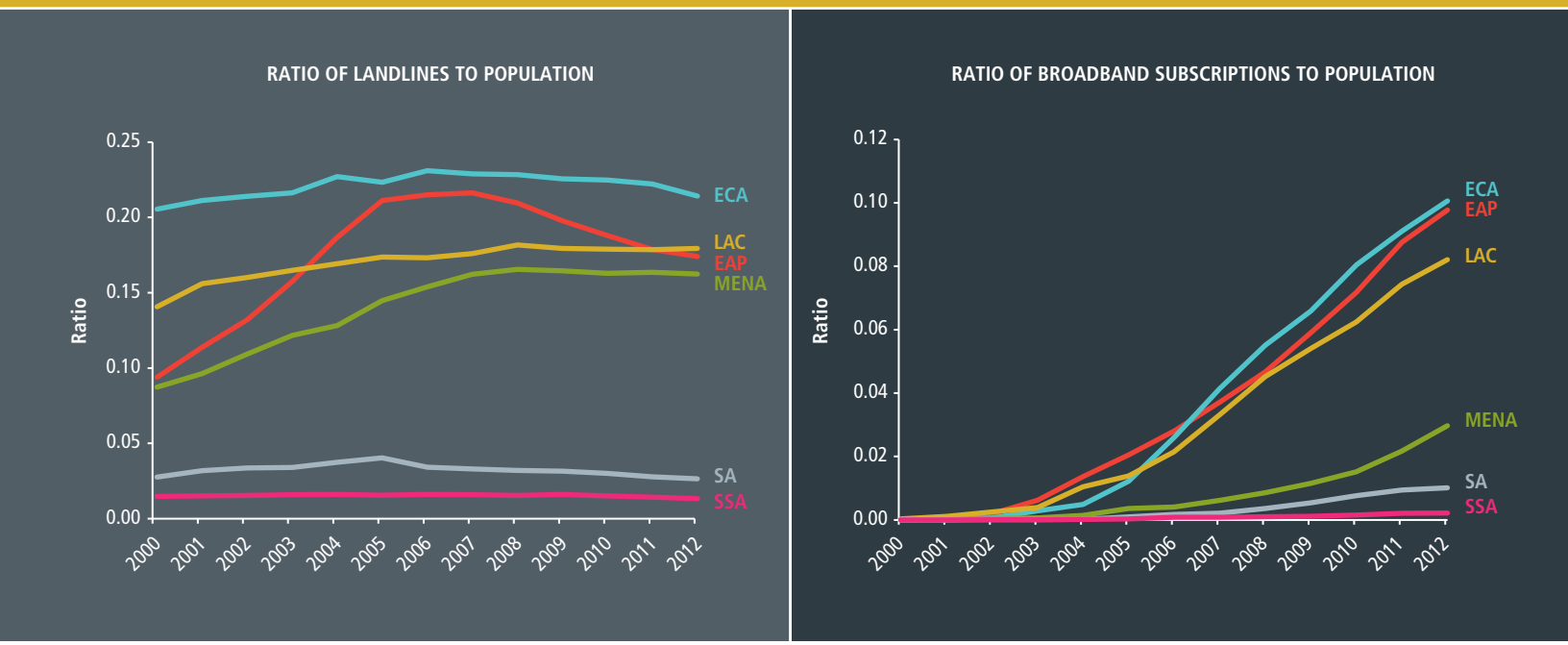
FIGURE 2 MOBILE PHONE SUBSCRIPTIONS AND GLOBAL POPULATION, 1993–2013



Source: Mobile phone subscriptions are from the International Telecommunication Union, and population figures are from the World Bank.

Note: Data for 2013 are incomplete.

FIGURE 3 LANDLINES AND BROADBAND PENETRATION FOR SELECTED REGIONS, 2000–2012



Source: Adapted from Figure 1 of E. Nakasone, M. Torero, and B. Minten, "The Power of Information: The ICT Revolution in Agricultural Development," *Annual Review of Resource Economics* 6 (forthcoming 2014). Data on landlines and broadband subscriptions are from International Telecommunication Union (mobile phone subscriptions) and the World Bank (country categories).

Notes: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA= Middle East and North Africa; SA = South Asia; and SSA = Africa south of the Sahara. High-income (OECD and non-OECD) countries are excluded from the sample.

Of the main potential gains from information use in agricultural markets, the most important is market efficiency.[7] Prices, in essence, can signal opportunities to producers, consumers, and traders—such as when excess demand is creating more profitable opportunities to sell or when excess supply leads to cheaper deals. For example, through increased access to mobile phones, farmers can better plan how much to plant each season and how much and what type of investments could be profitable based on supply-and-demand fundamentals.[8] They can also gather information from extended networks and cooperatives regarding market conditions and quality standards in higher-end markets. Better information through the use of these new technologies can generate a more efficient allocation of products, thereby creating higher overall gains for all market participants and allowing farmers either to find markets offering higher prices or to better negotiate with traders.

Anecdotal evidence suggests that these technologies might also affect transportation costs for both inputs and crops. A farmer in India related his experience this way: "I was in process to transport my produce of [approximately 1,000 boxes in two trucks] to Delhi when I got an SMS through RML [Reuters Market Light, a mobile phone–based information service] that the freight rate from Kotgarh to Delhi is Rs [rupees] 41.07 per box. I showed this message to the truck operator, who till then was citing a rate of Rs 44 per box. Following this I was able to settle the transporting deal at Rs 41.07, finally saving around Rs 3,000."[9]

Information and communication technologies can also be used to reduce price variability. In a context of limited information—and thus limited arbitrage—prices tend to vary based on the current local supply. As information flows improve, however, more opportunities for arbitrage emerge, effectively limiting the influence of local fluctuations and more closely relating market prices to less volatile aggregate supply. For example, farmers in areas with surplus harvests can sell their products to areas facing shortages. Finally, improved information can teach households about more profitable crops or previously unknown agricultural

techniques, thus potentially influencing production patterns in the long term.

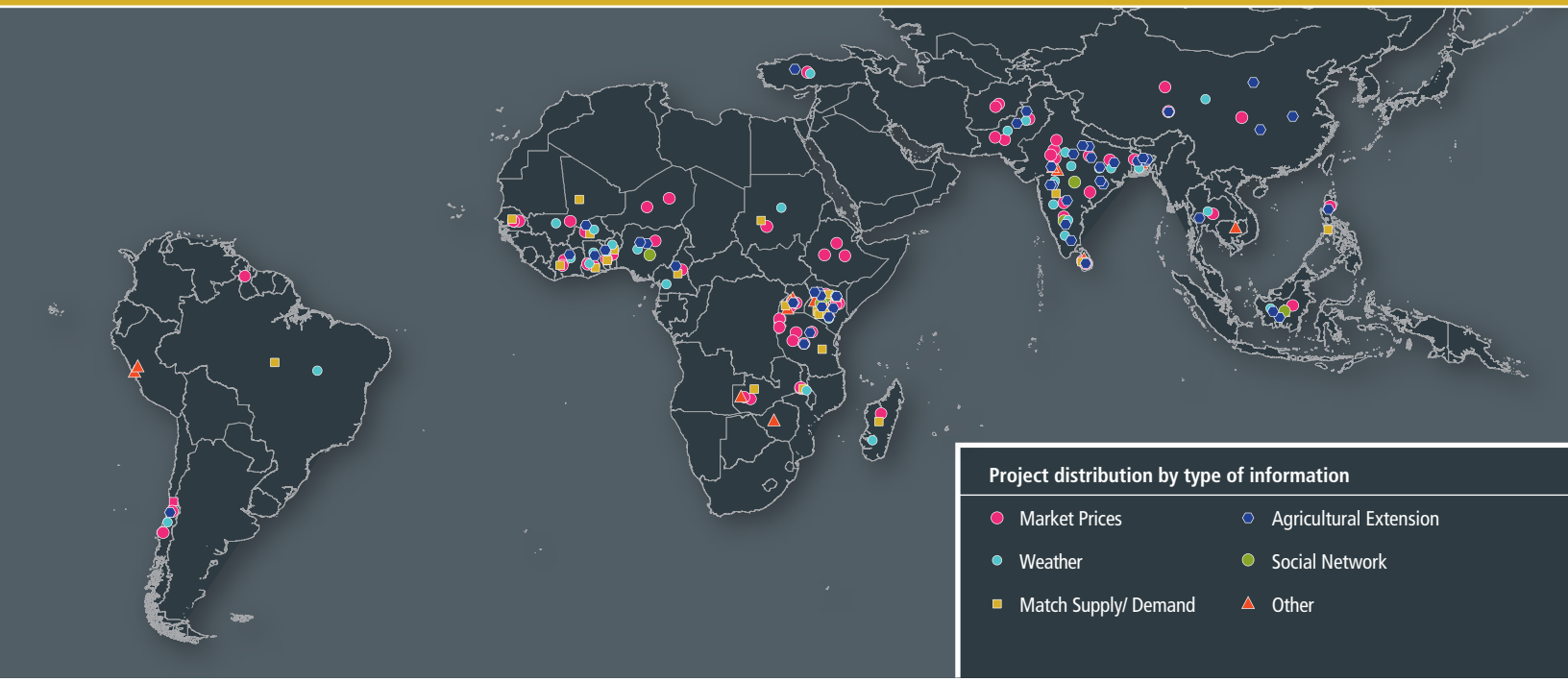
Although far from conclusive or uniform, some studies on the information flow of these technologies have provided a range of estimates for some of the hypothesized effects on smallholders' sale prices and profits. Investigating the impact of price dissemination through radio, for example, Svensson and Yanagizawa found large increases (around 15 percent) in farmgate prices for maize in Uganda.[10] Similarly large effects are suggested by preliminary research in Peru and the Philippines.[11] Others found much smaller or no effects.[12] A more thorough list of such studies is presented in Figure 5.[13]

Finally, information and communication technologies can play a role in reducing the three main constraints faced by traditional extension services in developing countries.[14] First, poor infrastructure makes it difficult and costly to visit remote areas. Second, traditional extension programs usually provide only one-time information to farmers, and the lack of follow-up information and feedback can restrict the long-term benefits of the information.

Of the main potential gains from information use in agricultural markets, the most important is market efficiency.

Finally, traditional extension is plagued by principal-agent and institutional problems, including a lack of accountability among extension agents. Information and communications technologies can overcome these problems by reducing the cost of extension visits, enabling more frequent two-way communication between farmers and agents, and improving the accountability of agents. Aker and Fafchamps have also claimed that in addition to reducing the cost of public information provided through extension services, these technologies can give farmers better access to private information through their own social networks.[15] By increasing communication among farmers, extension agents, and research centers, information and communication technologies can thus facilitate coordination of relevant content among all tree groups.

FIGURE 4 MOBILE PHONE–BASED INFORMATION AND COMMUNICATION TECHNOLOGY PLATFORMS FOR AGRICULTURAL DEVELOPMENT BEING IMPLEMENTED IN 2013



Source: GSMA, "Mobile for Development Intelligence," https://mobiledevelopmentintelligence.com/.

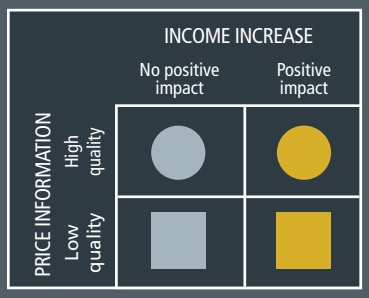
FIGURE 5 IMPACTS OF INFORMATION AND COMMUNICATION TECHNOLOGY IN AGRICULTURE

	PRODUCT	TECHNOLOGY	LOCATION	IMPACT	STUDY
1	Various crops	Public pay phones	Peru	16% increase in prices	Beuermann 2011
2	Various enterprises	Public pay phones	Peru	13% increase in farm income	Chong, Galdo, and Torero 2005
3	Various crops	Cell phones	Peru	11% increase in household consumption	Beuermann, McKelvey, and Vakis 2012
4	Maize, potato, olluco, barley	Cell phones	Peru	No positive impact	Nakasone 2013
5	Green peas, lima beans	Cell phones	Peru	11–13% increase in average prices	Nakasone 2013
6	Various products	SMS	Colombia	No positive impact	Camacho and Conover 2011
7	Various crops	SMS	Colombia	No positive impact	Camacho and Conover 2011
8	Maize	Radio	Uganda	15% increase in prices	Svensson and Yanagizawa 2009
9	Banana	Mobile phone coverage	Uganda	Somewhat positive impact, depending on distance to district center	Muto and Yamano 2009
10	Maize	Mobile phone coverage	Uganda	Somewhat positive impact, depending on distance to district center	Muto and Yamano 2009
11	Various products	Grameen/MTN village phones	Rwanda	No positive impact	Futch and McIntosh 2009
12	Cowpeas	Cell phones	Niger	No positive impact	Aker and Fafchamps 2010
13	Millet	Cell phones	Niger	No positive impact	Aker and Fafchamps 2010
14	Groundnuts	SMS	Ghana	9.7% increase in prices	Courtois and Subervie 2013
15	Maize	SMS	Ghana	12.7% increase in prices	Courtois and Subervie 2013
16	Yams	SMS	Ghana	7% increase in prices	Nyarko et al. 2013
17	Maize, cassava, gari	SMS	Ghana	No positive impact	Nyarko et al. 2013
18	Various crops	Cell phones	Philippines	11–17% increase in per capita consumption	Labonne and Chase 2009
19	Fisheries	Cell phones	Kerala, India	8% increase in fishermen profits	Jensen 2007
20	Soybeans	e-Choupal	Madhya Pradesh, India	1–3% increase in prices (average = 1.6%)	Goyal 2010
21	Potatoes	SMS	West Bengal, India	No positive impact	Mitra et al. 2012
22	Various products	SMS	Maharashtra, India	No positive impact	Fafchamps and Minten 2012
23	Eggs	Cell phones	Bangladesh	Positive impact, not specified	Bayes 2001

Source: Compiled by author. A full list of these studies is found in note 13.
Note: SMS = short message service; MTN = Mobile Telephone Network.

The analysis of the existing research presented in Figure 5 takes into account (1) the level of mobile phone penetration in the country when the interventions in the studies detailed were implemented; (2) the specific characteristic of the commodity in terms of its market value; (3) the specificity or quality of the content being provided to farmers—that is, whether price information is general or specific to the commodity and the markets relevant for the farmer; and (4) the significance of the interventions' impacts (yellow denotes significant; gray, not significant). Given the small number of existing studies and the preliminary nature of several of them, the synthesis presented in Figure 5 is not conclusive; yet several patterns suggest hypotheses to be further researched.

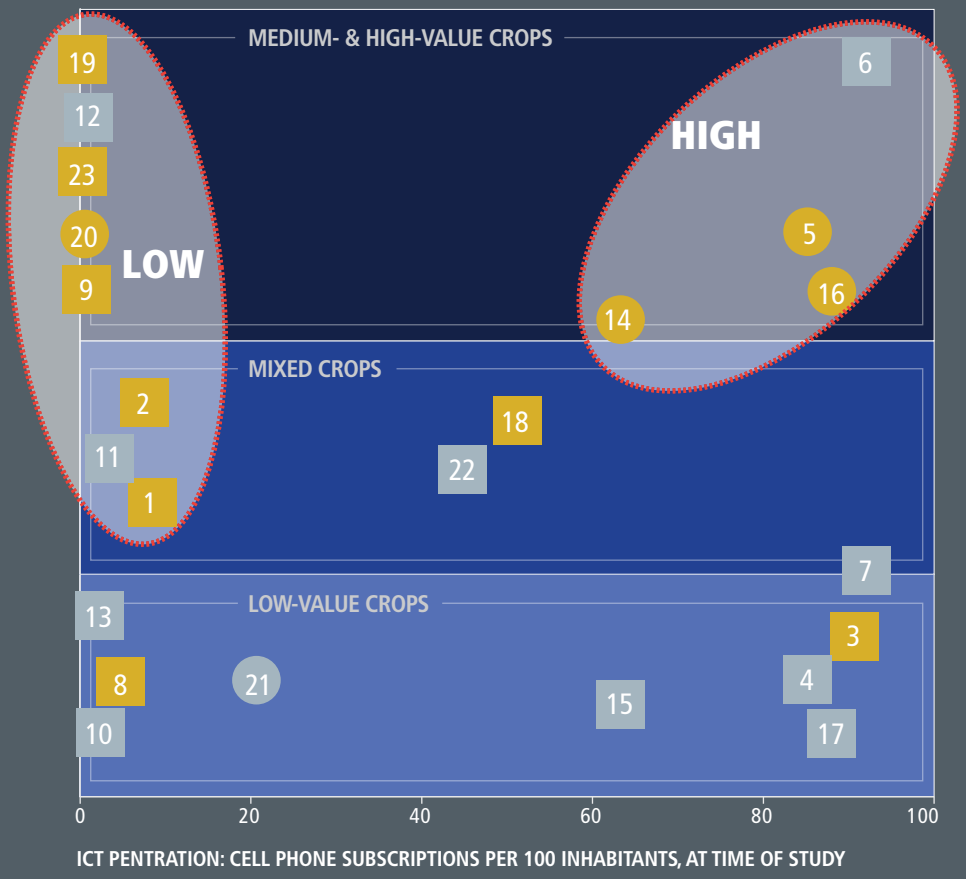
First, the figure shows that the lower the mobile phone penetration at the time of implementation, the more likely the case studies were to return significant findings, especially for mixed medium- and high-value commodities. A partial explanation for this result is that low penetration can be directly related to an important difference in knowledge about prices (or information asymmetry) among farmers; as penetration increases, all farmers might be better able to access the same price information, which has the potential to affect farmers' marketing decisions (such as whether to invest in medium- and high-value crops). Thus, an intervention that increases penetration has the potential to affect agricultural markets by reducing information asymmetry.



WHEN ICT PENETRATION IS LOW, almost any price information—general or specific—tends to have a positive impact on farmer income.

WHEN ICT PENETRATION IS HIGH, price information needs to be more specific to have a positive impact on farmer income, particularly for high-value crops that have a shorter shelf life.

*Numbers in graph correspond to numbered case studies in table.



Second, as the penetration of information and communication technologies (and therefore access to information) increases, the specific content of the information (that is, the usefulness of the information to the farmer) comes to matter. In fact, we see that studies of the impact of information return significant findings only when that information provides specific price information regarding high-value commodities (that is, where timely access to information matters most because of the perishability of the commodity). Fafchamps and Minten assessed the impact of information in regions of India where mobile phone penetration was higher than 40 percent but where only generic information was provided; they found no significant results stemming from that information.[16] On the other hand, other studies show significant results when the information provided was customized to the specific high-value commodities and varieties produced by the farmers studied.[17] One study also suggests that increased information, no matter how specific, for low-value and less perishable commodities is not significant.[18]

MAJOR CONSTRAINTS: THE TWO Cs

The use of information and communication technologies for development is constrained in two major areas: connectivity and content. Regarding connectivity, penetration rates may exaggerate true access to mobile phones. Detailed data from household surveys in developing countries show significant differences between rural and urban access. For example, in Brazil the rural penetration rate is 53.2 percent, whereas the urban

rate is 83.3 percent; in Bolivia, the figures are 18.7 percent and 77.6 percent, respectively; India, 51.2 percent and 76 percent; Malawi, 32.3 percent and 72.7 percent; and Ghana, 29.6 percent and 63.5 percent.[19] Clearly, access to mobile phones varies considerably between countries, and wide gaps in rural connectivity still exist in many developing countries.

One potential explanation for the variation in access between countries and for the access gap in rural areas is the cost of mobile phone service. In many countries even a low-volume basket of mobile service typical of a prepaid phone in a rural area is costly (Figure 6). Figure 7 shows the difference between the cost of a basket of low-volume prepaid service and 5 percent of the income of potential

Mobile Business Applications Link Small Farmers and Markets

CARSTEN FRIEDLAND

Information and communication technologies offer significant potential for connecting small-scale farmers with international food value chains. One example is the African Cashew Initiative, funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and the Bill & Melinda Gates Foundation, as well as several private companies and public partners. The initiative aims to increase the incomes of 330,000 farmers by US$90 a year by 2015. Before the initiative began training farmers in Good Agricultural Practices, the average net annual income of cashew farmers in the initiative's five project countries was US$144.[1] The initiative also promotes local cashew processing and works to improve market linkages along the value chain.

To enable farmers to engage in collaborative business practices in a transparent and sustainable way, the African Cashew Initiative, which is led by GIZ–Deutsche Gesellschaft für internationale Zusammenarbeit GmbH, has joined the software company SAP in a public-private partnership. SAP has developed a system geared toward the digital inclusion of small-scale producers in international value chains.[2] SAP's technologies provide cashew farmer cooperatives and buyers with information from independent cashew farmers. Smartphones are used in the field to record high-volume field transactions—such as farmer registration, prepayment, input supply, grading, purchase, logistics, and payments—and synchronize them in real time. An intuitive management application supports data analysis, facilitates operational field support, and ensures traceability of produce. In a pilot program carried out in Ghana in 2011, adoption rates were promising, with digital transactions totaling 90 percent of the traditional paper-based transactions.[3]

The system is applicable to other agricultural sectors. Since 2011, SAP and its partners have adapted the software for various internationally traded commodities sourced from smallholder farmers. About 20,000 small-scale producers in Burkina Faso, Côte d'Ivoire, Ghana, and Uganda have participated in pilot programs for shea nut, cocoa, cashew, and coffee. Transactions related to the delivery of about 2,000 tons of produce have been recorded digitally. Currently, pilot programs are being integrated with mobile payment systems, allowing for a reduction of cash transactions.

Information and communication technology systems like this one can help producers, producer groups, and buyers run their field activities more effectively and transparently. Producers get access to profitable markets that allow them to maintain and increase their income. By serving as proof of their economic activity, producers' recorded business transactions can improve their creditworthiness and may help them obtain financing for inputs and other investments. The interest shown by local processors, buyers, and multinationals in using the data collected by the system shows that these stakeholders profit from enhanced transparency and reliability when doing business with small-scale producers. Access to data on transactions with individual producers is a prerequisite for more accurate planning and forecasting and for implementation of structured quality assurance processes. Ultimately, such systems could help create more sustainable value chains, remove intermediaries that do not add value, and avoid excessive price fluctuation by allowing for longer-term contracts. This in turn could strengthen local economic activity and improve the well-being of many rural smallholders and their families.

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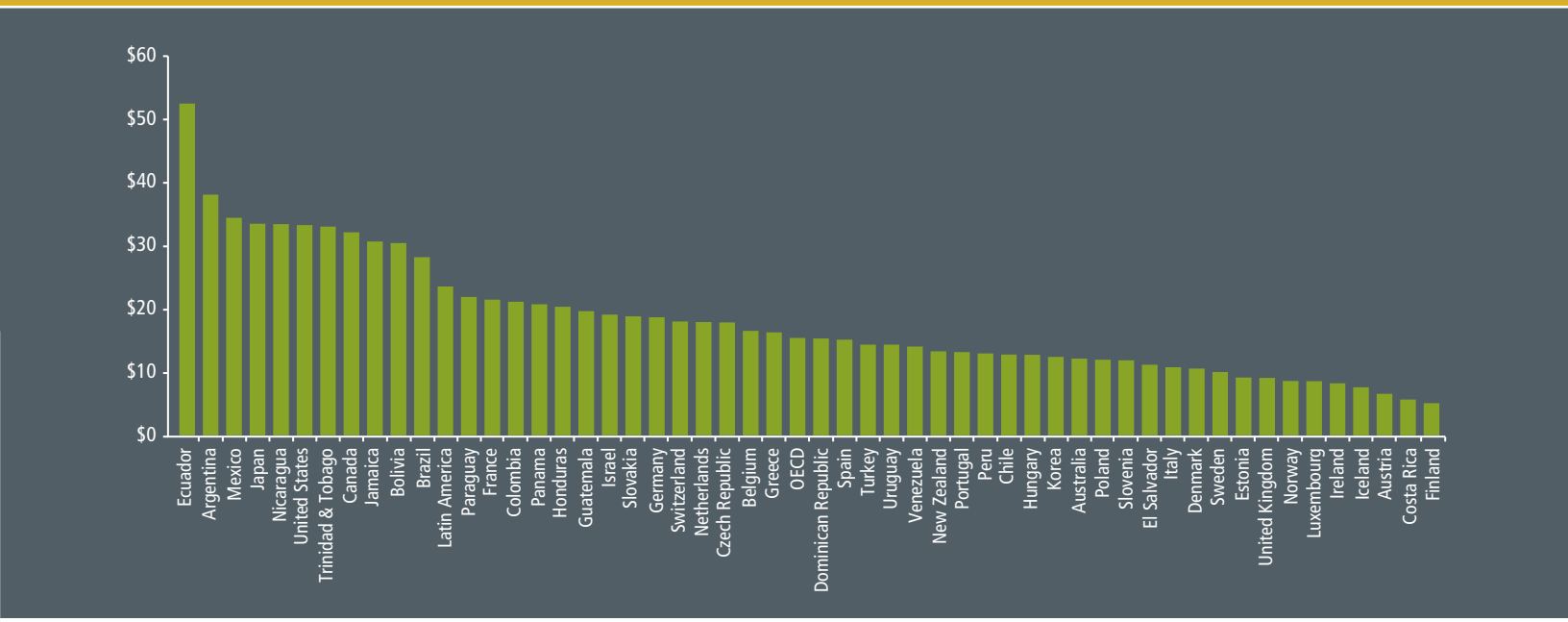
FIGURE 6 INTERNATIONAL COMPARISON OF THE COST OF A LOW-VOLUME BASKET OF MOBILE TRAFFIC, 2013 (US$ PPP)



Source: Hernan Galperin, *Broadband Prices in Latin America and the Caribbean,* Working Paper #15 (Buenos Aires, Argentina: Universidad de San Andrés, 2013).

Notes: PPP = purchasing power parity. Prices include taxes. Equipment and connection costs are not included. The low-volume basket includes 30 outgoing calls and 33 SMSs per month. The following structure of calls is assumed: local to fixed phones (15%), national (7%), mobile in-network (48%), mobile out-of-network (22%), and voice mail (8%). The estimations assume that 48% of calls take place during peak times, 25% in off-peak times, and 27% during the weekends. The following duration of calls is assumed (in minutes): 1.5 for local and national, 1.6 for mobile on-net, 1.4 for mobile off-net, and 0.8 for voice box. The tariffs are prorated according to the market shares of each operating company.

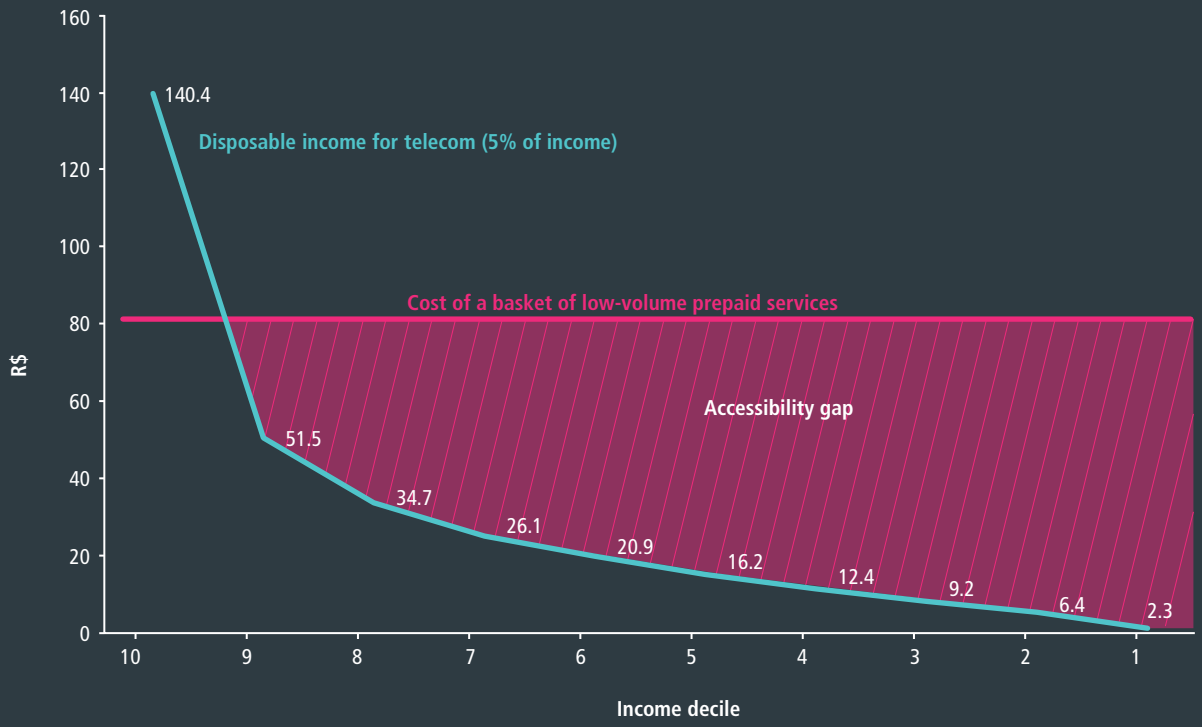
users in each income decile.[20] The results for Brazil show a wide gap between the cost of the service and the payment capacity of potential users. In this case, 90 percent of the population must spend more than 5 percent of its income to buy the basket of mobile services.

The high cost of mobile services seen in some developing countries may stem from the lack of significant competition among service providers or the lack of appropriate regulation. Network industries, such as telephony, are subject to strong economies of scale because significant initial investments are needed to establish operations. As a result governments need strong regulatory authority to ensure that existing infrastructure (normally under monopoly or oligopolistic power) is made available to all competitors at a reasonable access charge.

The second constraint faced by information and communication technologies relates to the relevance of accessible information. If the content provided is not the type of information needed, farmers may be less likely to use these technologies, thereby reducing the technologies' potential impact. The same logic holds true in the use of these technologies for extension. For example, Fafchamps and Minten looked at the effect of using SMS to provide crop advisory tips (offered for one crop chosen by the farmer) and local weather forecasts.[21] Counterintuitively, the authors found no evidence that this information changed cultivation practices or reduced harvest losses.

Other studies highlight how properly targeted, relevant information can affect farmers' production decisions. Cole and Fernando conducted an impact evaluation of the Avaaj Otalo program among cotton farmers in Gujarat, India.[22] This system used voice messages to both push content (providing weekly information on weather and crop conditions) and pull content (through a hotline allowing users to ask for specific advice). Calls from farmers to the hotline were processed by agronomists and answered through voice message. Cole and Fernando randomly selected a group of households to receive the toll-free Avaaj Otalo service. Their

FIGURE 7 DISPOSABLE INCOME FOR TELECOMMUNICATIONS IN BRAZIL (5% OF INCOME) BY INCOME DECILE, 2009



Source: H. Galperin, *Tarifas y Brecha de Asequibilidad de los Servicios de Telefonía Móvil en América Latina y el Caribe* (Lima, Peru: Diálogo Regional sobre Sociedad de la Información, 2009), 22.

Note: R$ = Brazilian real.

preliminary results suggest that households that benefited from Avaaj Otalo shifted to safer pesticides and were more likely to harvest cumin, a high-value cash crop. These findings suggest that the content provided through the voice messages, by being targeted and relevant, was useful for farmers and was thus adopted more willingly.

Similarly, Fu and Akter investigated the impact of a program called the Knowledge Help Extension Technology Initiative (KHETI) in Madhya Pradesh, India.[23] This initiative operates through agricultural specialists who travel from village to village with special mobile phones. These phones are able to record short dialogue strips (SDSs), or short videos, that depict a particular problem faced by a farmer. The SDSs are then sent to scientists, who determine solutions for each case, and the solutions are passed back to the farmers. Fu and Akter argued that those in the KHETI group increased their awareness and knowledge of extension services compared with those in a control group.[24] The authors also found that beneficiaries perceive this initiative to be more useful, faster, and of better quality than other services. It should be noted, however, that no increase in adoption of the solutions provided by this initiative has been identified, which implies that there have been no increases in farmer productivity and income.

These studies highlight the heterogeneity of extension projects—including one-way versus two-way communication between farmers and agricultural specialists, SMS versus voice transmission of advice,[25] and oral description versus visual representation of problems. Because most agricultural extension work being conducted through information and communication technologies is fairly recent, however, we still lack adequate evidence regarding which projects work effectively.

THE WAY FORWARD

The accelerating adoption of information and communication technologies around the world provides a significant opportunity. This is particularly true of cellular phone technology, which has increased rapidly in developing countries (though costs still prohibit wider adoption, and there still remains an important gap between access in urban and rural areas). Better access to price information can allow farmers to plan more effectively how much to plant each season, as well as how much and what type of investments could be profitable based on supply-and-demand fundamentals. These technologies can both promote learning and provide better access to price information and improved technology. All of these impacts could potentially affect agricultural productivity and income-generating opportunities for the poor.

Taking advantage of these opportunities, however, depends not only on connectivity, but also on relevant content provided in accessible and useful forms. These two Cs (connectivity and content) should progress simultaneously. Even though the cost of information and communication technologies is falling rapidly, there is still a need to continue improving both access to and use of new technologies in the poorest areas. In some countries subsidies have been implemented in response to this problem, with the goal of improving access to telecommunications for rural households and ensuring that poor people pay no more than their wealthier urban counterparts for this access. The economic rationale for subsidies is that these technologies have positive spillover benefits for people's consumption and production and create not only network externalities (that is, a change in the benefit, or surplus, that an agent derives from a good when the number of other agents consuming the same kind of good changes) but also the potential for economies of scale. The main problem with such schemes, however, is that they can be financially unsustainable.

One solution, adopted by telecommunication investment funds in Chile and Peru, is to use a small percentage of the gross operating revenues of existing private operators to pay for subsidies.[26] Other countries should consider this option. In addition, alternative technologies should be further explored. Broadband technology, for instance, has the potential to provide access to both data and voice services and thus increase competition in the delivery of services. A dual broadband strategy, promoting both the deployment of wireless broadband networks and the adoption of voice telephony applications targeted to low-income users, is one approach that should be carefully assessed, including the appropriate roles of the public and private sectors.

Content is also crucial, especially where cellular phone penetration is high. The existing evidence, though based on a small number of cases, suggests that content quality matters if information and communication technologies are to be useful for development. Thus, going forward, there is a clear need to continue assessing the impact of the quality of information. In addition, many aspects of agricultural information constitute a public good, and governments need to invest in providing the best possible information regarding not only prices for different markets, produce varieties, and produce quality but also production technologies and other agronomic information. If these investments are not made, the potential impact of these technologies could be limited, especially for high-value commodities and markets. We need innovative ways to bring together the public and private sectors to ensure that the two Cs are addressed as a whole. ■

NUTRITION POLICY AND PRACTICE

Unpacking the Politics

Stuart Gillespie

SUMMARY One of the biggest advances in the field of nutrition in 2013 was a growing consensus on the need to cultivate, strengthen, and sustain enabling environments to support nutrition-related actions. This chapter examines how policy, power, politics, and people come together in a multisectoral context to influence the creation of these critical environments.

The year 2013 was pivotal for international nutrition, with advances coming on many fronts. Most broadly, the challenge of undernutrition came to occupy a more prominent part of policymaking discussions. One key event was the rise of the Scaling Up Nutrition (SUN) Movement. This effort seeks to support national leaders in prioritizing efforts to address malnutrition by aligning policies and legal frameworks and by mobilizing partners, capacity, and resources. SUN membership now includes 45 countries.[1]

A second advance was that significant funds were pledged to help address the problem of undernutrition. In June, a Nutrition for Growth event (co-organized by the United Kingdom, Brazil, and the Children's Investment Fund Foundation) resulted in pledges of more than US$23 billion from a range of development partners to promote nutrition.[2]

Third, the international nutrition community gained better consensus on strategies for combating undernutrition. In June, *The Lancet*'s Maternal and Child Nutrition Series reported on recent evidence on the trends, causes, and consequences of malnutrition, as well as actions to address it. The articles in the series expanded upon an earlier 2008 *Lancet* series by reviewing nutrition-sensitive program options (including those within the agriculture sector) and the political economy of malnutrition. Also included was a discussion of the growing threat posed by the double burden of undernutrition and overweight or obesity. Yet another area in which there was growing consensus was *when,* within the life cycle, to take action. The 1,000 Days movement, for instance, has successfully communicated the growing body of evidence that the period from

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Nutrition: More Money and More Transparency Needed

MARIELLA DI CIOMMO

Financing to address undernutrition comes from several sources, such as national public expenditures, domestic and international private funds, and official development assistance from international donors. Information on resources other than official development assistance is scant, and details on official assistance are incomplete. The available data suggest, however, that current financing is not enough to cover financial need.

Nutrition attracted increased attention in 2013. Membership was boosted, for example, in the Scaling Up Nutrition (SUN) Movement, a global coalition to end undernutrition. Some SUN member countries presented national plans and estimates of costs to address undernutrition domestically.[1] At the June 2013 Nutrition for Growth event, hosted by the United Kingdom and Brazilian governments and the Children's Investment Fund Foundation, some developing countries committed to increasing domestic resources for nutrition and set targets for reducing stunting (that is, low height-for-age). International public and private donors pledged an additional US$4.2 billion for direct nutrition interventions and US$19 billion for nutrition-sensitive investments by 2020.[2]

Ninety percent of the world's stunted children live in 34 countries.[3] Recent estimates suggest that investing an additional US$9.6 billion a year in scaling up direct nutrition interventions in these countries would reduce child deaths by one million.[4] This additional investment would also reduce stunting and wasting (low weight-for-age), both of which cause physical and mental underdevelopment. Of this amount, US$3–4 billion could come from international sources.[5] Investments in nutrition-sensitive initiatives could further improve results.

Reported official development assistance for nutrition, despite being on the rise, remains inadequate. Official nutrition assistance amounted to US$408 million in 2011, constituting 0.3 percent of total official development assistance.[6] This amount was far less than both emergency food aid (US$3 billion) and development food aid (US$1.8 billion). Projects in other areas—such as health, agriculture, and humanitarian aid—can have a significant impact on nutrition outcomes, but data limitations make identifying, quantifying, and thus assessing such contributions problematic. Actual official development assistance to nutrition is likely to be higher than what is reported.

Encouragingly, 66 percent of nutrition official development assistance in 2009–2011 went to those 34 countries that are home to most of the world's stunted children. But disparities exist within the group. Despite representing only 35 percent of estimated financial need, the region of Africa south of the Sahara received 61 percent of official development assistance for these 34 countries. Although Asia accounts for 50 percent of estimated financial need, that region received just 21 percent of annual nutrition official development assistance.

The role of official development assistance should be assessed against both need and additional funding sources (be they international or within developing countries). The estimated US$9.6 billion cost of scaling up direct nutrition interventions is based on estimates of current coverage at the national level and costs by geographic region. Little is known, however, about which resources actually pay for current coverage at the country level. We need better data to draw firm conclusions on whether official development assistance specifically targets countries with the largest financial gap and how that assistance can complement other kinds of resources.

To hold both developing-country governments and donors accountable, we will need clearer reporting of nutrition investments and transparent tracking of progress toward these commitments. Because past experience suggests that pledges are not always fully met, monitoring progress is essential to delivering actual results.

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pregnancy to a child's second birthday is a critical window of opportunity to combat undernutrition.[3] Many in the nutrition community now also agree on the need to focus simultaneously on three levels of action: (1) implementing and scaling up a core package of nutrition-specific interventions; (2) maximizing the nutrition sensitivity of a wider group of development actions (in sectors such as agriculture, social protection, water, and sanitation); and (3) cultivating, strengthening, and sustaining enabling environments to support nutrition-relevant actions.

This chapter focuses on policy, power, and politics. Specifically it deals with how the issue of malnutrition gains traction within the development agenda and how this attention is then turned into effective action through formulating and implementing the right mix of policies and programs in different settings.[4]

A POLITICAL ISSUE

The challenge of addressing malnutrition is inherently political because malnutrition:

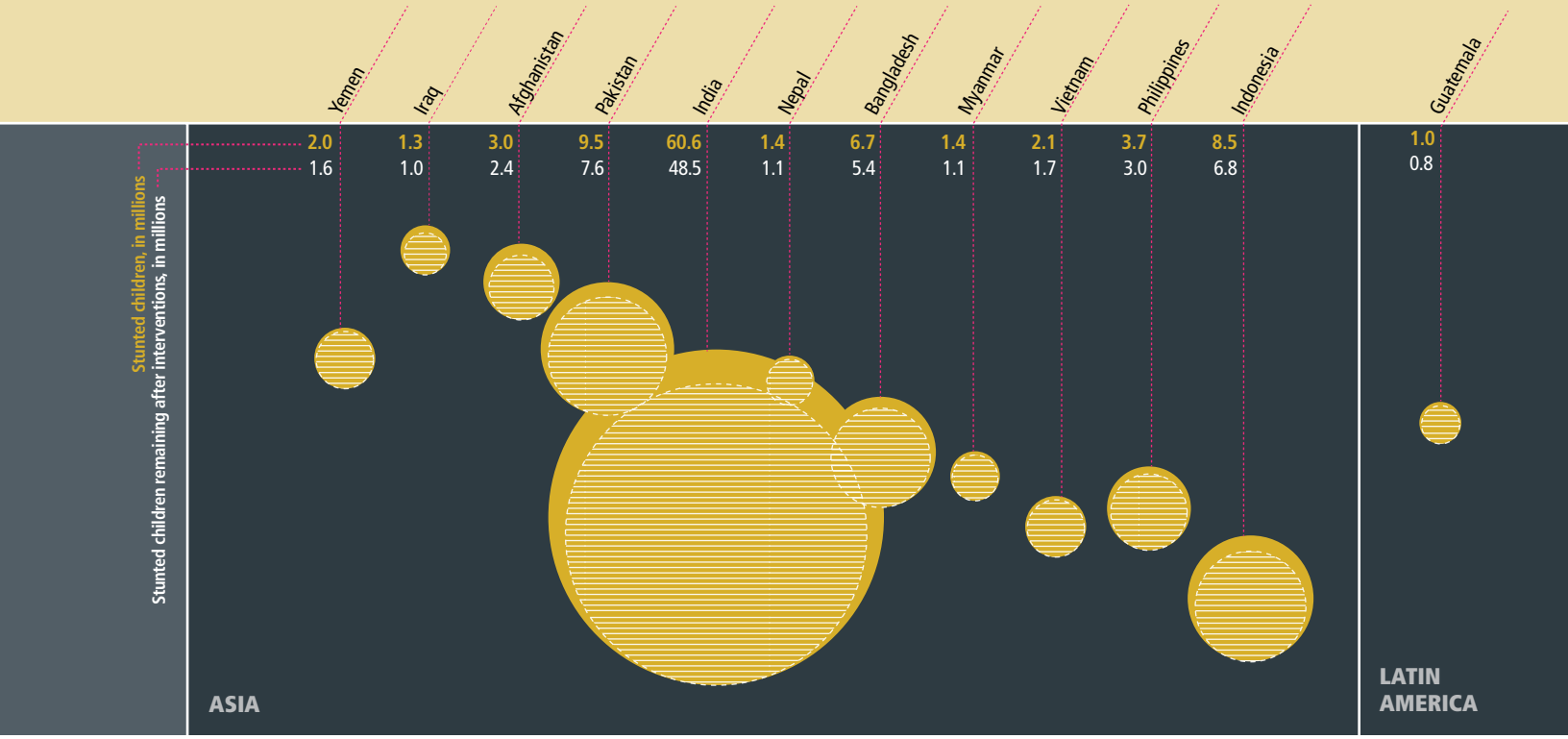
- **is multicausal in nature.** This is clearly illustrated by the conceptual framework used by *The Lancet* series, which depicts the various determinants of malnutrition in a pyramid, at the base of which lies a bundle of political and governance-related drivers.[5]
- **is a multisectoral challenge.** Many sectors need incentives (often from the government) to promote nutrition given that nutrition is not their core business and that undernutrition has a multifaceted etiology. Sometimes acting multisectorally requires sectors to apply a nutrition lens to their own programs, and sometimes it means sectors must be brought together in a more coordinated fashion to implement integrated programs.
- **is an institutional orphan.** Although nutrition is clearly a multisectoral issue, no country has a ministry of nutrition, and institutional arrangements to address malnutrition vary across governments.
- **extends beyond just economics.** Economic solutions are not enough. Economic growth (which itself is shaped by politics) is necessary but cannot significantly improve nutrition on its own.[6]
- **requires more than just technical solutions.** *The Lancet* series highlights a core package of 10 nutrition-specific interventions (Figure 1), which—if scaled up to 90 percent coverage in the countries with the highest burden of child stunting—would avert only *one-fifth* of the burden of stunting in those countries.[7]

Stunting and underweight are often "invisible," even to mothers of malnourished children.

- **can be a hidden problem.** Stunting and underweight are often "invisible," even to mothers of malnourished children. Ironically, the more widespread undernutrition is in a village, the more invisible it may be because being low in weight and short in stature become perceived as the norm.[8] Such a lack of visibility results in little community voice or bottom-up pressure for change. Given the evidence accumulated in the past two decades on the damage caused in *becoming* stunted, civil society and the media have a particular responsibility to step in and counteract the dangers of hidden stunting by promoting nutrition.
- **requires public-private cooperation to resolve.** Nutrition needs both public- and private-sector engagement; the regulation of the private sector (to protect breastfeeding, for example, by preventing violations of the International Code of Marketing of Breast-milk Substitutes) requires political action.
- **requires increased political transparency to resolve.** There is a pervasive lack of timely, actionable, nutrition-relevant data within high-burden countries, which leads policymakers to be less accountable to citizens. As a result, governments do not respond to either chronic undernutrition or emerging nutrition crises. In addition, it is often unclear how much governments spend on nutrition (within sectoral budgets) and what particular nutrition efforts they fund, further reducing transparency and accountability.
- **has multiple benefits, many of which only accrue over time.** Addressing malnutrition now will bring significant intergenerational benefits.[9] Politically, this represents a challenge because these benefits will not all become apparent while a politician is in office.

FIGURE 1 NUTRITION-SPECIFIC INTERVENTIONS ARE NOT ENOUGH TO END STUNTING

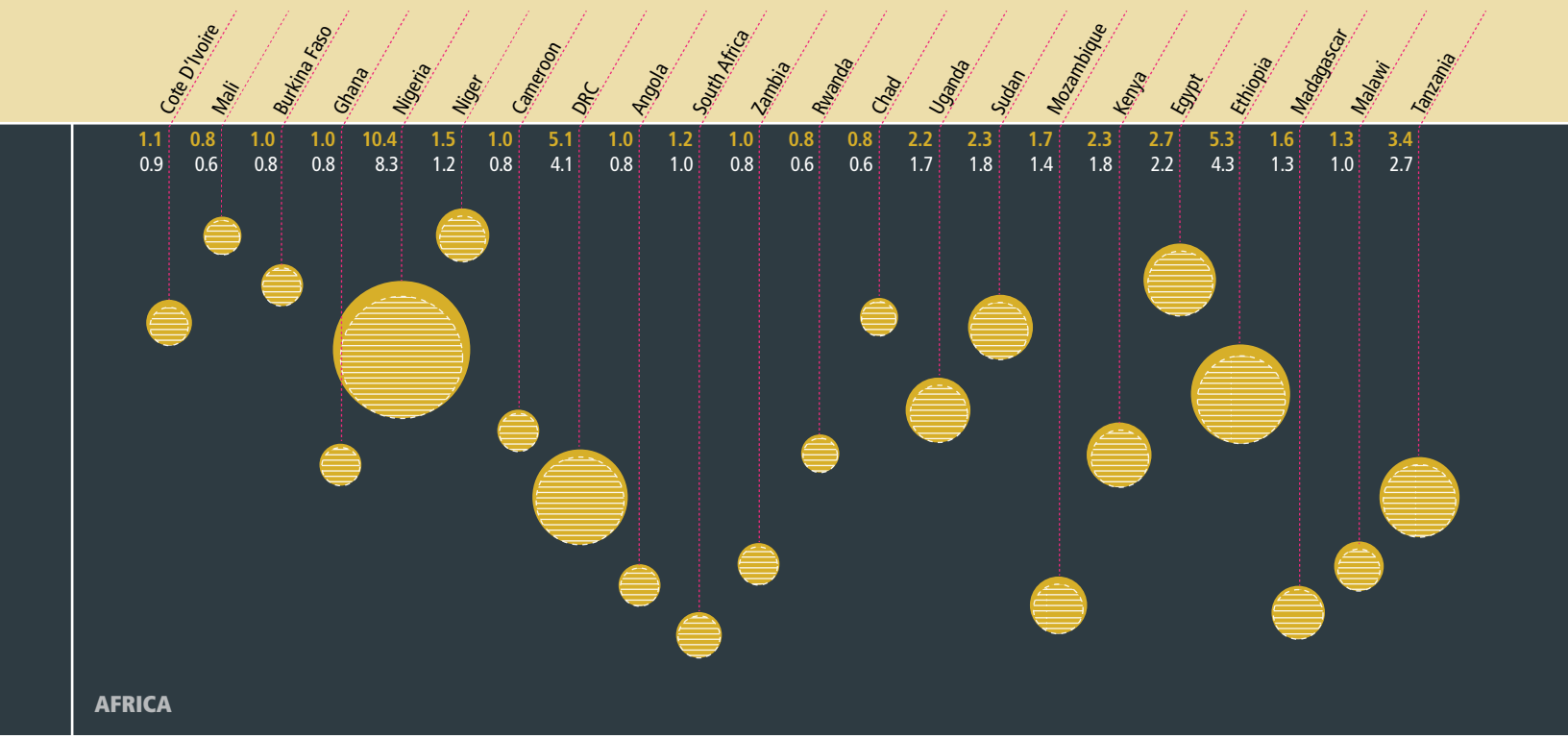
In June 2013 *The Lancet* recommended a core package of 10 nutrition-specific interventions to combat stunting. What if we scaled up these interventions to 90 percent coverage in the 34 countries with the highest burden of child stunting? The results, as shown here, are disappointing: such a massive effort would avert only one-fifth of the burden of stunting in these targeted countries. We clearly need a broader set of tools to deal with this critical health problem.



Source: Z. A. Bhutta, J. K. Das, A. Rizvi, M. F. Gaffey, N. Walker, S. Horton, P. Webb, A. Lartey, and R. Black, "Evidence-Based Interventions for Improvement of Maternal and Child Nutrition: What Can Be Done and at What Cost?" *The Lancet* 382, no. 9890 (2013): 452–477.

UNDERSTANDING NUTRITION-RELEVANT POLICY PROCESSES

Given that politics shapes policy, it is useful to review the historical evolution of attention to nutrition within policy processes. After an initial flurry of writing in the late 1970s and early 1980s, little was written about nutrition-relevant policymaking until 2003.[10] Since then, however, several multicountry studies have applied conceptual and analytical frameworks to unravel the main pathways and dynamics of nutrition-relevant policy change. In 2003, for example, the World Bank–United Nations Children's Fund (UNICEF) joint nutrition assessment described the evolution of key nutrition policy narratives in India, Madagascar, the Philippines, and Tanzania.[11] In 2008, one research effort assessed the opportunities and constraints for addressing nutrition as a development priority in Ghana, Mozambique, Nigeria, and Uganda.[12] In 2009, another analysis reviewed the history of nutrition policies, drivers of change, and main obstacles and challenges in Benin, Ghana, India, Madagascar, Senegal, and Tanzania.[13] In 2011–2012, the Mainstreaming Nutrition Initiative generated several papers on nutrition policy processes, including case studies from Bangladesh, Bolivia, Guatemala, Peru, and Vietnam.[14] Yet another research effort focused on the multisectoral coordination for nutrition in case studies of Colombia and Senegal.[15] One of the most recent efforts—a six-country study of governance in Bangladesh, Brazil, Ethiopia, India, Nigeria, and Peru—was completed in 2012.[16] Research within other fields, such as political science and health systems, has also contributed frameworks, tools, and methods to nutrition-relevant policy.[17]



To unpack the politics of nutrition policy and practice, a useful starting point is to assess the nutritional situation in a given context, such as a high-burden country. This is done by asking a host of questions: What is known about the drivers of these nutrition outcomes, and what types of policies and programs can control these drivers? How accessible is this information, and what are the dominant ideas, narratives, or stories of change that may influence policy and practice? Does political commitment to address malnutrition exist at the highest level? Is there a basic consensus on the type of nutrition-specific and nutrition-sensitive actions that are needed? Which sectors are involved? How well are they coordinated horizontally (between sectors) and vertically (within sectors, from the national to district levels) to ensure effective implementation of required actions? How are individual, organizational, and systemic capacities configured at different levels? Are financial resources adequate to support relevant action, or can funds be mobilized to do so?

The policy process literature that seeks to answer these questions has identified three issues of particular importance for combatting undernutrition:

1. Ensuring horizontal and vertical coherence (between sectors and at different levels within sectors)
2. Optimizing the use of information and evidence to shape both policy and pro-nutrition narratives
3. Strengthening nutrition-relevant capacity to support policy change

A few basic premises underpin the discussion in this chapter. First, political commitment or political will does not fall from the sky; rather, it

Africa's New Nutrition Initiatives

FRANCIS BRUNO ZOTOR

Africa is rich in economic resources, and yet the continent is unable to feed itself sufficiently. In 2013, however, a global wave of nutrition initiatives took place that offered new opportunities to improve food and nutrition security in Africa. For example, high-level commitments to address nutritional challenges were made at the Group of 8 Summit in Northern Ireland,[1] the Nutrition for Growth summit in London,[2] and the Sustaining Political Commitments to Scaling Up Nutrition event in Washington, DC.[3] In addition, the scope of the nutrition challenge and a range of possible solutions was presented in the new *Lancet* Series on Maternal and Child Nutrition.[4]

It is incumbent on African leaders to welcome and embrace these initiatives. To sustain the momentum that has been created, national governments and multilateral and bilateral donors must pledge long-term funding to mitigate Africa's nutrition challenges along the lines of a number of previous initiatives. These include US President Barack Obama's 2009 food-security initiative for Africa,[5] the First Africa Food Security Conference in Nairobi in 2013,[6] the Africa Food and Nutrition Security Day in 2010,[7] the Maputo Declaration on agriculture and food security by African heads of state and government (which celebrated its tenth anniversary in 2013),[8] and the European Commission's 2011 initiative called Sustainable Nutrition Research for Africa in the Years to come (SUNRAY).[9]

In addition, the Scaling Up Nutrition (SUN) Movement has generated considerable momentum, with 45 member countries worldwide as of the end of 2013, including 31 in Africa. Through this movement, significant improvements have been reported by a number of African countries, notably Malawi, Tanzania, and Zambia, where nutrition has been placed at the heart of government priorities.[10] Nutrition professionals who wish to see the Scaling Up Nutrition Movement succeed locally have formed an "academic platform," spearheaded by Ghanaian nutritionists, to provide technical input and to strengthen civil society organizations. In addition, through the African Nutrition Society, nutritionists are promoting professional training in nutrition and nutrition education to aid efforts to meet the UN Millennium Development Goals, support health workers' efforts to tackle nutrition-related health challenges, and advance the post-2015 agenda to support less-achieving countries in Africa. Moving forward in 2014, we urgently need to build capacity to support the Scaling Up Nutrition Movement at the country level across Africa. The concerted long-term approach represented by these various efforts is the most promising way to achieve sustainable solutions to Africa's nutrition challenges.

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needs to be proactively built.[18] Second, generating political momentum can be a challenging step, but translating such momentum into effective action (and ultimately impact) on the ground is often an even greater hurdle. Given this reality, what will most likely be effective is a view that "policy is what policy *does*"—that is, the emphasis should be on what needs to be done and how it should be done.[19] Third, in addition to politics, power, and policy, there is a fourth "P"—people. Public- and private-sector actors, civil society, academia, the media, frontline workers, and the public at large all have important roles to play in all three of these issues. As stated by James Grant, former UNICEF executive director, "It is the political will of the people that makes and sustains the political will of governments."[20]

ENSURING HORIZONTAL AND VERTICAL COHERENCE

Because undernutrition has a multifaceted etiology with drivers that lie within the mandates of different sectors, and given the absence of any dedicated ministry of nutrition, a degree of harmonization among sectors is particularly important to ensure that policies and programs are as pro-nutrition as possible. This is hard to ensure, however, because sectors have different objectives, and competition is often more common than collaboration.

Nutrition is multisectoral in that the outputs and outcomes of many sectors affect it, but this does not mean that *all* sectoral actions need to be coordinated. This mistake was made during the multisectoral planning era of the 1970s and 1980s, when too much time was spent choreographing elaborate multisectoral plans without thinking through incentives (why a sector should act) and implementation modalities (how and what it should actually do).[21] Nonetheless a degree of horizontal coherence between sectors is required for effective policy and practice.[22] Relationships are also vertical (because of the links that exist between national, state, and district levels, for example), and there is a particular need for vertical coherence within larger countries that have decentralized systems of governance.[23]

It is helpful to review the experiences of countries that have been successful in reducing undernutrition in recent years. These countries—such as Brazil, Colombia, Peru, and Senegal—share certain common ingredients (though causality is difficult to establish rigorously). These include the creation or existence of multisectoral platforms, a culture of inclusiveness (of institutions and actors), appropriate incentives, and lateral (as opposed to simply top-down) leadership. In Peru, for example, a civil society–led multistakeholder coalition extracted pledges from presidential candidates to address child stunting if elected. Peruvian president Alan García was reminded of his promise after he won the vote, and levels of child stunting dropped from 31 percent to 19 percent between 2000 and 2011.[24]

In Malawi, nutrition has benefited from high-level political endorsement with the Department of Nutrition, HIV, and AIDS (DNHA) being located in the Office of the President and Cabinet. The department has developed a standardized Scaling Up Nutrition (SUN) Movement rollout framework to better align sectors at the district and community levels to improve nutrition. Malawi is ranked higher than any other African country on the new Hunger and Nutrition Commitment Index.[25] At the global level, SUN has sought to promote horizontal coherence by establishing multisectoral platforms to catalyze and enable more complementary, coordinated, and integrated action.[26]

OPTIMIZING THE USE OF INFORMATION AND EVIDENCE

To shape the policy space for nutrition effectively, information on trends in nutrition outcomes and their core drivers is required. Also needed is evidence of the damage caused by malnutrition and the benefits of addressing it. Finally, evidence from successful countries and effective programs is also critical. Both the 2008 and 2013 *Lancet* nutrition series systematically assembled such evidence, and the two rounds of the Copenhagen Consensus process (in 2008 and 2012) ranked nutrition interventions among the most cost-effective in the field of development.[27] Yet there is still a need for more evidence of what works in scaling up nutrition-specific interventions, how to embed nutritional considerations in other sectoral actions, and how to make nutrition politically attractive.

In addition to politics, power, and policy, there is a fourth "P"—people.

Beyond information and evidence per se, the history of nutrition also suggests the importance of framing the evidence and employing the right narrative in the right place at the right time to influence action.[28] Certain meta-narratives are common. A sampling includes nutrition as an outcome of economic development (frequent), nutrition as a driver of economic development (less frequent), nutrition as a human rights issue, and the hidden hunger narrative of micronutrient deficiency. Historically these narratives have tended to be biased toward food-based solutions, with less recognition placed on health- and care-related drivers of malnutrition. Different narratives have driven political commitment to act, such as zero hunger policies in Brazil, Guatemala, and Peru. In India, the fact that progress in nutrition has lagged markedly behind economic growth over the past two decades has led to greater calls for action on nutrition, including by the prime minister. These calls have also, unfortunately, led to the revisiting of an old debate on whether the international standards for measuring nutrition actually apply to Indian children.[29]

With nutrition now a high priority for policymakers, it is time to invest national and global resources to support long-term capacity development.

Without timely and credible information that is effectively communicated to those with the power and the capacity to act, political commitment, accountability, and responsiveness will likely prove elusive. On the transparency of political commitment, recent progress has been made in the form of the Hunger and Nutrition Commitment Index. This index was developed by the Institute of Development Studies to rank countries (and, more recently, donors) in terms of their commitment to addressing undernutrition. It complements other outcome-based indexes such as the United Nations Development Programme's Human Development Index and IFPRI's Global Hunger Index. Improvement in nutrition will not be achieved until governments and other actors are given incentives to act and are held accountable for the quality and effectiveness of any nutrition investment. On-the-ground evidence of the large-scale impact on nutrition status is still relatively thin, but what does exist may provide a powerful incentive for action and can be used by civil society to hold governments to account. At the community level, innovations such as community scorecards that track progress in health show great promise.[30]

STRENGTHENING NUTRITION-RELEVANT CAPACITY: THE ELEPHANT IN THE ROOM

Because strategic planning and program design in many development-related sectors often ignore the issue of weak capacity, development goals are often not reached. Nutrition is no different. But strengthening capacity in the field of nutrition is a complex task because nutrition-relevant action must be both multisectoral and multilevel. Several types of capacity must be developed, allowing different actors and organizations to undertake a variety of tasks.

A first step in setting strategies that effectively strengthen capacity is to systematically assess gaps and weaknesses. Capacity assessment tools and protocols have been developed for this purpose.[31] They tend to highlight capacities needed at individual, organizational, and systemic levels. At an individual level, capacities range from the leadership and advocacy skills of nutrition "champions" (to generate high-level political commitment) to the capacity of frontline workers in remote villages (to support mothers in feeding and caring for their young children). Case studies suggest that individual and organizational capacity development needs to go beyond the conventional nutrition "toolbox" to encompass such skills as working across disciplinary boundaries, building and working through alliances and networks, leveraging other capacity and resources, and effectively communicating to different audiences.[32]

It is no surprise that poor-quality delivery of nutrition services tends to coincide in time and space with poor-quality nutrition training programs and academic curricula.[33] Many capacity-assessment studies are from contexts with a high burden of malnutrition, and they find training and curricula to be outdated, impractical, and misaligned with local nutrition priorities.[34]

One clear overarching priority—highlighted in both the 2008 and 2013 *Lancet* series—is the need to strengthen strategic and operational capacity for scaling up nutrition interventions and embedding nutrition considerations in other sectoral actions.[35] It is not enough just to strengthen the capacity of national-level policymakers and grassroots-level frontline workers. Also key is to strengthen midlevel actors (such as district-level program managers).[36]

With nutrition now a high priority for policymakers, it is time to invest national and global resources to support long-term capacity development. These capacity-strengthening investments will be based on funding cycles that extend well beyond the standard three- to five-year time frame characteristic of current donor-based program support.

Much needs to be done. But a concerted focus on capacity strengthening may result in many

achievements in a relatively short time frame. For example, the state of Maharashtra in India piloted an effort in 15 mainly tribal districts with high levels of child stunting. The goal was to uncover what could be achieved simply by boosting the capacity and skills of frontline workers of the Integrated Child Development Services program and then giving them the necessary support to do their jobs. As a result of this effort, stunting among young children dropped rapidly—from 39 percent in 2006 to 23 percent in 2012.[37]

CONCLUSIONS

Malnutrition is finally being taken seriously by politicians as a major development challenge. A degree of consensus now exists on the need to implement certain nutrition-specific and nutrition-sensitive actions. These actions, in turn, can only spring from a stable and enabling political environment. Various actors and organizations are developing partnerships and collaborations. The energy of the SUN Movement is driving, and being driven by, this momentum and raising the stakes.

A Window Half-Open: Nutrition Policy in Pakistan

HARIS GAZDAR

Over the past few years, nutrition has become a serious policy concern in Pakistan. With more than 180 million people, and undernutrition rates comparable to India's, Pakistan has been undergoing a democratic transition in the midst of an insurgency. It can provide insights into the politics of nutrition in a period of change. The country's new focus on nutrition has been due to a combination of political and administrative reforms, conspicuous natural disasters, and fresh research.[1] When constitutional reforms empowered provincial governments, this opened up the opportunity for active policymaking on nutrition where it mattered: provincial governments providing the public goods and services most pertinent to nutrition. The international donor community and national development professionals had already been sensitized to the need for action on nutrition by successive floods in 2010 and 2011, which revealed the scale and depth of undernutrition among the country's rural communities. These donors and development professionals began engaging with responsive and newly empowered provincial governments to create focal points for nutrition policy. The issue gained further public visibility when the results of a widely cited survey confirmed fears that vulnerability to hunger and undernutrition were prevalent and had remained unresponsive to economic growth.[2]

Even as the opportunity for raising policy interest in nutrition became apparent, there were also indications that this window may not remain open for long, given that nutrition has not played a prominent role in policymakers' priorities and parties' election manifestos. Elections held in May 2013 were hailed as historic, but mostly because they marked a departure from past trends of nonconstitutional regime change. These elections brought to center stage such issues as electricity shortages and terrorism, but undernutrition and its effects on millions of children were perhaps too complex to fit into neat sound bites for knockout political blows. Outright hunger, which might have attracted popular attention, was also conspicuous in its absence from the political debate. This was partly due to the government's prior success in reducing price volatility (though not price levels) and preventing shortages of the main staple—wheat—by following through on the recommendations made in 2008 by a National Task Force on Food Security.[3] Other aspects of food insecurity, such as the lack of dietary diversity, could not be translated into catchy slogans either.

The elections showed that although voters regarded electricity shortages and terrorism as signs of political failure for which they punished incumbents, apparently neither the general public nor elite opinion makers saw hunger and undernutrition as acute enough to command much attention or to rank among their highest priorities. Although the window of opportunity for nutrition policy remained open in 2013, the country's exercise in democracy made it clear that support for such policy is still limited to a small group of professionals dedicated to the issue. To be successful, these influential few will need to find ways to "sell" their message creatively to politicians, opinion makers, and the public, much like their counterparts in other democratic countries have done. At the moment, this effort is still a work in progress in Pakistan.

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Malawi Builds High-Level Commitment to Nutrition Policy

EDITH MKAWA AND FELIX PENSULO PHIRI

The government of Malawi recognizes nutrition as a human rights issue. In November 2004, to ensure that nutrition policies were well coordinated, it established the Department of Nutrition, HIV, and AIDS. The mandate of this department is to provide strategic policy direction, advocacy, coordination, resource mobilization, and capacity building on nutrition issues. Furthermore, in a demonstration of political will and commitment to addressing nutrition, President Joyce Banda herself serves as the minister responsible for nutrition, HIV, and AIDS, and she placed the principal secretary of the department within the Office of the President and Cabinet to oversee and coordinate the program activities and day-to-day operations. In addition, Malawi has established high-level political committees such as the Cabinet Committee on Nutrition, HIV, and AIDS; the Parliamentary Committee on Nutrition, HIV, and AIDS; the Principal Secretaries Committee on Nutrition, HIV, and AIDS; the Government and Development Partners Committee; and the National Nutrition Committee.

Malawi uses the "three ones principle" in addressing nutrition: one coordinating office, one monitoring and evaluation framework, and one strategic plan. The government of Malawi developed its national monitoring and evaluation framework to ensure accountability in the implementation of nutrition activities at all levels. Through its high-level commitment to the national nutrition agenda based on a multisectoral platform, the country has made notable progress in reducing some negative nutrition indicators.[1] However, Malawi is currently experiencing a rise in nutrition-related noncommunicable diseases, such as overweight, obesity, hypertension, and diabetes.

Through the Scaling Up Nutrition (SUN) Movement, Malawi made a number of strides in 2013. For example, it strengthened the country's multisectoral platform by setting up the Civil Society Network and the Cabinet Committee on Nutrition, HIV, and AIDS. It also rolled out sugar fortification with vitamin A and reviewed standards for wheat and maize flour and cooking oil. Implementation of community-based nutrition interventions was scaled up to 50 percent of the districts in the country, with a focus on reducing stunting. Malawi rolled out a nutrition education and communication strategy for 2011–2016, developed a micronutrient strategy for 2014–2018, began a review of the nutrition policy and strategic plan for 2014–2018, and scaled up the community-based management of acute malnutrition and school feeding programs in all districts. The president also established a Nutrition Champion Committee, which includes traditional leaders, and launched the first-ever nutrition project funded by the World Bank and the Canadian International Development Agency. And at the Nutrition for Growth summit in London in June 2013, President Banda committed to gradually increasing budgetary allocations for nutrition from 0.1 percent to 0.3 percent by 2020.

Currently, Malawi is focusing its nutrition policy efforts on community-based management of acute malnutrition, dietary diversification, micronutrient interventions (including supplementation, fortification, biofortification, and dietary diversification), behavior change promotion for maternal and child nutrition, and the Baby-Friendly Hospital Initiative,[2] among others.

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As the multisectoral nature of the nutrition challenge is taken onboard politically, issues of governance, accountability, and capacity become ever more important. The multisectorality of nutrition also means that implementation of effective nutrition programs is more complex than, for example, a vaccination program. In the context of nutrition, more attention needs to be paid to the "how" questions—especially how to implement effective large-scale programs where they are needed. Implementation or delivery science is becoming more prominent in development discourse, including in recent speeches by World Bank president Jim Yong Kim.[38] But again the politics of delivery should also be considered. Past delivery failures need to be addressed by focusing on the "missing

middle"[39]—the complex web of incentives, rules, and power relationships that link nutritionally vulnerable populations to service providers and different layers of government.

In terms of financial resource mobilization, generally speaking, the costs of required action are clearer than in the past,[40] and significant pledges of increased funding were made in 2013. But more will be needed. Some of these extra resources could be raised through public-sector reallocations or could come from the private sector. Others could arise through relatively untried innovations, such as creative government-donor matching funds.[41]

Ultimately, political will is a political choice—to place priority on raising healthier children. Improvements in the quantity, quality, and communication of appropriate information can raise the profile of malnutrition as a development challenge and keep the momentum high.

Past delivery failures need to be addressed by focusing on the "missing middle"—the complex web of incentives, rules, and power relationships that link nutritionally vulnerable populations to service providers and different layers of government.

As the demand for such information grows, and as nutrition becomes more widely recognized by the media and the public as a societal issue, politicians will more likely choose to promote nutrition. ■

Regional Developments

In addition to global developments and food policy changes, 2013 also saw important developments with potentially wide repercussions in individual regions and countries. This chapter reports on related trends and offers perspectives on food policy in various regions and food-security hotspots, including Africa, the Arab World, Central Asia and Russia, South Asia, East Asia, and Latin America and the Caribbean. Topics include

- the progress of the Comprehensive Africa Agriculture Development Programme (CAADP) on the occasion of its tenth anniversary,
- ongoing food policy reforms in various countries in the Middle East and North Africa,
- South Asian countries' strategies for achieving food security and adapting to climate change,
- agrarian and land reform in Central Asia and Russia,
- the policy challenges of extreme weather events and urbanization in East Asia, and
- policymakers' increasing focus on undernutrition and obesity in countries in Latin America.

Africa

Ousmane Badiane, Tsitsi Makombe, and Julia Collins

The year 2013 marked the tenth anniversary of the Comprehensive Africa Agriculture Development Programme (CAADP). Endorsed by African leaders in July 2003, CAADP is an Africa-wide framework for guiding country actions in stimulating broad-based economic growth, poverty reduction, and food and nutrition security through an agriculture-led growth strategy. This essay examines Africa's progress in implementing CAADP and reviews significant agriculture-related developments within the region in 2013, including (1) efforts to better integrate issues of nutrition and resilience into national agriculture and food-security investment plans, (2) actions to ensure mutual accountability through agricultural joint sector reviews, and (3) continent-wide and subregional dialogues to address policy constraints to achieving better development outcomes.

CAADP ENTERING ITS SECOND DECADE

As of December 2013, 46 countries had launched the CAADP roundtable process, 39 had signed compacts, and 28 had developed detailed national agriculture and food-security investment plans. Moreover, notable progress was made in 2013. For example, the Common Market for Eastern and Southern Africa and the Economic Community of Central African States both signed regional compacts. In addition, the Economic Community of West African States (ECOWAS), following the creation of a regional fund in 2012 to implement the regional CAADP agenda, launched a Regional Agency for Agriculture and Food based in Lomé, Togo.[1]

For Africa as a whole, progress has not been enough to achieve CAADP targets of both a 10 percent budget share and 6 percent annual growth for agriculture. Agricultural spending grew steadily, however, averaging an annual rate of 7.4 percent from 2003 to 2010, with a total of 13 countries having met or surpassed the budget target in any single year.[2] Over the same period, Africa's average annual agricultural growth rate stood at 3.8 percent, a marked improvement but still well below the 6 percent target.[3] However, a few countries—Angola, Ethiopia, Guinea, Mozambique, Nigeria, and Rwanda—have exceeded the growth target since 2003.[4] The development community has also responded positively; the share of agriculture in total official development assistance grew at an average annual rate of 10.5 percent during 2003–2010.[5] Improvements in agricultural expenditures and growth have translated into improvements in overall economic growth and reductions in poverty and undernourishment. For Africa as a whole, gross domestic product (GDP) and GDP per capita grew at an impressive average annual rate of 5.0 percent and 2.3 percent, respectively, during 2003–2012.[6] Meanwhile, the prevalence of undernourishment fell slightly from 26.7 percent in 2003 to 24.3 percent in 2010, while the proportion of people living below the US$1.25 a day poverty line fell from 55.7 percent in 2002 to 48.5 percent in 2010.[7] The absolute number of poor has continued to increase, however, rising from 390.2 million in 2002 to 413.7 million in 2010.

One of CAADP's successes has been to raise the profile of agriculture and build consensus around its centrality to poverty reduction and food security—as reflected in both the widespread buy-in of African governments and the alignment by donors

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to its institutional processes. In 2013, CAADP continued to solidify African ownership and leadership in defining the continent's development agenda and to reinforce the principle of inclusive policy dialogue and mutual accountability across different stakeholders. The African Union has declared 2014 both the Year of Agriculture and Food Security and the year to commemorate ten years of CAADP. The goal is to assess CAADP's performance thus far and chart a way forward for accelerating implementation, improving performance, and deepening impact over the next decade. In 2013, the African Union also planned and held several policy actions and events that will lead up to its July 2014 Summit of Heads of State and Government, which is dedicated to agriculture and food-security issues. As part of the rollout, the African Union Commission launched a new initiative entitled Sustaining the CAADP Momentum, which includes a new results framework to guide implementation in the coming decade.

TURNING ATTENTION TO NUTRITION AND RESILIENCE

The year 2013 also saw new initiatives to directly tackle the issue of nutrition among African countries. For example, at the end of June, the African Union, the Food and Agriculture Organization of the United Nations (FAO), and the Lula Institute jointly convened a high-level meeting in Addis Ababa, Ethiopia, entitled Renewed Partnership for a Unified Approach to End Hunger in Africa by 2025 within the CAADP Framework. At the meeting, heads of state and government, together with representatives from the private sector, civil society, farmers' groups, and other development partners, pledged to end hunger in Africa by 2025. At the subregional level, technical meetings were convened for East and Central Africa, Southern Africa, and West Africa. These meetings centered on how to better integrate nutrition into country investment plans, as part of the Nutrition Capacity Development Initiative launched by the New Partnership for Africa's Development (NEPAD). Other regional meetings—such as the June workshop for West Africa, held in Ouagadougou, Burkina Faso—discussed the integration of not only nutrition but also risk management and resilience into country plans.[8] Initiatives that started in previous years were also active in 2013, including efforts by NEPAD's Planning and Coordinating Agency, FAO, the World Bank, and other partners to support integration of resilience and risk management issues into country investment planning and implementation.

In addition, West African nations continued implementation of the Global Alliance for Resilience Initiative in West Africa and Sahel (AGIR), which was launched in December 2012. In April 2013, the alliance adopted a regional roadmap for its implementation. The roadmap specified the alliance's overall objectives and targets, which are to be implemented at the national and local levels according to local priorities. The overall objective of the alliance is to sustainably reduce food and nutritional insecurity and vulnerability. It aims to eradicate hunger in the long term and to improve the resilience of households and communities in the short term.[9] A workshop, held in Cotonou, Benin, at the end of August, launched AGIR's Country Inclusive Dialogue process, an important step in moving toward the in-country implementation phase by equipping countries to define resilience priorities.[10] Meanwhile, ECOWAS continued its efforts to establish a regional food reserve for West Africa.

ADDRESSING POLICY CONSTRAINTS AND PROMOTING MUTUAL ACCOUNTABILITY

Several continent-wide and subregional events were held that dealt with policy and institutional constraints to achieving better growth and development outcomes. The African Union Commission and the NEPAD Planning and Coordinating Agency organized an Agricultural Policy Exchange and Learning Event in Dakar, Senegal, in May as a forum for governments, the private sector, civil society, donor agencies, and research organizations to discuss policy challenges to meeting the goals and targets of the national agriculture and food-security investment plans, share lessons and experiences, and identify actions to overcome challenges.

Participants ended the event with country and regional action plans for strengthening policy systems and institutional capacity. Inputs from the event fed into the development of the CAADP Results Framework.

Input subsidy programs continue to be an important policy tool used by African governments to achieve agricultural development goals. Yet emerging empirical evidence from studies of fertilizer subsidy programs indicates that the costs are likely to exceed the benefits. This is particularly true in cases where subsidized fertilizers either are diverted from their targeted beneficiaries or displace supplies from the private sector.[11] Challenges regarding fertilizer subsidies are related not only to their often high cost but also to their design and implementation modalities. Seed subsidy programs that are designed to be less prone to diversion and private-sector displacement tend to show better outcomes. The evidence also suggests that investments in agricultural research and development and infrastructure are more cost-effective in promoting growth than are fertilizer subsidies.[12]

The year 2013 also witnessed a strong push to strengthen mutual accountability through agriculture joint sector reviews. Such reviews provide a multistakeholder platform for assessing not only agricultural sector performance but also how well state and nonstate actors have implemented their commitments as stipulated in the national agriculture and food-security investment plans, CAADP compacts, and other agreements. In support of this effort, the International Food Policy Research Institute (IFPRI) and the Regional Strategic Analysis and Knowledge Support System (ReSAKSS) developed a technical note and terms of reference to guide the conduct of these joint sector reviews. They also held training events in countries and at the continental level, including a technical workshop in April in Dakar, Senegal. Of the first group of six focus countries, Ghana and Rwanda already have active joint sector reviews; Mozambique launched its first in August; and efforts are underway to support Burkina Faso, Senegal, and Tanzania in launching their first reviews. In November, IFPRI, ReSAKSS, the African Union Commission, and the NEPAD Planning and Coordinating Agency held the Annual ReSAKSS Conference in Dakar, Senegal, which underscored the importance of fostering mutual accountability through effective and regular joint sector reviews in countries across the continent. Concurrently, Senegal's New Alliance for Food Security and Nutrition (or New Alliance) Cooperation Framework was launched; Senegal's commitment to the framework will be monitored through the country's joint sector review process.

Efforts to improve policies and foster mutual accountability are also being pursued through the New Alliance and the Grow Africa Initiative. Launched in 2012, the New Alliance represents a shared commitment by African governments, the Group of 8 and other donors, and private-sector companies to increase investments in African agriculture and to accelerate the implementation of priorities identified in CAADP investment plans. As part of the New Alliance, countries develop cooperation frameworks indicating government policy reforms, private-sector investments, and donor commitments to accelerate agricultural growth. Commitments under the frameworks are to be reviewed on an annual basis as part of the country joint sector review process. In 2013, the first six countries that joined the New Alliance—Burkina Faso, Côte d'Ivoire, Ethiopia, Ghana, Mozambique, and Tanzania—implemented many of the policy commitments they had made in their cooperation frameworks. By April, out of 97 different policy commitments made by these governments, 27 had been completed and 55 had achieved some progress.[13] Donor and private-sector commitments were also largely on track. Of the approximately US$1.5 billion in donor assistance pledged to have been disbursed by April, 91 percent had been paid out.[14] In addition, 89 out of 113 private-sector investment projects had seen at least some progress.[15] Four countries—Benin, Malawi, Nigeria, and Senegal—joined the New Alliance and signed their respective cooperation frameworks.

Another partnership platform is Grow Africa, founded in 2011 by the African Union Commission, the World Economic Forum, the NEPAD Planning and Coordinating Agency, and others. It works closely with the New Alliance and seeks to

mobilize private-sector investments. By May 2013, Grow Africa had attracted 97 investment projects from 62 companies (39 of which are from Africa), and more than US$60 million had been invested in linking small farmers to markets.[16]

Grow Africa holds an annual Agricultural Investment Forum and supports other similar events. One is the Business Forum for West Africa, which was organized by the Network of Farmers' and Agricultural Producers' Organizations of West Africa and private-sector actors and held at the end of October in Abidjan, Côte d'Ivoire. Participants discussed how farmer organizations can develop attractive investment proposals for businesses.

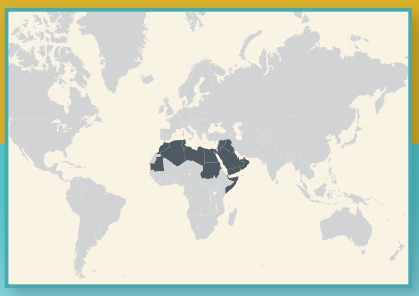
The African Green Revolution Forum, a partnership that unites players from multiple sectors to develop and promote investments in agriculture, held an event in Maputo, Mozambique, in September. Participants met to review CAADP progress, explore methods to connect smallholders with commercial agricultural value chains, and identify financing models to promote growth and value chain expansion.[17]

AN EMERGING AGRICULTURAL SCIENCE AND TECHNOLOGY AGENDA FOR AFRICA

Numerous efforts aimed at promoting partnerships and alliances in science and technology took place in 2013. In January, the African Union Commission and the CGIAR Consortium signed a memorandum of understanding on joint activities to further the Dublin Process agenda of aligning CGIAR research with the CAADP framework. The memorandum called for the alignment of CGIAR research programs with CAADP investment plans, the development of a Science and Technology Agenda for African Agriculture, and support for subregional research organizations. In support of the alignment efforts, IFPRI-led HarvestChoice is undertaking an exercise to map ongoing agricultural research and development activities in Africa by CGIAR centers. The Forum for Agricultural Research in Africa (FARA) is heading efforts to outline the Science Agenda (now called the Science Agenda for Agriculture in Africa). It held two meetings, in January and March, to outline the process of developing the agenda. The Africa Agriculture Science Week meetings followed in July, in Accra, Ghana, and allowed stakeholders to review progress and discuss the science agenda for the next three years. An expert panel, also convened by FARA, released a discussion paper in June to stimulate further discussion on the agenda and its process, followed by a virtual discussion forum in September. The agenda is expected to be unveiled at the African Union Summit in July 2014.[18] ■

The Arab World

Clemens Breisinger, Perrihan Al-Riffai, Olivier Ecker, and Maurice Saade



Improving food security remains a key strategic objective of Arab countries and is widely recognized as an important factor in stability and economic development, especially since the political uprisings that recently occured in the region.[1] What follows is an overview of key food security issues the region grappled with during 2013.

AGRICULTURAL PRODUCTION AND CEREAL IMPORTS INCREASING IN MOST ARAB COUNTRIES

In most Arab countries, agriculture performed better in 2013 than in 2012, largely because of more favorable weather conditions.[2] Cereal production increased in 11 out of 14 surveyed countries—particularly in Algeria, Iraq, Morocco, and Sudan. Countries with falling production included Saudi Arabia, Syria, and Tunisia.[3] Even as cereal production rose in most countries, however, cereal imports also continued to expand. To finance these growing imports, oil-exporting countries continued to rely on an oil-for-food trade strategy. Arab transition countries—that is, Egypt, Libya, Tunisia, and Yemen—faced severe challenges in financing food imports due to lower inflows of both tourism revenue and foreign direct investment.[4] Increases in development aid and remittances helped alleviate some of these shortfalls, especially in Egypt and Yemen.[5]

PERCEIVED FOOD SECURITY IMPROVING BUT CHILD MALNUTRITION REMAINS HIGH

Economic growth in most Arab countries remained modest and below the levels prior to the political uprisings, especially in transition countries. Unemployment either rose or remained stuck at high levels in Egypt, Jordan, Morocco, and Tunisia. Most worrying, perhaps, was that child malnutrition remained high relative to other countries at similar income levels (Figure 1). Nonetheless, food prices declined, largely due to lower global food prices. Possibly as a result, perceived household food security improved in many countries. Exceptions included Egypt, Sudan, and Syria, where sociopolitical conflict has led to higher prices and lower incomes, likely further increasing food insecurity (Figure 2).

FOOD SECURITY IN SYRIA

The ongoing war in Syria had serious food security implications both for Syria and several of its neighbors. By 2013, Syria's per capita gross domestic product had contracted by an estimated 42 percent compared with prewar levels, in part because the war had disrupted or destroyed key infrastructure and services.[6] Prices for food and other goods and services more than doubled between 2010 and 2013, leading the United Nations to estimate that 4 million Syrians are food insecure. In addition, 4.5 million people are internally displaced, and more than 2 million people have fled to neighboring countries.[7]

PROMISING DEVELOPMENTS IN FOOD POLICY

Algeria's Policy for Agricultural and Rural Renewal (PARR), launched in 2009, has begun to show impressive results. This policy seeks to stimulate

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agricultural modernization through private-sector investments, supported with generous credit subsidies and output subsidies targeting key strategic commodities (such as cereals, milk, potatoes, meat, and date palms). Although agricultural growth that is driven by heavy subsidies may not be sustainable, these reforms include other elements that are conducive to sustainable growth. The cornerstone of PARR is the Land Concession Law. By allowing farmers to obtain 40-year renewable concessions for formally state-owned land, the law in effect creates new private land ownership. The solid agricultural growth for 2009–2013, estimated by the government to have averaged 13.8 percent annually, was perhaps stimulated by this law.[8]

In Yemen, the outcome of the National Dialogue Conference is generating cautious optimism about possible political reform, whereas the Friends of Yemen meeting in September emphasized the importance of effectively managing the US$7.8 billion that donors have pledged to Yemen. The Yemen government reemphasized its commitment to implementing the National Food Security Strategy at a September workshop hosted by the prime minister in Sanaa. In an important step toward financing the implementation of the food strategy, Yemen secured a US$36 million grant from the Global Agriculture and Food Security Program.

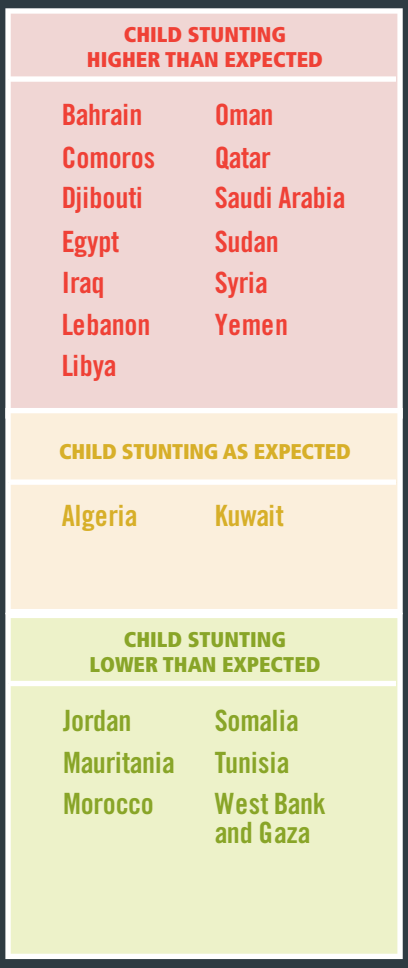
In Egypt, prospects rose for better-informed policymaking with the May launch of the open data initiative by the Central Agency for Public Mobilization and Statistics. With the support of the Economic Research Forum, the agency is providing open access to household and labor market surveys. In another move toward increased data transparency, in January 2014, IFPRI, the International Fund for Agricultural Development, and CGIAR's Research Program on Policies, Institutions, and Markets launched a revised version of the Arab Spatial Development and Food Security Atlas, the first interactive mapping tool for the region.[9]

MORE COURAGE FOR POLICY CHANGE NEEDED

In light of the continued tense political situation in many Arab countries, most governments in the

FIGURE 1 THE DISCONNECT BETWEEN NATIONAL INCOME AND CHRONIC MALNUTRITION

For most countries in the Arab world, the prevalence rate of child stunting—a measure of chronic malnutrition—is higher than would be expected given these countries' levels of per capita GDP.

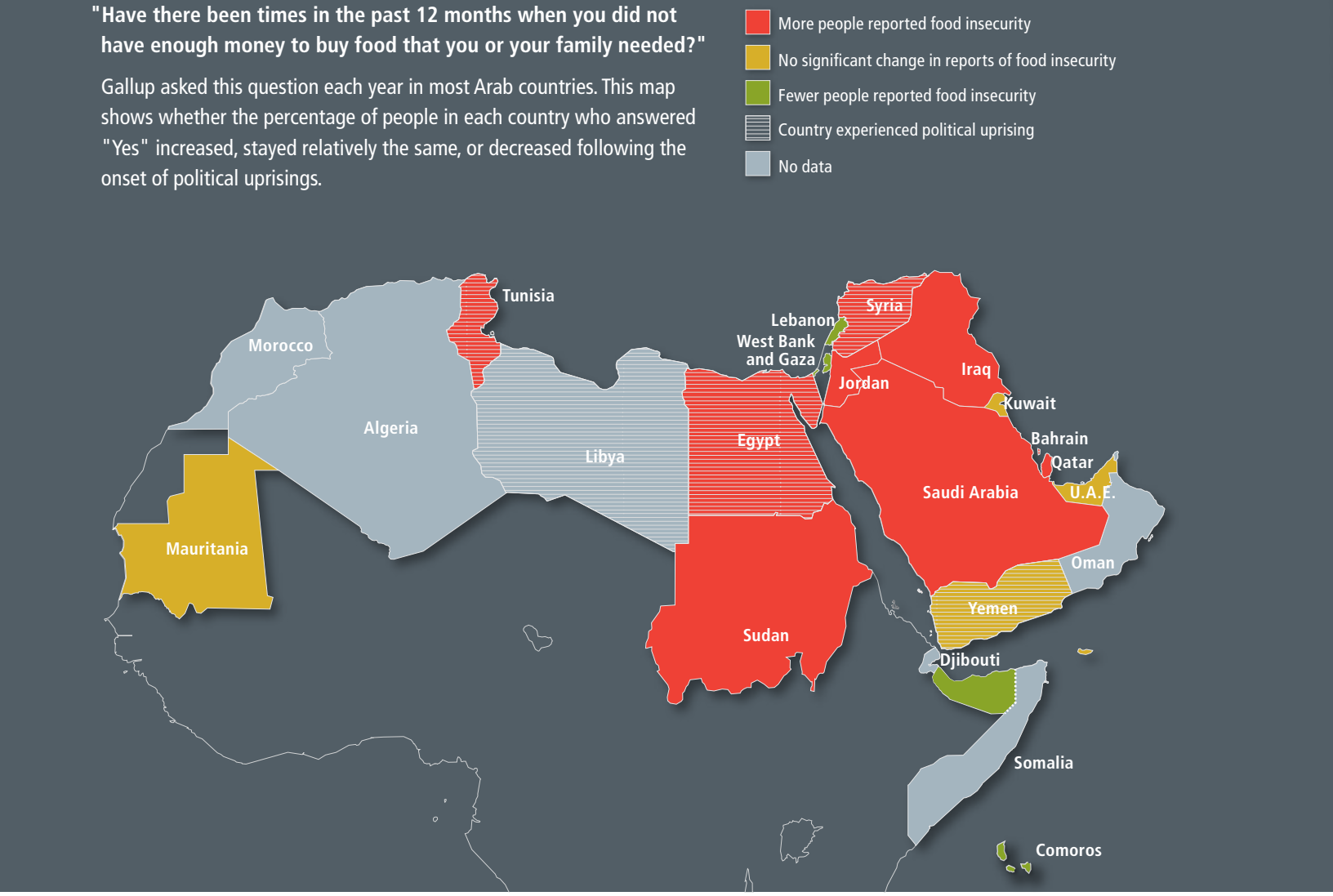


Sources: Expected stunting rate per GDP level was determined based on a population-weighted regression of the global relationship of the prevalence rate of child stunting and GDP per capita (across countries for several years). Data for child stunting, GDP, and population were from the World Bank's World Development Indicator database, http://data.worldbank.org/data-catalog/world-development-indicators. Missing GDP data were interpolated based on GDP growth rates from the United Nations Statistics Division's National Accounts Main Aggregates database, http://unstats.un.org/unsd/snaama/Introduction.asp. Missing population data were interpolated based on population growth rates from the United Nations Department of Economic and Social Affairs' Population Estimates and Projections database, http://esa.un.org/unpd/wpp/index.htm). All databases accessed on August 22, 2013.

FIGURE 2 PERCEIVED FOOD SECURITY AFTER POLITICAL UPRISINGS IN THE ARAB WORLD

"Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?"

Gallup asked this question each year in most Arab countries. This map shows whether the percentage of people in each country who answered "Yes" increased, stayed relatively the same, or decreased following the onset of political uprisings.



Source: Data from Gallup Analytics, https://analytics.gallup.com/, accessed December 7, 2013.

region continue to prioritize short-term stability over the economic reforms that are urgently needed for sustainable development and long-term stability. Thus, although several initiatives were implemented in 2013, more needs to be done—and in a transparent manner that involves the public in decisionmaking processes—to achieve food security in the Arab world. Most promising are those efforts that create jobs for the poor, improve the efficiency and allocation of public spending, and implement evidence-based national and regional food security and development strategies. ■

Central Asia and Russia

Kamiljon Akramov and Noah Cohen-Cline

In recent years, the governments of Central Asia and Russia have placed great emphasis on agriculture and food security. Although the recent global food and economic crises had significant impacts on all countries in the region, soaring food prices and financial strain were particularly painful for poorer countries, such as Kyrgyzstan and Tajikistan, which depend highly on food imports and remittances. Spiking food prices reduced the affordability of food, and downturns in the inflow of remittances from workers abroad further undermined the ability of these countries to finance food imports.[1] This essay outlines major food policy efforts taken in 2013 by Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and Uzbekistan to enhance food security by improving long-term agricultural productivity, agribusiness competiveness, and international trade.

KAZAKHSTAN

The Kazakhstan government adopted a multiyear agricultural development program targeting long-term efficiency and productivity improvements by stimulating adoption of efficient technologies and inputs, increasing investment in market and production infrastructure, and promoting land improvement. The program, Agribusiness 2020, prescribes a wide range of policy instruments aimed at boosting agricultural productivity and agribusiness competitiveness, including provision of concessional credit, investment grants, and input subsidies for agricultural producers; per-hectare payments to farmers for locally determined priority crops; a more favorable tax structure for agricultural enterprises; and a variety of credit and tax concessions to the food-processing sector.[2] These policies are designed to balance agriculture's share in output and employment, though not specifically to bolster domestic food security, which is less of a concern in Kazakhstan.

KYRGYZSTAN

In the Kyrgyz Republic, where land fragmentation and farm productivity are pressing food-security issues, the government has been vigorously debating approaches to land consolidation, with discussions centering on measures to facilitate farmer cooperatives. Although no related policies have yet been enacted, the government did make policy progress in the area of agricultural trade, which it needs to expand in order to increase agricultural gross domestic product and to raise the purchasing power of agricultural households. In 2013, the government adopted a new National Export Strategy focused on promoting exports of fruits and vegetables, dairy products, and meat. The strategy also focuses on improving sanitary, phytosanitary, and other quality-control measures; increasing farmers' access to finance; and promoting trade-facilitation measures. This strategy is expected to increase farmer incomes and improve the general well-being of rural households.

RUSSIA

In Russia, where the agricultural sector is relatively well developed, current priorities are to expand production and further develop agribusiness. The government adopted a long-term State Programme for Development of Agriculture, which seeks both to increase agricultural productivity and to achieve food self-sufficiency targets. The wide-ranging program

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prescribes more than 50 policy measures, the largest of which includes interest-rate subsidies for biotechnology development, crop, and livestock sectors; per-hectare crop payments and per-liter milk payments; input subsidies and discounted fuel prices; and a range of tax concessions. With these measures the Russian government expects to expand food production, keep food prices affordable, and increase trade competitiveness.[3] Although heavy subsidization of agriculture is generally not a sustainable way to bring about long-term agricultural growth, fiscal constraints are less of an issue in resource-rich Kazakhstan and Russia.

TAJIKISTAN

The government of Tajikistan continued implementing a comprehensive Agrarian Reform Programme, finalized in late 2012. This program addresses Tajikistan's major domestic food-security challenge—farm productivity—by reducing government interference in farmers' decisionmaking; increasing private incentives; and supporting access to rural finance, inputs, and advisory (extension) services. Some related key laws were also implemented. For example, a new farm law facilitated farm restructuring to enhance farmer incentives and decisionmaking. In addition, a new cooperative law created a legal basis for the development of farmer organizations and cooperatives—especially credit, leasing, and services cooperatives—to enable new individual and family farms to pool financial and capital resources. The government amended the land code to establish inheritable and exchangeable land-use rights for the first time and adopted an integrated water resources management approach that allows the establishment of local river basin organizations and water user associations to better manage hydrological resources.[4] The government also piloted an effort to create local advisory and information centers staffed by agronomists to support farmers.

UZBEKISTAN

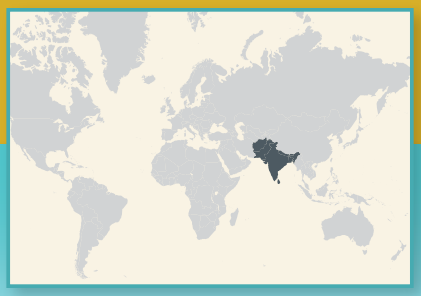
The government of Uzbekistan advanced its policy on land consolidation with provisions that set a minimum land area for cotton- and cereal-producing farms at 30 hectares and a limit for farms specializing in horticulture and other crops at 5 hectares.[5] The new resolution allows both voluntary and government-driven acquisition methods for ensuring that plot sizes meet these requirements. The rationale for the relatively large land size requirements is unclear, and some argue that this intervention in the land market may undermine farmers' perceptions of tenure security. With support from development partners, the government continued its policy on diversification of crop production toward nutritious and higher-value fruit and vegetable crops.

INTERNATIONAL TRADE

Finally, the year saw important developments in regional and international trade possibilities for agricultural products. After 18 years of negotiation, Russia acceded to the World Trade Organization (WTO) in August 2012, and in 2013, it enacted measures to fulfill its liberalization commitments. In March 2013, Tajikistan also acceded to the WTO, and Kazakhstan entered into advanced stages of negotiation. Membership will require all three countries to prioritize policies that improve food-safety regulations, reduce import quotas, upgrade infrastructure, and tackle land and water management challenges. This trend—together with a smaller, regional customs union among Belarus, Kazakhstan, and Russia, which promotes regional trade and may soon include some other countries—may have important implications for more efficient trade in agricultural products and inputs in the region. In addition, it could be especially important for smaller countries in the region, which have difficulty acquiring affordable inputs and also tend to have comparative advantages in high-value fruit and vegetable crops that they have not yet realized. More efficient trade structures that encourage cultivation of these crops, as well as continued cultivation of high-quality cereals in Kazakhstan and Russia should increase incomes and improve nutritional outcomes in the region. ■

South Asia

P. K. Joshi and Avinash Kishore



Despite rapid economic growth and an increase in food production in recent years, South Asia has yet to experience significant improvement in nutrition.[1] Home to nearly 35 percent of the world's poor, the region is plagued by persistent and alarming levels of hunger.[2] South Asia has both the highest rates of undernourishment in children and the largest number of undernourished children in the world. More than one-third of adult women in Bangladesh, India, and Pakistan are underweight.

Efforts to reform food systems in the region have unfortunately been largely stymied by the continued policy paralysis in most South Asian countries. The region has experienced inflationary food prices, and the resulting debate has centered on whether demand- or supply-side factors are responsible. Economic growth has led to rising incomes and thus increased consumer demand for food commodities. Yet on the supply side, efforts to meet this growing demand have been lukewarm. Going forward, the policy environment in most South Asian countries seems uncertain. Because general elections are due in Bangladesh and India in 2014, private-sector actors, both domestic and foreign, might choose to wait before launching new initiatives.

This essay provides an overview of the few important policy steps that South Asian countries did take in 2013. These policies were aimed largely at improving national food systems by increasing agricultural production, ensuring food security for the poor, and reducing climate risks.

BANGLADESH

National Agricultural Policy

In 2008–2012, nearly 17 percent of the population in Bangladesh was undernourished, and about 37 percent of children under the age of five were underweight.[3] In 2013, in a move to help make the country self-sufficient in food, Bangladesh launched a National Agricultural Policy.[4] Designed to make the country's agriculture more resilient and sustainable, this policy gives priority to increasing production of more nutritious food crops, including cereals. Reaching this goal of self-sufficiency in food production will, however, entail a trade-off with strict economic efficiency.

This new national policy includes a number of components. Once the policy is fully implemented, irrigation development, integrated pest management, and environmentally friendly sustainable agricultural systems will be key drivers for increasing agricultural production and augmenting farmer income. Other proposed programs include the utilization and extension of biotechnology, efforts to strengthen agricultural input and output markets and to provide timely farm credit, and opportunities to boost the agro-processing sector. The policy also calls for the country's active participation in international trade agreements and treaties, such as the World Trade Organization and the South Asian Free Trade Area.

If implemented effectively, the National Agricultural Policy is expected to increase agricultural production, generate more employment opportunities, and improve the sustainability of natural resources.

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Genetically Modified Eggplant

In another significant development of 2013, the government of Bangladesh finally released a genetically modified (GM) eggplant. This was made possible after the National Committee on Biosafety approved the release of the country's first GM food crop for commercial production.[5] Four such modified varieties of eggplant were initially approved for limited commercial production. The production of GM eggplant will prevent crop damage by insect borers and reduce pesticide use, thereby reducing costs, increasing productivity, and thus boosting farmer income.

By taking this step, Bangladesh has become the twenty-ninth country to grow GM crops. Elsewhere in the region, India and Pakistan are already growing GM cotton. Debate on approval of genetically modified crops is continuing in India, even as the moratorium on field trials of such crops remains in force. The decision by the government of Bangladesh to release GM eggplant for commercial production will likely continue to keep India's policy debate alive.

BHUTAN

Bhutan approved the implementation of an initiative to transform the country's agriculture into an organic system.[6] The National Organic Program aims to (1) develop and promote organic farming as a way of life among Bhutanese farmers; (2) enhance nutrition, health, and farm household income; and (3) turn the country into a net exporter of organic products. Given that the global organic food market is expanding, Bhutan could conceivably become the first completely organic country by 2020. The success of the new initiative will depend on Bhutan's ability to identify niche export-oriented commodities, develop an efficient value-chain strategy, and reduce transport costs. The proposed initiative will expand the commodity mix under the purview of organic farming in areas where agrochemicals have not been used.

INDIA

National Food Security Act

Across all of South Asia, the most important policy of 2013 was India's National Food Security Act. It is considered to be one of the largest social safety net programs in the world. This new legislation is discussed in detail in Chapter 3. Given the existing public distribution system and that many states already have been performing impressively, it is unclear how effectively this program will contribute to improving household food and nutrition security.

The Kisaan (Farmer) SMS Portal

As another major initiative in 2013, the Indian government launched the Kisaan SMS (short message services) Portal for Knowledge Dissemination, a program designed both to accelerate the dissemination of agricultural technology and to make the best use of information and communication technology.[7] The portal will disseminate relevant technical information, provide topical and seasonal advisories, and alert farmers on various other developments through SMS in local languages.

The service will be available to about 330 million mobile subscribers across rural India. By integrating such a large network into a knowledge-generating system (that is, the research apparatus), the project is designed to ensure that farmers and other stakeholders have quick access to timely and relevant information, thereby helping them increase production, reduce risks related to climate change, and sell their produce in remunerative markets.

Land Acquisition Act

To help end unfair land transactions between poor farmers, and real estate and corporate-sector entrepreneurs, the Indian government passed the Land Acquisition, Rehabilitation and Resettlement Act of 2013.[8] This legislation provides fair compensation, be it resettlement or other alternative opportunities, to those affected and also ensures

adequate safeguards for complete transparency in the process of land acquisition. The legislation, which replaces the age-old Land Acquisition Act of 1894, will apply whenever the government acquires land (1) for its own use and for public-sector undertakings; (2) to transfer to the private sector for a public purpose, such as a national highways project; and (3) for the immediate and declared purpose of the private sector for a public purpose. The new act bars any acquisition of multicrop irrigated land. The government can acquire agricultural land only by the consent of at least 70 percent of those slated to lose land. In cases where the private sector is acquiring the agricultural land, a consent rate of 80 percent is required.

The act is thus designed to protect the interests of farmers, especially smallholders, when the government or private sector acquires their land. The corporate sector, however, has expressed concern that the new legislation will restrict industrial development. Some stakeholders are also apprehensive that the provisions of the act may be violated given the absence of an adequate legal framework.

NEPAL

Nepal has a low seed replacement rate, which adversely affects the country's agricultural production.[9] This low rate is likely attributable to a variety of factors. There is a deficit of quality seeds in the country and a lack of knowledge about modern varieties and hybrids. Nepal's seed sector is also widely dispersed, and the seed chain for most agricultural commodities is fragmented and inefficient. In sum, an overall lack of capacity in seed production, certification, and marketing are arguably why Nepal has been unable to grow a more robust seed sector.

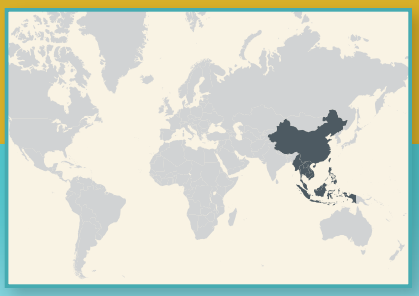
To overcome these problems, the government of Nepal proffered a seed-sector development strategy known as National Seed Vision.[10] This policy is designed to achieve multiple goals, such as ensuring food security, reducing poverty, generating employment opportunities, contributing toward biodiversity conservation, helping the country adapt to the adverse impacts of climate change, and contributing to gender equality and social inclusion. Once approved by parliament and then fully implemented, the program is expected to contribute to food security efforts and reduce reliance on food imports. In addition, the aim is to use better border and other regulatory measures to check the flow of exotic seeds—especially vegetable, maize, and paddy hybrids—into Nepal. It is estimated that effective implementation of Seed Vision will ensure that about one million farmers have access to quality seed and that the seed replacement rate will reach 25 percent for cereals and more than 90 percent for vegetables.

PAKISTAN

With frequent floods and droughts adversely affecting the livelihood of the country's farmers, Pakistan is highly vulnerable to the effects of climate change.[11] To help meet the challenge, in 2013, the Pakistan government launched its first ever National Climate Change Policy.[12] Broadly, the policy aims to (1) pursue sustained economic growth by minimizing the risk arising from extreme weather events, such as floods, droughts, and tropical storms; (2) integrate climate change policy with other interrelated national policies by strengthening interministerial decisionmaking and coordination mechanisms on climate change; (3) focus on pro-poor, gender-sensitive, and cost-effective adaptation strategies; (4) encourage public- and private-sector investment in adaptation measures (including promoting water-saving devices such as drip and sprinkler systems, scaling up conservation agriculture through appropriate machines and laser land leveling, and supporting weather advisory services and agricultural insurance);[13] and (5) promote conservation of natural resources and long-term sustainability. In sum, the hope is that these policies will promote climate-smart agriculture and strengthen local and national institutions for adapting and combating climate change impacts. ■

East Asia

Kevin Chen and Peter Timmer



Despite slowing in 2013, economic growth in East Asia remained impressive, with the region serving as the engine of global growth.[1] Yet despite—and sometimes because of—this growth, East Asia's agricultural sector is facing many challenges. This essay highlights the significant events that not only reshaped agriculture in East Asia in 2013 but might also have important implications for global agriculture in 2014 and beyond.

FLOODS AND REGIONAL FOOD SECURITY

East Asia was once again faced with disastrous and extensive flooding.[2] More than one million people across the region were affected by excessive monsoon rainfall during the year, with China and the Philippines suffering the majority of the damage. More than 660,000 people in eastern China were severely affected by the seasonal storms, with more than 22,200 hectares of crops damaged. The Philippines also sustained significant loss from a series of typhoons, including Typhoon Haiyan, all of which killed thousands and affected the lives of millions. Severe floods also affected Cambodia, Indonesia, Laos, Myanmar, Thailand, and Vietnam. Crop losses in several areas were significant, though no official estimate of the total damage exists.

Because the region is threatened by the increasing occurrence of such extreme weather events,[3] it is little wonder that agricultural disaster prevention and relief were identified as the top agenda item at the fifth Association of Southeast Asian Nations (ASEAN+3) Strategic Conference on Food Security, held in July in Harbin, China.[4]

Another major event was the adoption of a declaration on food security at the Eighth East Asia Summit hosted by Brunei in October. The declaration called upon member countries to (1) improve production and supply chain efficiency, (2) enhance awareness of healthy living, and (3) address environmental challenges associated with food security and mitigate the adverse impact of climate change.[5] Self-sufficiency in grain, even though it often entails a trade-off with economic efficiency, also remains a top priority for many East Asian countries. In 2013, for example, Indonesia began implementation of a food self-sufficiency law, which it had passed in October 2012.[6] The Philippines similarly renewed its own efforts in this area.[7] China has sought to boost national agricultural output by investing heavily in its major grain-producing provinces. After many years of meeting its national goal of maintaining a 95 percent grain self-sufficiency rate, however, China is beginning to exhibit a willingness to revisit this mandate.[8] For example, China will likely be the world's largest rice and corn importer by crop year 2013/2014; whether this new trend represents a permanent national policy shift remains to be seen.

URBANIZATION, STRUCTURAL TRANSFORMATION, AND FEEDING THE CITIES

The urbanization rate in East Asia, particularly in China, tends to outpace that in most other regions.[9] In fact, China's new leaders identified urbanization as the top social and economic issue in 2013 and beyond.[10] To adequately address the dimensions of urbanization, the region's leaders must consider the implications of the demographic change for food demand and supply, both regionally and globally. Given the rise in labor costs in recent

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years, East Asia is quickly losing its comparative advantage in terms of staple food production, and a recent preliminary study predicts that East Asia's food imports (particularly of staple foods) will increase.[11] What are the implications for the food self-sufficiency policies pursued by many governments in East Asia? Answering this question is critically important because the cost to economic efficiency will only increase. Furthermore, the structure of the farming sector has been changing, and growing incomes and aging populations are likely to induce significant changes in food-consumption patterns.[12] These changes are likely to prompt the rapid development of high-value food supply chains in East Asia. In fact, food supply chains are already upgrading rapidly throughout the region.[13]

These developments raise important questions: What are the implications for the region's smallholders, who already struggle to meet the quality standards of these chains? Which governmental policies and investment support programs can best facilitate this transition in East Asia? A number of ongoing studies supported by various donors and agencies are beginning to provide answers. For example, since 2009 the Asian Development Bank has supported several projects that IFPRI has undertaken on the dynamics of staple food value chains in select Asian countries.[14] The World Bank is also commissioning an East Asia–wide study on the transformation of the region's agriculture, a study in which China features prominently.

Improved understanding of the impacts of urbanization, global climate change, and water scarcity on agricultural production would enable the formulation of an effective policy and its integration into the planning of government agricultural expenditures. In 2013, the Chinese government released a document recognizing the need for a new approach to China's agricultural development in the face of industrialization and urbanization.[15] The document calls for innovative organizational forms for farming and encourages the coexistence of a variety of organizational modes, including specialized farm households, family farms, cooperatives, and corporate farming. The new policy initiative also calls for the introduction of a code of conduct for responsible investment in rural land, particularly in the leasing and acquisition of farmland. In 2013, China began implementing plans to spend more than 320 billion yuan (US$52 billion) over the next few years on improving land productivity through improved land leveling and irrigation. Similarly, the National Economic and Development Authority of the Philippines plans to implement several public infrastructure development projects in 2014 for a total allotment of 399 billion pesos ($9.1 billion), which is about 35 percent higher than the funds allocated for 2013. The move is aimed at lowering the cost of transporting goods, increasing agricultural productivity, reducing natural disaster–related risks, and generating economic investments and employment.

REGIONAL AGRICULTURAL TRADE, WTO DISCUSSION, AND FOOD SECURITY

Several important developments in agricultural trade occurred in East Asia in 2013. Reports emerged that Thailand had agreed to hand over rice and rubber to China in partial payment for building its new high-speed rail system.[16] China promises to purchase 1 million metric tons of rice each year from Thailand for five consecutive years starting in 2014. This agreement could have a significant impact on rice trade in Asia. After having managed record high levels of rice importation in 2012, China imported large quantities of rice again in 2013—2 million metric tons of it by September.[17] China is also expected to import the maximum allowed amount of corn (reaching its import quota of 7.2 million metric tons, as imposed by China's National Development and Reform Commission) during crop year 2013/2014.[18] At the same time, Southeast Asian countries, such as Thailand and Indonesia, have increasingly exported cassava to China for the country's biofuel industry.[19] Despite losing some steam in 2013, China's high levels of palm oil imports from Indonesia, Malaysia, and Thailand have continued to rise. There has been an ongoing discussion on the elimination of palm oil import tariffs between China and

ASEAN countries. If the tariffs are eliminated, increased palm oil exports to China should follow. A likely consequence would be an increase in the already critical levels of deforestation in exporting countries, a situation that is now being closely monitored.[20]

Several significant conferences took place in the final months of 2013. Conferences on food security and trade and transparency in the trade system were kicked off in Singapore in late October. These meetings called for improving the current understanding of the role of trade in food security.[21] Given the importance of rice to the region, it is particularly important to understand both the changing role that this staple plays in regional food security and the opportunities for improving regional cooperation with respect to its trade. Both topics were included in the agenda of the World Trade Organization's Ninth Ministerial Conference, held in Bali in December.

FOOD AND GENERAL INFLATION

Inflationary trends in the Asia-Pacific region persisted in August 2013, with the regional food and general inflation indices registering annual increases of 7.5 and 5.8 percent, respectively. Food inflation has continued to outpace general inflation since January 2013. In Southeast Asia, both the general inflation and food price indexes remained stable. Indonesia was an exception, however, posting annual increases of 8.8 percent and 15.1 percent, respectively, in its general inflation and food price indexes. These increases are largely attributable to rises in the prices of rice, wheat flour, soybean, and chicken.[22] In China, inflation rose to a seven-month high in September (a 3.1 percent increase), despite the economic slowdown. This increase was driven by a jump in food prices caused by floods and drought (a 4.7 percent year-to-year increase).[23] Food prices, particularly for vegetables, started to increase significantly toward the end of the year. Food and general inflation remain issues for the region that will require careful monitoring in 2014.

CHINA AND MYANMAR DYNAMICS

Two of the new policy directions in East Asia in 2013 are particularly worth watching in 2014 and beyond. First, in November 2013, the Central Committee of the Communist Party of China issued a Decision on Major Issues Concerning Comprehensively Deepening Reform.[24] The document detailed a number of broad reforms designed to support sustained economic growth and to address societal concerns. The decision, which seems to reflect a commitment of the Chinese government to continue deepening economic liberalization and enhancing the role of market forces, will likely put China on a trajectory to transform itself into a market economy. In particular, farmers will be allowed to sell or mortgage their homes and land and to pass on land-use rights to their children. They would also be given shares of land collectively belonging to the village. More details will likely emerge from different ministerial and department-level meetings, particularly as the Central Committee's decisions are analyzed and converted into specific policies over the first four months of 2014.

A second policy involves Myanmar, which currently ranks as the poorest country in Southeast Asia. By undertaking a new wave of political reforms in 2013, Myanmar has a chance to set itself on the same road to economic expansion that has brought prosperity to its regional neighbors. Without targeted policy efforts and regulations to level the economic playing field, however, the benefits of new public investments and policy reforms may only filter down to a select few. Small-scale farmers—the backbone of Myanmar's economy—could very well be excluded from the benefits of this growth. If Myanmar is to achieve its ambitions for equitable growth, political leaders must put the adoption of new policies and regulations to generate this equitable growth at the heart of their democratic reform agenda.[25] Michigan State University and IFPRI are now working together, under the support of the US Agency for International Development, to provide advice on strategic development support for Myanmar's agriculture. ■

Latin America and the Caribbean

Eugenio Díaz-Bonilla and Maximo Torero

As events in 2013 made clear, agriculture in Latin America and the Caribbean (LAC) matters. It matters for global food security, given the region's role as the largest net exporter of agricultural and food products. It also matters for global environmental sustainability, as LAC is the largest provider of global environmental goods, including biodiversity and oxygen, in the developing world. At the same time, new satellite data show that deforestation continues, though at somewhat lower rates. Substantial attention to research and development and to balanced public policies and investments is needed if the region's agriculture is to continue to remain strong while also reducing encroachment on forest areas. In addition, eradication of undernutrition in LAC is still unfinished business, even as countries in the region face an increasing obesity problem. These issues are examined in more detail below.

FOOD SECURITY AND NUTRITION

Out of the 24 LAC countries considered in IFPRI's 2013 Global Hunger Index, 10 ranked as having low levels of hunger, and 7 others fell in the moderate range. Only Haiti was categorized as "alarming." In addition, 21 countries maintained or improved their ranking from the previous year. When stunting is used as the primary indicator of undernutrition, however, LAC is not on track to meet the First Millennium Development Goal. Moreover the view from the perspective of the region's poorest, especially indigenous children, is even more discouraging.[1]

The challenge of undernutrition has been joined by the problem of growing obesity in the region. LAC is home to three of the four countries with the world's highest percentage of households having both an overweight mother and a malnourished child or children.[2] As a result, several countries in the region have either enacted or discussed the enactment of new legislation. Chile's new law, Nutritional Composition of Nutrients and Their Advertising, for instance, is one of the first in the world to require warning labels on foods high in fat, sugar, and salt. Peru has also recently passed a law to combat childhood obesity and to prevent increases in diabetes and cardiovascular problems. Mexico is considering the imposition of a tax on sugar in beverages and on other unhealthy food.

PRODUCTION AND TRADE

Although final data for 2012–2013 are not yet available, LAC seems to have maintained or even increased its share of global agricultural production (valued in constant terms) at about 13 percent of global output.[3] LAC remains the world's main net exporting region, being a major exporter of a variety of important agricultural and food products. The region accounts for 53 percent of global exports of oilseed meal cakes, 53 percent of sugar, 46 percent of coffee, 36 percent of oilseeds, 31 percent of poultry meat, 25 percent of corn, and 23 percent of bovine meat. Moreover, the region's share of total goods imported by several other regions as measured in calories is high, having increased to 3.5 times its 1991 level. In 2007, for instance, LAC supplied about 18 percent of the calories imported by Africa and 20 percent of those imported by Asia.[4]

Some recent developments related to production have implications for global food availability and prices. One was that during 2012–2013 Brazil

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displaced the United States as the largest exporter of soybeans, with Argentina a distant third and Paraguay ranking fourth. These LAC countries, which together produced about 51 percent of global soybean exports in 2011–2012, are projected to account for almost 57 percent of such exports in 2013–2014. Second, because of poor weather in the United States, Brazil and Argentina became the first- and second-largest exporters of coarse grain, respectively, in 2012–2013. A third development was that whereas Argentina exported almost 13 million metric tons (mmt) of wheat in 2011–2012, this output dropped to only 4 mmt in 2012–2013, due in part to weather conditions and to different marketing and price restrictions. Although production and exports are expected to improve in 2013–2014, given anticipated improvements in weather, they should still remain below historical levels. Fourth, although Brazil continues to be the second-largest beef and veal producer (responsible for 16 percent of total world production), according to US Department of Agriculture estimates, India overtook Brazil as the largest exporter of those products in 2013.

In addition, 2013 saw an outbreak of coffee leaf rust in Central America, Mexico, and Peru. The epidemic, according to the International Coffee Organization, was one of the worst ever recorded, affecting more than 50 percent of the total coffee-growing area in Central America. The organization expects the impact to be even more severe in 2013–2014.[5]

LAND, DEFORESTATION, AND CLIMATE CHANGE

The LAC region has a relatively high percentage of both suitable farmland that is currently uncultivated (such as the lowlands in Bolivia, Brazil, and Paraguay) and areas where there is a large gap between current and potential yields (such as in Ecuador, the highlands in Bolivia, and some countries in Central America).[6] Therefore the region can, in principle, further expand production by increasing both area under cultivation and productivity. However, given that LAC accounted for two-thirds of global deforestation from 1990 to 2010[7] and that land-use change contributes more to the region's greenhouse gas emissions than any other source, LAC countries are reconsidering the costs and benefits of further area expansion.[8] In fact, several countries have launched initiatives in recent years to reduce emissions from deforestation and forest degradation. It has, however, been difficult to evaluate the impact of those initiatives. With the 2013 launch of the Terra-i project, which uses NASA satellite data, it will now be easier to monitor deforestation in real time.[9]

OTHER POLICY ISSUES

Exchange rates in several LAC countries have appreciated, putting pressure on agricultural production and leading to calls to increase support for the sector. Conflicts over land ownership in Peru, Panama, and Honduras have prevented the implementation of projects to address deforestation and generate carbon sinks. Uncertainty over land ownership has also led recently to social tensions and even protests in Brazil and other countries. Exploratory talks between the government and guerrilla groups in Colombia that began in 2012 may offer the potential for expanding agricultural production in areas previously ridden by violence[10] and have led to broader requests for rural development and subsidies and trade protection for agriculture. ■

FOOD POLICY INDICATORS: TRACKING CHANGE

TO DEVELOP AND IMPLEMENT EFFECTIVE FOOD POLICIES, DECISIONMAKERS AND policy analysts need solid evidence and timely information, among other things. As part of IFPRI's mission to provide research-based policy solutions that sustainably reduce poverty and end hunger and malnutrition, the Institute develops and shares global public goods, including datasets, indicators, and indexes. This information can be used to gauge the impact of policy changes and the progress on specific aspects of development. This section provides updates on data generated by IFPRI research in 2013, including indicators on investment in agricultural research, public spending on economic development in agriculture, global hunger levels, food policy research capacity, and total factor productivity.

Agricultural Science and Technology Indicators

Policymakers increasingly recognize that greater investment in agricultural research is an essential element in raising agricultural productivity. Data on the size and scope of research capacity and investments, as well as on the changing institutional structure and functioning of agricultural research agencies, enhance our understanding of how agricultural research promotes agricultural growth. Indicators derived from such information allow the performance, inputs, and outcomes of agricultural research systems to be measured, monitored, and benchmarked.

IFPRI's Agricultural Science and Technology Indicators (ASTI) initiative is one of the few sources of statistics and other information on agricultural research in low- and middle-income countries. Working with a large network of country-level collaborators, ASTI conducts primary surveys to collect data from government, higher education, nonprofit, and private agricultural R&D agencies. After analyzing the resulting raw data, ASTI publishes quantitative and qualitative information and trends on funding sources, spending levels and allocations, and human resource capacities, at both country and regional levels (Table 1). ASTI's data and analysis constitute a powerful decisionmaking resource for national and regional research managers, policymakers, donor organizations, partners, and other stakeholders.

ASTI is currently active in over 70 countries in Africa, Asia, and Latin America and the Caribbean. The initiative is in the process of transitioning from what was, essentially, ad hoc data collection to a sustainable, institutionalized system of data compilation, synthesis, and analysis at regular intervals. This transformation will initially focus on South Asia and Africa south of the Sahara but will be expanded to other regions over time if funding allows.

ASTI has published a broad set of reports and briefs analyzing national, regional, and global agricultural R&D trends over time. ASTI's work is disseminated through a variety of datasets accessible via ASTI's interactive data tool at asti.cgiar.org. The interactive website also offers publications, datasets, country profiles, news, and updates.

Website: http://hdl.handle.net/1902.1/20514
Contact: Nienke Beintema (n.beintema@cgiar.org), Gert-Jan Stads (g.stads@cgiar.org), and asti@cgiar.org

TABLE 1 **ASTI data**

Low- and middle-income countries by region	Latest year available	Public agricultural research spending		Public agricultural research spending as a share of AgGDP (%)	Public agricultural researchers (FTEs)	Public agricultural researchers (FTEs) per million people economically engaged in agriculture	Share of women in total public agricultural research staff (%)
		2005 PPP dollars (million)	2005 US dollars (million)				
Africa south of the Sahara*	2011	1,691.8	766.7	0.51	14,230.1	70.5	21.8
Benin	2011	26.2	10.9	0.62	155.7	96.3	12.0
Botswana	2011	17.5	8.3	2.44	123.8	384.5	28.9
Burkina Faso	2011	25.4	9.6	0.42	218.0	30.5	17.5
Burundi	2011	8.4	2.7	0.57	132.3	34.8	15.5
Cape Verde	2011	2.1	1.6	1.12	21.0	656.3	38.1
Central African Republic	2011	2.7	1.4	0.16	134.0	105.9	19.4
Chad	2011	13.0	5.1	0.90	123.3	41.1	17.3
Congo, Democratic Republic of	2011	16.2	7.3	0.17	423.9	29.4	9.2
Congo, Republic of	2011	5.1	2.6	0.94	104.0	197.6	17.8
Côte d'Ivoire	2011	37.8	20.6	0.49	130.6	46.4	na
Eritrea	2011	1.2	0.5	0.30	116.8	73.5	6.8
Ethiopia	2011	69.6	18.1	0.19	1,876.6	57.9	9.6
Gabon	2011	0.7	0.3	0.09	42.6	231.4	25.0
Gambia, The	2011	5.5	1.5	1.03	65.9	105.9	13.7
Ghana	2011	68.1	22.9	0.69	607.0	97.4	18.8
Guinea	2011	4.3	1.4	0.21	273.8	70.0	4.2
Guinea-Bissau	2011	0.2	0.1	0.02	9.0	19.8	0.0
Kenya	2011	188.1	73.5	1.21	1,150.9	85.3	25.3
Lesotho	2011	1.8	1.0	0.68	41.1	112.6	46.3
Liberia	2011	4.8	2.4	0.42	45.1	48.2	20.4
Madagascar	2011	7.7	2.5	0.16	193.1	25.8	27.3
Malawi	2011	34.3	11.4	1.03	162.3	32.1	19.3
Mali	2011	33.6	15.3	0.61	307.0	98.3	22.4

Notes: na = not available. Table only includes countries where ASTI has conducted survey rounds since 2002. Data in italics are provisional estimates based on secondary data or macro-level survey rounds (for details see www.asti.cgiar.org/globaloverview). Regional totals are from ASTI's latest Global Assessment (Beintema et al. 2012, also available at www.asti.cgiar.org/globaloverview), except for Africa south of the Sahara, which is based on the latest ASTI data collection round. Nigeria and South Africa are estimated by scaling up 2008 data using investment and capacity trends for the main agricultural research agencies. Public agricultural research includes government, higher-education, and nonprofit agencies but excludes the private for-profit sector. Purchasing power parities (PPPs) measure the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods and services. PPPs are relatively stable over time, whereas exchange rates fluctuate considerably (for example, the fluctuations in the US dollar–euro rates of recent years). Measuring researchers in full-time equivalents (FTEs) takes into account the proportion of time researchers spend on research activities. For example, four university professors who spend 25 percent of their time on research would individually represent 0.25 FTEs and collectively be counted as 1 FTE.

* Regional totals and overall total of low- and middle-income countries include estimates for non-ASTI countries. The totals therefore do not match the sum of the entries listed for specific countries. Regional and overall percentages of public agricultural R&D spending as a share of AgGDP is based on the average of ASTI countries. For details see www.asti.cgiar.org/globaloverview and Beintema et al. 2012.

[a] Data for 2006.

Table 1 continued

Low- and middle-income countries by region	Latest year available	Public agricultural research spending		Public agricultural research spending as a share of AgGDP (%)	Public agricultural researchers (FTEs)	Public agricultural researchers (FTEs) per million people economically engaged in agriculture	Share of women in total public agricultural research staff (%)
		2005 PPP dollars (million)	2005 US dollars (million)				
Mauritania	2011	8.9	3.3	0.80	62.9	82.5	14.1
Mauritius	2011	26.0	13.0	4.88	150.7	3,206.4	37.9
Mozambique	2011	20.7	9.8	0.36	313.6	35.4	31.4
Namibia	2011	43.1	28.9	4.27	89.4	332.2	38.5
Niger	2008	6.6	2.8	0.18	98.4	22.5	8.3
Nigeria	2011	393.9	180.7	0.33	2,687.6	218.9	29.1
Rwanda	2011	27.2	9.1	0.69	180.4	40.2	24.3
Senegal	2011	24.8	11.8	0.83	112.2	28.5	18.6
Sierra Leone	2011	5.7	2.1	0.17	81.7	60.8	13.8
South Africa	2008	237.2	144.4	2.18	746.3	646.7	na
Sudan	2011	35.9	15.9	0.19	939.1	129.9	40.2
Swaziland	2011	4.7	2.4	1.43	27.1	197.8	30.6
Tanzania	2011	81.4	28.5	0.54	814.8	623.4	24.8
Togo	2011	7.6	3.4	0.42	114.7	10.1	8.0
Uganda	2011	106.8	37.2	1.22	353.9	20.4	21.5
Zambia	2008	9.6	5.2	0.26	233.1	70.1	22.9
Zimbabwe	2011	5.7	5.9	0.79	176.7	56.0	32.7
Asia-Pacific*	2008	7,725.1	3,319.7	0.42	na	na	na
Bangladesh	2009	125.9	44.3	0.31	2,081.3	64.6	15.8
Cambodia	2010	18.3	5.7	0.19	284.4	57.3	20.3
China	2008	4,047.6	1,703.0	0.50	43,200.0	85.7	na
India	2009	2,276.3	757.1	0.40	11,216.5	42.0	na
Indonesia	2009	*371.7*	*150.7*	*0.28*	na	na	na
Lao PDR	2003	10.4	2.9	0.24	123.4	56.9	22.3
Malaysia	2010	401.2	183.7	1.01	1,609.4	998.4	45.0
Myanmar	2003	4.6	4.6	0.06	618.7	32.6	54.2
Nepal	2009	22.3	7.1	0.23	388.7	33.2	9.5
Pakistan	2009	172.3	55.3	0.21	3,531.5	147.2	10.3
Papua New Guinea	2010	*21.0*	*9.1*	*0.43*	*163.1*	*77.3*	na
Philippines	2002	141.4	55.9	0.44	3,212.5	252.9	54.2
Sri Lanka	2009	37.5	13.1	0.34	618.8	154.3	34.8
Vietnam	2010	95.0	28.2	0.17	3,744.2	126.4	na

Table 1 continued

Low- and middle-income countries by region	Latest year available	Public agricultural research spending		Public agricultural research spending as a share of AgGDP (%)	Public agricultural researchers (FTEs)	Public agricultural researchers (FTEs) per million people economically engaged in agriculture	Share of women in total public agricultural research staff (%)
		2005 PPP dollars (million)	2005 US dollars (million)				
Latin America and Caribbean*	2008	3,297.0	1,819.1	1.10	na	na	na
Argentina	2008	*441.1*	*192.8*	*0.93*	*3,930.5*	*2,781.7*	41.7[a]
Belize	2006	2.6	1.3	0.95	16.7	596.4	31.1
Brazil	2008	*1,402.6*	*781.7*	*1.52*	*4,633.2*	*398.7*	33.8[a]
Chile	2008	*103.1*	*61.4*	*1.38*	*674.6*	*696.2*	29.7[a]
Colombia	2008	*142.8*	*66.6*	*0.55*	*956.6*	*268.8*	31.7[a]
Costa Rica	2006	29.9	15.9	0.93	282.9	865.1	27.4
Dominican Republic	2006	17.4	10.3	0.26	138.8	278.7	24.9
El Salvador	2006	5.7	0.3	0.15	76.9	124.3	14.8
Guatemala	2006	8.3	4.2	0.06	102.4	53.2	14.7
Honduras	2006	12.7	4.7	0.43	123.7	181.3	7.4
Mexico	2008	*585.4*	*382.8*	*1.15*	4,066.8	*502.2*	22.3[a]
Nicaragua	2006	24.1	8.1	0.94	133.4	364.3	26.8
Panama	2006	10.0	5.7	0.50	166.7	653.6	16.1
Paraguay	2006	3.1	9.7	0.20	128.3	163.0	32.1
Uruguay	2006	59.8	32.4	1.99	400.4	2107.6	42.5
Central and West Asia and North Africa*	2008	1,848.4	824.5	0.68	na	na	na
Armenia	2010	1.8	0.7	0.07	294.9	1966.0	44.3
Azerbaijan	2010	11.1	3.9	0.26	600.8	557.3	30.1
Iran (Islamic Republic of)	2008	*731.3*	*218.2*	*0.96*	*4,890.9*	*753.7*	na
Jordan	2008	*6.8*	*3.6*	*1.59*	*212.7*	*1849.1*	na
Kyrgyzstan	2010	1.7	0.5	0.09	160.5	313.4	26.5
Morocco	2008	*96.2*	*52.9*	*0.58*	*463.0*	*150.4*	na
Syrian Arab Republic	2008	*74.1*	*130.2*	*0.45*	*1,888.1*	*1501.5*	na
Tunisia	2002	51.2	22.9	0.91	440.8	574.0	27.6
TOTAL LOW- AND MIDDLE-INCOME*	2008	15,578.3	7,238.3	0.54	na	na	na

Statistics of Public Expenditure for Economic Development

The Statistics of Public Expenditure for Economic Development (SPEED) database is an IFPRI resource that contains information on agricultural and other sectoral public expenditures in 112 developing countries and 34 developed countries from 1980 to 2011 (see Table 2). IFPRI researchers have compiled data from multiple sources, including the International Monetary Fund, the World Bank, and national governments, and conducted extensive data checks and adjustments to ensure consistent spending measurements over time that are free of exchange-rate fluctuations and currency denomination changes. Differences from the data in the 2012 Global Food Policy Report may arise from revisions of the public expenditure data as well as other variables such as population, deflators, exchange rates, and total and agricultural GDPs.

Policymakers, researchers, and other stakeholders can use this robust database for many purposes. The data allow users to examine historical trends and the allocation of government resources across sectors and to make comparisons with other countries within a region or at a similar level of development. Because it covers many countries and over a long time period, the SPEED dataset provides many analytical possibilities. Analysts can examine the policy priorities of national governments as expressed in the allocation of public expenditures as well as extend the the analysis of government spending to include the tracking of development goals (such as the Millennium Development Goals) and the efficiency and cost-effectiveness of public spending both within and across regions.

Analysts can look at the policy priorities of national governments expressed in the allocation of public expenditures, and the analysis of government spending can also be extended to include the tracking of development goals (such as the Millennium Development Goals) as well as the efficiency and cost-effectiveness of public spending both within and across regions.

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TABLE 2 Agricultural public expenditure for economic development, by country

	Agricultural expenditure (billions 2005 constant US dollars)			Agricultural expenditure (billions 2005 PPP dollars)			Per capita agricultural expenditure (2005 constant US dollars)			Per capita agricultural expenditure (2005 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
Region/ country	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011
East Asia and Pacific																		
China	7.135	8.865	88.160	16.960	21.070	209.540	7.272	7.358	65.589	17.284	17.488	155.893	10.932	4.737	20.928	12.203	8.425	9.097
Fiji	0.035	0.028	0.009	0.041	0.033	0.011	55.760	35.865	10.381	65.947	42.418	12.278	8.484	5.775	2.413	7.237	4.006	0.843
Indonesia [4]	1.799	1.795	1.563	4.438	4.428	3.857	12.656	9.248	6.769	31.219	22.813	16.698	9.279	4.779	3.554	10.266	5.891	2.609
Malaysia	0.785	1.011	3.619	1.715	2.207	7.904	58.139	48.761	125.837	126.982	106.499	274.842	11.264	9.011	16.578	8.751	5.102	7.956
Mongolia [1]		0.010	0.024		0.030	0.069		4.472	8.801		12.917	25.423		1.856	4.261		2.783	2.362
Myanmar [1]	0.109	0.070	0.087	0.448	0.288	0.358	3.224	1.542	1.669	13.297	6.360	6.885	8.121	2.689	1.167	23.566	14.896	6.258
Papua New Guinea [4]	0.078	0.050	0.024	0.180	0.117	0.056	24.810	10.661	3.746	57.608	24.755	8.698	8.221	3.102	1.236	8.460	3.965	1.533
Philippines	0.426	0.855	0.784	1.077	2.166	1.985	9.228	12.290	8.248	23.365	31.120	20.884	3.224	5.722	4.421	6.062	6.902	3.659
Singapore	0.020	0.028	0.069	0.031	0.043	0.106	8.460	7.943	13.271	13.056	12.257	20.480	5.417	23.817	112.830	0.438	0.239	0.246

Note: PPP (purchasing power parity) dollars measure the relative purchasing power of currencies across countries by eliminating national differences in pricing levels for a wide range of goods and services. Because of the dramatic differences in countries' agriculture spending, entries have different numbers of decimal places; .
1 = last year of data available is 2010; 2 = last year of data available is 2009; 3 = last year of data available is 2008; 4 = last year of data available is 2007.

Table 2 continued

Region/ country	Agricultural expenditure (billions 2005 constant US dollars)			Agricultural expenditure (billions 2005 PPP dollars)			Per capita agricultural expenditure (2005 constant US dollars)			Per capita agricultural expenditure (2005 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011
Thailand	0.759	2.398	3.355	1.917	6.055	8.471	16.363	40.662	50.399	41.308	102.650	127.230	7.822	18.764	12.906	9.668	11.301	7.008
Tonga	0.004	0.001	0.002	0.007	0.001	0.003	46.198	5.320	20.600	74.502	8.579	33.222	9.443	1.053	3.868	9.965	0.798	2.026
Vanuatu [4]	0.001	0.003	0.003	0.003	0.005	0.006	12.628	16.726	13.586	23.731	31.432	25.532	4.420	5.450	3.244	2.959	3.135	4.979
Vietnam [1]		0.440	0.992		1.481	3.337		6.112	11.406		20.567	38.382		6.148	6.488		8.205	3.939
South Asia																		
Afghanistan			0.104			0.340			3.575			11.695			2.461			4.256
Bangladesh [2]	0.178	0.238	0.851	0.507	0.676	2.419	2.162	1.986	5.694	6.144	5.642	16.179	2.944	2.629	6.190	13.023	4.932	8.919
Bhutan [2]	0.011	0.030	0.043	0.031	0.084	0.120	27.006	59.184	60.718	75.670	165.832	170.130	17.555	21.644	19.796	31.855	19.693	11.183
India	1.771	3.405	13.413	5.324	10.238	40.324	2.592	3.563	10.984	7.794	10.711	33.021	2.443	2.879	5.890	7.179	5.259	6.508
Maldives [1]	0.003	0.023	0.008	0.004	0.036	0.013	18.910	93.545	25.139	29.758	147.211	39.561	8.999	39.154	17.573	8.844	12.068	1.334
Nepal	0.064	0.088	0.178	0.201	0.279	0.560	4.527	4.296	6.550	14.263	13.537	20.638	3.809	3.830	4.374	16.394	9.638	8.541
Pakistan	0.118	0.076	0.271	0.368	0.237	0.845	1.529	0.601	1.539	4.762	1.872	4.796	1.267	0.399	0.912	2.135	0.458	1.034
Sri Lanka	0.191	0.244	0.412	0.546	0.696	1.177	13.212	13.433	19.736	37.752	38.383	56.395	8.658	6.737	8.357	5.768	5.285	5.468
Europe and Central Asia																		
Albania		0.059			0.136			17.657			40.409			2.151			3.872	
Azerbaijan		0.000	0.000		0.241	0.706		0.002	0.005		31.393	76.980		6.206	15.046		8.015	2.863
Belarus		0.129	0.864		0.358	2.388		12.691	91.226		35.074	252.121		4.784	23.501		4.231	9.751
Bulgaria		0.016	0.069		0.042	0.182		1.911	9.427		5.022	24.772		0.466	3.912		0.252	0.631
Georgia			0.011			0.028			2.507			6.158			1.764			0.462
Kazakhstan			0.715			1.650			43.204			99.658			16.374			4.415
Kyrgyzstan [4]		0.015	0.016		0.055	0.058		3.348	3.035		12.095	10.962		2.236	1.869		3.536	2.366
Latvia		0.130	0.471		0.244	0.882		52.441	229.036		98.070	428.317		17.481	69.677		5.411	8.846
Lithuania		0.281	0.226		0.524	0.421		77.326	74.446		144.293	138.920		17.879	22.210		8.653	2.237
Moldova		0.012	0.038		0.034	0.107		3.212	10.556		9.127	29.995		1.496	7.493		1.383	2.925
Romania		0.881	0.395		1.803	0.809		38.822	18.466		79.489	37.810		5.144	4.971		3.045	0.907
Russian Federation		0.216	3.063		0.479	6.802		1.456	21.424		3.234	47.578		0.575	7.639		0.150	1.098
Serbia			0.184			0.462			25.350			63.665			7.174			2.451
Ukraine			0.542			1.654			11.855			36.197			6.863			2.245
Middle East and North Africa																		
Algeria [2]		0.525	1.717		1.210	3.956		17.918	47.201		41.278	108.739		7.242	22.027		2.418	3.649
Bahrain [3]	0.009	0.012	0.013	0.013	0.018	0.019	24.022	20.931	11.409	36.309	31.637	17.245	17.544	16.860	23.430	0.635	0.561	0.295
Egypt [4]	0.661	0.900	0.872	2.364	3.217	3.119	15.045	14.709	11.752	53.797	52.598	42.025	11.982	8.817	5.815	5.143	5.039	3.043
Iran, Islamic Republic of [2]	0.976	1.071	0.781	3.270	3.590	2.618	26.042	17.715	10.622	87.275	59.369	35.596	7.158	4.859	3.293	3.360	4.216	1.412
Jordan	0.019	0.110	0.043	0.035	0.205	0.081	8.840	26.207	7.001	16.471	48.831	13.045	5.109	32.211	7.444	0.976	4.461	0.746
Kuwait [2]	0.010	0.122	0.151	0.014	0.167	0.206	7.981	77.023	52.877	10.910	105.285	72.278	14.286	58.824	84.209	0.102	0.528	0.449
Lebanon		0.023	0.029		0.040	0.052		7.436	6.672		13.227	11.868		1.756	1.517		0.400	0.324
Morocco [4]	0.541	0.536	0.399	0.984	0.973	0.724	27.982	19.957	13.000	50.852	36.268	23.624	11.560	9.172	4.407	6.804	4.498	2.013
Occupied Palestinian Territory [1]			0.018			0.041			4.854			10.651			5.795			0.773
Oman	0.050	0.127	0.103	0.083	0.211	0.171	45.680	59.110	34.185	75.581	97.803	56.562	27.947	20.842	19.297	1.849	1.557	0.611

Table 2 continued

Region/ country	Agricultural expenditure (billions 2005 constant US dollars)			Agricultural expenditure (billions 2005 PPP dollars)			Per capita agricultural expenditure (2005 constant US dollars)			Per capita agricultural expenditure (2005 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011
Syrian Arab Republic [2]	0.266	0.507	0.427	0.715	1.365	1.150	30.707	35.375	20.326	82.619	95.178	54.687	11.475	8.061	5.340	5.036	10.237	4.713
Tunisia	0.527	0.443	0.569	1.176	0.990	1.270	84.760	49.499	53.298	189.187	110.483	118.963	27.877	17.124	17.316	15.632	8.325	5.401
Turkey	0.621	0.575	6.713	1.005	0.930	10.858	14.478	9.822	91.885	23.419	15.887	148.627	1.443	1.113	11.955	2.083	0.816	4.498
United Arab Emirates [2]	0.057	0.053	0.053	0.086	0.080	0.080	61.665	22.513	6.905	92.884	33.911	10.401	13.997	2.782	2.652	0.833	0.673	0.616
Yemen [4]		0.038	0.073		0.106	0.201		2.550	3.444		7.026	9.491		1.759	3.933		1.685	1.059
Latin America and Caribbean																		
Argentina [2]	0.170	0.144	0.899	0.389	0.329	2.057	6.043	4.133	22.470	13.822	9.454	51.398	2.158	1.728	5.156	0.646	0.577	1.651
Bahamas [1]	0.011	0.018	0.014	0.015	0.024	0.019	54.293	65.422	40.217	70.198	84.588	51.999	9.474	9.591	8.784	1.452	1.671	0.973
Barbados	0.023	0.027		0.037	0.044		90.748	104.282		146.754	168.640		9.913	17.145		3.196	2.801	
Belize	0.009	0.007		0.015	0.012		64.358	35.168		105.353	57.568		11.343	6.397			4.606	
Bolivia (Plurinational State of) [4]	0.030	0.003	0.030	0.109	0.012	0.109	5.623	0.430	3.124	20.318	1.555	11.286	2.836	0.281	2.243	3.333	0.348	1.363
Brazil		7.225	5.390		12.964	9.671		44.630	27.370		80.080	49.109		17.987	8.769		5.699	2.047
Chile	0.187	0.177	0.427	0.313	0.296	0.716	16.694	12.239	24.677	28.004	20.530	41.395	6.837	2.313	7.979	1.773	1.179	1.258
Colombia	0.178	0.274	0.539	0.381	0.587	1.156	6.595	7.483	11.443	14.146	16.051	24.546	1.344	1.550	4.104	2.001	1.771	0.515
Costa Rica	0.065	0.039	0.391	0.126	0.077	0.762	27.564	11.278	82.462	53.794	22.011	160.933	4.199	2.230	21.422	3.376	2.253	8.025
Dominican Republic [4]	0.298	0.187	0.131	0.527	0.330	0.232	52.383	23.398	13.655	92.619	41.370	24.143	11.991	9.265	4.978	16.712	8.980	1.858
Ecuador [1]			0.208			0.493			13.880			32.842			6.785			1.595
El Salvador	0.251	0.265	0.040	0.506	0.534	0.081	54.684	46.056	6.387	110.371	92.956	12.892	6.425	13.966	1.689	5.799	1.689	1.149
Grenada		0.012			0.017			115.895			171.261			26.382			9.652	
Guatemala	0.137	0.047	0.104	0.259	0.089	0.197	19.996	4.679	7.072	37.955	8.882	13.424	3.541	0.926	2.498	7.878	2.724	2.018
Jamaica [1]		0.068	0.075		0.114	0.125		27.543	27.761		46.003	46.366		7.147	10.530		2.334	1.980
Mexico [1]	8.447	3.174	4.734	12.917	4.854	7.239	122.932	33.277	40.158	187.978	50.884	61.407	20.392	9.430	13.117	14.565	4.085	2.318
Panama	0.108	0.040	0.106	0.207	0.078	0.203	55.452	14.661	28.257	106.440	28.142	54.239	18.097	5.111	10.319	5.286	1.638	1.513
Paraguay	0.015			0.045			4.724			14.542			1.222			3.474		
Peru			0.180			0.399			6.084			13.489			1.919			1.228
Saint Vincent and the Grenadines [4]	0.002	0.004	0.003	0.004	0.006	0.005	20.662	32.831	27.915	36.072	57.318	48.736	7.611	6.987	7.764	3.805	3.465	2.071
Trinidad and Tobago [2]	0.155	0.108	0.132	0.255	0.178	0.218	144.724	85.864	99.721	238.916	141.748	164.623	68.724	52.248	118.281	5.096	4.485	1.829
Uruguay [4]	0.036	0.045	0.062	0.067	0.083	0.115	12.483	13.928	18.673	23.013	25.677	34.424	2.163	3.490	3.177	2.077	1.041	1.507
Venezuela (Bolivarian Republic of) [2]			1.552			2.814			54.313			98.449			21.994			2.061
Africa south of Sahara																		
Angola [3]		0.067	0.407		0.131	0.797		5.545	22.203		10.863	43.501		7.107	12.871		1.745	2.270
Benin [3]			0.050			0.119			5.524			13.268			3.215			4.632
Botswana	0.050	0.119	0.127	0.105	0.251	0.268	50.083	75.150	63.839	105.724	158.641	134.764	21.000	49.128	41.339	9.709	5.961	3.023
Burkina Faso [1]	0.127	0.272	0.191	0.335	0.717	0.502	18.656	26.965	12.261	49.146	71.037	32.301	25.777	26.709	8.002	31.300	45.217	10.826
Burundi		0.012			0.038			1.937			6.110			2.318			4.640	

Table 2 continued

Region/ country	Agricultural expenditure (billions 2005 constant US dollars)			Agricultural expenditure (billions 2005 PPP dollars)			Per capita agricultural expenditure (2005 constant US dollars)			Per capita agricultural expenditure (2005 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011
Cameroon	0.030	0.053		0.064	0.111		3.405	3.800		7.155	7.984		1.118	2.042		2.222	4.162	
Cape Verde [1]		0.002	0.017		0.002	0.022		4.252	34.607		5.436	44.241		2.475	12.607			3.307
Central African Republic [1]	0.030	0.020	0.007	0.060	0.040	0.014	13.116	6.090	1.591	26.232	12.180	3.182	6.865	3.416	0.792			1.764
Congo		0.005			0.010			1.823			3.577			1.072			0.341	
Côte d'Ivoire [2]	0.131	0.119	0.078	0.240	0.218	0.144	15.837	8.370	4.216	29.058	15.357	7.735	4.167	3.432	1.787	2.605	3.523	2.110
Congo, Democratic Republic of the [4]		0.108	0.044		0.239	0.098		2.568	0.775		5.679	1.714		2.655	1.293		0.182	1.800
Equatorial Guinea [2]		0.007	0.046		0.012	0.084		15.279	67.863		28.039	124.540		2.300	12.197			0.801
Ethiopia	0.052	0.119	0.216	0.199	0.456	0.830	1.496	2.082	2.415	5.752	8.004	9.286	1.522	2.867	2.389	7.020	9.716	3.895
Gambia	0.015			0.056			25.324			95.715			20.951			17.125		
Ghana [4]	0.059	0.017	0.014	0.144	0.042	0.033	5.612	1.039	0.601	13.670	2.531	1.463	2.215	0.600	0.383	12.206	0.728	0.455
Guinea-Bissau		0.000			0.000			0.088			0.214			0.031				
Kenya	0.183	0.275	0.327	0.468	0.703	0.837	11.677	10.017	7.784	29.882	25.633	19.919	6.420	6.261	5.771	8.285	6.995	5.122
Lesotho [3]	0.014	0.067	0.031	0.026	0.123	0.056	10.985	38.403	15.611	20.016	69.975	28.445	9.495	36.123	24.381	8.024	12.405	3.153
Liberia [3]	0.022	0.004	0.007	0.045	0.008	0.013	12.166	1.996	1.803	24.701	4.052	3.660	5.190	4.874	1.295	5.018	2.759	3.384
Madagascar [3]		0.040	0.085		0.122	0.263		2.944	4.287		9.078	13.218		3.978	5.717		6.104	
Malawi [2]	0.050	0.053	0.233	0.151	0.160	0.698	8.335	5.358	15.968	25.017	16.082	47.924	8.059	8.522	20.558	10.151	8.848	23.249
Mali [3]	0.000	0.001	0.002	0.001	0.003	0.004	0.043	0.138	0.124	0.094	0.302	0.273	0.024	0.082	0.066	8.311	16.281	0.127
Mauritius	0.033	0.050	0.051	0.067	0.100	0.102	35.139	44.295	39.584	70.618	89.018	79.550	14.203	11.735	17.735	6.874	5.519	2.500
Mozambique			0.105			0.222			4.273			9.032			3.370			3.247
Namibia [4]		0.103	0.106		0.153	0.157		62.131	50.760		92.640	75.686		17.664	13.770		6.039	4.670
Niger [2]	0.054	0.054	0.124	0.126	0.126	0.289	9.540	5.905	8.108	22.201	13.742	18.869	5.296	5.529	8.255	13.178	13.870	12.112
Nigeria	0.514	0.225	0.460	1.119	0.490	1.002	7.172	2.074	2.800	15.631	4.520	6.103	3.317	0.970	0.784	2.923	3.602	2.460
Rwanda			0.084			0.251			7.514			22.514			6.548			7.252
Senegal [1]	0.041	0.053	0.390	0.085	0.111	0.817	7.519	6.070	30.087	15.758	12.721	63.059	5.128	4.443	21.718	4.348	5.234	13.900
Seychelles		0.007	0.003		0.012	0.005		96.278	32.957		156.701	53.641		24.904	12.375		1.990	0.767
Sierra Leone [4]		0.003	0.005		0.008	0.014		0.730	0.969		1.965	2.607		0.846	0.744		1.567	
South Africa		0.254	0.475		0.417	0.779		6.497	9.381		10.670	15.407		4.042	6.644		0.514	0.533
Sudan	0.145	0.003		0.329	0.006		10.454	0.114		23.649	0.257		4.694	0.047		27.330	3.590	
Swaziland [4]	0.026	0.025	0.061	0.050	0.047	0.118	44.235	25.522	53.722	85.425	49.288	103.745	15.879	10.118	27.685	12.977	5.681	3.054
Togo [3]	0.041	0.020	0.033	0.089	0.044	0.072	15.372	4.728	5.514	33.730	10.374	12.100	10.181	3.315	3.519	7.028	5.558	8.021
Uganda	0.008	0.009	0.116	0.022	0.027	0.335	0.634	0.452	3.312	1.821	1.298	9.517	0.599	0.390	3.485	6.713	1.867	3.619
United Republic of Tanzania [2]	0.130	0.119	0.416	0.370	0.338	1.188	7.157	3.959	9.544	20.424	11.296	27.233	8.909	3.086	7.852	10.899	8.545	6.704
Zambia [2]	0.406	0.034	0.175	0.751	0.062	0.323	71.770	3.798	13.641	132.658	7.020	25.214	56.313	3.688	8.914	22.807	2.804	9.274
Zimbabwe [4]	0.213	0.256	0.332	0.144	0.173	0.225	29.170	21.917	26.611	19.750	14.839	18.017	13.478	10.265	12.492	7.027	4.177	7.333
High-income European countries																		
Austria	3.834	3.199	1.587	3.478	2.902	1.440	507.852	402.528	188.437	460.708	365.162	170.945	41.862	50.707	30.723	2.513	2.364	0.936
Belgium	0.881			0.788			89.360			79.876			16.530			0.876		
Croatia		0.172	0.675		0.261	1.025		36.790	157.599		55.901	239.467		7.686	26.322		2.501	3.995
Cyprus	0.134	0.183	0.165	0.146	0.200	0.180	197.335	214.202	147.999	214.978	233.354	161.232	26.606	30.119	38.652	15.064	4.609	1.839

Table 2 continued

Region/ country	Agricultural expenditure (billions 2005 constant US dollars)			Agricultural expenditure (billions 2005 PPP dollars)			Per capita agricultural expenditure (2005 constant US dollars)			Per capita agricultural expenditure (2005 PPP dollars)			Ratio of agricultural expenditure to agricultural GDP (%)			Share of agriculture in total expenditure (%)		
	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011	1980	1995	2011
Czech Republic		2.786	0.792		4.662	1.325		269.747	75.427		451.406	126.223		60.236	22.559		5.408	1.216
Denmark	0.863	0.241	0.426	0.602	0.168	0.298	168.584	46.037	76.506	117.692	32.139	53.411	11.590	3.300	13.876	0.909	0.193	0.284
Estonia		0.003	0.008		0.069	0.194		1.922	5.776		48.190	144.800		10.432	20.808		1.471	2.086
Finland	6.157	6.604	2.209	5.066	5.434	1.818	1292.171	1292.929	409.946	1063.269	1063.892	337.326	61.520	108.312	36.145	10.745	7.893	1.914
France		8.226	9.012		7.164	7.849		138.155	137.861		120.318	120.062		14.355	20.052		0.876	0.718
Germany	2.959	14.968	6.961	2.745	13.884	6.457	37.875	183.252	85.106	35.133	169.986	78.945	7.001	48.048	26.111	0.487	1.114	0.504
Greece	2.906	2.387	0.074	3.273	2.688	0.083	304.390	224.473	6.555	342.791	252.793	7.382	17.656	17.724	1.122	5.297	3.110	0.064
Hungary	5.228	1.580	0.576	8.114	2.452	0.894	488.027	152.953	57.740	757.436	237.390	89.615	33.371	25.255	14.692	7.850	3.637	1.055
Iceland	0.333	0.256	0.192	0.212	0.163	0.122	1474.238	957.061	601.521	937.136	608.380	382.372	33.311	21.286	18.161	12.440	7.223	2.404
Ireland	2.640	1.163	1.119	2.101	0.926	0.891	757.254	322.390	244.538	602.755	256.614	194.646	36.111	16.255	47.598	6.965	2.751	1.123
Italy	8.265	7.383	6.554	7.669	6.850	6.081	146.759	129.879	107.933	136.170	120.508	100.146	11.998	14.487	19.512	1.096	0.913	0.741
Luxembourg	0.111	0.142	0.187	0.094	0.120	0.157	307.208	347.674	359.921	259.243	293.391	303.726	47.616	58.935	146.588	2.160	1.526	1.060
Malta	0.011	0.010	0.047	0.016	0.013	0.066	36.188	25.663	111.941	51.358	36.421	158.869	13.314	7.448	35.788	3.770	0.538	1.595
Netherlands	2.343	1.430	1.644	2.102	1.283	1.475	166.877	92.486	98.473	149.739	82.988	88.360	17.570	8.384	12.101	1.052	0.517	0.478
Norway	5.143	3.470	1.915	3.725	2.513	1.386	1262.910	796.004	386.548	914.558	576.440	279.925	84.714	49.955	36.986	7.161	2.993	1.342
Poland		2.079	2.445		3.598	4.233		53.861	63.461		93.235	109.853		12.943	17.313		2.684	1.407
Portugal		1.363	0.703		1.602	0.826		135.899	66.602		159.688	78.260		16.377	14.968		2.176	0.738
Slovakia [1]			0.903			1.642			166.249			302.447			38.932			3.753
Slovenia		0.386	0.223		0.507	0.293		193.965	108.493		255.028	142.649		36.341	23.261		3.613	1.110
Spain [1]	5.879	4.734	6.051	6.181	4.977	6.362	158.041	120.194	131.350	166.143	126.355	138.083	14.818	13.348	18.892	3.358	1.353	1.109
Sweden	3.681	1.907	0.760	2.933	1.519	0.606	443.866	216.021	80.442	353.692	172.135	64.099	36.918	23.128	9.970	2.869	1.076	0.356
Switzerland [2]	7.404	10.096	9.661	5.290	7.214	6.903	1176.261	1433.972	1247.557	840.424	1024.555	891.364	84.799	155.732	203.199	4.867	9.242	6.814
United Kingdom	6.467	1.607	4.459	5.591	1.389	3.855	114.967	27.695	71.051	99.393	23.944	61.426	26.895	5.406	26.159	1.192	0.218	0.386
Other high-income countries																		
Australia	1.398	1.733	1.741	1.319	1.635	1.642	95.160	95.922	77.969	89.754	90.472	73.539	5.763	10.431	9.197	1.775	1.244	0.780
Canada [2]	2.177	3.366	2.358	2.174	3.360	2.354	88.518	114.659	69.914	88.381	114.481	69.805	8.875	14.182	11.388	2.201	1.926	1.307
Israel [4]	0.692	0.609	0.219	0.835	0.735	0.264	182.765	109.804	30.443	220.664	132.573	36.756	24.788	33.537	8.855	1.970	1.488	0.414
Japan [2]	15.057	10.551	16.027	12.810	8.976	13.636	129.944	84.110	125.648	110.552	71.558	106.897	19.961	15.902	31.120	3.492	1.687	1.684
New Zealand [3]	1.178	0.275	0.663	1.090	0.254	0.614	378.799	74.762	155.397	350.487	69.174	143.783	19.448	4.581	10.212	5.419	1.072	1.405
Republic of Korea	1.541	8.573	9.831	2.000	11.129	12.762	41.055	190.113	197.490	53.294	246.791	256.366	5.854	24.663	36.416	5.592	11.589	4.674
United States of America	18.377	11.887	18.245	18.377	11.887	18.245	81.654	44.641	58.555	81.654	44.641	58.555	10.940	8.197	11.673	1.485	0.638	0.573

Global Hunger Index

Each year, IFPRI calculates the Global Hunger Index (GHI), which is designed to comprehensively measure and track hunger globally and by country and region. To reflect the multidimensional nature of hunger, the GHI generates one index number from three equally weighted indicators: (1) the percentage of people who are undernourished, (2) the percentage of children younger than age five who are underweight, and (3) the mortality rate of children younger than age five. According to the 2013 GHI, global hunger has improved since 1990, falling by one-third. Yet it remains at a level characterized as "serious" (see specific country scores for 2013 in Table 3). The greatest improvements in absolute scores from the 1990 to 2013 GHI took place in Angola, Bangladesh, Cambodia, Ethiopia, Ghana, Malawi, Niger, Rwanda, Thailand, and Vietnam. However, hunger worsened to varying degrees in Burundi, Comoros, Guatemala, Paraguay, and Swaziland. By highlighting successes and failures in hunger reduction and providing insights into the drivers of hunger, the GHI both points to the geographic areas where policy action is most needed and suggests policy lessons.

Website: http://dx.doi.org/10.7910/DVN/22795
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GHI Severity Scale

≥ 30.0	Extremely alarming	5.0–9.9	Moderate
20.0–29.9	Alarming	< 5.0	Low
10.0–19.9	Serious	–	No data

TABLE 3 Global Hunger Index scores (various years), ranked by 2013 country scores

Rank	Country	1990	1995	2000	2005	2013
1	Albania	9.2	6.0	7.8	6.1	5.2
1	Mauritius	8.5	7.6	6.5	5.9	5.2
3	Uzbekistan		8.3	9.3	6.6	5.3
4	Panama	11.6	10.8	11.4	9.0	5.4
4	South Africa	7.2	6.5	7.4	7.7	5.4
6	China	13.0	10.4	8.4	6.7	5.5
6	Malaysia	9.5	7.1	6.9	5.8	5.5
6	Peru	16.3	12.3	10.5	9.9	5.5
9	Thailand	21.3	17.1	10.2	6.6	5.8
10	Colombia	10.4	8.0	6.8	6.9	5.9
11	Guyana	14.3	10.2	8.2	8.0	6.6
12	Suriname	11.3	9.9	11.1	8.9	6.7
13	El Salvador	10.9	8.7	7.4	6.4	6.8
14	Dominican Republic	14.9	11.7	9.7	8.8	7.0
15	Gabon	9.7	8.0	7.8	6.9	7.2
16	Vietnam	30.9	25.1	18.1	13.7	7.7
17	Honduras	14.2	13.6	10.8	8.5	7.9
18	Ghana	25.5	19.6	15.6	10.7	8.2
19	Ecuador	14.0	11.6	12.3	10.1	8.5
20	Moldova		7.7	8.8	7.3	9.2
21	Georgia		16.6	9.2	11.3	9.3
22	Nicaragua	24.1	19.9	15.4	11.5	9.5
23	Indonesia	19.7	16.9	15.5	14.6	10.1
23	Paraguay	9.3	7.5	6.5	6.3	10.1
25	Mongolia	19.7	23.6	18.5	14.1	10.8
26	Bolivia	18.8	16.9	14.2	13.8	11.2
27	Lesotho	13.2	14.6	14.6	14.9	12.9
28	Mauritania	22.7	16.2	17.2	14.6	13.2
28	Philippines	19.9	17.4	17.7	14.0	13.2
30	Benin	22.5	20.5	17.3	15.2	13.3
31	Senegal	18.1	19.8	19.2	13.7	13.8
32	Botswana	16.8	17.0	17.8	16.3	13.9
33	Gambia, The	19.1	20.4	16.1	15.6	14.0
34	Guinea-Bissau	21.7	20.8	20.6	17.7	14.3
35	Swaziland	10.4	12.9	12.7	12.5	14.4
36	Cameroon	23.7	23.8	20.3	16.3	14.5
37	Togo	23.0	19.1	20.4	18.2	14.7
38	Mali	27.4	26.9	24.3	20.7	14.8
39	Nigeria	25.3	22.6	17.9	16.3	15.0
40	Malawi	30.6	27.6	21.6	18.7	15.1
41	Rwanda	30.8	37.3	29.0	23.6	15.3
42	Guatemala	15.0	16.1	17.0	17.0	15.5
43	Sri Lanka	22.3	20.7	17.8	16.9	15.6
44	Côte d'Ivoire	16.3	16.5	17.3	16.4	16.1
45	Tajikistan		21.2	22.6	19.0	16.3
46	Zimbabwe	20	22	21.7	20.5	16.5
47	Cambodia	32.2	30.7	27.8	20.9	16.8
48	Guinea	21.4	21.2	22.4	18.2	16.9
49	Nepal	28.0	27.3	25.3	22.3	17.3
50	Liberia	23.4	28.2	24.7	20.6	17.9

Table 3 continued

Rank	Country	1990	1995	2000	2005	2013
51	Kenya	21.4	21.0	20.5	20.2	18.0
51	North Korea	18.8	22.6	22.5	20.0	18.0
53	Namibia	22.1	21.9	17.5	17.1	18.4
54	Lao PDR	33.4	30.3	28.0	23.7	18.7
55	Angola	39.5	38.5	31.6	22.7	19.1
56	Uganda	21.4	22.9	19.9	18.6	19.2
57	Pakistan	25.9	22.8	21.6	21.2	19.3
58	Bangladesh	36.7	35.1	24.0	20.2	19.4
59	Djibouti	33.5	28.5	27.7	24.0	19.5
60	Niger	36.4	34.6	30.3	25.6	20.3
61	Congo, Rep.	23.7	23.9	19.3	18.4	20.5
62	Tanzania	23.4	26.9	26.1	20.5	20.6
63	India	32.6	27.1	24.8	24.0	21.3
64	Mozambique	36.0	32.0	28.5	25.1	21.5
65	Burkina Faso	26.9	22.7	26.1	26.6	22.2
66	Sierra Leone	31.3	29.5	30.0	28.4	22.8
67	Central African Rep.	30.7	29.4	28.0	28.5	23.3
67	Haiti	33.8	31.7	25.7	27.0	23.3
69	Zambia	24.9	24.5	26.3	25.3	24.1
70	Madagascar	25.5	24.6	25.9	24.4	25.2
71	Ethiopia	42.3	42.7	37.1	31.0	25.7
72	Yemen, Rep.	29.8	27.7	26.9	27.9	26.5
73	Chad	38.8	34.9	29.8	29.7	26.9
74	Sudan	31.1	25.7	27.2	24.7	27.0
75	Timor-Leste				26.0	29.6
76	Comoros	24.0	27.5	33.3	29.8	33.6
77	Eritrea		40.6	40.2	39.3	35.0
78	Burundi	33.8	38.1	39.5	39.5	38.8

TABLE 4 Countries with 2013 Global Hunger Index scores of less than 5

Country	1990	1995	2000	2005	2013
Algeria	7.0	7.7	5.3	<5	<5
Argentina	<5	<5	<5	<5	<5
Armenia		10.2	8.2	<5	<5
Azerbaijan		14.5	11.9	5.4	<5
Belarus		<5	<5	<5	<5
Bosnia & Herzegovina		<5	<5	<5	<5
Brazil	8.7	7.6	6.4	<5	<5
Bulgaria	<5	<5	<5	<5	<5
Chile	<5	<5	<5	<5	<5
Costa Rica	<5	<5	<5	<5	<5
Croatia		5.4	<5	<5	<5
Cuba	5.5	7.4	<5	<5	<5
Egypt, Arab Rep.	7.0	6.2	5.2	<5	<5
Estonia		<5	<5	<5	<5
Fiji	5.8	5.1	<5	<5	<5
Iran, Islamic Rep.	8.5	7.4	6.1	<5	<5
Jamaica	5.9	5.0	<5	<5	<5
Jordan	5.1	5.2	<5	<5	<5
Kazakhstan		<5	5.3	<5	<5
Kuwait	12.4	5.1	<5	<5	<5
Kyrgyz Republic		9.3	8.8	5.3	<5
Latvia		<5	<5	<5	<5
Lebanon	<5	<5	<5	<5	<5
Libya	<5	<5	<5	<5	<5
Lithuania		<5	<5	<5	<5
Macedonia, FYR		5.8	<5	<5	<5
Mexico	7.4	5.8	<5	<5	<5
Montenegro					<5
Morocco	7.8	6.9	6.2	6.5	<5
Romania	<5	<5	<5	<5	<5
Russian Federation		<5	<5	<5	<5
Saudi Arabia	6.5	6.4	<5	<5	<5
Serbia					<5
Slovak Republic		<5	<5	<5	<5
Syrian Arab Republic	7.7	6.1	<5	5.1	<5
Trinidad & Tobago	8.4	8.6	6.9	7.0	<5
Tunisia	<5	<5	<5	<5	<5
Turkey	<5	5.0	<5	<5	<5
Turkmenistan		10.3	8.6	6.6	<5
Ukraine		<5	<5	<5	<5
Uruguay	5.5	<5	<5	<5	<5
Venezuela, RB	7.8	7.7	7.2	5.2	<5

Notes: Countries with a 2013 GHI score of less than five are not included in the ranking but are shown in Table 4. Countries that have identical 2013 GHI scores are given the same ranking (for example, Paraguay and Trinidad & Tobago both rank fourth). The following countries could not be included owing to lack of data: Afghanistan, Bahrain, Bhutan, Democratic Republic of Congo, Iraq, Myanmar, Oman, Papua New Guinea, Qatar, and Somalia. Data for calculating the 1990 GHI are from 1988–1992; for the 1996 GHI, from 1994–1998; for the 2001 GHI, from 1999–2003; and for the 2013 GHI, from 2008–2012.

Food Policy Research Capacity Indicators

How can the global community strengthen a country's capacity to conduct food policy research? How best to ensure that such research guides evidence-based policymaking to achieve agricultural development and food security goals? The first step is to understand what each country's current capacity looks like—delineating the components of capacity into measurable indicators helps to develop that understanding. Data collection for the set of indicators presented here was initiated in 2010, and we continue to expand the dataset each year and refine our data collection methods. This year's report contains a new set of data for Indonesia and revised data for Ethiopia, Ghana, Malawi, Mozambique, and Rwanda.

The indicators presented here reflect the following definition of food policy research capacity: any socioeconomic or policy-related research in the areas of food, agriculture, nutrition, or natural resources. We assess food policy research capacity first by quantifying capacity and then by qualifying that capacity. The first indicator is a head count of people employed at domestic organizations who undertake food policy research or analysis as part of their work. However, because the type of organizations that are most involved in food policy research varies from country to country and because researchers at different organizations spend differing amounts of time on research, we also present a modified quantification of the head count: fulltime analysts/researchers with a PhD equivalent. This also accounts for the level of analysis that researchers are able to undertake due to their educational attainment. Four researchers with a bachelor's degree is the equivalent of two researchers with a master's degree, which in turn is the equivalent of one researcher with a doctoral degree. This research capacity is then divided by the country's rural population to obtain an indicator of per capita research capacity in the food policy realm.

The quality of a country's food policy research capacity is estimated by the number of relevant publications in international, peer-reviewed journals over a five year period. This measure facilitates cross-country comparisons as it ensures that an internationally accepted standard of quality has been met, enabling the ability of donors to set research capacity-building priorities across countries. This indicator is tallied from searches in two journal databases: EconLit and Web of Science.

The combination of the quantitative and qualitative indicators reflects the efficiency of the research process in each country, which helps shed light on the extent to which a country's institutions promote high quality research (including the availability of relevant resources). In other words, we view the number of publications per full-time analyst/researcher with a PhD equivalent over a five year period as a reflection of the country's enabling environment for food policy research. IFPRI is currently undertaking research to better understand the factors that influence a country's enabling environment, including governance, resource allocation, ICT availability, and human resources management, as well as the factors that affect how and when research is taken up within the policy process in various spheres of decisionmaking in the food, agriculture, and natural resource sectors.

This dataset will continue to be developed and updated over the coming years to better facilitate cross-country comparisons, especially among countries who have similar agroecological environments or who anticipate facing similar food security-related challenges as a result of climate change. It will also help in understanding what the minimal food policy research capacity threshold is for a country and what the returns to scale are. Additionally, it is hoped that such data will aid in sensitizing policymakers to the importance of investing in local food policy research capacity. Lastly, this data will provide donors with a framework for prioritizing investments in food policy research capacity building across as well as within countries.

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TABLE 5 Food policy research capacity indicators, 2012

Country	Analysts/ researchers (head count), 2012	Full-time equivalent analysts/ researchers with PhD, 2012	International publications produced, 2008–2012	Full-time equivalent analysts/researchers with PhD per million rural population, 2012	Publications by full-time equivalent researchers with PhD, 2008–2012
Afghanistan	43	2.975	0	0.131	0.000
Bangladesh	66	22.9	43	0.208	1.878
Benin	38	4.3	26	0.786	6.047
Burundi	39	5.125	1	0.586	0.195
Colombia	85	6.45	28	0.553	4.341
Ethiopia*	141	30.4	27	0.401	0.888
Ghana*	153	23.3	51	1.935	2.189
Guatemala	45	11.9	5	1.585	0.420
Honduras	33	6.125	6	1.633	0.980
Indonesia*	146	42.375	11	0.354	0.260
Kenya	155	31.6	59	0.968	1.867
Laos	9	1.75	2	0.407	1.143
Liberia	34	3.075	0	1.427	0.000
Madagascar	187	11.525	12	0.774	1.041
Malawi*	68	18.175	10	1.358	0.550
Mali	60	10.05	0	1.050	0.000
Mozambique*	37	3.325	16	0.193	4.812
Nepal	27	3.65	2	0.161	0.548
Niger	29	8.825	4	0.628	0.453
Nigeria	349	77.4	28	0.921	0.362
Peru	54	7.15	19	1.063	2.657
Rwanda*	64	5.5	2	0.596	0.364
Senegal	71	9.3	9	1.186	0.968
South Africa	198	50.325	217	2.617	4.312
Swaziland	32	2.85	3	2.940	1.053
Tanzania	91	20.75	12	0.597	0.578
Togo	81	6.825	10	1.671	1.465
Uganda	34	10.925	18	0.358	1.648
Vietnam	175	32.525	5	0.536	0.154
Zambia	29	5.3	9	0.623	1.698
Zimbabwe	42	8.875	12	1.062	1.352

*The number of analysts or researchers or the number of institutions surveyed changed between 2011 and 2012.

Agricultural Total and Partial Factor Productivity

Total factor productivity (TFP) is the ratio between total output (crop and livestock products) to total production inputs (land, labor, capital, and materials). An increase in TFP implies that more output is being produced from a constant amount of resources used in the production process. Measures of partial factor productivity (PFP), such as labor and land productivity, are often used to quantify agricultural-production performance because they are easy to estimate. These measures of productivity normally show higher rates of growth than TFP because growth in land and labor productivity could result from increases in TFP but also from a more intensive use of inputs (fertilizer and machinery, for example).

Table 5 presents estimates of TFP and PFP measures for developing countries for three sub-periods between 1991 and 2011 (1991–2000, 2001–2005, and 2006–2011) using data on outputs and inputs from the Food and Agriculture Organization of the United Nations (FAO). The output values are FAO-constructed gross agricultural outputs, each of which is a composite of 190 crop and livestock commodities aggregated using a constant set of global average prices from 2004–2006. Inputs include agricultural land, measured by the sum, in hectares, of cropland and permanent pasture; labor, measured by the number of economically active persons in agriculture; livestock, measured as the total number of animals of main species weighted to account for differences in body sizes; machinery, measured by the total number of tractors in use; and fertilizer, measured by tons of fertilizer nutrients used.[1] This dataset of outputs and inputs was checked and cleaned using different statistical techniques.

Measures of the average land and labor productivity for the regions (such as Africa south of the Sahara) were calculated as the sum of individual country outputs divided by regional agricultural area and regional number of economically active persons in agriculture, respectively.[2] TFP estimates were obtained using Data Envelopment Analysis (DEA) techniques. These techniques have been extensively used because they make TFPs easy to compute, do not involve restrictive assumptions such as specific production functions (used to calculate productivity) or constant input shares across countries, and do not require information about input or output prices or assumptions regarding economic behavior, such as cost minimization and revenue maximization. On the other hand, DEA productivity estimates are sensitive to data noise and outliers and can also suffer from the problem of "unusual" weights when aggregating inputs to measure TFP. Given these limitations, outlier detection methods were used to determine influential observations in the dataset and input weights were allowed to vary only within a certain range of expected values because specific lower and upper bounds were imposed for each input in different regions.[3] Results are also affected by data characteristics and quality issues. In particular, the data series on fertilizer and machinery show high volatility and could result in high variability of TFP estimates for some countries.

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TABLE 6 Average annual growth of agricultural output and total factor productivity (TFP) and levels of land and labor productivity, various years

Country/region	Land productivity				Labor productivity				Output growth (%)			TFP growth (%)		
	1990	2000	2005	2011	1990	2000	2005	2011	1991-2000	2001-2005	2006-2011	1991-2000	2001-2005	2006-2011
Africa south of the Sahara	81	109	128	140	620	680	742	767	3.1	2.9	2.9	1.8	1.3	1.4
Angola	15	24	39	68	258	315	367	473	4.8	6.3	7.9	3.0	4.1	4.7
Benin	395	511	532	630	820	1175	1239	1300	6.1	3.5	1.7	3.3	5.2	0.4
Botswana	8	8	9	12	1055	728	783	913	-0.6	2.3	4.8	-5.2	2.5	4.6
Burkina Faso	110	147	205	190	294	338	363	344	4.4	4.3	1.5	0.2	1.5	-1.6
Burundi	487	396	428	500	412	348	337	230	-0.9	2.8	-3.9	-0.5	-1.2	-6.4
Cameroon	238	325	423	577	700	847	939	1171	3.2	3.8	3.9	1.7	2.6	4.0
Central African Republic	108	152	158	193	521	643	679	760	3.5	1.7	3.1	2.1	1.3	2.7
Chad	17	23	30	28	456	509	505	515	3.6	3.1	2.3	-0.1	0.7	-0.1
Congo	20	26	32	40	462	546	615	734	2.9	3.4	3.5	0.9	4.2	4.2
Congo, DR	172	150	147	163	474	320	286	268	-1.8	-0.5	1.8	-2.0	0.3	1.3
Côte d'Ivoire	209	289	273	306	1422	1823	1935	2240	3.5	1.1	2.5	1.2	3.6	2.4
Ethiopia	82	144	190	244	248	230	247	288	2.6	5.0	5.1	-1.4	2.6	3.2
Gabon	39	48	48	57	991	1179	1235	1615	1.7	0.3	4.5	1.6	-2.8	2.8
Ghana	160	294	352	430	696	907	977	1065	5.7	4.3	4.0	2.5	0.7	2.8
Guinea	73	111	127	147	435	447	491	530	3.7	3.7	2.6	-0.4	2.1	-0.3
Guinea-Bissau	105	130	150	198	437	534	571	620	3.5	2.9	3.5	0.8	-0.0	2.2
Kenya	148	165	217	258	505	426	455	485	1.5	4.0	2.3	-0.5	2.2	1.5
Liberia	103	153	160	154	501	530	532	471	3.3	1.3	1.4	2.4	0.2	-1.8
Madagascar	69	65	76	89	624	505	472	477	0.5	2.2	3.7	-0.1	1.3	1.9
Malawi	244	410	324	562	302	450	466	557	5.6	3.1	4.9	4.7	1.9	1.5
Mali	46	47	65	88	759	838	879	1037	3.0	3.7	4.9	1.2	3.5	1.4
Mauritania	9	10	11	12	762	689	675	670	1.7	2.3	2.6	1.0	-0.5	0.3
Mozambique	24	34	40	65	202	246	247	236	5.3	2.2	1.7	3.0	0.9	0.1
Namibia	10	10	12	10	1747	1531	1694	1557	0.1	2.8	-1.2	-1.9	-3.7	0.2
Niger	34	46	56	71	483	584	644	872	5.2	5.9	8.0	1.9	2.4	6.4
Nigeria	235	390	458	471	1368	2249	2642	2943	4.9	4.0	1.9	3.6	2.0	1.9
Rwanda	590	742	830	1223	403	367	397	436	0.7	4.6	4.9	0.1	-0.0	1.2
Senegal	101	139	141	129	403	367	335	369	1.5	0.0	1.5	-1.2	-1.5	-1.8
Sierra Leone	153	118	170	234	395	364	443	525	-1.2	8.7	4.4	1.3	5.3	2.4
Somalia	33	33	37	42	738	720	702	708	0.7	1.3	2.0	1.9	-1.6	1.5
South Africa	96	111	118	135	5594	6928	8057	10614	1.3	1.9	2.8	4.3	4.1	3.4
Sudan	31	55	69	0	829	1115	1211	1141	5.0	3.0	0.6	3.9	-1.3	-0.8
Tanzania	116	129	175	222	361	337	397	445	1.8	5.8	4.8	-0.6	2.8	2.1

Note: Land productivity is agricultural gross production per hectare of agricultural land; labor productivity is agricultural gross production per economically active person in agriculture. Both types of agricultural gross production are measured in constant 2004-2006 US dollars.

Table 6 continued

Country/region	Land productivity				Labor productivity				Output growth (%)			TFP growth (%)		
	1990	2000	2005	2011	1990	2000	2005	2011	1991-2000	2001-2005	2006-2011	1991-2000	2001-2005	2006-2011
Togo	151	176	214	247	518	616	603	620	3.8	1.1	2.5	2.5	-1.3	0.6
Uganda	322	395	418	440	566	595	583	524	2.9	1.9	1.2	-0.0	-0.1	-0.0
Zambia	36	39	49	73	345	328	369	423	1.4	4.5	4.1	1.3	3.0	2.0
Zimbabwe	121	138	91	101	533	577	510	502	2.2	-3.4	1.0	1.0	3.4	1.4
Latin America & Caribbean	223	294	349	415	3630	4853	5935	7506	3.2	3.0	3.2	1.8	2.3	2.2
Argentina	192	252	281	292	16338	22000	25034	31799	3.0	3.5	3.6	-0.2	0.3	2.4
Bolivia	48	65	77	97	1377	1542	1600	1688	3.9	3.1	3.8	2.6	-4.5	-0.2
Brazil	253	341	421	536	4476	6761	8764	12861	3.7	5.9	3.8	1.9	5.3	5.1
Chile	280	411	472	549	4666	6612	7411	8408	3.9	2.9	2.3	0.5	2.5	3.8
Colombia	216	255	301	303	2830	3244	3542	4121	1.8	3.4	2.4	4.5	2.2	0.7
Costa Rica	710	1245	1395	1520	5153	6892	7448	9449	3.6	2.6	4.2	3.6	3.1	3.1
Dominican Republic	629	753	894	1194	2909	3438	4125	5869	0.4	3.0	4.1	1.7	2.9	3.1
Ecuador	430	624	825	1046	3054	4311	5004	6058	4.3	4.2	2.9	-0.7	3.4	2.2
El Salvador	603	679	670	803	1305	1506	1613	2072	1.5	2.0	2.8	1.8	0.9	4.0
Guatemala	470	637	765	1000	1301	1895	1740	1980	3.9	3.3	3.7	3.2	0.9	1.7
Haiti	582	568	593	591	522	456	455	444	-0.2	1.4	0.4	-4.6	0.5	0.6
Honduras	355	456	600	664	1706	1843	2462	3078	1.7	5.2	3.4	-0.6	3.6	2.4
Jamaica	1031	1118	1120	1231	1625	2251	2368	2630	2.3	-0.5	1.1	2.4	2.8	6.7
Mexico	219	279	319	351	2663	3444	3919	4546	2.9	2.5	1.0	3.2	3.5	1.2
Nicaragua	162	203	242	326	1645	2501	3187	4069	4.3	4.2	3.8	4.0	4.0	2.3
Panama	383	373	381	421	3175	3212	3327	3868	0.6	1.1	2.2	-1.6	4.0	-0.5
Paraguay	156	140	183	264	4411	4222	4794	6419	1.7	4.8	8.2	-7.6	-0.9	1.1
Peru	156	279	321	427	1274	1714	1898	2397	5.0	4.2	4.8	3.5	2.9	4.4
Trinidad and Tobago	1743	2187	2742	3000	2600	2855	3235	3812	1.0	2.3	2.7	0.6	7.2	-3.2
Uruguay	147	191	234	273	11941	14162	16017	21132	2.4	3.3	3.3	0.4	3.0	2.7
Venezuela	196	265	274	308	4922	6805	7390	9130	2.6	1.4	2.1	3.8	0.6	2.2
Asia	500	724	859	1079	555	765	869	1076	4.0	3.5	4.0	2.1	1.4	2.9
Bangladesh	1073	1633	1890	2492	357	457	510	688	2.8	2.5	5.2	2.0	-0.2	3.6
Cambodia	275	397	495	691	385	454	518	757	4.2	6.8	8.1	-0.8	-2.3	6.5
China	447	718	850	1067	717	1073	1249	1823	5.3	2.9	3.7	3.1	3.1	3.1
India	720	922	1034	1370	616	695	714	861	2.6	2.2	4.7	0.8	1.5	3.7
Indonesia	670	835	971	1117	706	791	942	1205	2.4	5.2	3.7	0.3	1.6	1.2
Laos	428	632	692	853	441	587	648	741	5.3	4.9	4.3	0.5	2.9	2.2
Malaysia	1042	1252	1601	1947	3887	5367	6798	9186	2.8	5.6	3.5	0.1	0.8	2.2
Mongolia	7	7	6	7	3736	3521	2856	3589	-0.9	-4.9	2.9	4.3	-5.2	7.1
Myanmar	596	975	1367	1645	445	606	797	1092	4.9	8.4	5.8	2.5	8.5	3.3
Nepal	703	916	1055	1293	431	443	436	423	3.0	3.4	3.1	-2.4	5.2	0.9
Pakistan	808	1098	1251	1511	1396	1552	1551	1568	3.3	2.6	3.3	0.8	-0.9	0.6

Table 6 continued

Country/region	Land productivity				Labor productivity				Output growth (%)			TFP growth (%)		
	1990	2000	2005	2011	1990	2000	2005	2011	1991-2000	2001-2005	2006-2011	1991-2000	2001-2005	2006-2011
Philippines	1148	1400	1629	1759	1120	1263	1386	1602	2.6	3.5	2.5	0.2	2.2	2.5
Sri Lanka	900	992	993	1114	566	630	632	717	1.2	1.7	2.5	1.6	0.5	1.6
Thailand	829	1268	1375	1543	880	1167	1299	1604	2.3	3.3	2.9	3.3	1.9	1.3
Vietnam	1588	2132	2387	2823	470	729	838	980	5.9	4.8	3.8	0.5	1.8	3.4
Middle East & North Africa	201	228	274	315	2311	2938	3373	3871	2.9	2.3	2.7	2.2	2.1	1.8
Algeria	74	94	131	177	1599	1464	1681	1949	2.7	5.4	3.5	2.6	5.4	-1.1
Egypt	4178	5220	5623	6222	1565	2661	2932	3372	4.8	3.3	1.6	2.2	0.8	1.0
Iran	217	303	527	549	2594	3468	3783	3920	4.3	3.7	2.0	2.9	2.4	1.7
Iraq	332	319	304	377	4203	5361	5763	6456	0.9	-0.7	1.7	4.2	-0.1	-0.4
Jordan	554	741	943	1310	5391	6395	8111	10402	3.3	5.1	3.7	0.4	6.8	3.8
Kuwait	643	971	1159	1897	8012	13477	14974	15034	7.2	4.7	2.4	12.2	2.3	2.7
Lebanon	1762	2082	1861	1981	15859	25480	31532	45793	1.2	0.0	1.3	0.7	3.0	2.6
Libya	53	66	70	78	6253	10221	11947	15886	2.9	0.0	0.0	5.1	-0.0	0.8
Morocco	167	170	224	315	1564	1697	2100	2777	1.2	4.2	3.1	-0.6	3.3	3.4
Oman	167	284	214	218	717	995	1118	1199	4.7	2.1	3.5	3.0	1.6	1.9
Qatar	448	708	629	880	4059	10727	9576	7982	4.3	-0.6	8.0	6.2	0.7	5.3
Saudi Arabia	20	16	19	21	2493	4208	5101	7269	1.4	4.0	1.9	-1.3	2.9	3.0
Syria	272	408	505	499	3893	5048	5387	4815	4.3	4.0	0.0	3.6	0.1	1.9
Tunisia	282	303	353	355	3617	3861	4266	4583	2.2	3.2	2.3	0.4	2.4	1.1
Turkey	677	785	821	1012	2548	3368	3700	4555	1.5	1.3	2.8	2.4	2.9	2.9
United Arab Emirates	819	2366	1311	1210	3354	10443	7844	5348	14.1	-4.8	2.4	8.9	-3.0	0.4
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4 The issue of the impact on marginalized groups is taken up in the feature by Sukhadeo Thorat and Nidhi S. Sabharwal that appears in this volume.

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A New Regional Push for Agricultural R&D in Africa

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FOOD POLICY INDICATORS: TRACKING CHANGE

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2013 GLOBAL FOOD POLICY REPORT

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ISBN 978-0-89629-562-9

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