Food Policy for the Poor

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Expanding the Research Frontiers

Highlights from 30 Years of IFPRI Research

Edited by Joachim von Braun and Rajul Pandya-Lorch

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Foreword

IFPRI's Board of Trustees is proud to be celebrating the institute's 30th anniversary in 2005. When IFPRI began in 1975, its first concern was the urgent world food situation of that period. Since then, IFPRI has spent three decades broadening its research programs and tackling research questions in new ways. At the same time, IFPRI has kept its sights on the ultimate goal of alleviating hunger and malnutrition and has become a respected source of research and analysis on policies related to food and agriculture in developing countries. The first step in overcoming hunger and malnutrition is to understand what works and what doesn't, and this is the task that has now engaged IFPRI for three decades.

IFPRI was fortunate to have as its first board chairman Sir John Crawford, an Australian economist who was a passionate advocate for international agricultural research and an architect of the Consultative Group on International Agricultural Research (CGIAR). Crawford and the rest of the first Board of Trustees helped set the institute on a course that has proven to be fruitful and sustainable, and each of IFPRI's five directors general has played a distinct and critical role in advancing IFPRI along that course.

Over the past 30 years, highly dedicated groups of professionals have served as IFPRI's Board of Trustees, playing an important role in offering guidance and establishing a direction for the institute through their involvement in strategic planning, budgets, personnel appointments, and oversight. We have benefited from a consistent policy of drawing half of the board's members from developing countries. But the board's efforts would be worth little without the ideas and hard work of a superb staff. IFPRI's researchers and support staff have worked tirelessly to keep the institute at the cutting edge of knowledge about food policy. They have been firmly committed to generating policy-relevant research that can point the way to improving the lives of hungry and malnourished people.

In anticipation of the institute's 30th anniversary, the Board of Trustees asked IFPRI to produce a book to honor the occasion. This compilation of highlights from IFPRI's research over the years shows how work done at IFPRI has contributed to the body of knowledge concerning the factors that contribute to agricultural development and increases in agricultural productivity and their impact on poverty, hunger, and malnutrition. In addition to conducting studies and analyzing results, IFPRI has steadily advanced its efforts to spread this knowledge and understanding to wide groups of academics, development practitioners, and policymakers around the world.

While it is satisfying to look back on past accomplishments, this anniversary also serves another purpose: it offers an occasion to remind ourselves that there is still much work to be done to bring about a healthy and productive life for all people. Herein lies the challenge that IFPRI must meet in the next 30 years.

Isher Judge Ahluwalia
Chair, IFPRI Board of Trustees

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We warmly thank IFPRI's four former directors general—Just Faaland, Dale Hathaway, John Mellor, and Per Pinstrup-Andersen—for contributing insightful essays looking back over IFPRI's first 30 years and looking ahead to the future; IFPRI research fellow emeritus Nurul Islam for his thoughtful essay; IFPRI colleagues Shenggen Fan, Ashok Gulati, Peter Hazell, John Hoddinott, Mark Rosegrant, Marie Ruel, and Klaus von Grebmer for their inputs and suggestions; and Jock Anderson and Patrick Webb for reviewing the introductory materials.

We extend our appreciation to all the IFPRI researchers and collaborators, many of whose work is included in this volume, for their tremendous contributions to IFPRI and to food policy research over the past 30 years. In view of IFPRI's productivity we had to be highly selective with the entries in this volume.

We also thank our peers who have greatly influenced and extended the boundaries of food policy research; we have endeavored to make reference to the influential work of leading experts but are fully cognizant that there are many other great scholars we have inadvertently left out. We at IFPRI look forward to continued collaboration with existing and new partners in coming years.

This volume would not have been possible without the extraordinary project management and editorial support of Heidi Fritschel—it was a great pleasure to work with her! We also warmly acknowledge the cheerful support of Djhoanna Cruz, Luz Marina Alvare, Evelyn Banda, Ellie Dumont, and Uday Mohan.

Joachim von Braun
Rajul Pandya-Lorch

Editors' Note: This volume retains the text citations that appear in the original editions of the works excerpted here, but it does not contain reference lists for these works. For complete references for works cited in excerpted text, please see the original publications, many of which appear on the accompanying CD-ROM.

Food Policy for the Poor

Chapter 1

Introduction

Joachim von Braun and Rajul Pandya-Lorch

In the mid-1970s it looked like Thomas Malthus's predictions of runaway population growth and consequent food shortages and famine were coming true. Famines in Bangladesh and Ethiopia had killed hundreds of thousands of people, poor weather had reduced harvests in a number of countries, and world cereal stocks were perilously low. There was talk of food "triage," in which food-abundant countries would decide who should get food and who should not, thereby dooming some to death. With the new level of alarm over the world's food supplies, a host of meetings were held and organizations created to search for solutions. One of these organizations was IFPRI.

Part of the solution, analysts noted, to the so-called world food crisis would certainly have to be agricultural technology, like the new high-yielding varieties of rice and wheat that had led to the Green Revolution in India. But India's experiences taught another lesson as well—that policies play a crucial role in increasing food production. In the late 1960s bold Indian policymakers, in an effort to reduce their dependence on food aid and promote domestic food production, had taken steps to encourage farmers to adopt the new varieties, thus helping get the Green Revolution off the ground. Accordingly, some people in the development community began to suggest that an international organization be formed expressly to conduct research on how policies could promote greater production and better distribution of world food supplies. Various proponents of the idea argued that policymakers and development practitioners needed to know more about how to create incentives for farmers to use new agricultural technologies, about the entire process of

rural and agricultural development, and about the evolution of the world food situation overall and its implications for developing countries.[1]

A World Food Conference was convened in 1974 to assess the magnitude of the food problem and to discuss solutions, but the role of policy was barely touched upon. Also in that year the Consultative Group on International Agricultural Research (CGIAR) had rejected the idea of establishing a food policy institute under its umbrella. Still, three organizations—the Ford Foundation, the Rockefeller Foundation, and the International Development Research Centre of Canada—made the decision to move ahead on their own and create the International Food Policy Research Institute, which officially opened in 1975 (former director Dale E. Hathaway discusses IFPRI's founding further in his essay on pages 21–24). A few years later, in 1979, IFPRI joined the CGIAR, which it has considered its home ever since.

IFPRI started small. The staff initially consisted of about 25 people, made up of professional and support staff. Over the three decades since its founding, IFPRI has grown dramatically, both in the size of its staff and in the scope of the research it conducts. Besides research, it has extended its work to include strengthening capacity for food policy research in developing countries and extensive communication of research results to a wide range of audiences. It has been guided by four previous directors general—Dale Hathaway, John Mellor, Just Faaland, and Per Pinstrup-Andersen—who were highly capable leaders and scientists (their thoughts on the past and on future challenges for IFPRI on the occasion of the institute's 30th anniversary are sprinkled throughout this book). And it has benefited from sound guidance on strategic decisions by its Board of Trustees (a full list of board members appears in Appendix 2). Currently IFPRI has six research and outreach divisions containing a total staff of about 200, many of whom are posted around the world.

IFPRI's 30th anniversary in 2005 offers an opportunity for stock taking—for looking back on the institute's contribution to and its place in the food policy field and in the broader development field. This book presents highlights from some of IFPRI's most notable published research results in the form of brief excerpts (many of the full publications are contained on the accompanying CD-ROM). In view of copyright restrictions, we offer here only research published by IFPRI—much more of the work conducted by IFPRI's researchers has been published in other outlets, such as books from other publishers, journal articles, and reports. Nonetheless, the excerpts here show the scope of IFPRI research over three decades and how

1. For more on IFPRI's early history, see Curt Farrar, *IFPRI's First 10 Years* (Washington, DC: IFPRI, 2000).

that scope has changed and broadened. They also show how perspectives and ideas related to food policy have evolved over time in the international community.

IFPRI was, of course, not the only provider of relevant food policy research over the past three decades. Its research and agenda have built on longstanding development economics and agricultural economics research in the global profession. For instance, the research by Nobel Laureate T. W. Schultz—an IFPRI board member in the late 1980s and early 1990s—changed the earlier perspective on the limited capacities of small farmers to innovate and be responsive to incentives. Nobel Laureate Amartya Sen's breakthrough in research on understanding famines had a deep impact on IFPRI. Mohammed Yunus's innovative approach to microfinance stimulated IFPRI research. The household economics research by Nobel Laureate Gary S. Becker had a strong influence on the string of micro-level, survey-based research at IFPRI. And the innovative research by Alain de Janvry on linking local and economywide effects of policies and technologies has had a profound effect on IFPRI research designs. Not only these prominent thinkers, but the whole stream of research by dozens of development economists and food policy analysts has directly and indirectly shaped the course of innovative research at IFPRI. We like to believe that through intensive collaboration or through helpful debate with many of these researchers—not just in academia but also in key United Nations agencies such as the Food and Agriculture Organization, UNICEF, and the World Food Programme; multilateral institutions like the World Bank and the Asian Development Bank; and nongovernmental organizations like Oxfam and CARE—IFPRI became a significant element in the overall stream of innovative and relevant food policy research.

A Changing IFPRI in a Changing World

When IFPRI got underway, it articulated its objectives as follows: to analyze the current and future world food situation and its implications for developing countries, to identify ways to increase agricultural production, and to explore policies for improving production, trade, and distribution of food so that an increase in the quantity and quality of food would be available to all people. In part, the point of IFPRI's work today is still the same as it was at the start—to help show the way toward food and nutrition security for all of the world's people. But IFPRI now pursues this overarching objective through a wider range of research topics—some of which were entirely unknown 30 years ago. Given the dozens of possible research topics that bear on universal food and nutrition security, IFPRI has had to choose carefully where to devote staff and resources.

As this compilation shows, over its 30-year history IFPRI has been shaped by the changing world situation and by new thinking about food policy and overall

development. When IFPRI began, the Cold War was still in full swing, and dozens of countries had command economies. Over the next three decades, nearly all of these countries liberalized their economies and became more open to international markets. During the same period, the role of the environment and the need for sustainable development became better appreciated. The spread of microcredit opened new opportunities for poor people. The crucial role of women in achieving household food security was increasingly recognized. When scientists learned how to transfer genetic material between species, they created the new field of agricultural biotechnology, with both its promise and its biosafety concerns. And tragically, HIV/AIDS deeply affected Africa and other parts of the developing world, and is still doing so. IFPRI has responded to these changes, and others, with careful scientific research on the role of policy in confronting these issues.

We offer here a few key areas in which IFPRI research has helped shape the thinking of policymakers and development professionals.[2] One example is IFPRI's early research on food subsidies, which showed that by directing subsidies only to the neediest people, instead of to all income groups as was commonly done, countries could reduce the economic distortions posed by subsidies while also helping the poor. Of course, narrowing the beneficiaries of an existing food subsidy presents a political challenge.

IFPRI also advanced the empirical understanding of agricultural growth linkages —that is, how agriculture's links through consumption and employment to the rest of the economy often make rapid agricultural growth a prerequisite for broader economic growth. Studies of the Green Revolution in India and elsewhere in Asia showed that agricultural growth had a strong impact on poverty and that further attention to agricultural growth is needed there to further reduce poverty.

In the 1980s IFPRI produced important research showing that because of developing countries' focus on industrialization rather than agricultural growth, the agricultural sector was struggling against a considerable bias, with the result that agriculture could not serve as an engine of growth for such economies. This conclusion has become part of the conventional wisdom of the development profession.

And IFPRI researchers debunked a myth about the commercialization of agriculture. It was once believed that poor farmers who switched from subsistence farming to cash cropping would suffer nutritional disadvantages, because they would sell food they then would lack. After all, they could not resort to eating their cash crops. Work at IFPRI revealed, however, that commercialization of farming offered an op-

2. For more information on research at IFPRI between 1975 and 2000, see Per Pinstrup-Andersen, *25 Years of Food Policy Research* (Washington, DC: IFPRI, 2000).

portunity for farmers to raise their incomes and climb out of poverty and malnutrition. Today, high-value agriculture is seen as one opportunity for small farmers to get out of poverty.

On the environment, IFPRI, much influenced by changed perspectives in the late 1980s and early 1990s, has focused attention on the little-recognized potential of less-favored lands—those lands that are steep, degraded, or characterized by uncertain rainfall or poor soils. Semi-arid lands and drylands are home to many of the world's poor people, but IFPRI research has shown that with the right investments and technologies, it is possible to alleviate poverty and reduce environmental degradation in these areas.

IFPRI's groundbreaking model of the international food and agricultural system, the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT), has proved to be a versatile tool for projecting the effects of various scenarios for policy, trade, and investment on food and nutrition security. Researchers have also used the model to study regional food economies, changes in water use and management, and the role of specific commodities like livestock and fish. IMPACT is now recognized as a leading agricultural model that sheds light on the investments needed to sustain the levels of food production that are called for by projected global demographic and economic changes.

How does IFPRI conduct its research on these and other topics? Typically, an IFPRI research project lasts five to seven years. During this project cycle, existing data are compiled or new data are collected. IFPRI researchers, often working with collaborators from developing countries, as well as developed countries and international organizations, conduct their analysis and clarify their conclusions. Collaboration in research has expanded over 30 years to include not just other research institutions and international agencies, but also civil society organizations in developing countries. In addition, IFPRI research has become more multidisciplinary, with increased participation of social scientists like sociologists and political scientists, who can help provide a more complete picture of a complex world. At the same time, researchers have continually worked to improve their research methods and stay at the cutting edge of food policy research.

Given the many issues that impinge on food and nutrition security, IFPRI has had to be selective about which topics to focus on. Its approach has been to concentrate its efforts on those issues that affect the greatest number of poor people in the greatest need. With hindsight, it is clear that IFPRI has neglected some important issues, failed to examine others in enough depth, and should have addressed others earlier. The essay by Nurul Islam in this volume looks at what IFPRI might have done better.

From the beginning IFPRI established a strong peer review system and internal peer culture for quality control of its research products. All IFPRI books and

research reports are exposed to external, anonymous peer review, managed by a publications review committee. This practice has kept the institute on its toes and continues to do so.

An increasingly important part of IFPRI's work is strengthening the capacity of researchers and policymakers in developing countries to conduct food policy research and analysis themselves. IFPRI has made a commitment to enhancing the skills and knowledge of key people in those countries. During the 1980s IFPRI began to post staff overseas, and in some of these countries IFPRI has had a long-term presence. But with or without outposted staff, IFPRI has worked to collect data and conduct studies while also building local capacity by working closely with local researchers, academics, and analysts. In 2004 the International Service for National Agricultural Research (ISNAR), a formerly freestanding CGIAR institute, was merged into IFPRI as a new division. ISNAR now houses much of IFPRI's capacity-strengthening activity. Besides enhancing human capital in developing countries, this capacity strengthening can help countries better translate research results into sound policies.

In recent years IFPRI has intensified its efforts to communicate its research results and food policy information to the broadest possible audience, in the realization that in addition to policymakers and researchers, the general public also has an impact on policy. Besides publishing books and research reports of interest to academic audiences, it has made extensive use of the Internet and other forms of digital media. To reach the general public, it has actively sought coverage in newspapers and television and radio outlets in both developed and developing countries.

Part of IFPRI's heightened effort to raise awareness of emerging food security issues and to reach out beyond the traditional stakeholder community is its 2020 Vision for Food, Agriculture, and the Environment Initiative, launched in 1993. This initiative has sought to help build a consensus on these issues and to promote policy actions that will lead to food and nutrition security. To bring a wide range of stakeholders together, the 2020 Vision initiative has organized three groundbreaking international conferences, each of which drew hundreds of participants representing many sectors and countries—one in Washington, D.C., in 1995, one in Bonn, Germany, in 2001, and an all-Africa conference in Kampala, Uganda, in 2004. These conferences, along with their extensive lead-in and follow-up activities, generated new research and fruitful discussions, which have clarified the policy actions that national governments and the international community must take to bring about food and nutrition security. The 2004 Africa conference, coming just as a new commitment to action was emerging in Africa and in the international community, contributed to setting the agenda for food and nutrition security in Africa.

As IFPRI looks back over its 30 years of history, it is also important to look ahead to consider the future course of the institute. How can IFPRI meet the need for more information and analysis of issues that are just now emerging? How can it ready itself to address challenges that are as yet unknown? And how can it best promote actions that will lead to much faster reductions in food and nutrition insecurity? The essays by former directors general of IFPRI and the concluding chapter of this book take up these questions.

Chapter 2

Projecting the World Food Situation

From Trends and Variability Analysis toward Models and Scenarios

IFPRI was born amid great concern about the future world food situation. Policymakers wanted to know more about the world's food prospects and believed that an independent research institute that had no commercial, national, or any other interests would serve that purpose best. Thus, the institute's first major research activity concerned trends in food production and consumption. This research was designed to inform planners and policymakers of the size of the gaps in agricultural production that would need to be filled if all people were to have access to adequate food. Historical data were assembled and trends extrapolated under varying assumptions. Initial research reports projected the food needs of people in the developing countries over time frames of about a decade or two. The output from this trends work became the first trusted research product from IFPRI (see excerpt from *Food Needs of Developing Countries: Projections of Production and Consumption to 1990,* 1977). IFPRI continued this trends work through the 1980s.

The research on food trends was transparent and based on the best data then available, but from an economic standpoint it said little about how the gap between production and consumption could be filled and whether the gap really posed a problem. Alberto Valdés's 1981 book *Food Security for Developing Countries* (see excerpt) brought economic considerations to the concept of food security at the country level and solidly critiqued the then-widespread notion that policymakers could improve food security by pursuing increased national food self-sufficiency. It showed that key factors determining national food security include the capacity to buy imports on international markets and the variability and risks in domestic and international markets.

In the early 1990s IFPRI researchers, in collaboration with colleagues from Japan, developed a global partial equilibrium trade model for looking at the future world food situation: the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT). In contrast to the trends research, in this model the "gaps" between production and consumption are closed through trade and producers and consumers respond realistically to price changes (see excerpt from *2020 Global Food Outlook: Trends, Alternatives, and Choices,* by Mark W. Rosegrant et al., 2001). The research team has continually updated and expanded this model to include different commodities, different policy and investment options, and more natural resource conditions, as well as longer time horizons. IMPACT has been used to model various policy scenarios and their consequences for food prices, production, demand, trade, and food security.

IFPRI's trends and scenarios work has benefited from technical cooperation with sister CGIAR centers such as the International Livestock Research Institute (see excerpt from *Livestock to 2020: The Next Food Revolution,* Christopher Delgado et al., 1999), the WorldFish Center (see excerpt from *Fish to 2020: Supply and Demand in Changing Global Markets,* Christopher L. Delgado et al., 2003), the International Potato Center (for roots and tubers scenarios), and the International Water Management Institute (see excerpt in Chapter 6 from *World Water and Food to 2025: Dealing with Scarcity,* Mark W. Rosegrant et al., 2002).

IPFRI researchers are, of course, not the only ones to engage in projecting the world food outlook. As Alex F. McCalla and Cesar L. Revoredo note in their 2001 review, *Prospects for Global Food Security: A Critical Appraisal of Past Projections and Predictions* (IFPRI, 2001), there have been at least 30 quantitative projections of world food prospects over the past 50 years. The Food and Agriculture Organization of the United Nations (FAO) has led the way by producing not only a regular series of medium-term projections of 5 to 10 years, but also three longer-term projections that were released in seminal reports, first in 1981 with *Agriculture: Towards 2000,* then in 1993 with *Agriculture: Towards 2010,* and more recently in 2000 with *Agriculture: Towards 2015/30.* The U.S. Department of Agriculture has also engaged in short-term projections at regular intervals for a number of years. Others who have contributed to enriching food projections work during the past 30 years include the World Bank, the Food and Agricultural Policy Research Institute (FAPRI), and the International Institute for Applied System Analysis. Over time the number of players in the projections business has diminished; today IFPRI is only one of three or four institutes around the world to produce scenarios for world food security. With its rigor, comprehensiveness, and flexibility, IMPACT has gained recognition within the policy research community as a leading agricultural model for assessing global food production and the performance of global food markets.

Food Needs of Developing Countries: Projections of Production and Consumption to 1990

IFPRI Research Report 3, Washington, DC: IFPRI, 1977, pages 20–23

Food Policy Alternatives

The food deficits emphasized in this study provide indicators of the size of the job facing the food deficit DMEs [developing market economies] to provide adequate food supplies for their populations. These food deficits will need to be met either through domestic production, commercial imports or food aid. The only other alternative would be to reduce food consumption from the projected levels through either increased prices or some other form of rationing. This could mean further reductions in the already inadequate consumption levels prevalent in many low income countries. . . .

Policy choices vary widely among countries. The high income countries have good prospects for generating foreign exchange. Many may find it advantageous to invest in nonagricultural economic activities and depend on commercial export earnings to purchase their food import needs. Some middle income countries also have favorable foreign exchange prospects. Several, such as Mexico and Brazil, have been able to attain rapid rates of growth in food production. However, others such as Peru, Chile and Turkey may face difficult problems unless food production can be increased much more rapidly than in the past.

In most low income countries, policy choices are limited. Food consumption of much of the population already is below dietary energy requirements. Only a few have attained rapid increases in food production. Commercial imports of the huge projected deficits are doubtful because of the large amount of foreign exchange that would be required (US$14–17 billion at 1975 import prices) and the need to finance other development activities. The oil countries, Indonesia and Nigeria, and perhaps a few others, may be exceptions but most will find it difficult to finance enough food imports to meet the large deficits projected. Prospects for obtaining such massive quantities of food aid also appear unlikely.

In order to narrow the projected food gap, development efforts in these countries must emphasize policies to radically improve production performance. Large increases in investments in agriculture accompanied by appropriate policies and effective programs to improve production performance will be required. Even so, it appears unlikely that the increases in production will come quickly enough to meet the food needs of the 1980s. At the projected production growth rate of 2.7 percent a year, food deficits arising from expanding market demand would increase at an average of around 5 million metric tons a year during the next decade. However, several years will likely be required before additional investments and improved agricultural policies can raise production growth rates to 4 percent or more a year. More-

over, serious production shortfalls arising from adverse weather conditions in a number of developing countries are likely to continue to occur. Consequently, increases in food aid programs beyond the target of the World Food Council of 10 million metric tons per year are likely to be necessary in the next decade if the basic human need for food is to be met.

Closely related is the question of how to come to grips with the problem of the malnourished. Meeting food demand which arises from economic growth will only partly alleviate the conditions of the underfed in most low income countries. In the past, the number of poor and underfed in most developing countries has increased despite economic growth. In order to reduce their numbers, policies must be developed to increase the income and effective demands of the poor. Approaches would include effective intervention programs to meet critical food needs and longer term programs to generate employment opportunities and improve income distribution.

Other important questions arise from this report, questions that have no answers now but need to be pursued. The supply/demand balance of trade of the developed market economies, the USSR, the People's Republic of China and other centrally planned countries can have a great effect on the ability of the DMEs to feed their people while they are increasing their production. Also important would be the development of supply management policies to provide adequate food security for developing countries during periods of seriously adverse weather fluctuations. Equally important is the need for a better assessment of the foreign exchange and trade prospects in relation to prospective food import needs of the low income, food deficit countries. A better understanding of the causes of the rapid production growth attained in several of the developing countries is also needed to provide guidelines for rapid agricultural development in other food deficit countries in similar circumstances.

Food Security for Developing Countries

Edited by Alberto Valdés
Boulder, Colo.: Westview Press, 1981, pages 1–2 and 18–20

In 1974 the World Food Conference was convened in Rome to discuss the world food crisis. Food security was the dominant theme. Food security may be defined as the ability of food deficit countries, or regions within those countries, to meet target consumption levels on a year-to-year basis. Agricultural prices had risen to record highs, carry-over stocks of grain were at precariously low levels, and concern was focused on the undernourished millions in the Third World suffering from the scarcity and high price of food. Fears grew that the world was irrevocably moving

toward chronic food shortages, attributable to unfavorable long-term climatic changes and continued high rates of population growth.

The current global food situation is, fortunately, much improved. International prices of cereals have fallen in real terms, grain stocks have been rebuilt, and the crisis atmosphere has abated. World food security has ceased to be a major concern for the press and for the general public. Yet, the underlying causes of food crises such as the one in 1972–1974 have not disappeared; in fact, even though the developing countries have themselves made some important strides in dealing with food insecurity, on the international scene only limited progress has been made to help them in these efforts.

Discussions of potential remedies have tended to overlook the enormous differences in nature and magnitude of the food security problems in countries or regions in Asia, Africa, and Latin America. From these discussions, only a limited number of policy instruments were seen as relevant to the problem of food security. Often, the debates gave the impression that less developed countries (LDCs) would surmount the problem if only larger grain reserves were available. Food security proposals often seemed to underestimate the complexity of the practical problems at the level of individual countries in designing and implementing policies for stabilization of food supplies, particularly for the rural areas. It was in light of these concerns that the Conference on Food Security for Developing Countries was organized. . . .

The solution to the food insecurity problem must begin at the national level, and every country can take important initiatives to reduce food insecurity. The analysis indicates that these will probably include large investment in food distribution systems, transport and communications, early warning systems, and a mix of stock and trade policies. Although there is considerable scope in many LDCs for larger investment in working stocks, one clear generalization that can be made on the basis of past research is that relying mainly on domestic grain reserves to cover year-to-year fluctuations is an expensive solution when trade is a real possibility. Beyond this, the design of food security policies would have to consider specific country situations.

Given their food consumption stabilization objectives, LDCs seek to minimize the resource cost of managing the short-term variation in real income. The three implications of these food consumption stabilization policies are (1) the incentive for private domestic stockholding would be reduced, (2) the foreign trade balance and the government budget would have to absorb the instability, and (3) the loss in purchasing power or real income of farmers and farm laborers due to the crop failure must be compensated for. Otherwise, stabilizing national food supply per se would be insufficient to offset declines in effective demand in the rural areas. This last implication, which could be resolved only at very high financial cost if followed,

has not been discussed much in the literature. Part of the unfinished business is a more explicit recognition of the connections among the markets for food, nonfood products (agricultural and others), and foreign exchange, which could open for consideration a wider range of policy instruments for managing the real income adjustment. The manner in which a country copes with short-term instability may well influence the longer term performance of its agricultural sector, and specifically the mean levels of food consumption.

The international initiatives discussed in this chapter include an international grain reserve system, consumption and production adjustments in developed countries, and food aid and financial approaches to alleviate the foreign exchange constraint. Empirical analysis clearly demonstrates that these initiatives do reduce the costs of national solutions in LDCs, although they do not replace the role of national policies. Numerous opportunities exist for donor countries and multilateral action to help alleviate food insecurity in LDCs, such as the lifting of foreign exchange constraint of food imports, technical and financial assistance to improve food delivery systems in LDCs, and agricultural policies that are less disruptive to world grain trade.

Insofar as instability in the import bill is concerned, there is nearly professional consensus that compensatory financing schemes are the most effective approach, far better than international grain reserves. Creating such a financial facility for food is highly desirable. With such an approach the focus is where it should be: on the import bill rather than on import prices. This proposal may be implemented by liberalizing the existing scheme of compensatory financing to take into account fluctuations in "real" export earnings—that is, compensating for unexpected or excess imports of food.

An unexpected increase in the food import bill will result in a larger than usual current account deficit. Given the temporary nature of this excess demand for foreign exchange, painful macroeconomic policy adjustment would not be required if the country has access to additional financing at normal borrowing rates. The argument in favor of a food financial facility is based on the premise that (a) downward consumption adjustment of food is undesirable and often not feasible; (b) the country must act rapidly to assure the additional imports of food, and thus cannot wait for the results of an overall evaluation as required in general balance of payment support; and (c) for many poor countries, borrowing on short notice in the international capital market is not a feasible possibility. Thus, a multilateral financial scheme that offers rapid processing based on clear, predetermined rules seems an effective instrument. In addition to the advantage that it is less subject to political criteria—such as those prevailing in food aid—a liberalized financial facility is likely to help the poorest of the developing countries.

2020 Global Food Outlook: Trends, Alternatives, and Choices

Mark W. Rosegrant, Michael S. Paisner, Siet Meijer, and Julie Witcover
IFPRI Food Policy Report, Washington, DC: IFPRI, 2001, pages 13–14

Policy Choices Make a Big Difference

Most people, if given a moment to think about it, probably could assemble a reasonable list of the factors that determine how much food humankind has available to eat. Some of these forces are not under human control, such as the weather. Many others are, at least to a degree. They include the speed of population growth, the level of investment in technologies that allow increased food production, and the ability of farmers to take advantage of available methods for growing food.

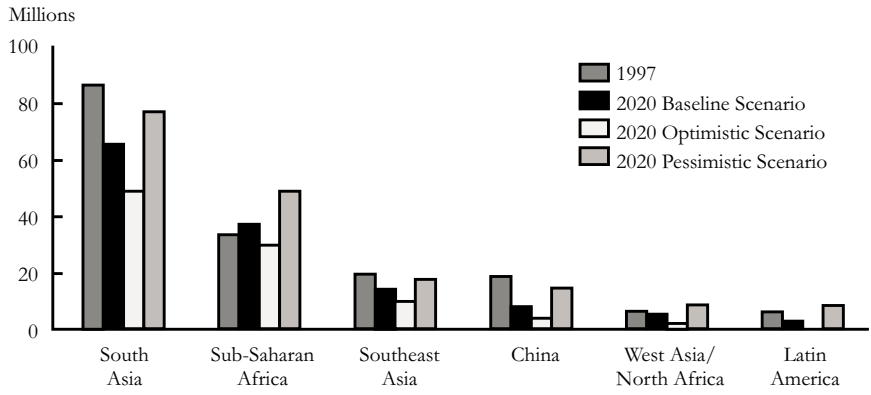
But how much of a difference do these humanly controlled factors make? Put another way, how would the world be different in 2020 as a result of a concentrated effort to improve the global food situation? How different would that be from a world in which governments, civil society, the private sector, and indeed all stakeholders devoted little attention to such issues?

Compare two alternative futures, an optimistic scenario characterized by increased attention to key drivers of food security and a pessimistic scenario characterized by relative neglect of these key drivers. In the first, economic growth accelerates by 25 percent, compared with the baseline projection, and population growth rates decline. The number of people with access to clean water and the number of women with access to secondary education both increase by 10 percent. Depending on the region, agricultural yields increase between 10 and 20 percent faster than anticipated by the baseline scenario. The area of irrigated land increases substantially.

The second alternative foresees a reversal of these developments. Instead of accelerating, economic growth slows, while populations grow more rapidly. Access to clean water and to education declines. Agricultural yields slow down, and no additional land is irrigated.

Global cereal production in the more optimistic scenario increases by 5 percent relative to the baseline scenario, whereas it decreases by 4 percent in the pessimistic scenario. Moreover, in the first scenario, food becomes much cheaper. Rice, for instance, falls in price by 44 percent compared with the 2020 baseline projection. In the pessimistic scenario, by contrast, its price rises by 45 percent. These shifts in food production and prices reverberate through world food markets. If food production should increase substantially, Asian countries would become less dependent on imports for their food supplies because they would be able to grow more of their own food. Sub-Saharan Africa, on the other hand, would import more, because food would become more affordable. If food production stagnated, on the other hand,

Figure 17 Malnourished children in 1997 and 2020 under alternative scenarios



Source: IFPRI IMPACT projection, June 2001.

South Asia's net imports of food would rise by 90 percent. Sub-Saharan Africa would increasingly become priced out of world food markets; the region's consumers would need just as much food but would not have the income to buy it.

The most dramatic result of this simulation is also the most vital for humanity. The two alternatives for the future show enormous differences in the ability of families to feed their children. Under the optimistic scenario, the number of malnourished children in developing nations would decline from 166 million in 1997 to 94 million in 2020, well below the 132 million of the baseline scenario. In China, this number would drop by 80 percent over two decades. Latin America could virtually eliminate the scourge of malnutrition. In Sub-Saharan Africa, where childhood malnutrition is now on the rise, progress would be less dramatic but still substantial. Instead of increasing, as predicted by baseline estimates, the number of malnourished children would decrease by 3 million (Figure 17). The central causes of this improvement in child malnutrition are threefold: broad-based and rapid agricultural productivity and economic growth, reduction in population growth rates, and increased investment in education and health. Each factor accounts for about one-third of the improvement in childhood malnutrition.

The pessimistic scenario, on the other hand, depicts a slowly unfolding catastrophe. Instead of substantial declines in the childhood malnutrition over the next 20 years, the problem would become worse, especially in Sub-Saharan Africa, where the number of malnourished children would increase from 33 million to 49 million. On a global scale, the developing countries would be home to 178 million malnourished children, compared with 94 million in the optimistic scenario. This is the human price of economic and agricultural failure.

Livestock to 2020: The Next Food Revolution

Christopher Delgado, Mark Rosegrant, Henning Steinfeld, Simeon Ehui, and Claude Courbois
2020 Discussion Paper 28, Washington, DC: IFPRI with the Food and Agriculture Organization of the United Nations and the International Livestock Research Institute, 1999, pages 59, 63, and 65

Truly it is not inappropriate to use the term "Livestock Revolution" to describe events in world agriculture in the next 20 years. Like the well-known Green Revolution, the label is a simple and convenient expression that summarizes a complex series of interrelated processes and outcomes. As in the case of cereals, the stakes for the poor in developing countries are enormous. Not unlike the Green Revolution, the "revolutionary" aspect comes from the participation of developing countries on a large scale in transformations that had previously occurred mostly in the temperate zones of developed countries. And like the gradually but steadily rising cereal yields in the 1970s and 1980s that typified the Green Revolution, the Livestock Revolution started off gradually and increased its rate of growth. But the similarities end there.

The Green Revolution for cereals was a supply-side phenomenon; it rested on fundamental technological change and the adaptation and extension of seed-fertilizer innovations in developing countries. The Livestock Revolution is demand-driven. With notable exceptions for milk and poultry in the developed countries, where technological progress arguably preceded and precipitated changes in demand through lower prices, the supply side of the Livestock Revolution until now has mostly responded—often under distorted incentives—to rapid increases in demand.

This paper shows that the Revolution has seven specific characteristics, each of which offers both dangers and positive opportunities for human welfare and environmental sustainability. The seven are: (1) rapid worldwide increases in consumption and production of livestock products; (2) a major increase in the share of developing countries in total livestock production and consumption; (3) ongoing change in the status of livestock production from a multipurpose activity with mostly nontradable output to food and feed production in the context of globally integrated markets; (4) increased substitution of meat and milk for grain in the human diet; (5) rapid rise in the use of cereal-based feeds; (6) greater stress put on grazing resources along with more land-intensive production closer to cities; and (7) the emergence of rapid technological change in livestock production and processing in industrial systems. . . .

Taken together, the many opportunities and dangers of the Livestock Revolution discussed above suggest that it would be foolish for developing countries to adopt a laissez faire policy for livestock development. . . . The focus here . . . is on

the four broad pillars on which to base a desirable livestock development strategy for developing countries. These are (1) removing policy distortions that artificially magnify economies of scale in livestock production; (2) building participatory institutions of collective action for small-scale farmers that allow them to be vertically integrated with livestock processors and input suppliers; (3) creating the environment in which farmers will increase investment in ways to improve productivity in the livestock sector; and (4) promoting effective regulatory institutions to deal with the threat of environmental and health crises stemming from livestock. . . .

In sum, it is unwise to think that the Livestock Revolution will somehow go away in response to moral suasion by well-meaning development partners. It is a structural phenomenon that is here to stay. How bad or how good it will be for the populations of developing countries is intricately bound up with how countries choose to approach the Livestock Revolution. Policies can significantly improve poverty alleviation, environmental sustainability, and public health, but only if new actions are undertaken. Failing to act risks throwing away one of the few dynamic economic trends that can be used to improve the lives of poor rural people in developing countries.

Fish to 2020: Supply and Demand in Changing Global Markets

Christopher L. Delgado, Nikolas Wada, Mark W. Rosegrant, Siet Meijer, and Mahfuzuddin Ahmed

Washington, DC: IFPRI, and Penang, Malaysia: WorldFish Center, 2003, pages 151–152

Five major structural shifts can be predicted for global fisheries in relation to developing countries, aquaculture development, poverty alleviation, and environmental sustainability. These "sea changes" (in the full sense) are already underway, although they are more visible in some cases than in others; by 2020, they will be pervasive. Forward-looking policy discourse, research, and technology development addressing the above issues should focus on these changes.

First, developing countries, particularly in Asia, will dominate production systems; aquaculture development is central to this shift, but it will become more apparent in capture fisheries as well. The remaining quarter of world marine capture fisheries that are not fully exploited (and which are all in the tropics, largely within the EEZs [exclusive economic zones] of developing countries) will become more heavily fished.

Second, the source of net fisheries exports on a global scale has already shifted from the North to the South, and South-South trade will become increasingly

important with the further emergence of urban middle classes. Developed countries will continue to be large net importers, and their domestic producers will continue to gradually exit the sector. Over time, it is likely that public policy in the North will increasingly favor import-friendly regimes for fish. On the other hand, it is quite possible that trade wars—perhaps based on both real and spurious food safety claims—will become more prominent in the South. Fish will become an increasingly high-value food commodity in relative terms, and trade is likely to continue to shift from low-grade and frozen whole fish to fresh fillets and the like.

Third, environmental controversy will continue in the fisheries sector but will change focus. Overfishing in marine areas will remain a huge concern. Sustainability-motivated environmental regulations and institutions will rapidly become more prominent, starting in the developed countries and then spreading to developing countries. Relatively more attention will be devoted to the exploitation of reduction fisheries and of the stocks preyed on by traditional marine food fish. It seems likely that the relationship between pollution and food safety in fisheries will be given much more attention in both the North and the South. If problems become worse, and as the consumer base for fish becomes larger and more wealthy, more attention will be given to sources of pollution such as dioxins, PCBs, and heavy metal residues that accumulate in food fish, directly affecting capture fisheries and both directly and indirectly affecting aquaculture (through reduction fish). These pollution sources are outside the fisheries sector (via runoffs from agricultural chemicals, industrial dumping of heavy metals, chemical-laden rain, and so on), and the interests behind the activities causing the pollution have typically been stronger than the constituency worried about the pollution's effects on fisheries—but this will change.

Fourth, the importance and focus of fisheries technology development will also shift to meet new challenges. Technology to profitably reduce the fishmeal and fish oil requirements for carnivorous aquaculture are key, and efforts will be expanded by private-sector interests. Some efforts will be focused on fish, others on synthetic feeds, and still others on modification of crops used in aquafeeds. Private-sector technology development will also continue to find ways to lessen the negative environmental impacts of intensifying large-scale aquaculture, through the design of relatively capital-intensive innovations. In the public arena, interest will increase in finding technological solutions to mitigate the negative environmental externalities associated with progressive intensification of small-scale pond aquaculture under tropical conditions, where, to date, technological solutions to environmental problems have not been forthcoming. Environmental and food-safety regulations that require capital-intensive approaches to compliance will receive increased scrutiny. In capture fisheries, information technologies for improved management will become increasingly important both in the North and the South but will pay off for

public purposes only where the right form of institutional development accompanies use of the technology.

Fifth and finally, the issue of institutional development in fisheries will be a necessary condition for poverty reduction through fisheries development, as it is for improving environmental sustainability and food safety. The outlook for traditional fishers in developing countries in the absence of such institutional innovation is not bright. Both capture and culture fisheries are scaling-up and becoming more capital-intensive, and increased focus on food safety and environmental externalities under current technologies is likely to further this tendency. Food safety certification will become important to the survival of all fishers in the next two decades, and eco-labeling will become important to most. The world has not yet found a way to deliver such certifications cost-effectively and credibly to large numbers of small-scale fish producers, but the stakes are increasingly clear.

Essay

A Look Back and a Look Ahead for IFPRI

Dale E. Hathaway
IFPRI Director, 1975–77

I will begin by looking back at the circumstances under which IFPRI was founded in the mid-1970s and then look forward at some trade issues that may affect how IFPRI approaches research on trade as it affects developing countries, and particularly agriculture in those countries.

Why was there a call for an international institute to conduct food policy research in the mid-1970s? Concern about global food supply and distribution was enormous, and there was no independent, international organization prepared to deal with broad food-related issues from a developing-country perspective. Yet the idea of creating such an institute was not universally embraced. The Technical Advisory Committee of the Consultative Group on International Agricultural Research (CGIAR), established in 1971, proposed forming an international policy institute in the early 1970s, but the CGIAR rejected the idea. It was not until three other organizations—the Ford Foundation, the Rockefeller Foundation, and the International Development Research Centre (IDRC)—decided to move forward on the idea that IFPRI was created. At the end of 1974, the three organizations made a commitment to support IFPRI for five years, assuming that it would eventually be accepted as a center of the CGIAR, which it ultimately was. And in 1975, IFPRI opened its doors.[1]

The first Board of Trustees, headed by Sir John Crawford, appointed me director of the new institute after my detail at the World Food Conference

1. For more on IFPRI's early history, see Curt Farrar, *IFPRI's First 10 Years* (Washington, DC: IFPRI, 2000).

Secretariat for the Ford Foundation. In my prospectus for the new institute, I spelled out three possible ways of dealing with the world food shortage:

1. an increased rate of growth in food production in developing countries

2. increased commercial imports of food by food-deficit developing countries

3. greater concessionary food aid to some developing countries

I thought it likely that all three approaches would be followed. Each would involve significant policy decisions by governments and international organizations. And the success or failure of these three actions would depend heavily on the appropriateness of these decisions. The developing countries at that time had little capacity to conduct technical analysis on these issues. So we believed that a food policy institute that conducted research and policy analysis on food production, trade, and other such issues could add to the stock of knowledge upon which national governments and international organizations would base their decisions.

We saw IFPRI's objectives as follows:

1. using all available sources of information, to provide an objective analysis of the current and prospective world food situation and the implications of this analysis for policymakers giving special emphasis to the needs of developing countries;

2. to identify major opportunities for expanding world food production, giving emphasis to development actions and policies best suited to reducing constraints on production, and to establishing a framework for the sustained use of the agricultural production capacities which exist in low income nations;

3. to determine and publicize those actions which could be undertaken, and those policies which could be adopted by governments, regional and international agencies, to effect a continued increase in the quantity and quality of food supplies available to all people—through enhanced food production, wider trade opportunities, and improved efficiency and equity in food distribution.

These objectives guided IFPRI as it got off the ground in the mid-1970s. In 1977 I left IFPRI for the U.S. Department of Agriculture, and John Mellor ably took over the reins as the new director.

I have spent my career working largely on trade issues. I will take a brief look at the decades during which I have been active in policy analysis and in trade negotiations to recount a few facts as I perceived them. Then I will identify a few key lessons that might have a bearing on the next rounds of trade policy analysis and negotiations.

Here is how I would characterize the past five decades of international trade: The 1960s were a decade of commodity agreements, during which there were huge accumulations of grain stocks and attempts to negotiate price stabilization for grains. Overall these efforts produced few results. The 1970s were a period of shocks and continued stabilization efforts. There was a huge run-up of world grain prices. Although no significant new arrangements emerged, there was a build-up of production capacities and stocks. In the 1980s, we were coping with collapsing commodity prices. The United States undertook new programs to reduce production capacity via land retirement, with little impact on prices, and started to move to tariffication of trade barriers. The 1990s were marked by attempts to resuscitate international trade negotiations in agriculture, including discussions about reducing trade barriers. The main result was preparation for follow-up in the next round of trade negotiations. The first decade of the new millennium appears headed in the direction of reforming domestic policies to avoid trade distortions. Developing countries have become a major force in trade negotiations by focusing on domestic reform in the rich countries. It remains to be seen how successful they will be. Much depends on the leverage the developing countries can bring to bear on rich countries, for there is substantial resistance to domestic reform in Europe, Japan, and the United States.

The experiences I have described suggest four lessons that might be relevant for the future.

Lesson number one: Trade negotiations are driven by perceived self-interest, not enlightened self-interest. Do not expect revolutionary changes. Do not expect quick success. Trade negotiations will continue to be tedious.

Lesson number two: The focus on reforming national policies is crucial! But negotiations will continue to be driven by special interest groups. As we have seen in Europe, however, new domestic alliances around food and the environment are creating new balances of power, which in turn affect the direction of international negotiations. The formation of new alliances and

new political balances is much slower in Japan and the United States, but it is taking place.

Lesson number three: Poor developing countries will *not* benefit that much from agricultural trade liberalization. We should not assume that trade policies can solve international social problems. Poor countries will not benefit from trade liberalization as much as some World Bank reports would want us to believe.

Lesson number four: Trade negotiations require continued support through impartial facts and analysis. Granted, trade negotiations will remain a political business. The idea that rationality will drive negotiations is an illusion. On the other hand, relying on solid and impartial facts will help us all to become more effective.

Dale E. Hathaway was the founding director of IFPRI. He was also undersecretary for international affairs and commodity programs of the U.S. Department of Agriculture and executive director of the National Center for Food and Agricultural Policy.

Chapter 3

Development Strategies and the Role of Food and Agriculture

From Growth Linkages to Institutions and Economywide Policy Analysis

In the 1960s and 1970s agriculture was a backwater in the development profession—industrialization was "where the action was," notwithstanding the fact that many countries were getting poorer and hungrier. The Green Revolution in Asia changed all that. The boost in agricultural productivity that came from the use of high-yielding varieties of wheat and rice started raising farmers' incomes and lowering food prices. The induced innovation model of agricultural development proposed by Yujiro Hayami and Vernon Ruttan pointed out the importance of biotechnological change in promoting agricultural productivity in land-scarce countries. This model, together with Ruttan's later work, contributed siginificantly to convincing developing countries and the donor community that effective national and international agricultural research systems are key to agricultural development.

Agricultural growth not only contributed directly to poverty reduction in rural areas, but also spread from there to other parts of the economy. John Mellor, IFPRI's second director general, was a pioneer in exploring the growth linkages between agriculture and the rest of the economy, and IFPRI researchers have conducted numerous empirical studies to spell out how these linkages worked and how policy could play a role in strengthening them (see excerpts from *Rural Growth Linkages: Household Expenditure Patterns in Malaysia and Nigeria,* Peter B. R. Hazell and Ailsa Röell, 1983; and *Agricultural Change and Rural Poverty: Variations on a Theme by Dharm Narain,* John W. Mellor and Gunvant M. Desai, eds., 1985).

Since the early work on agricultural growth linkages, strategy research at IFPRI has grown to include examination of the political economy of food policy—what are the incentives operating on various actors in the food policy arena (see excerpt from *The Political Economy of Food and Nutrition Policies,* Per Pinstrup-Andersen, ed., 1993)?

Of strategic importance in the 1980s and early 1990s were considerations about the role of agriculture "on the road toward industrialization" and the opportunities and pitfalls of agricultural commercialization for development and food security. IFPRI conducted extensive analytical and empirical research projects to help clarify these issues and to correct the conventional wisdom (see excerpts from *Agriculture on the Road to Industrialization,* John Mellor, ed., 1995; and *Agricultural Commercialization, Economic Development, and Nutrition,* Joachim von Braun and Eileen Kennedy, eds., 1994).

Outside of IFPRI, researchers such as Walter Falcon and Peter Timmer emphasized the role of agriculture in economic transformation—that is, how the role of agriculture may change over time in the course of economic development, from providing surplus labor and capital for industrialization in developing countries to being a protected sector in industrialized economies.

In the early 1990s dynamic changes were taking place in rural credit and microfinance, with a household and gender perspective. IFPRI responded by highlighting the circumstances under which these institutional innovations would contribute to food and nutrition security (see excerpt from *The Triangle of Microfinance: Financial Sustainability, Outreach, and Impact,* Manfred Zeller and Richard L. Meyer, eds., 2002).

Beginning in the late 1990s, researchers began to study which kinds of public investments can make the biggest dent in rural poverty, to help governments set priorities for their public spending (see excerpts from *Linkages between Government Spending, Growth, and Poverty in Rural India,* Shenggen Fan, Peter Hazell, and Sukhadeo Thorat, 1999; and from *Road Development, Economic Growth, and Poverty Reduction in China,* Shenggen Fan and Connie Chan-Kang, 2005).

As the agricultural sector shrinks, relatively speaking, in a successful economic growth and transformation process, an economywide perspective on food and agriculture becomes even more important. IFPRI included that perspective in its research program led by Sherman Robinson in the 1990s, making significant contributions to research on computable general equilibrium (CGE) modeling (see excerpt from *A Standard Computable General Equilibrium (CGE) Model in GAMS,* Hans Löfgren, Rebecca Lee Harris, and Sherman Robinson, 2002). Since then, the important economywide perspectives in development thinking and related modeling (especially as provided by leading scholars such as François Bourguignon, Tom

Hertel, and others) have become part of the mainstream in several IFPRI research programs.

In more recent years IFPRI has undertaken research to better understand and support development of food and agriculture strategies in the context of overall development strategies of developing countries. It has also devoted research and communications activities to the issues encapsulated in the Millennium Development Goals (MDGs) and to steps for achieving those targets. And it has at times stepped back to take a big-picture view of the world food situation, laying out its vision for what is required to achieve global food and nutrition security (see excerpts from *Ending Hunger in Our Lifetime: Food Security and Globalization,* C. Ford Runge, Benjamin Senauer, Philip G. Pardey, and Mark W. Rosegrant, 2003; and *Reaching Sustainable Food Security for All by 2020: Getting the Priorities Right and Responsibilities Right,* 2002). The 2005 report of the United Nations Millennium Project's Hunger Task Force, *Halving Hunger: It Can Be Done,* with which IFPRI was closely involved, is a clear reflection of the directions and findings championed by IFPRI over the years.

Whereas much of IFPRI's early work on development strategy concentrated on Asia, which had suffered from food crises in the 1960s and 1970s, by the 1980s there was growing recognition of the intractable poverty, hunger, and malnutrition in Africa. As a result, the locus of IFPRI's attention has been expanded to include extensive work in Africa (see excerpts from *A Way Forward from the 2020 Africa Conference,* 2004; and *Transforming the Rural Asian Economy: The Unfinished Revolution,* Mark W. Rosegrant and Peter B. R. Hazell, 2000).

Rural Growth Linkages: Household Expenditure Patterns in Malaysia and Nigeria

Peter B. R. Hazell and Ailsa Röell
IFPRI Research Report 41, Washington, DC: IFPRI, 1983, pages 54–56

The analysis has shown that in both Muda [Malaysia] and Gusau [Nigeria], the share of any increment to total household expenditures that is allocated to foodgrains is much lower for high income than low income households. At the same time, the share of incremental expenditure allocated to local nontradables is greater. In Muda the additional expenditure on nontradables goes mostly to nonfood goods and services, particularly those associated with housing, education, health, transport, personal services, entertainment, and social obligations and festivities. In contrast, additional expenditures on nontradables in Gusau are focused on higher quality foods, particularly fruits, vegetables, meat, and dairy products. The results are similar when the households are sorted according to the size of the farms; the larger farm households behave like the richer households and the smaller households behave like the poorer households, even though there is a surprisingly low correlation between farm size and per capita expenditure in both study areas.

In both regions aggregate income depends heavily on the production of agricultural crops, particularly foodgrains, the greater part of which are exported out of the region at given prices. The production of these crops is fixed by the land and technology available, and can only be increased through the kinds of public investments that were undertaken by the World Bank. In contrast, the output of most nontradables is essentially constrained by demand, and the underlying supply structure is elastic.

Within this simplifying framework, the households of the larger farms in Muda have the most desired expenditure patterns for stimulating secondary rounds of growth in the local economy. Furthermore, this growth would be focused on locally produced nonfood goods and services whose production is labor intensive. The larger farms are therefore suitable targets for technology or for public investment that increases agricultural production.

A similar though more qualified conclusion holds for Gusau. Focusing agricultural growth on the larger farms would do more to stimulate the local economy, but the linkages would be mostly with other farmers who produce eggs and dairy products, such as the Fulani. The amount of secondary growth induced in the region is not likely to be nearly as large as in Muda, nor would it be as labor intensive.

It is tempting to conclude that the Muda results are typical of the labor-intensive agricultural systems of Asia, whereas the Gusau results typify the contrasting situation in Africa, where land/man ratios are high. But this thought is tempered by the

Mudalike results obtained by King and Byerlee for rural Sierra Leone, and by the similarity of the regional land/man ratios in Muda and Gusau. A more plausible explanation of the different results lies in the more poorly developed infrastructure in Gusau, and particularly the poor communication links between the villages and towns. These undoubtedly impede farm household access to nonfood goods and services and increase their cost relative to the price of foods. Within that setting, even the richer households will be discouraged from diversifying their expenditure into nonfoods.

The conclusion that large farms are desired targets for technology or public investments that increase agricultural production warrants a number of important qualifications.

First, the simplifying assumption about the supply structure of nontradables may be wrong. The secondary growth induced in a region by increases in agricultural productivity will be greater if the initial income gains accrue to households that spend the largest shares of their gain on nontradables that have elastic supplies. If some types of nontradables are found to have inelastic supplies, then the conclusion may have to be modified. More generally, one might expect the supply elasticities of nontradables to depend on how well developed the infrastructure of the region is and on government policies that assist or impede nonfarm businesses. If so, these are areas in which public policy can act to increase the supply elasticities and hence to enhance the regional multipliers arising from agricultural growth.

Second, increased consumption of foodgrains is only undesirable within the region if the demand for its exports is elastic. This is a fair characterization of the Muda and Gusau regions, but it may not be true for all poor rural regions. If the export demand is inelastic, then increased regional consumption of foodgrains would increase both export revenues and regional income. Since small farmers spend larger shares of incremental income on foodgrains, they would become much more attractive targets for increases in agricultural productivity.

Third, household savings have been ignored. Richer households generally save larger shares of incremental income, and unless these savings are invested locally in goods or services with a high content of nontradables, they could easily become a significant source of leakage from the regional economy. But savings are typically a small share of incremental income, so the bias against nontradables in investment expenditure would have to be large to offset the strong consumption links to nontradables exhibited by richer households.

Fourth, if larger farms are more mechanized, then the amount of extra employment they will generate directly in agriculture as a result of productivity increases will be less than if the same productivity increases were focused on small farms. This loss in direct employment must be offset by the greater amounts of indirect em-

ployment generated by the expenditures of large farm households. This concern was not particularly relevant in Muda or Gusau at the time of the surveys, but it is more relevant today in Muda as a result of widespread mechanization of land preparation and harvesting activities. However, since mechanization services are widely available on a contract basis, differences in technique are probably more related to field topography and the physical possibilities for mechanization than to farm size.

Fifth, the conclusion presumes that regional growth is an end in itself and it gives no regard to spillover effects that might be induced elsewhere in the national economy. For example, imports into the study regions are leakages as far as regional growth is concerned. But if these goods are produced in other poor rural areas, or if they create jobs for the urban poor, they will still be desirable from the national viewpoint. Similarly, savings that are invested outside the region represent a loss to regional growth, but they are nevertheless valuable in furthering national economic growth. This regional preoccupation was defended on the grounds that Muda and Gusau were relatively backward regions within their national economies, and were linked poorly to other rural areas. This argument will not be valid for all rural regions, nor will it suffice once a region has benefited substantially from public investments or agricultural technology.

Sixth, it must be stressed that the large farms in our samples are really medium-sized farms by most standards, particularly when the productivity of the land is considered. In Muda the average size of farms in the top decile is only 11 acres, and in Gusau it is 42 acres. It is possible that the marginal budget share for nontradables eventually peaks out when plotted against farm size and that large shares of incremental income received by really large farms are spent on regional (if not national) imports. But these hypotheses will have to be tested in less egalitarian societies than Muda or Gusau.

Despite these qualifications, this analysis highlights the potentially important role that "middle-sized" farms, such as the large farms of Muda and Gusau, may have to play in enhancing the downstream effects of agricultural growth. In this sense, the study provides additional empirical evidence to support Mellor's pioneering thinking on this subject.[51]

A less favorable aspect of these findings is that they do suggest a trade-off between growth and equity in rural growth. Targeting technologies or public investments on small farms leads to immediate equity and production gains, but the secondary growth in income and employment generated by that increased production may not be nearly as great as it would be if the initial increase in agricultural pro-

51. Mellor, *New Economics of Growth.*

duction were focused on middle-sized farms instead. Such trade-offs between growth and equity are accentuated by the fact that richer households probably benefit more from the secondary income growth than do the poor. Focusing productivity gains on middle-sized farms may accelerate regional growth, some of which will help alleviate absolute poverty and malnutrition. But this strategy might lead to a worsening of the relative distribution of incomes in rural areas. To the extent that these trade-offs exist, a suitable balance can be achieved by targeting agricultural technologies and public investments on a broad range of farm size groups.

Agricultural Change and Rural Poverty: Variations on a Theme by Dharm Narain

Edited by John W. Mellor and Gunvant M. Desai
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1985, pages xi–xii and 208–210

During the past two decades there has been increasing concern that the development strategies of the 1950s and 1960s would neither eliminate nor even greatly reduce rural poverty—even as the pervasive nature of that poverty became more widely recognized. This increase in concern coincided with the drama of the major biological breakthroughs in food production associated with the "green revolution." A debate began on whether there was a causal relation between the technology of the green revolution and the incidence of rural poverty. The conclusion of this debate is of importance not only because food is vital but because population growth is placing greater pressure on existing food supplies and because limited land area is shifting the means of expanding food production towards yield-increasing technology. If the means of increasing food production are associated with immiserizing processes, the prospects for the poor are bleak, and policies must be sought to break such a connection.

Beyond this contemporary debate about the green revolution, mitigation of poverty requires knowledge of what are now recognized as enormously complex causes. Empirical identification of these causes is a formidable task because of the conceptual issues involved in defining the many dimensions of poverty, the data constraints in measuring its incidence, and the econometric problems in estimating the relationships between the causal factors and the poverty levels. The papers in this volume analyze these questions from several points of view. A notable finding pointed up in these papers is the enormous short-term fluctuation in the number of rural people in absolute poverty. Why this fluctuation occurs and what can and should be done about it is an important issue. The papers also note sub-

stantial differences in the levels of poverty from one place to another despite similarities in average income and stage of development. Such differences provide the basis for understanding more about the causes of poverty and hence the means of treating it. . . .

This volume originates from Dharm Narain's unfinished research on the forces behind temporal changes in rural poverty. At the heart of his efforts was the idea that rural poverty is a function of the growth performance of agriculture, of prices of commodities consumed by the rural poor, and of a set of trend factors. Unfortunately, he passed away just when results of his efforts were beginning to emerge.

To discuss and extend Dharm Narain's work, persons familiar with his research who are scholars in their own right were invited to write papers covering different aspects of rural poverty. . . .

Seven broad policy conclusions can be stated based on this synthesis. First, in largely rural low-income countries, accelerated growth in agricultural production is central to alleviating poverty, and technological change is, in turn, central to that process. This leads not only to strengthening of agricultural research and rapid promulgation of research results but also to enhanced investment in infrastructure, including roads, rural electrification, irrigation, and drainage. It also leads to institutional changes and other policies to help spread the technology, especially to small farmers.

Second, all pervasive technological change in agriculture takes time. In the short run new technology may be confined to a few areas, which may exacerbate regional income disparities. If yield-based growth in agricultural production remains confined to a small geographical base, excess demand may soon push up the unit cost of agricultural output because of diminishing returns and hurt the poor as consumers. Thus, on several grounds, efforts in research and institutional change need to be expanded to broad national coverage.

Third, rapid growth in the agricultural population is a dominating factor in creating rural poverty. Population growth has this deleterious effect through added pressure on employment opportunities which reduce the income flow to labor and through the upward pressure on food prices derived from the additional demand arising from the larger population. Thus, population growth can easily nullify the favorable effects from agricultural growth rates of historically large proportions. Thus, effective policies to reduce rates of population growth and to increase nonagricultural employment opportunities as well as to absorb population in agriculture itself are vital to reduce rural poverty.

Fourth, there is a huge potential for agricultural production growth to stimulate growth of employment in the secondary and tertiary sectors of the rural economy. But this also requires policies that facilitate the growth of such employment

by developing activities such as dairying, poultry raising, fisheries, and sericulture; establishing agroprocessing industries in the rural areas; and facilitating growth of consumer-goods industries and services. The role of infrastructural and institutional development, as well as technical education, in these activities is crucial. Such diversification of the rural economy counters the inequalities that may result in the initial stages of technological change in agriculture, because the diversification benefits the landless poor. It also minimizes the need for price-support programs to promote technological change, because it expands effective demand for agricultural output. In the long run, diversification of the rural economy is important because it siphons some of the rapidly growing labor force from agricultural to nonagricultural activities.

Fifth, low consumer food prices are highly favorable to the poor. Therefore, changes in food prices may be an extremely important diagnostic tool for spotting increases in poverty and taking counteractions. Food prices have an especially strong effect on changes in poverty in the short run. This leads to a concern for policies that counter high food prices by subsidizing food prices for the poor or by increasing their employment. The divergence of the calorie and income measures of the incidence of poverty leads to a further emphasis on food subsidies if nutrition considerations are to receive special weight in a market-oriented pricing system. If the fiscal and administrative burden of such antipoverty programs is not to increase so much that public resources for other development tasks are depleted, it is especially important to contain the rising cost of producing additional agricultural output. This brings us back to the need for cost-reducing technology and the need to extend agricultural growth to areas and farms with factor endowments reflecting lower costs.

Sixth, disparities in the distribution of assets and power, which are often based on the social as well as the economic structure, must be recognized, and continuous monitoring must be provided to ensure prompt initiation of special programs to ensure access to inputs, to markets, and to employment of the most disadvantaged people. The need for radical institutional changes may have been overstated in recent years vis-à-vis technological change in agriculture, but the necessity for such change must always be examined. In this context, state-sponsored dualism, which is so frequent now in Africa, must be guarded against. Although it is beyond the scope of this volume to examine dualism in detail, a full attack must be made on all discriminatory practices that restrain the poor.

Seventh, socioeconomic research is important for defining effective policies for the poor. First, it is needed to accelerate technological change and to ensure broad participation in those processes. Second, efficient price policies that are fiscally acceptable, encourage production, and protect the poor need to be generated. Third,

policies must be found to reinforce indirect favorable effects on employment. Fourth, widespread studies of poor families are needed so that both long-term and short-term policies can be structured to the actual profiles of poverty as they vary from place to place and time to time.

The Political Economy of Food and Nutrition Policies

Edited by Per Pinstrup-Andersen
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1993, pages 225–227

Policy and Program Types

It seems clear from the evidence presented in this book and elsewhere that food and nutrition-related policies and programs are at least as susceptible to political economy considerations and manipulations as other government policies and programs. Since nutrition-related policies and programs are needed to correct for undesired effects of a skewed asset distribution and insufficient endowment among certain population groups, they usually involve direct government transfers or market distortions. Opportunities for capturing the resulting benefits and rents are present, and the competition from groups that are not at risk of malnutrition is strong.

Nutrition does not have a natural home in government, in contrast to, say agriculture or health. Therefore, in the traditional structure and organization of the government, it is unlikely that any government agency places first priority on nutrition improvements. Past multisectoral nutrition planning efforts were made to remedy this situation by creating new institutional arrangements; including nutrition units in various ministries or the president's office and in semiautonomous nutrition institutes. However, even in cases where special responsibilities and powers were given to these new units to override priorities of existing sectoral ministries and related agencies, the results were disappointing. The existing power structure and vested interests within it made it virtually impossible for the nutrition units to achieve the prescribed goals. In spite of a great deal of rhetoric, integrated multidisciplinary nutrition strategies or policies generally exist only on paper. Although an integrated multidisciplinary approach makes eminent sense from a nutrition perspective, such an approach cannot be effective within most countries' political economy framework.

This does not mean, however, that efforts to improve nutrition should be relegated to the ministry of health and limited to small, direct intervention programs as practiced in the past. Most government policies and programs have implications for the nutritional status of the poor, irrespective of their intent. Therefore, rather

than dealing with nutrition problems only in programs designed specifically for that purpose, it is important to consider explicitly the nutritional effects in deliberations, design, and implementation of all policies and programs expected to have significant nutrition implications.

Policies and programs that can be expected to influence incomes of the poor, the prices of food and other basic necessities, access to primary health care, sanitary conditions, and access to clean water offer great promise for improving nutrition. Unfortunately, these same types of policies and programs may also be harmful for nutrition. If the nutrition effects are explicitly considered at the time of policy choice, design, and implementation, desirable effects may be enhanced and undesirable ones avoided.

In addition to food price, wage, and employment policies, transfer and social programs of various kinds, and health programs, close attention should be paid to macroeconomic and sectoral adjustment as well as to agricultural policies and programs affecting productivity, cost of production and marketing, access to input and output markets by small-scale farmers, and land tenure. Finally, the magnitudes and nature of changes in rural infrastructure may have important implications for the rural poor's nutrition within as well as outside agriculture, because their income-generating capabilities as well as their access to food and nonfood commodities and the prices they have to pay for them may change.

Decisions regarding the above policy and program types are made in different government agencies and influenced by different interest groups with different priorities, which in most cases probably do not include nutrition improvement. Therefore, it is important to generate information not only about the potential effects on the nutritionally at-risk groups but also the effects on the groups who make or influence the policy decisions and the extent to which they are likely to achieve their goals under policy scenarios that are beneficial to nutrition. It is important to explicitly consider the trade-offs, if any, between the achievement of the policy goals and the desired nutrition effects. However, one should not assume that such trade-offs always exist. Better information may identify policy modifications that will result in better nutrition without sacrificing the achievement of the policy goals.

A policy or program may be justified in part by malnutrition, even though the principal policy goal is different. For example, cheap-food policies for the urban populations are frequently justified by the poor's need for sufficient food to meet nutritional requirements, even though no attempts are made to limit access to cheap food to the poor. While nutrition is a convenient justification, other interests are being served. Knowing what those interests are and whom they serve may be an important tool for the enhancement of the nutrition effect. Could the most powerful

interests be served by some alternative policy that would increase the nutrition effect without compromising the political sustainability of the policy? A two-pronged targeting of the nutritionally vulnerable and a large enough subset of the politically powerful to assure sustainability, leaving the rest of the urban population to pay market prices for food, would be one option.

Agriculture on the Road to Industrialization

Edited by John W. Mellor
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1995, pages 324–329

Structural Change and Linkages

. . . The thrust of this examination of the relation between agricultural growth and structural change and their linkages in the process of economic development—or as it is put in the title, agriculture on the road to industrialization—focuses attention on the domestic aspects of development. Professor Gustav Ranis of the Center has turned our attention once more to "domestically oriented development as between agriculture and nonagriculture, a truth which has sometimes been lost sight of in the wake of the oil crisis of the 1970s and the debt crisis of the 1980s, which drew away too much of our attention to the international dimensions of successful economic development."

The cases in this book all emphasize the importance of agricultural exports and how they are hurt by closed-economy processes. International trade is clearly important to the growth process in many other ways as well. That point comes up repeatedly and is strongly represented in this chapter. Professor Ranis is not urging a return to thinking in terms of closed economies, but rather is suggesting that the core around which the international fits is the set of domestic policies and issues. In addition, one does have to worry not just about the economics but also the implicit social policies if the effective demand for growth in developing countries comes largely from foreign sources.

Three key elements of this discussion set it apart from much of the main stream of development economics. First, *technological change* is the most important driving engine of growth—the emphasis then is on the agricultural sector for two reasons. It is initially such a large sector. It has well-proven immense potentials to absorb factor productivity increasing technological change. Second, given the large increase in net national income from technological change in agriculture, the emphasis is on *domestic effective demand,* particularly for consumption goods and services as a driving engine for additional growth. Third, and following from the first two,

is a concern with respect to the characteristics and requirements for growth of the *rural, small- and medium-scale nonagricultural sector,* and particularly the potential for that sector to graduate into playing a major role in the industrialization of the economy.

The approach also assumes substantial market imperfections in low-income countries, particularly in the labor market, but also with respect to the elements Bruce Johnston and Albert Park emphasize in their illuminating chapter on Kenya, such as a whole host of factors under the rubric of scale economies.

The authors of the two cases, Kenya and Thailand, reach clear conclusions of at best a little link between agricultural growth and industrial growth and effectively strike hard against the heart of the argument. The Johnston and Park chapter deals effectively with the arguments in both of those chapters, while concentrating on Kenya. One must understand that labor markets are imperfect in poor countries, that nontradables are critical in labor absorption, and that scale economies in institutional development play an important role. With that understanding, in essence, however, both Kenya and Thailand turn out to illustrate much that is positive with respect to the agriculture-nonagriculture relation. Nevertheless, it is well to first look at the surface message of little link.

First, the Kenya and Thailand studies confirm, and I think without legitimate counterargument, that there is not a strong link between growth in agricultural incomes and the industrial firms of the major metropolitan centers. That is very important. It states that the kind of growth and stimulus desired is not particularly consistent with the kind of industrial growth stimulated even in countries with quite liberal trade regimes. In the Thailand case, the budget share that rural people allocate to the major urban-based consumption goods industry is very small. As an aside, one should point out that the same is roughly true of the mass of urban people also, and that even for those industries the total rural market is some multiple of the urban market (in India, market surveys by large-scale private firms, for their own products, suggest $2^1/_2$ times as large). But that is not the point, the point is that if output is to be led by domestic demand it has a *very* different structure than if it is led by exports. Of course, export industries led by domestic demand have a similar structure for foreign and domestic demand.

Second, their analysis confirms that if one is truly interested in this set of demand-led relationships one needs to develop the data sources. It is striking, that, in the Punjab case, the point is made that the data for the small-scale rural enterprises are completely inadequate and that the author then goes on, inadvertently, to show how superior the Indian data base is in these areas in relation to virtually every other developing country! But the analysis suffers greatly from the data darkness.

Both the Kenya and Thailand cases emphasize the importance of the construction industry, substantially for rural housing, and the Thailand case mentions locally made furniture. Both industries have the potential to expand through learning by doing. Transportation bulks large, and the local component is probably understated, as is the potential to expand repair enterprises into metal working shops, small industries, and eventually larger firms. But this whole approach of starting with a service orientation, evolving to manufacturing, and then growing is alien to the modern approach to stimulating industry at a much larger scale.

The Kenya case remarks on the poor links of rural nonagricultural activities outside the rural area—but the question that now needs to be asked is about the dynamics. One can look to Taiwan for some hints and note that in general the consumer goods industries in urban areas are not producing goods of interest in rural areas. That suggests incorrect industrial policy, along the lines of misguided import substitution. Why is it that in Taiwan so much of even export industry is small scale and located in the countryside? Perhaps the reason for the sharp contrast with the Republic of Korea is that Taiwan's initial steps concentrated on agricultural and domestic demand and substantial domestic capital, whereas Korea was foreign-demand led, and substantially foreign financed, from the start. . . .

Among the most important issues raised in nearly all of the cases was the effect of the distribution of income and assets, or more specifically of land, on the growth of agriculture and its effects on other sectors. In every case in which it was raised, land reform played a major role in the processes at hand wherever land reforms had occurred, or acted as a continuing barrier where it had not. . . .

The land tenure issue has two important implications in the structural transformation context: it influences both production and consumption patterns, and hence the nature of the links to nonagricultural production. . . .

Conclusion

This discussion of linkages concludes with four reminders. First, it is not important to understand the linkage process in detail. Because of the very complexity and flexibility of this process, all that is required, once technology has increased rural purchasing power, is that markets function as they are supposed to and that small- and medium-scale private firms respond to market signals. Second, with rare exception, rapid growth in the agricultural sector is associated with an increase in employment that is sufficiently rapid to raise real wage rates in the relatively short run. Third, employment increases arising from accelerated agricultural growth are broadly distributed throughout rural regions—that is, they are not concentrated in the capital city. And fourth, the employment intensity of the firms stimulated by agricultural growth tends to be fairly high, either because of generally high employment elastic-

ities or sufficiently high cross-elasticities of demand, and thus it is eventually able to shift consumption to employment-intensive activities for which demand is elastic.

Interestingly, several readers of drafts of this manuscript, particularly Hsi Huang Chen, have asked why countries would want to pursue bad development policy to begin with. Richard Sabot raised the same question in a different guise in response to chapter 4, on the Philippines, when he noted that "the distorted trade regime may only be a symptom rather than the underlying cause of the failure by the Philippines to capitalize on rapid agricultural growth." Surely that answer must give us all pause to reflect about the recent round of macroeconomic policy conditioning by the foreign assistance donors.

In Argentina, the "bad" policies seemed designed to strengthen organized labor, and probably the landed aristocracy found an acceptable way to live with a bias against agriculture as long as their asset positions remained undisturbed. In the Philippines, a wealthy elite felt suited to running a large-scale, capital intensive industry in Metro Manila. Again, the landed interests could accommodate if their assets were left undisturbed. If favorable policies for such interests are removed, will those interests be able to think up new favorable policies faster than foreign aid conditioners can think of the means to remove them? When will the weight of political influence swing to growth? What can be done to assist that shift? Can policies be devised that will meet the minimum acceptable needs of the powerful and still provide growth? Perhaps in Argentina the system got so bad that everyone wanted change. Perhaps developing countries are becoming more democratic and providing at least an opportunity to debate policies in support of growth. Perhaps the changes will come innocuously—through the efforts of institutions for technological change in agriculture, expansion of rural infrastructure, the processes described in this book, and a gradual change in political structure. Some bad policy must surely be the result of ignorance. We are at least better at vanquishing ignorance than reforming skewed power structures. Moreover, examples of the economic take-off of the type described here seem to be growing. Like the best of the cases reviewed in this volume, they, too, are all covered with warts. But that is the best news of all. Perfection seems unnecessary for processes and rates of growth that cut poverty in half every 15 years.

Above all, it is important to remember that in-depth analysis is the only way to understand these processes. As mentioned throughout this chapter, the processes are complex and interact with underlying diversity. Broad generalizations are possible, but successful growth requires detailed application. The hope is that this book provides enough hints to move those processes forward.

Agricultural Commercialization, Economic Development, and Nutrition

Edited by Joachim von Braun and Eileen Kennedy
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Agricultural commercialization, economic development, and nutrition are linked with one another. Policies influence the strength and direction of these linkages and welfare outcomes. Ignoring the linkages may be to the disadvantage of the nutritional welfare of the poor; opportunities to improve the well-being of the poor may be lost. In this concluding chapter, we attempt to draw some generalized lessons from the preceding chapters.

Integration of traditional smallholder agriculture into the exchange economy is part of a successful development strategy. Specialization and commercialization of farming households within a more diversified agricultural and rural economy are part of the development process. Specialization and development of markets and trade, which are characteristic of commercialization, are fundamental to economic growth.

Agricultural commercialization in low-income countries will generally grow over the coming decades due to urbanization and growing incentives for regional and farm-specific specialization in the context of diversifying rural economies. An optimistic scenario of a smooth transition from subsistence-oriented smallholder production systems to commercialized agricultural systems, cannot, however, be assumed. The commercialization of agriculture for economic development and nutritional improvement is not a matter of isolated projects but of a range of policies. The policies needed for a smooth transition to overcome the disadvantages of subsistence agriculture are discussed below. They include macro policy reform, infrastructure policy, agricultural technology development and dissemination, land tenure, rural finance policies, and complementary measures in education and health.

A pessimistic scenario where commercialization of agriculture would hamper economic development can be easily painted, too. This could happen in areas where rural infrastructure is deteriorating and the policy and security environment is such that rural households are forced into subsistence orientation. Large parts of Sub-Saharan Africa's rural areas may be threatened by such antidevelopmental trends. A related set of market failure factors may accelerate the shift into subsistence agriculture in several former centrally planned economies, such as in Central Asia. The mix of earlier excessive specialization in agriculture, disruption of interregional exchange, and the absence of social safety nets may further stimulate subsistence orientation. Thus, we may expect that the commercialization of agriculture will not progress smoothly and that there will be backlashes resulting from past or current policy fail-

ures. This topic will probably stay with the development research community for longer than we hope.

However, the developing world cannot afford the inefficiencies in resource allocation, especially of human and land resources, that subsistence agriculture entails under a long-term perspective. Of course, given current infrastructure, technology, education, and social security systems—or rather the lack of all these—subsistence agriculture is often the only feasible and most efficient mode of economic activity in rural areas of low-income countries. To overcome the subsistence orientation, however, in such a way that the poor are not adversely affected even in the short run remains the challenge of policy on commercialization of agriculture for economic development and nutritional improvements.

Scope for Public Policy

The foreign exchange constraints and heavy debt burdens of many developing countries provide further impetus for greater export orientation of agriculture. An expanded and more efficient agricultural export sector is a cornerstone of many economic reform programs in low-income countries.

Obviously, successful development in the staple food sector, through technological change and appropriate sectoral policies, and growth in the cash crop sector are not mutually exclusive. Appropriate policies for input supply, output marketing, and rural infrastructure development benefit both sectors and are crucial for their growth. . . .

While commercialization of agriculture might essentially be considered a matter of stimulated private sector activity, it is also true that public action is essential for facilitation of the power of its "driving forces." As principal driving forces of commercialization, we identified . . . macro and trade policies, market reform, rural infrastructure improvement, and the development of legal and contractual (institutional) environments in which farmers and processors may operate. Policies related to these driving forces will strongly influence the nature and speed of the agricultural commercialization process, which, in turn will determine to which extent and how soon the risks of subsistent agriculture for farmers and nonfarmers, that is, the risks of thin and volatile markets, can be reduced.

The trade and exchange rate policies of countries are of critical importance for the profitability of crops. The picture of protection and taxation in the study settings is mixed: while sugar in the Philippines and Kenya and rice in The Gambia were protected, export vegetables in Guatemala were implicitly taxed. . . . An open trade environment, both domestically and internationally, is a prerequisite for success in capturing the long-run gains from specialization. . . .

It should be stressed that not only at the (macro) level of the driving forces does public and state action play a key role in shaping the commercialization process. It

also applies to the program level. In virtually every one of the 11 cases studied, central or local government action or policies impacted on stimulation of commercialization and its outcomes.

High risks to poor farm households and high transaction costs are the basic reasons for high prevalence of subsistence farming. Subsistence farming must be phased out in low-income countries via developmental progress in the driving forces of commercialization mentioned above. Policy must facilitate a transition that does not unduly replace (old) subsistence-related production risks with (new) market and policy failure risks, which poor smallholders may not be in a position to estimate. Avoidance of trade shocks and concern for appropriate scheduling of input and output market reforms are important considerations in this respect.

Even with well-functioning factor and product markets, it is easy to construct scenarios in which some poor producers would lose from commercialization. Such scenarios discussed below include the "agricultural treadmill," late access to new commercialization and technical options, and a host of "bad policies."

Increased market supply facing highly inelastic demand is one such scenario in which some producers lose. The resulting agricultural treadmill—increased supply leading to lower prices—is a reality with important regional and international dimensions. However, its potentially serious damage is often diluted by inbuilt compensating effects. In particular, the favorable effects for consumers should be taken into account when one is weighing the disadvantages of the agricultural treadmill for small nonadopters. Assessing the effects of commercialization and technical change from the perspective of producers only is misleading. Once the consumption effects and other general equilibrium effects are included in the assessment, the treadmill effects are usually seen to be diffused (Binswanger and von Braun 1991). Commercialization and specialization are usually introduced for commodities whose demand is elastic—often as a means of bypassing the problem of inelastic demand faced by traditional commodities. It is, therefore, difficult to construct scenarios in which commercialization by itself—unaided by failures of institutions, policies, or markets—has adverse consequences.

The relative seriousness for the poor of the various scenarios differs; the worst outcomes arise when several scenarios or effects coincide. Late adoption of new technology or commercialization options is a case in point. The risks associated with new technology or new crops discourage poor farmers from adopting them early; when combined with treadmill effects, late adoption, then, is likely to injure the profits of poor farmers or close their doors to adoption, or both. Many of the case studies in this book show that late adoption is not a general problem, and that policy and program designs have a key role to play. Potential adverse effects can also be mitigated by government action. Credit policies and extension services are often biased against the poor. Government policies can facilitate market or capacity ex-

pansion where doors have been closed and can help the poor to seize opportunities related to commercialization and technical change and thereby derive the benefits (Binswanger and von Braun 1991).

Many adverse circumstances arise not because of the inherent nature of the commercialization opportunity but because of bad policy. Constraints on trade. . . , coercion in production, and ill-advised tenancy laws are government actions that may turn a promising opportunity into a disadvantage for the poor. The answer to many of these issues, then, is policy reform rather than reversal or deceleration of technological advance and commercialization (Nerlove 1988).

The Triangle of Microfinance: Financial Sustainability, Outreach, and Impact

Edited by Manfred Zeller and Richard L. Meyer
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2002, pages 361–363

A new paradigm emerged in the 1990s about the appropriate way to nurture the development of financial markets. The old paradigm, used to rationalize state intervention in small farmer credit programs, defined the financial problem largely as one of overcoming the supposed market imperfections that prevented creditworthy farmers from accessing formal loans. The financial system came to be viewed not as a market but rather as part of the input supply system to promote new technology, stimulate production, and raise incomes. Governments and donors provided large amounts of funds at subsidized rates to lenders that on-lent to targeted clients at cheap rates. The health of financial institutions was largely ignored, as was client demand. The new paradigm now employed widely in microfinance emphasizes the concept of financial sustainability. The costs and risks of lending are considered to be key factors that impede access to loans, and appropriate pricing is viewed as crucial for sustainability. Innovations are valued that reduce costs and risks and are designed to provide more demand-oriented financial products for the poor.

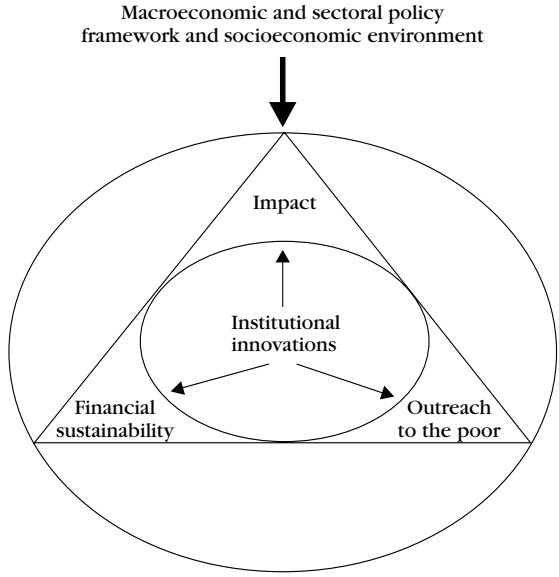
Financial sustainability is now one of the three principal objectives of public support. The second is to improve outreach to the poor, that is, the expansion of the financial frontier to people previously excluded from accessing banking services. Clearly, not all market failures that impede access to finance can be sustainably addressed by the state, but some can, for example through institutional and technological innovations that reduce the costs and risks of microfinance. The third policy objective is to improve the impact of microfinance; that is, to increase the benefits received by the poor. While financial sustainability is a necessary precondition for the stability and permanence of the financial system, outreach to and impact for the

poor are important determinants of the economic sustainability of public support for microfinance. If outreach and impact were not public policy concerns, there would be little justification to invest public resources in microfinance institutions. In this context, subsidies may be a legitimate way to stimulate start-ups and speed innovation rather than create dependency and directly reduce interest rates for borrowers, as was done under the old paradigm.

The three objectives emphasized in the new paradigm of outreach, financial sustainability, and impact form what we term the "critical triangle of microfinance" represented in our conceptual framework schematically represented by Figure 1.1. . . . The inner circle within the triangle represents the many actions and innovations of financial institutions that contribute to meeting these three objectives. Microfinance policy can also contribute through targeted subsidies for institution building and institutional innovations. This circle focuses attention on what financial institutions can and should do. An important difference between the largely failed experience of small farmer agricultural credit and the recent microfinance revolution is the amount of experimentation conducted by MFIs [microfinance institutions] leading to breakthroughs in methods to serve the poor. One of the most important developments is that group lending has been improved so that it works far better for many MFIs today than it ever did for agricultural credit. Moreover, a few flagship organizations, such as BancoSol in Bolivia, the Bank for Agriculture and Agricultural Cooperatives in Thailand, and Bank Rakyat Indonesia-Unit Desas (BRI-UD) in Indonesia, have demonstrated how to expand outreach and improve sustainability simultaneously. Their experience, as well as that of others, provides cautious optimism for a massive, sustained expansion of financial services to those outside the frontier of formal finance by financial institutions that couple microfinance best practices with a commitment to experiment with new approaches for different target groups in diverse socioeconomic and agroecological settings.

The outer circle in Figure 1.1 represents the equally important factors outside the direct control of financial institutions that affect attainment of the three objectives. These are mainly the policy framework, both macroeconomic and sectoral, and the socioeconomic, agroecological, and political conditions influencing the performance of financial institutions. The policy framework primarily includes macroeconomic and financial policies affecting economic growth and stability. It also includes financial infrastructure such as courts, land registries, and property rights, as well as sectoral policies that directly or indirectly influence the economic activities and opportunities of the clientele of MFIs and the demand for financial services. Moreover, the underlying conditions include factors such as population density, telecommunications and road infrastructure, human and social capital, and other determinants of growth and equity. These conditions are particularly relevant

Figure 1.1 The critical triangle in achieving economic sustainability of microfinance



for determining the success and failure of agricultural finance. Repressive urban-oriented policies undermined agriculture and contributed to the failure of agricultural finance programs in the 1960s and 1970s. Recent policy reforms have reduced much of that urban bias, increased the demand for financial services, and improved the prospects for successful rural financial intermediation. Many countries, however, still lack an enabling environment and supportive institutions, so that financial market development in rural areas remains constrained.

Linkages between Government Spending, Growth, and Poverty in Rural India

Shenggen Fan, Peter Hazell, and Sukhadeo Thorat
IFPRI Research Report 110, Washington, DC: IFPRI, 1999, pages ix–xi

Poverty in rural India has declined substantially in recent decades. The percentage of the rural population living below the poverty line fluctuated between 50 and 65 percent prior to the mid-1960s, but then declined steadily to about one-third of the rural population by the early 1990s. This steady decline in poverty was strongly

associated with agricultural growth, particularly the Green Revolution, which in turn was a response to massive public investments in agriculture and rural infrastructure. Public investment in rural areas has also benefited the poor through its impact on the growth of the rural economy, and government expenditure on rural poverty and employment programs, which have grown rapidly, has directly benefited the rural poor.

The primary purpose of this research is to investigate the causes of the decline in rural poverty in India and particularly to determine the specific role that government investments have played. The research aims to quantify the effectiveness of different types of government expenditures in contributing to poverty alleviation. Such information can assist policymakers in targeting their investments more effectively to reduce poverty. More efficient targeting has become increasingly important in an era of macroeconomic reforms in which the government is under pressure to reduce its total budget.

The research uses state-level data to estimate an econometric model that permits calculation of the number of poor people raised above the poverty line for each additional million rupees spent on different expenditure items. The model is also structured to enable identification of the different channels through which different types of government expenditures affect the poor, distinguishing between direct and indirect effects. The direct effects arise in the form of benefits the poor receive from employment programs directly targeted to the rural poor. The indirect effects arise when government investments in rural infrastructure, agricultural research, health, and education of rural people stimulate agricultural and nonagricultural growth, leading to greater employment and income-earning opportunities for the poor and to cheaper food. Understanding these different effects provides useful policy insights for helping to improve the effectiveness of government expenditures in reducing poverty.

But targeting government expenditures simply to reduce poverty is not sufficient. Government expenditures also need to stimulate economic growth, to help generate the resources required for future government expenditures. Such growth is the only way of providing a permanent solution to the poverty problem and to increase the overall welfare of rural people. The model is therefore formulated to measure the impact of different items of government expenditure on growth as well as on poverty, thus enabling the ranking of different types of investment in terms of their growth and poverty impacts, as well as quantifying any trade-offs or complementarities that may arise between the achievement of these two goals.

The results from the model show that government spending on productivity enhancing investments, such as agricultural research and development, irrigation, rural infrastructure (including roads and electricity), and rural development targeted directly to the rural poor, have all contributed to reductions in rural poverty, and

most have also contributed to growth in agricultural productivity. But differences in their poverty and productivity effects are large.

The model has also been used to estimate the marginal returns to agricultural productivity growth and poverty reduction obtainable from additional government expenditures on different technology, infrastructure, and social investments. Additional government expenditure on roads is found to have the largest impact on poverty reduction as well as a significant impact on productivity growth. It is a dominant "win-win" strategy. Additional government spending on agricultural research and extension has the largest impact on agricultural productivity growth, and it also leads to large benefits for the rural poor. It is another "win-win" strategy. Additional government spending on education has the third largest impact on rural poverty reduction, largely as a result of the increases in nonfarm employment and rural wages that it induces.

Additional irrigation investment has the third largest impact on growth in agricultural productivity but only a small impact on rural poverty reduction, even after trickle-down benefits have been allowed for. Additional government spending on rural and community development, including Integrated Rural Development Programs, contributes to reductions in rural poverty, but its impact is smaller than expenditures on roads, agricultural R&D, and education. Additional government expenditures on soil and water conservation and health have no impact on productivity growth, and their effects on poverty through employment generation and wage increases are also small.

The results of this research have important policy implications. In order to reduce rural poverty, the Indian government should give priority to increasing its spending on rural roads and agricultural research and extension. These types of investment not only have a large impact on poverty per rupee spent, they also promote the greatest growth in agricultural productivity. Additional government spending on irrigation has a significant impact on productivity growth, but no discernible impact on poverty reduction. Government spending on power has little impact on either productivity growth or poverty. While these investments have been essential investments in the past for sustaining agricultural growth, the levels of investment stocks achieved may now be such that it may be more important to maintain those current stocks rather than to increase them further. Additional government spending on rural development is an effective way of helping the poor in the short term, but since it has little impact on agricultural productivity, it contributes little to long-term solutions to the poverty problem.

Road Development, Economic Growth, and Poverty Reduction in China

Shenggen Fan and Connie Chan-Kang
IFPRI Research Report 138, Washington, DC: IFPRI, 2005, pages vii–viii

Beginning in 1978, China adopted a series of economic reforms leading to rapid economic growth and poverty reduction. National GDP [gross domestic product] grew at about 9 percent per annum from 1978 to 2002, while per capita income increased by 8 percent per annum. The post-reform period was also characterized by an unprecedented decline in poverty. However, income inequality has worsened between coastal and interior provinces as well as between rural and urban areas. A number of factors contributed to this widening disparity in regional development in China, including differences in natural resources endowments and infrastructure and human capital development.

When the policy reforms began in 1978, the transportation infrastructure in China was poor. With rapid economic growth, the demand for road transport soared, and transportation shortages and congestion problems surfaced as a consequence. Since 1985, the government has given high priority to road development, particularly construction of high-quality roads such as highways connecting major industrial centers in coastal areas. In the 1990s, investment in infrastructure became a national priority and various policies were implemented to promote the rapid construction of highways. The development of expressways has been particularly remarkable, with the total length increasing from 147 kilometers in 1988 to 25,130 kilometers in 2002, equivalent to an average annual growth rate of 44 percent. In contrast, the length of low-quality, mostly rural roads increased very little, by only 3 percent per year over the same period.

The objective of this study is to assess the impact of public infrastructure on growth and poverty reduction in China, paying particular attention to the contribution of roads. The beneficial impacts of roads on production and productivity, as well as on poverty alleviation, are well recognized in the literature but some important gaps remain. First, the impact of road quality has received little attention. While the total length or density of roads is a useful indicator of the road infrastructure availability in a country, it is important to account for quality differences because different types of roads (e.g., rural versus urban) can have very different economic returns and poverty impacts. Second, most studies have focused only on rural poverty in China, as urban poverty has only recently emerged as an important and growing problem. To address these limitations, this study disaggregates road infrastructure into different classes of roads to account for quality. The study also estimates the impact of road investments on overall economic growth, urban growth,

and urban poverty reduction, in addition to agricultural growth and rural poverty. To achieve these goals, an econometric model that captures the different channels through which road investment impacts on growth and poverty is developed and estimated using provincial-level data for 1982–99.

The most significant finding of this study is that low-quality (mostly rural) roads have benefit-cost ratios for national GDP that are about four times greater than the benefit-cost ratios for high-quality roads. Even in terms of urban GDP the benefit-cost ratios for low-quality roads are much greater than those for high-quality roads. As far as agricultural GDP is concerned, high-quality roads do not have a statistically significant impact while low-quality roads are not only significant but also generate 1.57 yuan of agricultural GDP for every yuan invested. Investment in low-quality roads also generates high returns in rural non-farm GDP. Every yuan invested in low-quality roads yields more than 5 yuan of rural non-farm GDP.

In terms of poverty reduction, low-quality roads raise far more rural and urban poor above the poverty line per yuan invested than do high-quality roads.

Another significant finding of the study is the trade-off between growth and poverty reduction when investing in different parts of China. Road investments yield their highest economic returns in the eastern and central regions of China while their contributions to poverty reduction are greatest in western China (especially the southwest region). This implies the need to formulate different regional priorities depending on whether economic growth or poverty reduction is the most important goal for the country.

The results of this study have important implications for future road project investments. In the past, China invested heavily in building expressways and intercity highways. These investments have been a major force in China's economic transformation during the 1980s and 1990s. However, as more and more investments are being poured into these projects, the marginal returns are beginning to decline, although they are still positive and economically sound. At the same time, low-quality roads or rural roads have received less attention than high-quality roads, and as a result, their marginal returns are much larger today than the returns for high-quality roads. Low-quality roads also raise more poor people out of poverty per yuan invested than high-quality roads, making them a win-win strategy for growth and poverty alleviation. The government should now consider giving greater priority to low-quality and rural roads in its future infrastructure investment strategy.

A Standard Computable General Equilibrium (CGE) Model in GAMS

Hans Löfgren, Rebecca Lee Harris, and Sherman Robinson, with assistance from Marcelle Thomas and Moataz El-Said
Microcomputers in Policy Research 5, Washington, DC: IFPRI, 2002, pages 1–2

Over the past 25 years, computable general equilibrium (CGE) models have become a standard tool of empirical economic analysis. In recent years, improvements in model specification, data availability and computer technology have improved the payoffs and reduced the costs of policy analysis based on CGE models, paving the way for their widespread use by policy analysts throughout the world. . . .

Although most CGE models have been developed for countries, the basic framework applies, and has been applied, in settings ranging from the world (divided into multiple regions) to disaggregated regions within a country, such as villages, and even to households. In most applications, the markets and prices in the model represent actual markets with money used as a medium of exchange. However, especially in household models, they may be viewed as "implicit" markets where the solution wages and prices represent "shadow prices" or "exchange values." Our standard CGE model is written for application at the country level and has been implemented with a number of country data sets, but only minimal changes are needed to apply the model to a region within a country or to a producer-consumer household.

The standard model includes a number of features designed to reflect the characteristics of developing countries. The specification follows the neoclassical-structuralist modeling tradition presented in Dervis et al. (1982). It incorporates additional features developed in recent years in research projects conducted at IFPRI. These features, of particular importance in developing countries, include household consumption of nonmarketed (or "home") commodities, explicit treatment of transaction costs for commodities that enter the market sphere, and a separation between production activities and commodities that permits any activity to produce multiple commodities and any commodity to be produced by multiple activities.

Ending Hunger in Our Lifetime: Food Security and Globalization

C. Ford Runge, Benjamin Senauer, Philip G. Pardey, and Mark W. Rosegrant
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2003, pages 203–206

Without major changes, progress against poverty and hunger will be too slow to win this fight. The Hassan children and granddaughter, emblematic of the world's poor,

will have little hope of leading better lives than their parents. We have detailed what needs to be done—increase investments in poor people, pursue new innovations in agricultural science and environmental sustainability, and create new institutional remedies to global dilemmas. Robust economic growth is the sine qua non for generating the funds for this process. Trade must play a crucial role as an engine of this growth. For this to happen, rich countries must open access to their markets for products in which developing countries have a comparative advantage—in agriculture, textiles, and clothing. And while necessary, economic growth is not sufficient. For the poor to share broadly in the economic gains, major investments in their education, nutrition, and health care are also required. Countries like Thailand, which have pursued such a strategy, have been able to make remarkably rapid progress in reducing the number of poor and hungry.

Progress against world hunger will also require more and better science and substantial investments in agricultural research. More research should focus on the needs of farmers in tropical areas, especially small peasant farmers. Increases in agricultural productivity can propel the whole rural sector forward. Much of the research required will not be done if left to the private sector. Public international and national research must be reinvigorated, incentives designed to direct private research toward the needs of poor farmers, and greater public/private cooperation fostered. A major reason for the increasing poverty and hunger in Sub-Saharan Africa is the neglect of these issues.

The science underlying agricultural research has become increasingly complex. Part of this complexity revolves around intellectual property rights. Intellectual property issues require protection of incentives without locking out those who need access to new technologies. Biotechnology is part of the answer. If its critics succeed in slowing its application, the poor may suffer more than the privileged rich, who have generated most of the criticism.

The environmental base of agriculture must be protected and sustained. Environmental degradation is caused mainly by the intensification of production, the cultivation of marginal land, and the consequences of increasing livestock concentration. Widespread agricultural policies that distort incentives and discourage farmers from caring for the environment must be reformed. With the right technology and investment, yields can be maintained and even boosted, not only on the best land but also on less-favored lands, helping to keep the most fragile lands out of production. Industrial animal systems also pose major environmental threats, which must be controlled and closely managed.

Water resources will need to be more carefully and efficiently used. The worldwide demand for water is rapidly increasing, yet affordable supplies are limited. Incentives to conserve water, improved recycling, and more efficient use hold great potential. Large-scale water projects, with major economic, social, and envi-

ronmental costs, are being replaced by more efficient small-scale efforts. Irrigation can provide the greatest gains, but there is also room for much greater efficiency in industrial and urban uses. Water markets and user groups can encourage more efficient use, but their successful establishment is complicated. Improvements in rural communications and transportation infrastructure are also essential to improving market access and expanding opportunities for rural people.

International organizations need to be reformed, as do many national agricultural policies, including those of the United States and the European Union. International trade policy should be redirected toward the needs of the developing countries. The Doha Round of WTO [World Trade Organization] trade negotiations for agriculture should be renamed the "Food Security Negotiations," augmented by offers of greater technical support and guidance on trade issues to developing-country trade delegations.

The primary responsibility for the welfare of citizens, including food security, rests with national governments. However, given the growing interdependencies among nations, food security has taken on characteristics of a global public good, necessitating a multilateral response. The denial of this interdependence and the pursuit of nationalistic self-sufficiency policies have created inefficient distortions and left unresolved problems of poverty and hunger.

The means of improving poverty, health, and food security are closely interconnected, and so must cooperation be among the various international agencies involved. Reforms are needed in the World Bank to support pro-poor growth strategies, a direction in which the Bank has begun to move. Its resources should shift toward grants to the poorest countries and the poorest segments in middle-income LDCs [less-developed countries]. There are also expanded roles for FAO [Food and Agriculture Organization of the United Nations] and WHO [World Health Organization], requiring commensurate increases in funding. A GEO [global environmental organization] is needed to address directly transboundary environmental issues, rather than forcing existing organizations such as the WTO to respond to issues for which they are ill suited. NGOs [nongovernmental organizations] have done much to bring the perspective of civil society into the debate on the environment, trade, and development, but they should expect to be held to the same standards of accountability, transparency and legitimacy that they impose on international organizations.

Much of the criticism of globalization is fundamentally related to concerns about distributive equity and social justice. International institutions and the rich countries of the North must not only increase the efficiency of the global food distribution system, but they must assure LDCs that the international market economy

is both fair and just, if these countries are to become full players in the system and increase their reliance on it for their national food security.

The investments necessary for widespread progress against food insecurity and hunger will not be possible without adequate funding. As detailed in the previous chapter, foreign private investment is playing an increasingly important role in economic development, along with domestic investment. However, most foreign direct investment is concentrated in only a handful of developing countries. The poorest countries receive little. Moreover, much of the social investment in public goods, such as education and scientific research, will not attract private investment. There is an opportunity for a new generation of philanthropists to follow the example of Bill and Melinda Gates, George Soros, and Ted Turner and serve as catalysts in addressing global problems. However, even the substantial accumulation of wealth of the current foundations and most successful entrepreneurs is limited in comparison to the task. In the final analysis, if the rich countries of the North are going to take seriously the goal of sharply cutting global poverty and hunger in our lifetime, a much greater financial commitment to foreign assistance will be required.

Reaching Sustainable Food Security for All by 2020: Getting the Priorities and Responsibilities Right

Washington, DC: IFPRI, 2002, pages 3–5

Getting the Priorities Right

Rapid economic growth is essential for achieving sustainable food security for all by 2020. The challenge is to achieve that growth in a way that benefits the poor—that is, propoor economic growth. This kind of growth, together with empowerment of the poor and effective provision of public goods, will be the foundation of any successful attempt to achieve the 2020 Vision. The specific policies that will be most appropriate will vary according to local and national circumstances.

1. Investing in Human Resources

Healthy well-nourished, literate citizens are an essential precondition for successful propoor economic growth. Universal access to primary and preventive health care and access to clean water and safe sanitation are critical for people's good health and good nutrition. Like good health, education has a tremendous impact on economic growth and on the material well-being of individuals. Educating girls, especially, has beneficial effects on family size, spacing of births, child care practices, child nutrition, and household income.

2. Improving Access to Productive Resources and Remunerative Employment

Propoor economic growth can take place only if poor people have access to productive resources and remunerative employment. Small-scale, nonagricultural rural enterprises can play an increasing role in providing livelihoods for rural people. More productive agriculture is also vital. To be more productive farmers, many poor rural people need access to credit and savings institutions, yield-increasing crop varieties, improved livestock, appropriate tools, fertilizer, and pest management technology as well as secure access to land.

3. Improving Markets, Infrastructure, and Institutions

Many rural regions consisting primarily of poor people, including small farmers, are often the last regions to get investments in infrastructure and, partly for that reason, markets in these areas are poorly developed. Rural poor people, whether farmers or not, will not benefit if they are excluded from participation or fair competition in the mainstream market economy.

4. Expanding Appropriate Research, Knowledge, and Technology

Technological developments in the biological sciences, energy and information and communications offer new opportunities that could benefit poor people, their food security and natural resource management. These benefits will materialize only if policies are in place to guide technological developments toward solving poor people's problems.

5. Improving Natural Resource Management

In many developing countries poverty, low agricultural productivity, and environmental degradation interact in a vicious downward spiral, as desperately poor farmers mine soil fertility and climb the hillsides in an effort to survive. Unless properly managed, fresh water may well emerge as the key constraint to meeting future food security, and needed reforms include providing secure water rights for users and reducing or eliminating water subsidies. Low soil fertility and lack of access to reasonably priced fertilizers constrain farmers in many countries. Policies should encourage farmers to make appropriate use of organic and inorganic fertilizers and improved soil management.

6. Good Governance

Good governance—the rule of law, transparency, the elimination of corruption, sound public administration, and respect and protection for human rights—supports efforts to achieve food security for all. In the past 20 years or so the role of the public sector has shrunk while NGOs [nongovernmental organizations] and business and industry have taken on additional responsibilities. Although this shift may be

appropriate, the for-profit sector and NGOs have limitations in providing public goods, such as peace, the rule of law, affordable access to clean water and electrical power, public health, public research, and rural transportation infrastructure. Governments must also have the political will to stamp out corruption and must persuade business and industry NGOs, and citizens to work to this end.

7. Propoor National and International Trade and Macroeconomic Policies

Unless governments are committed to long-term macroeconomic stability reforms in agriculture are unlikely to be effective. In addition, developing countries must participate effectively in the current round of global agricultural trade negotiations and pursue better access to industrialized countries' markets. Industrialized countries must reduce and eventually end trade-distorting agricultural subsidies. These countries must also continue the recent reversal in the decline in overall levels of development aid. Aid to agriculture and education are especially important to food security. Developed-country governments and international financial institutions must also do more to lift the burden of debt from highly indebted poor countries.

Whose Job Is It to Achieve Food Security?

The forces that produce persistent and widespread hunger are local, national, and international. National governments in developing countries bear the primary responsibility for creating an environment within which individuals and communities can effectively address hunger. In addition, governments of industrial countries, parliaments and judiciaries, international organizations and multilateral institutions, civil society business and industry, the private sector in developing countries including farmers, and food-insecure people themselves all have crucial roles to play in achieving sustainable food security for all.

A Way Forward from the 2020 Africa Conference

Washington, DC: IFPRI, 2004, page 1

Africa may at last be poised to make real progress on achieving food and nutrition security. Although the number of Africans who are undernourished has been on the rise for decades and now stands at about 200 million people, a new commitment to change has emerged both among African leaders and in the international community. To help determine how to bring about actions that will assure food and nutrition security, the 2020 Vision Initiative of the International Food Policy Research Institute (IFPRI) facilitated an African-owned and African-driven conference in Kampala, Uganda, on April 1–3, 2004. The conference, "Assuring Food and Nutrition Security in Africa by 2020: Prioritizing Actions, Strengthening Actors, and

Facilitating Partnerships," brought together more than 500 traditional and new actors and stakeholders representing perspectives and experiences from all major sectors across Africa.

This statement on the way forward from the 2020 Africa Conference was developed by the Conference Advisory Committee (CAC), comprising about 35 distinguished African policymakers, civil society leaders, and researchers as well as representatives of cosponsor institutions. . . . A draft of this statement was shared with CAC members and participants at the 2020 Africa Conference, and a subcommittee of the CAC then finalized it.

This statement is designed not as an immutable set of instructions, but as a set of guidelines, or a framework, pointing the way toward a food- and nutrition-secure Africa.

- Food and nutrition security for Africa must be achieved because it is a human right as well as a moral and socioeconomic imperative.

- Food and nutrition security in Africa is receiving renewed attention and commitment, and it is increasingly recognized that the goal can only be achieved with a positive change of attitude, increased investments, and prudent management of resources.

- The 2020 Africa Conference is part of a longer-term consultative process on real action toward food and nutrition security in Africa. The steps forward must focus on implementing action and on developing a process of learning and change. Specific "road maps" of change must be developed at regional and country levels, building on existing strategies where appropriate, and facilitated by an organic process. Thus, this statement is not another declaration or another investment plan.

- The highest-priority actions are (1) raising agricultural productivity; (2) fostering pro-poor economic growth through improved access to markets, better infrastructure, and greater trade competitiveness; (3) building institutional and human capacity; (4) improving nutrition and health with due attention to HIV/AIDS; and (5) strengthening governance. All of these require added resources, but the benefits of food and nutrition security outweigh the resource needs.

- Strengthening actors calls for acknowledging and respecting their diversity, creating windows of opportunity for them to exercise their influence, enhancing their capacity to influence and implement action, and empowering them with information and analysis.

- The rights of all who have a stake in achieving food security, especially food-insecure people themselves, must be respected, protected, facilitated, and fulfilled. Without mechanisms for generating improved incentives for good governance and accountability of all actors, no sustainable progress can be expected.

- Sharing responsibilities through sound partnerships to achieve food and nutrition security is needed and is promising. African governments, private sector, farmers' organizations, civil society organizations, and traditional institutions must commit to measurable good governance, pro-poor development policies, and the scaling up of best practices. Rich countries for their part must commit themselves to providing access to their markets, expanded knowledge and technology transfer, and greater financial assistance. Facilitating partnerships calls for mutually agreed upon clear contracts and achievable targets that are enforced and monitored.

- Sound decision making and implementation of needed action is possible with capacity, good governance, and strengthened institutions. Implementation must focus on strong government capacity, farmers' organizations, incentives for the business sector to engage in agriculture and the food industry, consumers' associations, media, and health systems serving the needs of the poor. As part of good governance, the remaining conflicts on the continent of Africa must be speedily brought to an end if we are to achieve food and nutrition security.

Transforming the Rural Asian Economy: The Unfinished Revolution

Mark W. Rosegrant and Peter B. R. Hazell
Hong Kong: Oxford University Press for the Asian Development Bank, 2000, pages 378–380, 411–412

Agricultural Growth: An Engine for Asia's Economic Development

Stable macroeconomic policies, market-friendly policies, relatively open trade policies, and aggressive public investments in education and infrastructure have driven the accumulation of capital and technological change that produced rapid growth in East Asia. Economic reforms to apply this policy package in South Asia and in several Asian transition economies show promise of accelerated growth in these regions. But successes with this policy agenda were in most cases built upon rapid agricultural and rural economic growth during the early stages of the transformation. This agricultural growth was driven by the green revolution, a cost-reducing tech-

nological package that led to significant improvements in productivity on small and large farms alike. Because of the size of the agricultural sector, the productivity gains that were achieved had economy-wide significance and the benefits of growth were distributed widely across income groups in rural areas. Rapid growth in agriculture freed up labor and capital for the nonfarm economy, maintained a downward pressure on the prices of food and key primary inputs for agro-industry, contributed to foreign exchange earnings (through reduced food imports and increased agricultural exports), and provided a buoyant domestic demand for nonfarm goods and services. These results of agricultural growth not only led to rapid growth in the rural nonfarm economy, but also contributed importantly to the transformation of the urban-based economy.

Agricultural growth and the move to more open, market-oriented policies were synergistic. Economies with massive public intervention (for example, the centrally planned countries and India), weak infrastructure, and inward-looking rather than export-oriented economic direction were least successful in using the agricultural revolution to stimulate a broader economic transformation. For example, the PRC initiated rapid agricultural growth through green-revolution technologies relatively early, but failed to capitalize on this for successful national economic growth until the process of economic liberalization was begun. National economic growth in India and the Philippines was also relatively slow despite successful green revolutions, but their growth performance is improving as they reform and liberalize their economies.

As economic growth proceeds and agriculture declines in relative size, economy-wide policies that support factor accumulation and productivity growth, including fiscal discipline, market-oriented policies, open trade policies, investment in education, and institutional quality, are increasingly important in determining the pace of economic transformation. But recent experiences in the transition economies and with the Asian financial and economic crisis have shown the continuing importance of agriculture in Asia. The agricultural sector has played a pivotal role in determining the pace of reform and constitutes an important backbone for the acceleration of economic growth in transition economies. The rigid, centralized, and collectivized agriculture structure in the Central Asian economies fell apart with the collapse of the Soviet Union and paralyzed growth prospects in the initial reform years, despite the gradual adoption of market reforms.

The central control of agriculture was much weaker in the East Asian transition economies at the onset of reform. The higher prevalence of smallholder agriculture contributed to a smoother transition in the agriculture sector and thus in the overall economy. The existence of surplus labor that could be released to the industrial sector was also favorable for economic growth during the transition process. As economic transition proceeded, the agriculture sector helped cushion the adverse

impacts of initial dislocations due to reform in the nonagricultural sectors, stimulating economic sectors in several ways:

- through its linkages with related industries, like food-processing;
- through the provision of social stability while a large segment of the population remained employed in the agriculture sector;
- through the provision of food security and savings in foreign exchange on food imports; and
- through the creation of foreign exchange through exports of cash crops.

The agricultural sector has been an important factor in countering some of the negative effects of the financial and economic crisis. The urban economy has been the hardest hit by the crisis, and sharp increases in unemployment in urban areas have been compounded by the lack of social safety nets for the newly unemployed and the newly poor. However, the agricultural and rural regions in Thailand and Indonesia have absorbed large numbers of persons returning from urban areas, relieving pressure in overburdened urban social services. Moreover, the agricultural sectors in these countries have responded strongly to the real exchange-rate depreciation that has improved the competitiveness of the sector. Increased agricultural production and exports have helped compensate for the negative income effects of the crisis. . . .

Conclusion

On the threshold of the 21st century Asia stands, if not at a crossroads, then at a point of decision. Unprecedented rates of rural and national economic growth have transformed many parts of rural Asia. But not all Asia shared in the transformation. Moreover, the regional economy has hit a rough spot that some fear may turn the clock back on rapid growth where it occurred and stymie growth elsewhere.

In the face of this challenge, the completion of the rural transformation of Asia will take renewed efforts on the part of governments. Successful economies must not turn away from their market orientation, but rather support the private-sector role where possible and supplement it where not. But meeting the challenge must also involve a renewal of governance itself: transparency responsiveness, and eradication of corruption are all keys to sustained growth in the next century.

Governments will also have to increase the level of productive investment made in rural infrastructure, agricultural research and extension, education, and health, as well as expand the reach of social safety-net programs. A significant part of these

costs could be met in some countries by reducing wasteful public expenditure in rural areas, particularly on subsidies for credit, fertilizers, pesticides, electricity and irrigation water. These subsidies may have played an important role in launching the green revolution, but today they are rarely needed and can be counterproductive because they create incentives for the overuse of water and farm chemicals, leading to environmental degradation.

There is also considerable scope for "getting more with less" by improving the efficiency of many of the public institutions that implement public investments. This again requires changes in governance structures, with increased transparency and accountability to key stakeholders and greater roles for the private sector, user groups and NGOs [nongovernmental organizations] where they can better provide the required services. There is also scope for raising more revenues from rural people through user fees and local taxation. These kinds of changes might provide much of the financing needed for rural areas in the future, but they will take time to implement. If poverty and malnutrition are to be seriously reduced within the next generation, then additional allocation of central government funds will almost certainly be required, at least in the near future.

While the specter of famine that hung over Asia in the 1960s has not returned in the 1990s, widespread poverty and malnutrition still coexist with great wealth. Completion of the rural revolution, radical reduction in poverty and improvement in food security in Asia hang in the balance. They are attainable, if complacency is resisted.

Essay

Dynamic IFPRI

John W. Mellor
IFPRI Director, 1977–90

These are immensely dynamic times. Everyone connected with IFPRI should be proud that it has adapted and grown in keeping with the global dynamics. Institutions adapt if they have an adaptive institutional structure, diverse, committed staff, and imaginative leadership. A little good luck helps! I arrived at IFPRI in 1977 and was the director for just short of half of its 30 years. To help build an institution that is considered the best in its field, adapts to changing times, increases its relevance, and grows efficiently under a succession of directors is an ultimate source of pride. Of course, a heartfelt thanks goes to Sir John Crawford for the original vision of IFPRI and the tenacity to see it through.

Changes in the Context

I note five major changes in the world important to the demands placed on IFPRI and the mode of adaptation. First, there has been extraordinary economic growth in the developing world. IFPRI was founded in the days when Bangladesh was called a basket case. Such wrongheaded language is now more narrowly applied to just one geographic area—and it is presumably as wrong for Africa as it was for so much of Asia in the 1970s. The famine of the early 1970s had much to do with the founding of IFPRI (and IFPRI stands as the shining success among the several initiatives prompted by the food emergencies in Asia). Famine in Asia is in the past. The future is extraordinary growth in markets for high-value livestock and horticulture products.

Second, the few areas that have not taken off with an immense increase in food security, largely in Africa, are very difficult cases. That is the result of their being left out of the agricultural growth process and its massive multipliers

for the rural nonfarm poor. Poor governance is in part the result of that failure. A doubling of population combined with a slow decline in incomes is a recipe for disaster. Concurrently, consensus about strategy and a unified approach to agricultural development have evaporated.

Third, this is a world awash in capital. This situation in theory relaxes a major constraint to providing the central infrastructure essential to agriculture as well as industry and releases local capital for rural infrastructure. It also means that technology transfer and technical assistance are relatively more important than in the early 1970s, when capital was more constraining. Of course, abundant capital may not flow to Africa and the few other countries like those in Africa—but that is part of the challenge.

Fourth, globalization is pervasive because of continual radical reductions in transport costs and greater control of perishability. Now farmers compete through low transfer costs and use of cost-reducing technology, or they revert to subsistence agriculture with slowly, or even rapidly declining incomes, as in most of Africa. Catching up is probably easier now, but getting started with poor infrastructure and no capacity to generate cost-reducing technology is more difficult.

Fifth, there has been an extraordinary decline in professionalism in the foreign assistance community. In a world in which agriculture is still the dominant source of employment growth and poverty decline even in middle-income countries, and in which agricultural growth is even more dependent on improved technology, the foreign aid donors have fewer professional agriculturalists, or even economists, than in the early 1970s and before. How can foreign aid play a pivotal role in getting agriculture moving and consequently in reducing poverty in Africa, as it did in Asia, without large numbers of staff who are leaders in thinking about the essential processes?

Major Breakthroughs at IFPRI

Singling out individual exploits is arbitrary. IFPRI has always done a great job of setting research priorities—and defending them—and then proceeding to implement them. But I have six favorites. They are, of course, biased toward my tenure at IFPRI, even though I have read every IFPRI research report from beginning to end (I used to read them twice!). Research, especially trailblazing research, is done by specific people, but it is bad enough to single out a few breakthroughs and should not be made worse by naming a few individuals when many were at work.

Dear to my heart is the pioneering work at IFPRI on income multipliers, which laid the groundwork for understanding the huge employment multipliers generated by agricultural growth. This work shows how raising the incomes of farmers who are not poor by the standards of their own communities is the driving force in the massive poverty reduction that is statistically demonstrated by researchers at the World Bank, Harvard, and IFPRI.

We have been in a dry period with respect to rural infrastructure investment, but we continue to fall back on pioneering IFPRI work showing the impact at the village level of infrastructure, especially all-weather roads. That work is helping, even at this late date, to bring foreign aid donors back to rural roads, which will prove just as essential to social programs as agriculture. Schools without teachers and clinics without doctors are just like rural banks without accountants—all of these people will live where year-round road access exists. I am using that work in my current efforts in Afghanistan, the Altiplano of Guatemala, the Planalto of Angola, and Rwanda, and I made special use of it a decade ago in the agricultural Perspective Plan for Nepal.

One of the blows against smallholder commercial agriculture, and particularly export commodities, was the illusion that they reduced food security. IFPRI has always blazed the trail in showing the benefits of commercialization and still does in showing how commercialization can enhance nutrition. IFPRI's work against anti-commercialization has been important in policy, and I am using it even now in Guatemala.

IFPRI's exhaustive work on the causes of growth in fertilizer use—the role of commercial crops in getting the process started, the role of supply push, the alternatives to subsidies—has been immensely helpful throughout Asia in giving a boost to the single most important source of agricultural growth. It is a shame that this work has hardly penetrated Africa.

IFPRI has continuously documented the ongoing disaster of rising poverty, food insecurity, and famine in Africa and has much to say about how to deal with it and, more important, how to prevent its continuance.

Finally, after IFPRI's reputation as a world-class research institution had been built, the 2020 Vision Initiative was a breakthrough in carrying research results into policy deliberations and action.

What did we miss? Not much, maybe nothing. Arrogant? No, IFPRI has listened to the outside world and has always had a few free sprits to take care of the unconventional! And remember IFPRI's directors have always been accomplished scientists in IFPRI's field of work. That has been critical to success.

Major Breakthroughs of the Future

Only the present director general of IFPRI, with all the resources and free spirits circulating around him, can answer this question. But I will suggest three areas that rise specifically from my current work.

First, growing rural-urban income disparities will outstrip poverty per se in importance (assuming we can get Africa moving), and the solutions will probably be different from those of Europe and the United States. Perhaps part-time farming will increase in importance in the densely populated regions of Asia. Perhaps high-value commodities can play a larger role in the much wealthier world of the future. Much of what we now know will be useful, but surely some major new ideas will rise.

Second, what is the right balance between expenditure on agricultural growth and social programs? Agricultural growth requires immense outlays on rural physical infrastructure, and, although practitioners often do not recognize it, so do social programs. Understanding the shared need for big expenditures will help. But as we press for resources in agriculture, do we argue that health and education are unimportant? Of course not, but all three cannot be fully satisfied instantly. So what are the allocation rules at the margin? Surely IFPRI's broad range of collaborative research efforts can answer that question or at least provide the framework for answering it in differing contexts. Closely related is the issue of the optimal use of relief funds, including for food, to reduce future requirements for relief.

Finally, most developing countries are not making the hard choices on agricultural research priorities that we make in the United States. Thus in the face of the rapidly escalating cost of doing research and indivisibilities, resources are spread so thin as to be useless. How can those decisions be made? What are the implications for the centers of the Consultative Group on International Agricultural Research (CGIAR)? Now the centers are adding to the dispersion of funds, not helping with priority setting (partly under donor pressure to include many diverse activities). Some of the needed research is about institutions, but some is also data based. Both can be tackled by IFPRI and the CGIAR. Related to this is the question of the right balance between public and private research. I hear expatriate consultants in Afghanistan saying research and extension should be in the private sector. If so, good luck Afghanistan—you may be on the road to becoming an African country. I hope not, as I hope that Africa will escape from failure to recognize the pivotal need of smallholder agriculture for public goods.

I do not mention a major research breakthrough in Africa, because Africa needs first to learn the basic lessons from Asia, just as Asia learned from Japan and Europe and North America. Yes, there is an immense need for IFPRI research in Africa, but the basic relationships entailed in agricultural growth have been well articulated at least since the Meiji restoration in Japan. And infrastructure was well understood in Tokugawa Japan, to say nothing of Ashokan India and the Jacksonian United States.

In conclusion, IFPRI is a great institution with staying power, dynamically adapting to the times. All should be proud.

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Chapter 4

Markets and Trade

From International Commodities and Trade Policy toward Analyses of Domestic and Regional Markets

Trade was a controversial field of study for IFPRI in its early years. Some observers were worried that IFPRI would use its platform to be critical of Europe's Common Agricultural Policy or other countries' trade policies, and thus discouraged IFPRI from pursuing any work on trade. Nonetheless, IFPRI conducted a range of studies on agricultural protectionism and on agriculture's role in international trade negotiations (see excerpts from *Agricultural Protection in OECD Countries: Its Cost to Less-Developed Countries,* Alberto Valdés and Joachim Zietz, 1980; and *Agriculture in the GATT: An Analysis of Alternative Approaches to Reform,* Joachim Zietz and Alberto Valdés, 1988).

Recognizing that agricultural prices have tremendous human and political implications in developing countries, IFPRI also examined agricultural price policy in the broader context of technological and institutional changes and identified pragmatic approaches for managing price fluctuations (see excerpt from *Agricultural Price Policy for Developing Countries,* John W. Mellor and Raisuddin Ahmed, eds., 1988). The relationships between trade and food aid received considerable attention early on at IFPRI (for instance, in work of Barbara Huddleston). IFPRI has also considered the potential for developing countries' exports of nontraditional products (see excerpt from *Horticultural Exports of Developing Countries: Past Performances, Future Prospects, and Policy Issues,* Nurul Islam, 1990) and the prospects for regional trade agreements among developing countries. An important contribution was a 1993 study of the bias against agriculture created by developing countries' trade and macroeconomic policies (see excerpt from *The Bias against Agricul-*

ture: Trade and Macroeconomic Policies in Developing Countries, Romeo M. Bautista and Alberto Valdés, eds., 1993); this study was part of a larger effort, guided by Anne Krueger, in which IFPRI researchers participated.

In the 1990s a wave of economic liberalization swept the developing world and raised new questions about how to manage liberalization without leaving the poor behind. IFPRI's study of rice markets in Viet Nam showed how carefully managed liberalization could work to benefit the poor (see excerpt from *Rice Market Liberalization and Poverty in Viet Nam,* Nicholas Minot and Francesco Goletti, IFPRI Research Report 114, 2000). And work in Africa helped explain why market reforms there did not have the hoped-for dramatic results (see excerpt from *The Road Half Traveled: Agricultural Market Reform in Sub-Saharan Africa,* Mylène Kherallah et al., 2000). This research found, among other things, that the sequence of reforms is key to their success.

The opportunities that more open trade regimes offer to developing countries were on IFPRI's agenda for a long time, as were related adjustment needs. IFPRI's trade policy thinking and research has been much influenced by leading policy researchers such as Kym Anderson, Tim Josling, and Soren Frandsen. IFPRI has also emphasized that liberalization alone does not connect small farmers to markets. To function well, markets need—to begin with—good infrastructure as well as institutions that reduce transaction costs. IFPRI research on road infrastructure highlighted the strong implications of deficient versus good infrastructure (see excerpt from *Road Development, Economic Growth, and Poverty Reduction in China,* Shenggen Fan and Connie Chan-Kang, 2005, in Chapter 3).

Agricultural Protection in OECD Countries: Its Cost to Less-Developed Countries

Alberto Valdés and Joachim Zietz
IFPRI Research Report 21, Washington, DC: IFPRI, 1980, page 9

This report assesses the effects of agricultural protectionism in developed countries on the annual export earnings and concomitant welfare gains of less-developed countries (LDCs). It measures the results of a hypothetical 50 percent reduction across the board in tariffs and other trade barriers for 99 commodities in 17 developed countries belonging to the Organization for Economic Cooperation and Development (OECD).

Such a reduction would increase world trade by about $8.5 billion per year. Approximately 36 percent of this expansion would accrue to the selected LDCs, 20 percent to OECD exporters, and 44 percent to the remaining countries.

Because of the wide variety and complexity of domestic policies among the OECD countries and the inadequacy of the information on relevant elasticities, exact measurements are virtually impossible, but the estimates arrived at in this study are believed to provide a realistic approximation of the extent of agricultural protectionism and its implications for the balance of payments of LDCs, both as exporters and importers.

The trade restrictions imposed by developed countries include tariffs and nontariff barriers (NTBs), and they vary considerably in severity among countries and products. They all tend to lower world prices and restrict the volume of exports from both LDCs and developed-country exporters. In addition, trade restrictions tend to escalate as goods are developed from raw materials to semiprocessed products to finished goods. This discourages LDCs from processing raw materials in their own countries.

In recent years LDCs have greatly increased their imports of cereals, predominantly wheat. Because trade liberalization would lead to higher prices on cereal imports, some LDCs could be adversely affected by trade liberalization in developed countries. But greater market access would probably encourage agricultural production in LDCs.

The study analyzes the geographic distribution of the benefits accruing to LDCs from trade liberalization and identifies the products with the most potential for export growth for Asia, Sub-Saharan Africa, North Africa and the Middle East, and Latin America. For LDCs as a whole, raw sugar, refined sugar, and beef and veal are the three most significant commodities, followed by green coffee, wine, tobacco, and maize. When the commodities are formed into the groups used in the General Agreement on Tariffs and Trade (GATT) negotiations, sugar and derivatives and

meats capture 47 percent of the total increase in export revenues expected for the LDCs. In most commodities LDCs capture 50 to 80 percent of the increase in world trade.

Wheat, pork, and mutton and lamb, however, play a significant part in world agricultural trade, and most of the benefits from liberalization in these commodities accrue to developed countries.

Among the OECD members the major increases in the cost of imports would occur in Japan, Germany, the United Kingdom, and Italy. Major increases in exports would be experienced in the United States, Canada, Australia, New Zealand, and Sweden. French and Italian exports would be substantially decreased.

The results of trade liberalization arrived at in this report are probably lower than would actually take place because existing trade patterns have greatly distorted the import levels on which calculations are based. Furthermore, LDCs would most likely experience other gains from liberalization that cannot be determined numerically. These might arise from expansion of export markets to include new products or processing industries and stimulation of investment in and concern for agriculture in LDCs.

Agriculture in the GATT: An Analysis of Alternative Approaches to Reform

Joachim Zietz and Alberto Valdés
IFPRI Research Report 70, Washington, DC: IFPRI, 1988, pages 7–9

Much trade in agricultural products is conducted under conditions that bear little resemblance to the letter or the spirit of the General Agreement on Tariffs and Trade (GATT). Nontariff barriers proliferate, export subsidies increasingly substitute for a natural competitive advantage, trade wars erupt with frightening regularity.

There is some hope that the Uruguay Round can achieve more for agricultural trade than prior GATT rounds. Sharply rising budgetary costs of national farm policies in recent years seem to have made the European Community (EC), the United States, and other industrial countries more open to the idea of agricultural trade reform than ever before. There is a danger, however, that diminishing budgetary pressures, which are the result of recently rising world prices and certain adjustments in domestic farm policies, could reduce the current momentum for reform. Piecemeal accommodation on a commodity-by-commodity basis could then be the outcome of the Uruguay Round. Although this might suffice to further stabilize government budgets, it would not bring lasting improvement. It is therefore important not to lose sight of the final objective of trade reform in agriculture: to establish an environment that is free of trade-distorting government interven-

tions, fully integrated into the GATT, yet flexible enough to deal with domestic structural adjustment problems and income instability.

Not every reform proposal that is under current discussion is likely to ease the transition to this state of world trade. Some may make it actually impossible to ever get there. It is important, therefore, to analyze the properties of a given reform proposal before much time is spent on it during the trade negotiations. For that purpose, a number of criteria are developed to check (1) to what extent a given reform proposal is consistent with the final objective of trade reform, (2) whether the proposal has any practical value in day-to-day operations, and (3) whether it has the potential to win the approval of the main players in the Uruguay Round—the United States, the EC, the nonsubsidizing exporters united in the Cairns Group, and Japan.

When these criteria are confronted with actually proposed ideas for trade reform, it becomes clear that there is no single idea or element of trade reform that would satisfy all the criteria that are established. Yet there is some evidence that an appropriate combination of reform ideas might achieve this goal. One such combination would consist of two elements: a strict ban on export subsidies, and comprehensive tariffication.

The ban on export subsidies would eliminate the special treatment for agricultural, fishery, and forestry products in the General Agreement and the Subsidies Code. Tariffication consists of two components: the replacement of all unbound tariffs and nontariff barriers with bound base tariffs that are uniform across broad commodity groups for each country and the extension of that change to the safeguard Article XIX of the General Agreement.

The bound base tariff represents the basic tariff concession of a country. It is the tariff level that a given country would apply uniformly across broad commodity groups, once the adjustment to a system based only on tariffs is completed. A country is bound to this tariff at all times unless it invokes Article XIX. Extending tariffication to Article XIX implies that safeguard measures are limited to temporary tariff increases. A revised safeguard Article XIX is envisioned to operate as follows. A country using a temporary tariff increase, or excess tariff for short, would bind itself to a timetable for lifting the safeguard measure. This timetable would specify the dates on which the excess tariff would be reduced to zero as well as the step size of the individual reductions. To avoid prohibitive tariffs the use of excess tariffs under the safeguard article could be conditioned on some minimum-access provision similar in spirit to that currently written into Article XI:2(c). Article X1:2 could be rewritten so as to apply to all trade regardless of sector and whenever a country uses any import restriction other than its bound base tariffs.

The excess-tariff provision is envisioned as the major vehicle to eventually reach a system based only on bound, uniform tariffs. Excess tariffs would offer temporary import relief for all products that are currently protected by nontariff barriers with

tariff equivalents far in excess of the uniform base tariff that a given country would adopt after the adjustment to the new system.

As excess tariffs are lowered over time, according to some fixed schedule, to the level of the bound base-tariff, and as the resultant adjustment pressure grows, countries may resort to gray-area measures to reduce this pressure. Four types of gray-area measures to avoid the disciplines of tariffication are of particular interest in this context: voluntary export restraints, state trading arrangements, domestic subsidies, and exchange-rate manipulations.

The potential problem of voluntary export restraints could be contained by prohibiting them explicitly and, at the same time, giving the GATT Secretariat an active role in supervising this prohibition, including the right to initiate cases against a country that forces export-restraint agreements on its trading partners. Treating export subsidies in agriculture the same as in other sectors should go a long way toward eliminating implicit export subsidies by state trading enterprises in agriculture. Implicit quantitative import restrictions, in contrast, are more difficult to prevent. The only practical solution may be to restrict their operations on the import side indirectly through binding the nominal rate of protection for all those goods under their control. In particular, it could be stipulated that the price difference between the border price and the domestic wholesale price of products under the control of state trading enterprises should not exceed the equivalent of the bound base tariffs for those products.

As long as it is believed that domestic subsidies will not be a major issue under a system of relatively low uniform tariffs, it may be most efficient to resolve domestic subsidies issues on a case-by-case basis. This could be achieved either through negotiations outside the GATT or through dispute settlement inside the GATT. The latter would require, however, that the current dispute-settlement procedure be made more responsive. This is in the special interest of developing countries because they generally lack the necessary political or economic clout to settle subsidy issues (or other issues, for that matter) through direct negotiations outside the GATT. Attempts of governments to circumvent the disciplines of tariffication and an export subsidy ban through exchange-rate manipulations may be handled in the same way as domestic subsidies, that is, without adding new provisions to the General Agreement or to its subsidiary codes law.

Compared with alternative suggestions for trade reform (for example, fixing overall protection levels), the above package has a number of advantages. At its core, the reform proposal is not dependent on new policy instruments or measurement techniques that have not been tested. Rather, it relies on well-known GATT instruments and principles. Everything else being constant, this should ease rather than complicate the transition from the current state of trade in agriculture and other

industries to the final objective of free trade. Trying to incorporate a completely new, untried approach such as the Producer Subsidy Equivalent into the GATT framework could not only cause the negotiations to deadlock over measurement concepts and problems, but would also have the negative side effect of firmly establishing a "special case" for agriculture rather than integrating this sector fully into the GATT system.

Whether a proposal such as tariffication has a realistic chance of being adopted during the Uruguay Round depends ultimately on its ability to garner enough domestic political support in the major trading nations. Domestic acceptability hinges on a favorable political constellation. It is particularly important that the political power of the groups that stand to lose from a trade-reform proposal in the short run be kept in check by a sufficient amount of countervailing power. This means there have to be other special interest groups, apart from consumers, that are strongly in favor of a trade reform and, at the same time, have enough political influence to counter the efforts of those groups that oppose the reform.

Sector-specific, commodity-based reform proposals that lead to piecemeal trade arrangements for one commodity at a time do not generate the necessary countervailing power. Instead they maximize the influence of special interest groups on the negotiations at the expense of the interests of the whole country. The aggregate negotiating approach advocated by the United States in its reform proposal for agriculture fares somewhat better in generating countervailing power. It suggests that an agreement on all agricultural support programs be concluded in a single package. In this way the political influence of a commodity group that is losing can be counteracted by the influence of a commodity group that stands to gain. This negotiating approach runs into a problem, however, if there are countries with few or no commodity groups that expect to gain from a given reform package. Japan, some northern European countries, and, to some extent, the EC are likely to fall into this category.

The obvious solution is to negotiate in one package not only all of agriculture but all sectors, so that gains anticipated in industry can help to compensate for losses in agriculture or vice versa. Countervailing power would be established across sectors and industries. But just as a package deal in agriculture alone requires a unifying negotiation and measurement concept, so will negotiations across sectors necessitate a unifying principle. Tariffication as defined above could be this sought-after unifying theme or principle. It is applicable for all sectors and is fully compatible with the spirit of the GATT. It could replace the "across-the-board" tariff-reduction idea of the Kennedy and Tokyo rounds.

Agricultural Price Policy for Developing Countries

Edited by John W. Mellor and Raisuddin Ahmed
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1988, pages 1–3

Determination of agricultural prices is intensely political because of its profound influence on equity, income distribution, consumption, production, and economic development. Thus agricultural price policy occupies a major place in political debate, the deliberations of government bureaucracies, and the decisions made by consumers and producers. This is so in both high-income countries, where food and agriculture represent a small part of aggregate income but are still important in consumption and politics, and in low-income countries, where they are central to the political and economic processes.

The bulk of adjustment to food supply shortfalls in low-income countries is borne by low-income people through drastic reduction in their intake of basic nutrients. Since the poor spend essentially all their income on food, a rise in food prices causes an almost equivalent reduction in their income. Richer people, who spend a smaller proportion of their income on food, can maintain their food consumption even when food prices rise substantially. In India, for example, a typical person in the poorest one-fifth of households reduces food consumption by ten times as much when food prices rise as does a typical member of the "richest twentieth" of households (Mellor 1978). A 10 percent reduction in the aggregate supply of food results, via increased prices, in a 37 percent reduction in food consumption by the 20 percent of the population with lowest income. Given the initially low level of consumption of this group, such a cut means that famine conditions are present (Mellor and Gavian 1987). Thus, governments in developing countries do not leave provision of adequate food supplies to the vagaries of weather or the market. It follows, of course, that government intrusion into the market to deal effectively with extreme circumstances may persist into more normal periods, with unfavorable effects on efficiency.

Governments are generally aware of the role of agricultural prices in distributing income between farm and nonfarm sectors, among geographical regions, and among income classes. In developing countries, where the urban population, particularly public employees and the military, may exert a disproportionate political influence, food pricing is likely to be used to benefit the urban constituency at the expense of farmers. In these circumstances, government is particularly likely not to understand the requisites of technological change in agriculture. As a result, enforcement of low agricultural prices tends to go hand in hand with neglect of the modernization of agriculture. As such political systems mature, however, particularly as they become more democratic, the increasing political power of the rural population may bring a reversal of this price policy. Problems of excessive subsidies and

stock-building, which keep prices to producers above international levels, may then replace excessive government expenditure on subsidies to urban consumers that keep prices below international levels. In either either case, the fiscal costs tend to become unmanageable.

The small, family-size farms that dominate the agriculture of most developing countries are responsive to price as well as to other economic forces. Consequently, agricultural prices play a role in achieving efficient allocation of a country's resources within agriculture, between agriculture and non-agriculture, and between domestic production and imports. Changes in prices that affect relative profitability may occur through market forces, in which case the farmer's response may increase efficiency. However, they may result from government manipulation of exchange rates, trade regimes, and public expenditure. In that case, what is an efficient response for farmers may reduce the efficiency of the national economy.

Four caveats concerning price responsiveness are in order. First, markets in developing countries are particularly imperfect. Farmers may be reluctant to risk their own food supplies by switching to nonfood crops. Second, farmers are often severely constrained in their ability to respond to price changes by fixed land area (e.g., Asia) or by extremely low productivity of labor (e.g., Africa). It is for this reason that we emphasize the interaction between price policy and technological change that may increase land and labor productivity. Third, for price policy alone to increase production presumes that farmers can increase input use and obtain a favorable output response independent of other actions by government. If they cannot, increased prices will only transfer income to producers, with little effect on output. Finally, when agricultural output is increased by prices higher than international prices, a cost is paid in less employment, as domestic wages are pushed above those of other low-income countries by the higher cost of food.

Governments have limited power to maintain food prices that are substantially at variance with the forces of supply and demand. This is because food production is so diffused throughout the economy and the macro aggregates in the food sector are so large. If domestic demand is greater than supply at a government-imposed price, an unofficial market is likely to develop that will divert more and more supplies away from the low-price market until the official market effectively ceases to operate. Of course, the efficiency of the unofficial market may be low. Perhaps more important, if imports are used to reduce food prices below international levels, both the subsidies and the foreign exchange requirements will soon become so large as to bring pressure on government to change policies.

These considerations apply particularly to developing countries. Developed countries can be more successful in manipulating food prices because agriculture is a smaller part of their economies and thus is more easily supported by other sectors. Developing countries with massive oil revenues or ample foreign assistance can, of

course, maintain agricultural price distortions much longer than those without such resources.

While maintaining prices at sharp variance with the balance of supply and demand may be difficult, non-price policies of developing countries have a major effect on the levels of both supply and demand and thus may alter prices markedly. If the bulk of the capital of a country is coopted by the public sector for large-scale industry or capital-intensive import substitution, employment growth and hence the demand for food will be sharply constrained. That facilitates a low food price policy. In practice, overvalued exchange rates are associated with such an investment and employment policy. Thus the slow growth in effective demand for food commonly associated with exchange rate overvaluation makes it feasible to maintain relatively low agricultural prices. . . .

The extraordinary complexity of agricultural price policy arises from the immense magnitude of the economic forces involved, the large fluctuations in agricultural prices and their profound implications for the distribution of income and power, the small size of production and consumption units for food in low-income countries, their wide geographical dispersion, and the peculiar limitations imposed by land and other natural factors. Governments decide on the appropriate level of agricultural prices and their range of fluctuations in the context of changing economic circumstances, political configurations, and national goals.

If prices are not at an appropriate level or within a desired range, governments design policy instruments to change them. The choices are large, the limits manifold. The choice of objectives and instruments involves considerations that necessarily range far beyond the initial objective. Thus, governments must build substantial institutions with well-trained people to develop an effective price policy.

Horticultural Exports of Developing Countries: Past Performances, Future Prospects, and Policy Issues

Nurul Islam
IFPRI Research Report 80, Washington, DC: IFPRI, 1990, pages 9–12

In recent years, policymakers, analysts, and development specialists have expressed broad interest in the potential contribution of horticultural products to agricultural diversification, employment expansion, and foreign exchange earnings in developing countries. Yet little research has been done on world trade in horticultural products or on the production, marketing, and export of such products in developing countries. . . .

Given their importance, it is surprising that horticultural products have been neglected or underestimated in the past. The share of horticultural exports in world

agricultural trade has risen over the years; by 1983–85, horticultural products constituted about 12 percent of world agricultural trade, next in importance to cereals, livestock products, and oilseeds, fats, and oils. . . .

A limited number of developing countries dominated horticultural exports. Twelve countries accounted for 22 percent of the world market and 65 percent of the exports of developing countries in 1983–85. There was stiff and aggressive competition between them, and their relative shares of world trade shifted from time to time. The limited number of competitive countries was explained partly by the agroecological characteristics of individual countries and partly by the limited size, in many cases, of the total world market for individual commodities. No less important were obstacles to entry into export markets that resulted from the specialized nature of the export-related infrastructure, including strict quality and health standards, as well as established consumer preferences for specific products in particular markets. For products with a value of US$50 million or more, four leading exporters, each having a share of at least 5 percent of the total developing-country exports of that commodity, accounted for about 80 percent or more of the exports.

Trade restrictions in the industrial countries, including tariff and nontariff barriers, constrained the growth of exports. Fresh vegetables were subject to higher duty rates—an average of 9 percent—than fresh fruits, which averaged 5 percent, while rates of 15 percent for processed fruits and 12 percent for processed vegetables were imposed. These rates escalated with the degree of processing. Tropical horticultural products in general had lower rates of duty. The nontariff barriers were, on the whole, higher for fruits than for vegetables, with the differences between import and domestic prices ranging from 22 to 180 percent for fruits and from 30 to 80 percent for vegetables. In general, both tariff and nontariff trade restrictions were higher in Japan and the European Community than in the United States, except for processed fruits.

The success of the multinational trade negotiations under the General Agreement on Tariffs and Trade (GATT) is essential for an effective liberalization of trade in horticultural products. The tropical horticultural products are expected to receive special and early consideration in the negotiations in view of their importance to developing countries and the lack of serious competition with exports or domestic production of developed countries. . . .

Future prospects of horticultural exports of developing countries will depend predominantly on the growth of import demand, mostly in the developed countries. Given the high per capita consumption of fruits and vegetables today and the projected slow rates of growth of income and population in developed countries, the annual rate of growth in their aggregate domestic demand is unlikely to exceed 1.31 percent for fruits and 1.08 percent for vegetables between now and the year 2000. However, the ratio of imports to aggregate domestic demand in developed countries

is estimated to increase by 28 percent for fruits and 45 percent for vegetables between now and 2000. Developed countries are expected to diversify their food consumption patterns, including consumption of horticultural products, in the future. This heightened concern with health and nutrition and familiarity with more fruits and vegetables because of wider availability, increased travel, and improved communications will lead to an increase in the ratio of imports to domestic products in total demand. Differences in per capita consumption of fruits and vegetables among developed countries with similar patterns and levels of living may also indicate a potential for increases in import-oriented consumption in countries where consumption is relatively low at the present time. . . .

The organization of an effective system of packaging, processing, storage, transportation, and distribution, both nationally and internationally, is crucial to success in horticultural exports. Economies of scale benefit these activities by reducing their costs significantly, and this price advantage helps promote exports.

Different horticultural products have varying degrees of labor-factor intensity; therefore countries must choose appropriate commodities to take advantage of their labor endowment, including skilled labor. Also, labor intensity differs for the same product from one country to another. Ongoing research efforts in developed countries are devoted to offsetting their rising labor costs. Developing countries need to design appropriate techniques and to organize production in ways that will facilitate the linking of large-scale marketing and distribution channels with small farmers in order to take advantage of their comparatively low labor costs.

For successful export performance, a country must be first in the field, and it must carefully nurture its markets to attract consumer preferences toward its products. In addition, a large domestic market often provides both a springboard for the growth of exports and a cushion to absorb the shocks or uncertainties of export markets, except in the case of products exclusively produced for and sold in export markets.

Macroeconomic policies, especially trade and exchange rate policies that generally favor the export orientation of an economy, also help promote horticultural exports.

Detailed individual country studies are needed to analyze the factors, some agroecological and some manmade, that affect the production and exportation of horticultural products in specific circumstances. The lessons learned from their experiences will help identify the most important factors relating to institutions, technologies, and policies that contribute to an efficient horticultural sector and its success in export markets.

The Bias against Agriculture: Trade and Macroeconomic Policies in Developing Countries

Edited by Romeo M. Bautista and Alberto Valdés
San Francisco: Institute for Contemporary Studies Press for the International Center for Economic Growth and IFPRI, 1993, pages 301–303

The empirical findings presented in the country studies and regional surveys in this volume indicate that the trade, macroeconomic, and sector-specific pricing policies adopted in developing countries since the early 1950s have given rise to strong incentive biases: (1) against the production of tradable goods and in favor of nontradables; (2) within the tradable goods sector, against exports compared with import-competing goods; (3) within the export sector, against agricultural products compared with manufactured goods; and (4) within agriculture, against export crops compared with food crops. In failing to provide a more neutral incentive structure that could have encouraged a more efficient allocation of scarce resources in both static and dynamic terms, these policies have had an adverse effect not only on agricultural performance, but also on the economy as a whole and thus have inhibited overall economic growth.

It appears that improved policies could be a significant boon to future growth, particularly in the area of agricultural income and foreign exchange earnings. Institutional changes, new agricultural technologies, the development of rural infrastructure, and other productivity enhancing public investments, as well as access to foreign markets, may be necessary to boost the growth of agriculture to any degree. Such changes are likely to prove inadequate, however, if the relative incentives continue to be heavily biased against agricultural production.

The complementary nature of improved incentives for farm producers and increased public investment in agriculture is often neglected in discussions of their relative effectiveness in raising agricultural output. In most developing countries, each of these two policy instruments is likely to increase the effectiveness of the other. Moreover, where agricultural products are heavily taxed and rural infrastructure is severely underdeveloped, it would not be wise to address only one of these two problems.

Because this book has concentrated on trade and macroeconomic policies, it has said little about the need to develop the "trade infrastructure." Most low-income developing countries will find it virtually impossible to realize their potential comparative advantage unless they improve the existing organizational framework of the economy. In Myint's (1985, 26) model of organizational dualism, this would require "investment in social overhead capital, including the 'invisible' infrastructure of the marketing, credit, and information network" aimed at reducing the differential transaction costs between the "traditional" and "modern" sectors. An important

implication of that model is that organizational adaptations to achieve comparative advantage represent a movement toward the "neoclassical production possibility curve." Thus, instead of facing a trade-off between food and export crops, countries that expand export crop production can also expect to increase their food crop output.

What cannot be generalized is the capacity of developing country governments to reform the incentive structure and expand agricultural investment. In view of individual budgetary constraints, the repercussions of adopting alternative policy packages involving different levels and types of public investment and reform of price policy need to be considered at the country level. There, a number of pertinent questions merit close attention. For example, can certain forms of public expenditures (such as subsidies for credit, fertilizer, and irrigation) be reduced without a significant decline in output? What are the revenue effects of replacing a "cascading" tariff structure with a uniform tariff set at alternative levels?

Although this is not a book about economic development, some mention should be made of the implications of trade and macroeconomic policy reform (to improve agricultural incentives) for the national economy and its long-run growth. The increased rural incomes that would arise from higher agricultural prices can be expected to stimulate the demand for nonagricultural production, setting in motion a sequence of employment and income multiplier effects on the rural, regional, and national economies. This form of interconnected growth is at the heart of an agriculture-based development strategy (for an early statement, see Mellor 1976). The basic assumption is that both large and small agricultural producers are capable of responding to improvements in the economic environment by adjusting output supply and factor inputs to reflect prices and technology. In addition to increasing public investment in the rural sector, an agriculture-based development strategy would do well to eliminate policy-induced price biases against agriculture. The removal of taxes on agricultural exports and of any direct price disprotection for food crops would be a significant step in the right direction for many developing countries. Attention should focus not only on explicit export taxes levied on farm products, but also on the implicit taxation resulting from the pricing policy of state marketing boards. Developing countries need to check the tendency to tax excessively and to develop costly bureaucracies.

For the sake of efficiency, it is preferable to rely as much as possible on land, value added, or consumption taxes, rather than on trade taxes that distort production incentives. If revenue considerations dictate that export taxes and import tariffs cannot be avoided, governments should at least try to make the tax rates more uniform across commodities. They should also recognize that quantitative restrictions on trade are inferior to a system of equivalent taxes and subsidies; aside from the

higher administrative cost and loss of government revenue, direct trade controls create rent-seeking opportunities, induce noncompetitive behavior, and magnify the dynamic efficiency losses. Beyond the standard neoclassical propositions, recent research on trade externalities, scale economies in production, and growth of total factor productivity indicate that expanded export and import activities allow many other benefits to accrue to the national economy.

The greatest price penalty usually imposed on agriculture is the implicit (or indirect) tax on tradable agricultural products arising from the overvaluation of the real exchange rate. Therefore, apart from paying attention to sector-specific pricing policies, governments should monitor and carefully examine the effects of trade and macroeconomic policies on the real exchange rate. Officials at the Ministry of Agriculture could play a larger role in promoting agriculture's interests by placing themselves on the side of policy reform to reduce industrial protection, strengthen the financial system, foster fiscal discipline, and manage the nominal exchange rate rationally. A great challenge for developing country governments is to develop the institutional arrangements necessary to ensure that agricultural policy makers are not left out in the formulation of trade and macroeconomic policies.

Rice Market Liberalization and Poverty in Viet Nam

Nicholas Minot and Francesco Goletti
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This report focuses on market liberalization in the rice sector of Viet Nam and its impact on income and poverty. This topic is of interest for several reasons. First, the transition from central planning to a market-oriented economy in Viet Nam has been more extensive and more rapid than in many other nations. Second, on an aggregate level, the reform of the rice sector has been successful in transforming the country from a rice importer to a major exporter. Third, rice policy is important to the 76 million inhabitants of Viet Nam because rice accounts for three-quarters of the caloric intake and is grown by more than two-thirds of Vietnamese households. And finally, since Viet Nam now supplies 9 to 17 percent of world exports, the prospects for exports have important implications for world rice markets.

The main objective of this report is to examine the new set of food policy issues facing Viet Nam as a result of its transformation into a major rice exporter and its transition toward a market economy. In particular, the report aims to shed some light on two key issues: (1) What would be the effect on income and poverty of further liberalization of rice markets in Viet Nam? (2) What lessons can other countries learn from market liberalization in Viet Nam?

The liberalization of Vietnamese agriculture has proceeded in a series of small steps in response to poor agricultural performance and reduced assistance from the Soviet Union. Reforms began in 1980 with the introduction of the contract system, accelerated in 1988 with the devolution of decisionmaking to the farm household, and were complemented by liberalization of other sectors in the early 1990s. These reforms have generated impressive results, with rice production and the agricultural sector growing at close to 5 percent per year.

Rice production in Viet Nam is characterized by small irrigated farms, multiple cropping, labor-intensive practices, and growing use of inorganic fertilizer, though there are substantial regional differences. The Mekong River Delta is the rice bowl of Viet Nam, producing about half of national output on relatively "large" farms of 1.1 hectare. The Red River Delta is one of the most densely populated agricultural areas in the world. Although farms average only 0.25 hectares, the Red River Delta manages to produce rice surpluses, though they are much smaller than those of the Mekong. Rice cultivation is less intensive in the other regions, but rice is by far the most important staple in every region.

More than 57 percent of the rice production growth during 1985–95 was accounted for by yield growth, with rice area actually declining. Crop intensification (increasing the number of crops per year) and interaction among these factors account for the rest. Although all regions have seen impressive rice production growth, the Mekong Delta accounts for two-thirds of national growth.

There is little potential for expansion of rice area and only minimal potential for further intensification. Rice output growth will increasingly rely on yield expansion. Yield growth has far exceeded the Asian average, probably reflecting lagged response to liberalization. Thus, yield growth can be expected to fall in the coming years.

The structure of the rice marketing system in Viet Nam suggests that it has rapidly developed into a complex system without the central management that policymakers once thought was necessary. Tens of thousands of traders handle millions of tons of rice every year, channeling it from surplus farmers to urban consumers, rural rice-deficit areas, and exporters. Furthermore, the channels are numerous and differ from one region to another. The role played by the state-owned enterprises in the rice marketing system is minimal, except in the area of long-distance trade, where it dominates, and exports, where it has a legal monopoly.

As the overall economy has stabilized, rice prices have become less volatile, but market liberalization does not seem to have had a noticeable effect on marketing margins between paddy and rice prices, between farm and retail prices, or between prices in the north and south of the country. Spatial market integration analysis indicates that the degree of market integration has increased somewhat since the late 1980s, but it remains weak.

Two types of restrictions on trade affect the performance of the marketing system. First, internal trade was restricted in 1995, as indicated by the responses of traders in a 1995–96 IFPRI survey and by the large price differential between rice prices in the north and south. Second, the rice export quota is used by the government to ensure adequate domestic supplies. This report compares domestic and border prices, finding that the rice export quota was binding at least over the period 1990–95 and that it was equivalent to an export tax of 20 to 25 percent.

Rice is by far the most important staple in the Vietnamese diet, accounting for more than 60 percent of the caloric intake in every region. Per capita rice consumption is lower among urban households than rural ones. In addition, rice consumption rises with income at low and middle income levels, but it falls as income rises further. Econometric analysis of household data carried out in this study suggests that the expenditure elasticity of rice demand is 0.38 at the mean income level, while the price elasticity is –0.24.

In order to understand how a rice policy affects the poor, the distribution of poverty in Viet Nam is examined. Poverty is almost four times as widespread and five times as severe in the rural areas as in the urban areas. Furthermore, poverty tends to be concentrated in the more remote, hilly regions, namely the North Central Coast, the Northern Uplands, and the Central Highlands. Household survey data suggest that the two delta regions, with 45 percent of the population, are surplus regions that would gain from higher rice prices; the other five regions are rice-deficit areas that would lose on average. Higher prices would also benefit the average rural household at the expense of urban households.

A uniform 10 percent increase in rice prices would hurt urban households, nonfarmers, and residents of the five deficit regions, although the effect on real income would be less than 2 percent on average. On average, the price increase would benefit farmers, particularly those in the Red River and Mekong deltas. Somewhat paradoxically, in spite of the higher average income, the poverty rate would rise slightly from 25.0 to 25.2 percent in the long run.

A simulation model, the Viet Nam Agricultural Spatial Equilibrium Model, was constructed to examine the impact of alternative rice marketing policies on prices, production, consumption, and income. The impact on poverty is estimated by combining the results of the simulations with household data on rice marketing patterns.

With regard to the rice export quota, the model indicates that there is some justification for the concern of the Vietnamese government that eliminating rice export quotas would raise prices and hurt some Vietnamese households. The model confirms that rice prices would rise 14 to 22 percent (depending on whether internal restrictions were also removed) and have an adverse effect on urban households, nonfarm rural households, and households in the Central Highlands. For example,

according to the 1992–93 Viet Nam Living Standards Survey, the poorest quintile of urban households spends almost one-third of their income on rice.

At the same time, the model shows that the net gains to rice farmers and consumers would be around US$200 million. Three-quarters of this gain would represent a transfer from state-owned enterprises exporting rice and one-quarter a net gain to the country. Furthermore, poor households tend to gain both in absolute terms and relative to nonpoor households because they are predominantly rural farmers who benefit from higher rice prices.

The government could liberalize rice exports slowly by replacing the quota with an export tax and gradually reducing the tax rate. The model indicates that a 22 percent tax would be equivalent to the 2.5 million tons quota. This option has the advantage of generating revenue that could be used to alleviate the impact of higher rice prices through targeted assistance.

With regard to restrictions on the internal movement of food, the model suggests that the impact on average prices and incomes would be relatively small. Nonetheless, the absolute gains are large compared with the negligible costs of such a policy. Removing restrictions on internal trade would have substantial regional effects, however, lowering prices in the north and raising them in the south. The distributional effects are relatively small and tend to cancel each other, so there is no change in the national poverty rate.

The Road Half Traveled: Agricultural Market Reform in Sub-Saharan Africa

Mylène Kherallah, Christopher Delgado, Eleni Gabre-Madhin, Nicholas Minot, and Michael Johnson
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The Future of Agricultural Market Reform in Sub-Saharan Africa

The reform efforts of the 1980s and late 1990s have generated a positive response in the agricultural sector of Sub-Saharan Africa. Despite the progress that has been made, however, the results of market reform have generally not met expectations, and much remains to be done.

The reforms focused on eliminating government control and increasing the producer price of tradable agricultural commodities but placed little emphasis on developing the institutions needed to support private sector activity. Improving price incentives and liberalizing markets were expected to be enough to generate a supply response and create well functioning markets. The private sector was expected to take over the institutional functions the state had been providing. The reality has been quite different. While private trade has increased in virtually all

agricultural markets, the private sector has been unable or unwilling to supply credit and marketing services in remote areas. And although the elimination of policies enforcing a uniform, nationwide price has been a boon for many producers and consumers close to markets, it has often left farmers in remote areas worse off than they were before liberalization.

Constraints to Further Reform

Sub-Saharan Africa faces a number of constraints in its efforts to reduce poverty through agricultural market development. These constraints include

- Structural factors: Investments in infrastructure, communication, research and extension, and marketing information have been reduced as part of broader budget-cutting efforts.

- Institutional factors: Government regulations regarding property rights, quality control, contract enforcement, and good governance continue to be weak.

- Implementation factors: The reform process has suffered from incomplete reforms, delays, and reversals owing to a lack of government commitment and political opposition by those with a vested interest in the status quo.

- Exogenous factors: Drought, disease, war, and civil strife have contributed to the poor economic performance of Sub-Saharan Africa.

These constraints mean that traders in the region still face a great deal of risk. Transaction costs are generally high and unstable, and postreform marketing systems do not operate efficiently yet, nor do they provide market stability. Improving price incentives for farmers, while necessary, has not been enough to boost production. Furthermore, in liberalized food- and cash crop markets, farmers have less access to credit to purchase modern inputs. Finally, Sub-Saharan African governments still intervene in agricultural marketing activities in many countries, sometimes because of market failures.

What must be done to overcome the remaining constraints and make agricultural market reform more effective?

A New Agenda

Further progress in developing well-functioning markets will require not only further liberalization but also a more concerted effort to go beyond the withdrawal of the public sector from agricultural marketing. The state must assume a new, supportive role as market facilitator. One aspect of this role is to strengthen investment

in public goods such as infrastructure, research and extension, and public market information. The second is to foster institutions required for the development of competitive and efficient markets. The new agenda for market development in Sub-Saharan Africa includes the following eight priorities:

1. *Fully implement all reforms.* Experience shows that market performance improves and marketing costs fall once the government no longer monopolizes trade.

2. *Find institutional solutions to provide input credit to farmers.* Credit for input use can be provided through a number of institutional innovations, including contract farming, credit associations, group lending, and farmers' organizations.

3. *Develop a legal infrastructure for market transactions.* This long-term step will reduce the risk of investment and decrease transaction costs for both farmers and traders by clarifying property rights, enforcing contracts, ensuring quality control, and establishing rules of market conduct, among other legal concerns.

4. *Increase investment in infrastructure and institutions.* Higher productivity and effective markets require investment in research and extension, access to market information, and efficient transportation and communication networks.

5. *Promote effective governance and state capacity to monitor market development.* Proper governance will prevent investment from being channeled to rent seeking groups and will ensure that funds are distributed to their intended uses. Improved state capacity to monitor market development would allow governments to anticipate undesirable market developments and devise appropriate responses to eventual short-term difficulties in a timely and effective manner.

6. *Encourage smallholder production of export crops.* In many areas, food and export crop production are highly complementary and export crop production has positive spillover effects on input use and food crop productivity. Therefore, promoting smallholder production of export crops should have beneficial impacts on agricultural production in general and on the food security and income of smallholder farmers in particular.

7. *Address the problems of vulnerable groups in remote areas.* Farmers in remote rural areas have suffered from the loss of parastatal activity and official pricing that effectively subsidized high transportation costs. Short-term targeted interventions may be needed to alleviate these problems.

8. *Institute credible, sustainable macroeconomic policies.* Indirect taxation through overvalued exchange rates and protective industrial policies can have a more negative effect on agricultural incentives than direct taxation. In addition, stable and predictable macroeconomic policies encourage savings and investment and focus private sector effort on efficiency rather than on anticipating and reacting to macroeconomic shocks.

Chapter 5

Increasing Agricultural Production and Productivity

From Green Revolution Assessment to Broader Technology Policy Research

The role of technology in agricultural development was addressed by a broad range of agricultural economists around the world whose work had a strong influence on the IFPRI research agenda throughout the 1980s and 1990s. Early work by Vernon Ruttan and Yujiro Hayami tested several hypotheses on the relationships between productivity growth and income distribution using the case of India during the Green Revolution. Walter Falcon was among the first researchers to bring together the controversial issues of production effects, marketing needs, and potential social consequences of technical change. Jock Anderson's 1994 book *Agricultural Technology: Policy Issues for the International Community* made an important contribution to the technology policy debate in agriculture.

Given the concern about food scarcity when IFPRI was established, early IFPRI research focused on how to increase food production and on what inputs farmers needed to do so: seeds, water, fertilizers (see excerpt from *Accelerating Food Production in Sub-Saharan Africa*, John W. Mellor, Christopher Delgado, and Malcolm J. Blackie, eds., 1987). Although the Green Revolution seemed to show the potential for new technologies and agricultural practices to boost agricultural productivity and raise farmers' incomes, critics began to argue that it had bypassed the poor.

In the early 1990s research at IFPRI looked at the effects of the Green Revolution over time and found that in some important cases small farms had indeed achieved rice yields comparable to those of large farms, agricultural workers in-

creased their employment and incomes, and poverty declined (see excerpts from *Incentives and Constraints in the Transformation of Punjab Agriculture*, Anya McGuirk and Yair Mundlak, 1991; and *The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India*, Peter B. R. Hazell and C. Ramasamy, 1991). But results were more mixed in some areas, and IFPRI research also showed that the right conditions must be in place to allow the poor to benefit from new technologies. Several critics of the distributional consequences of new varieties, such as Keith Griffin, dominated the debate for some time, but Michael Lipton and Richard Longhurst, in their 1989 book *New Seeds and Poor People,* provided a more complex picture of when new technologies help the poor and when they do not. Another line of criticism was based on a perception that the improved varieties performed with greater instability and were thus riskier. This perception was addressed in evidence assembled in a 1989 book called *Variability in Grain Yields: Implications for Agricultural Research and Policy in Developing Countries* edited by Jock Anderson and Peter Hazell. In recent years, Gordon Conway has pointed out that a second transformation of agriculture is required—specifically, a "doubly green" revolution that stresses conservation as well as productivity.

Another revolution in agricultural technology that has drawn enormous attention and controversy is biotechnology. IFPRI has been an important voice in the debate over agricultural biotechnology and what it means for developing countries (see excerpts from *Seeds of Contention: World Hunger and the Global Controversy over GM Crops*, Per Pinstrup-Andersen and Ebbe Schiøler, 2001; and *The Politics of Precaution: Genetically Modified Crops in Developing Countries*, Robert L. Paarlberg, 2001). IFPRI research has helped elucidate the policies that developing countries must have in place to take advantage of biotechnology for the benefit of poor people while mitigating its negative consequences. At the same time, IFPRI has contributed to research regarding the use and conservation of crop genetic resources within the CGIAR (see excerpt from *Saving Seeds: The Economics of Conserving Crop Genetic Resources Ex Situ in the Future Harvest Centres of the CGIAR*, Bonwoo Koo et al., 2004). IFPRI researchers have also investigated the determinants of and value of crop biodiversity. Outside of IFPRI, Robert Evenson has systematically quantified the economic benefits to developing countries of varietal improvement by CGIAR research centers.

Work by IFPRI and by scholars such as Julian Alston, Robert Evenson, and Ramón López has shown the high rates of return to agricultural research and the benefits of productive investments compared with subsidies on inputs such as fertilizer and water that distort incentives and cause misallocation of resources.

As the rate of technological change has accelerated in recent decades, IFPRI researchers have also taken a broader look at the role of science and technology in agriculture. They have turned their attention to studying what constraints farmers face

in adopting new technologies, how developing countries can create effective systems for agricultural research and development, and how to direct the benefits of agricultural science to poor people (see excerpts from *Slow Magic: Agricultural R&D a Century after Mendel*, Philip G. Pardey and Nienke M. Beintema, 2001; and *Science and Poverty: An Interdisciplinary Assessment of the Impact of Agricultural Research*, Ruth Meinzen-Dick, Michelle Adato, Lawrence Haddad, and Peter Hazell, 2004).

Accelerating Food Production in Sub-Saharan Africa

Edited by John W. Mellor, Christopher L. Delgado, and Malcolm J. Blackie
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1987,
pages 354–358

Priority to the Smallholder Food Sector

For African governments to place the food sector on center stage requires acceptance of five premises, each controversial and none established beyond reasonable doubt. First, substantially accelerating the food production growth rate in sub-Saharan Africa is feasible. Second, it is appropriately done in the smallholder sector. Third, the resource requirements are immense. Fourth, future progress in the nonfood sectors requires much less public resources than in the past. And fifth, accelerated growth in the food sector will stimulate growth in other sectors.

Increased Food Production

Each chapter in this book illustrates the difficulties of accelerating growth in the food sector of sub-Saharan Africa. The record of growth has been poor and is getting worse. Soils and climate over large inhabited areas are inhospitable and ill understood. Rural population densities are low and infrastructure poor, features that tend to go together and serve to make modernization difficult. The numbers of trained people are low, the necessary institutional structure embryonic at best, and policies unfavorable to food production growth are embedded in the political structure. Finally the developed countries' market economies continue to build an unprecedented capacity to export food, which builds pressure to continue rapid expansion into Third World markets.

On the other hand, African agriculture has numerous bright spots other than the perennial export crops such as smallholder cocoa, coffee, oil palm, and tea. Annual crops such as cotton and groundnuts have had periods of rapid growth when they were properly supported by public services and policies. Hybrid maize varieties have had a sweeping impact in wide areas of East Africa, where key institutional and policy complements were available. In large areas of less well-known parts of West Africa, technical analysis of soils and rainfall indicates a hospitable environment for modernization of agriculture. The implications for Africa of the sharp turnaround in the smallholder food sector of Asia from the 1960s to the 1970s, often under difficult conditions, are not to be dismissed lightly. Today the conclusions in a widely read book of the 1960s, *Famine-1975!*—which recommended the practice of triage for three quarters of a billion people of Asia—seem incredible (Paddock and Paddock 1967). At that time, Africa was not considered to have a food problem.

Thus, both popular perceptions and reality do change radically and rapidly. An increase of more than one-fifth in the growth rate of basic food staples in Asia from

one decade to another is no small accomplishment. We now understand the basic developments that brought about this acceleration and therefore have a knowledge base for a similar effort in Africa. The issue is whether our knowledge of agricultural science and institutional development has progressed sufficiently to make the more difficult task of raising African food production growth significantly above population growth rates a feasible proposition. We believe it is feasible.

The task of moving Africa without moving the food sector would be equally daunting. This would involve giving development priority to nonagricultural or export crop sectors, even though the majority of the population derives a high proportion of its real income from food production. Exports of the major noncereal agricultural products accounted for roughly one-third, by value, of production of major crops in sub-Saharan Africa in 1980–82.[1] Although data are not available, it seems likely that food production is economically efficient relative to other options in large areas of the continent and in substantial parts of every country.

Centrality of the Smallholder Sector

In Asia, emphasis on the smallholder sector has been generally accepted. Debate decisively favored smallholder production prior to the green revolution era, except for a short-lived official position by the Congress party of India in favor of cooperative farming (reminiscent of Tanzania's much more serious ujamaa policy) and, in various countries, some discussion of plantation versus smallholder production in export crops such as rubber and oil palm.

In Africa, the policy debate has been less conclusive. In eastern and southern Africa this has no doubt been due to widespread bimodalism in production, with substantial areas in large-scale, often European-operated farms. These farms are typically well serviced by public or private institutions, giving the appearance of much greater efficiency than the African smallholder sector, which has few services at its disposal. Large-scale plantations in parts of coastal West Africa and a socialist penchant for large-scale state farms to provide a marketed surplus for urban areas have also kept the debate alive.

Nevertheless, there was a clear consensus at the Victoria Falls conference that large-scale agriculture cannot make a major impact on the African food problem, despite its contributions in the high-potential areas of eastern and southern Africa. At present, it is unlikely that more than 5 percent of sub-Saharan African food production comes from large-scale farms. The area in large-scale production is relatively small, and its expansion is both technically difficult and politically impossible.

1. The calculations used include 1981 world prices in U.S. dollars (World Bank 1983d) and volumes of production and exports (World Bank 1984b).

Management and investment resources are scarce, and their costs even higher than their nominal values would suggest.

Assumptions based on Asian experience with smallholder farming appear valid for Africa. There is little scope for economies of scale in farm production (as distinct from research, input supply, marketing, and other support institutions). The food sector is already dominated by the small farmer who, as elsewhere, is responsive to good support services. The last point has been strikingly demonstrated where both improved technology and supporting services have been provided—for example, the Kenya Tea Development Authority, hybrid maize production in much of East Africa, cocoa development in Ivory Coast, and cotton in Mali. . . .

The Immense Resource Requirements of Increased Food Production

The Asian experience drives home the fact that resource requirements for moving the food sector are immense. They are larger in Africa than in Asia because of sparser populations, poorer initial infrastructures, lower initial base of formal education, and generally lower-fertility soils. A common reaction to these observations is to search for means of developing agriculture in Africa that do not require a large investment.

The attraction of this approach is reinforced by the continuing deterioration of rural infrastructure and by environmental and ecological concerns. However, Lipton, Idachaba, and Wanmali emphasize the immense resource needs for developing agriculture. Lipton opts for less investment in infrastructure to conserve resources for other even more essential needs. Thus there seems to be less disagreement about the size of the resource requirements for agriculture than about their availability. This at least drives home the need for setting priorities for resource use.

Lower Investment in Other Sectors

The massive investment required for getting food production moving would necessarily mean taking resources from other uses. It is clear that urban services and many manufacturing activities, particularly those that require large concentration of financial and human capital, would receive a lower priority than in the past.

On the other hand, the domestic food sector and the agricultural export sector are frequently complementary, rather than competitive. Some investment—roads, research, extension, input supply systems, for example—that is useful to one is also useful to the other. This is fortunate, since a dynamic food sector is a heavy user of foreign exchange in most developing countries. Thus an investment-led incentives strategy is likely to support both types of agricultural production. Increased labor productivity in food production has a particularly important simulative effect on both food and export crop production. Farmers generally insist on using their resources first for producing the families' food.

The complementarity of investment in nonfood agricultural exports and investment in food crops is probably greatest for those investments that are crop specific, such as commodity-based agricultural research. This is because farmers have too little trust (advisedly so) in market processes to give up food production for home use in order to specialize in presumably more lucrative export crops. With low labor productivity, there may be little labor available for export crops after food production needs have been met. However, improvements in smallholder food production that would lower the cost (and risk) of providing food would likely be associated with increased output of export crops.

In the longer run, expanded food production and improved marketing and food security arrangements among areas may result in higher specialization in export and food crops among regions. That is particularly likely in the humid lowland tropics, where food crops are already strongly disadvantaged by soil, topography, and climate that generally favor perennial crops, which tend to be exported.

Increased Food Production as Stimulus to Other Sectors

One of the primary arguments for a high priority to agriculture, and especially the domestic food sector, is its powerful role in facilitating and stimulating growth of other sectors of the economy (Mellor 1976; Mellor and Lele 1973). In the long run, development must involve diversification away from agricultural production—that is, other sectors must eventually grow even faster than agriculture. Because of the linkages and multipliers, initial emphasis on agriculture can be expected to lead to a diversified economy more rapidly than initial emphasis on other sectors (Mellor 1976).

Because of the lack of surplus labor in the rural sector, labor transfers to the nonagricultural sector will result in less production of food and export crops and higher food imports than would otherwise be the case. These food imports cannot be sustained unless the countries have a comparative advantage in export of nonagricultural goods and services. This is rarely the case in sub-Saharan Africa. Development of the food sector would not only reduce dependence on food imports but would release labor for the nonagricultural sector.

Accelerated growth in the smallholder food and export crop sectors would also stimulate demand for nonagricultural goods and services. Production of the latter tends to be labor intensive, and labor productivity is generally higher than in the traditional food sector. This is a salutary influence for employment, for the incomes of low-income people, and for conservation of capital. Furthermore, it is reasonable to assume that existing linkages would strengthen with improved infrastructure, rising rural incomes, and improved overall economic policy.

Incentives and Constraints in the Transformation of Punjab Agriculture

Anya McGuirk and Yair Mundlak
IFPRI Research Report 87, Washington, DC: IFPRI, 1991, pages 9–10

Much of the rapid growth in output experienced by Punjab, India, during the period of this study was generated by agricultural growth. Most of this agricultural growth is attributed to growth in crop production resulting from improvements in the overall yields of wheat and rice and, to a lesser extent, in the yields of maize and cotton. The pattern of growth in overall yields for the various crops, particularly wheat and rice, suggests that the main improvements came as a result of a shift to modern higher-yielding varieties rather than as a result of intensifying cultivation of the existing varieties.

The extremely rapid adoption of the modern varieties (MVs) of wheat and also rice, once suitable rice varieties were introduced, indicates that factors usually associated with a slow rate of implementation of new techniques, such as imperfect information, uncertainty, institutional constraints, and inadequate human capital, did not appear to play a prominent role in the adoption process. These factors could not have changed much over the extremely short transition period and therefore could not have influenced the rate of adoption. Alternatively, the speed at which the new varieties were implemented, particularly MV wheat, suggests that the pace of transition was largely determined by the productivity of the MVs relative to the traditional varieties and by physical constraints such as, initially, the availability of seeds and, later, the availability of irrigation facilities and fertilizers. Thus, physical capital played a crucial role in the growth process.

The conceptual framework used to model the growth in Punjab agriculture is that of choice of technique. Given that much of the agricultural growth can be attributed to the implementation of new techniques of production, an understanding of the growth process requires that the factors affecting the decision to implement these techniques be identified explicitly. Analyses that aggregate techniques by crop potentially provide distorted views of the technology and therefore of the growth process. Thus, the results of this study not only have important policy implications for agricultural growth but also provide evidence of the usefulness of the choice-of-technique approach.

The techniques of production analyzed are those of the major crops in Punjab, identified by variety, season of growth, and method of production (irrigated or dry). The short-run area-allocation decisions are influenced by the expected revenues of the different techniques; the availability of fertilizers, irrigation, and cropped area; and the local environment. Overall yields by crop are determined by the composition of techniques implemented, the availability of fertilizers, and the local physical environment.

Because resources are scarce and therefore have to be attracted to agriculture from other uses, changes in the availability of fertilizers, irrigation, and cropped area are determined by the overall availability of resources and the differential rate of return between agriculture and nonagriculture. The relative importance of these factors depends on whether the decisions are made by the public or private sector.

Equations analyzing the investment decisions of both the private and public sectors are estimated simultaneously with the area allocation and yield equations. The data base utilized in this study consists of district-level observations over the period 1960 through 1979. The effects of the local physical environment, the initial levels of infrastructure, and the availability of human capital on choice of technique and overall level of output are detected by the inclusion of fixed district effects.

The results are summarized by deriving both short-run and long-run elasticities. The specification of the model implies that the size of both the short-run and long-run elasticities depends on the productivity of the implemented technology; the more productive the implemented technology, the greater are the elasticities (in absolute value).

The short-run output elasticities with respect to price are generally small, as the constraints are binding. The short-run aggregate output elasticity with respect to a change in prices increased from nearly zero before the onset of the "green revolution" to a high of 0.18 in 1979, when the transition to MVs of wheat and rice was largely complete. Thus, conditional on the availability of quasi-fixed inputs, total output responds little to changes in price.

The short-run elasticities of output with respect to the constraints indicate that the availability of quasi-fixed inputs played a major role in the determination of the pace of transition to MVs. The magnitude of these elasticities is large relative to their price counterparts. The availability of private irrigation and roads appears to have been particularly important in the transition process.

The results from the quasi-fixed input equations suggest that the decisions made by farmers about irrigation, and indirectly about net cropped area, were responsive to the increase in profitability spurred by the introduction of MVs. The long-run elasticities of area irrigated by private resources with respect to prices and the availability of roads and fertilizers were particularly large.

Although similar responses were not obtained in the government investment equations as specified, the observed increases in the provision of electricity and the availability of fertilizers and roads suggest that the government responded to the new opportunities.

The long-run output elasticities with respect to prices are all large relative to their short-run counterparts. These elasticities reflect the strong response of private irrigation and the somewhat more moderate response of net cropped area and fertilizers as the prices changed. The long-run aggregate supply elasticity, although

negligible before the onset of the green revolution, reached a high between 1.3 and 1.5 in the late 1970s.

The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India

Peter B. R. Hazell and C. Ramasamy
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1991, pages 239–244

Questions and Answers about the Green Revolution

. . . Early writers on the green revolution were apprehensive about its likely impact on the rural poor. In this section we summarize those concerns in four key questions and marshal our evidence to answer them for the case of North Arcot.

Did small farms adopt the new technology and obtain levels of productivity comparable to the large farms?

The evidence from the Cambridge and Madras universities study shows that the early adopters of HYVs were typically the larger farmers. Chinnappa (1977) reports that the average size of the operational holding for HYV adopters was about 2 hectares, compared with 1 hectare for nonadopters. Also, the percentage of HYV adopters increased across farm size groups, as did the percentage of the paddy area planted to HYVs. Only 15 percent of the farmers operating less than 0.4 hectare planted HYVs in 1972/73, compared with 67 percent of the farmers operating more than 4 hectares. The proportion of paddy area planted to HYVs increased from 10 to 23 percent between the same groups.

By the time of John Harriss' return visit to North Arcot in 1976, adoption of HYVs was much more widespread (Harriss 1977). And by the time of the IFPRI-TNAU surveys in the early 1980s, over 90 percent of the paddy area was consistently planted to HYVs, with no systematic differences by farm size group.

There are a number of reasons why adoption by small farms may have lagged. Chinnappa (1977) identifies greater problems in obtaining credit and fertilizers for small farmers, and John Harriss (1977) emphasizes the need for reliable water supplies over a relatively long growing period for early HYVs such as IR5 and IR8.

The provision of formal credit and farm inputs did improve . . . , in part because of a crash program mounted by the government to increase rice production in Tamil Nadu. The release of locally developed HYVs in the mid-1970s that were better adapted to the growing conditions of small farms with their less reliable water supplies also helped. Both developments highlight the importance of government

action in preventing the development of serious inequities when green revolution-type technologies are first released. Necessary inputs should be made readily available to all farmers, and local research institutions have an important and timely role to play in adapting genetic material from external sources to local conditions. In North Arcot, plant breeders at TNAU were very successful in adapting International Rice Research Institute (IRRI) genetic material to local conditions.

Turning now to the productivity issue, our analysis of paddy yields . . . shows that while large-scale farmers obtained higher yields than small-scale farmers in 1973/74, this difference had disappeared by the early 1980s. This finding again reflects the later adoption of HYVs by small farmers. In North Arcot the potential "scale neutrality" of the new technology, therefore, appears to have been realized.

Did the employment and earnings of agricultural workers increase as a result of the new technology?

Although Cost of Cultivation of Principal Crops (CCPC) data show that HYVs require a little more labor per hectare than the available local varieties (about 5 to 10 percent more, depending on the year . . .), total employment in crop production declined by 4 percent per paddy farm in the resurvey villages between 1973/74 and 1983/84. This decline is attributable to a downward trend in labor use per hectare for both HYVs and local varieties during the 1970s, a reflection of the increased mechanization of irrigation pumping and paddy threshing. The loss in per hectare paddy employment was sufficiently large, in fact, to offset the employment gains from an increase in the paddy crop area on both small and large farms.

The use of family labor increased on both small and large farms between 1973/74 and 1983/84 . . . , hence the brunt of the decline in total employment fell on the hired workers. On average, their employment fell by 25 percent per paddy farm, or by 11 percent per farm if attached labor is also included.

Yet despite this loss in the use of hired labor, real wage rates increased modestly for some tasks—though not consistently in all the sample villages or for all tasks. . . . Moreover, agricultural employment earnings virtually doubled in the resurvey villages for small-paddy-farm, landless-labor, and nonagricultural households . . . and increased by 40 percent for nonpaddy-farm households. . . . These increases were possible because of a decline in the amount of hired labor supplied by farms operating more than 1 hectare of land . . . and because of competing employment opportunities in dairying and nonfarm activities.

Additionally, there were two key features of the transition to the new technology in North Arcot that facilitated these favorable results. First, the incidence of landlessness changed little. Most farmers were able to retain access to their land, and migration to urban areas reduced the impact of demographic pressures on the agricultural labor market. . . .

Second, despite an initial and worrying increase in the number of tractors (Harriss 1977), there has been little mechanization of land preparation in the region. Water pumping for irrigation is now almost exclusively mechanized, and some farmers rent threshing machines, but these activities have not displaced large amounts of hired labor. That tractors did not make greater inroads is probably a consequence of the small size of the farms in the region and the prohibitive per hectare costs of private ownership. However, it remains a puzzle as to why a rental market emerged for threshing machines but not for tractor services.

Did the distribution of land become less concentrated?

Neither the available survey data nor John Harriss' own field data . . . provide evidence of any general increase in the concentration of land, or of the loss of land by small landholders.

As a result of population growth and the partitioning of some holdings, the average farm size declined marginally from 1.23 to 1.18 hectares in the sample villages between 1973 and 1983. This decline was nearly all concentrated in the rich villages—that is, the ones with better irrigation resources. . . . The average farm size also declined in all four quartiles of the size distribution in the rich villages. The farms in the first and second quartiles lost relatively more land than average, but the farms in the top quartile lost the most land in absolute terms.

Average farm sizes also declined in the first three quartiles of the poor villages, but the average farm size of the top quartile increased by about 8 percent. Thus, the only evidence for a (modest) worsening of land distribution comes from the villages that, having the poorest irrigation resources, benefited the least from the green revolution.

Duli is the only village in which the distribution of land became substantially worse. . . . Based on an in-depth field investigation, Harriss attributes the change to larger farmers buying back land owned by moneylenders and silk weavers in the town of Cheyyar who acquired the land in the 1930s, rather than to any significant transfer of land from smaller to larger landholders.

Harriss . . . also provides evidence that, of his sample of households that initially inherited land and still owned it in 1973, virtually none of them were dispossessed between 1973 and 1984.

Land leasing is relatively rare in North Arcot, and over 90 percent of the farms are now owner occupied. Moreover, the farms are typically small, and there are virtually no farms larger than 30 hectares. Within this context, the risk that with the advent of the green revolution landlords would dispossess tenant farmers, or that large farmers would buy up small farms, seems to have been small. The implications for regions with least equitably distributed land resources are obvious.

Was there a decrease in the inequality of income and a reduction of absolute poverty?
The available evidence from the resurvey villages shows that small paddy farmers and landless laborers gained the largest proportional increases in family income between 1973/74 and 1983/84—90 and 125 percent, respectively. . . . Large paddy farmers (because of sharp cost increases, especially for fertilizer and labor), nonpaddy farmers (who do not have access to irrigated land), and nonagricultural households did less well, but the real value of their family incomes still increased by 18, 17, and 55 percent, respectively.

These changes are corroborated by measured changes in the real value of household consumption expenditure . . . , by a sharp improvement in calorie and protein intake . . . , and by the growing importance of higher-quality foods and nonfoods in total household expenditure. . . . Moreover, the regional model in Chapter 8, which normalizes to average rainfall conditions, also predicts that the green revolution increased the incomes of farmers and landless laborers by about 30 percent and of nonagricultural households by 20 percent. . . .

We conclude, therefore, that there were sizable absolute gains for all household groups, and that absolute poverty declined. The relative distribution of household incomes improved in that the small paddy farmers and the landless workers gained relative to other groups. . . . On the other hand, households that did not gain directly from the green revolution because they do not participate in paddy farming lost in their relative standing. In particular, the nonagricultural households became the poorest income group, whereas previously they had been about as well off as the small paddy farmers.

There are a number of factors that explain these favorable income changes. First, because the distribution of land did not become noticeably more concentrated, there was little increase in the size or number of large farms, and hence there was limited scope for a greater concentration of income at the top end of the distribution.

Second, agricultural wage earnings increased significantly and these translated into higher incomes for landless laborers, nonagriculturalists, and small farmers. This process was facilitated by rural-urban migration and a low incidence of increased landlessness, both of which helped to curtail any increase in the number of hired workers in agriculture. . . .

Third, the per hectare net returns to paddy farming, and especially to HYVs, declined after the initial gains of the early 1970s. This was partly because of sharp increases in the costs of labor and fertilizers, but also because the real price of paddy stagnated and perhaps declined. The net result was that farm incomes did not increase in direct proportion to the area of HYVs grown, but the gain depended, among other things, on a farmer's dependence on hired labor, his skill in managing fertilizers and irrigation, and his choice of crop and livestock to rear. . . .

Fourth, there were significant increases in nonfarm sources of income. These were not only crucial to the specialized nonagricultural households, but were also an important component of the increase in incomes for the small paddy farmers, the nonpaddy farmers, and the landless laborers. . . .

Since the increase in family incomes was reasonably equitable, the green revolution does not seem to have increased antagonisms between classes within the villages. On the contrary, John Harriss . . . finds that because the government is now a more important economic factor in village life through its involvement in providing credit, electricity, and transport, as well as its employment programs and subsidized food and school meals schemes, then political alliances are emerging to make demands on the state that cut across existing class antagonisms.

Seeds of Contention: World Hunger and the Global Controversy over GM Crops

Per Pinstrup-Andersen and Ebbe Schiøler
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2001, pages 143–146

Slow and Steady Wins the Race

The outcry elicited by the hasty launching of GM foods onto an unprepared market has certainly taught the major seed producers an expensive lesson. Even the best discoveries—and these particular ones were not in that category—need time to be accepted. Instead, the companies' hell-for-leather approach has turned what could have been a case-by-case discussion into an all-out, all-embracing confrontation for or against genetic modification. As such, the debate bears little resemblance to the model normally employed in addressing vital concerns in a compromise-oriented democratic society. One of our essential aims must be to get back to a reasonable form of debate. Not every kind of genetic engineering is justifiable and not every risk scenario is relevant in every case.

Much harm has been done to the debate by the bundling together of a number of different agendas. When biologists argue the scientific aspects of the matter (and of course, they do not all see eye to eye), their arguments are met by denunciations of the multinationals' monopolization and concentration of capital. When attention is drawn to the food deficit in developing countries, out come the statistics to prove there is plenty to eat if only the food were distributed evenly across the globe. Arguments about the dispersal risk of GM maize in Mexico are used as a line of attack against using potatoes with an inbuilt resistance to pests in Denmark!

Obviously we cannot start the discussion again from scratch, ignoring all the dust already stirred up. But we could follow a piece of good advice from researchers

working at the Royal Danish Veterinary and Agricultural University: "Turnips on their own, rape on its own."[11] What they are getting at is that (in Denmark, at least) the risks of crossbreeding with wild varieties are very different for these two crops: the fodder turnips now being cultivated in test fields are biennials harvested before they flower; rape is an annual. So the precautions that need to be taken with GM turnips are not necessarily the same as those that apply to rape, under Danish conditions. This piece of advice also has a broader application, of course: considerations that may be relevant in one context cannot be allowed to dictate the rules in another, quite different context. Such a mistake could lead to both too little and too much regulation and control, if what we are left with is some sort of standard package. For example, Danish experts have had such serious reservations about the possible crossing of GM rape with local weeds that a GM variety ready to be marketed has now been shelved, for the time being at least. Similar concerns about GM potatoes might be valid for Peru but would be pointless for Denmark, because potatoes have no wild relatives in Denmark.

An approach to genetic modification based on a case-by-case evaluation, as practiced in E.U. authorization procedures, is a reasonable requirement to set. And such an approach would undoubtedly enhance the objectivity of the entire debate and reduce the chance of several different agendas becoming mixed up. All issues can be discussed, with or without consensus; but they ought to be kept apart. The political aspects of dependency and monopolization, for example, go far beyond genetic modification to the broader issue of globalization. The limits to human manipulation of God's creations is another aspect that can be discussed independently. The argument about organic versus traditional agriculture would be an ideal subject for a general debate on what we expect from tomorrow's agriculture. Social utility is an issue in itself, for all countries. Then comes the problem of resolving all the technical risk factors, which is undeniably a job for the specialists. In the public debate, the need for a certain amount of professional wherewithal to decide specific points about the risks of the new technology is still not fully accepted. This is due in part to a general distrust of new technology and the competence and integrity of both government authorities and private companies.

Free Choice for Everyone—Us and Them

On a Saturday morning, for those standing in line at the checkout in their local supermarket in Europe or the United States, an adequate food supply appears to be anything but a problem. They see not only plenty of food but also an overwhelm-

11. Lykke Thostrup, "Roer for Sig og Raps for Sig [Turnips on their own, rape on its own]," in *BioInfo NYT.*

ing variety of products, brands, and qualities. What more could one ask for? It is easy to dismiss the notion that there is any need for GM products. If such products do find their way onto grocery store shelves, shoppers certainly do not have to pop them into their shopping carts. But can a strong case be made for stopping others from doing so?

We, the authors of this book, do not believe the arguments against genetic modification are strong enough to dictate that the world should stop any further development of GM plants. And we find it extremely worrying that a minority that has more than enough to eat should make life so difficult for those who do not. Potential public and private investors, facing a vociferous and hostile response from some quarters, may well decide that the only easy and logical solution is to discount the use of genetic engineering technology in food production and focus exclusively on its use in human medicine. Society may be turning its back on some possible advances, but we, the well-fed of the world, will get by just the same.

The developing countries, with the possible exception of China, will have no chance to benefit from GM food research unless they can draw on knowledge and contacts in the wealthy part of the world. If the continuation of research in the donor countries—those that invest, through aid contributions, in development-oriented public international research—is deemed unacceptable, the international research groups will have to stand by as the funding dries up. And researchers in the developed world will naturally turn their attention to areas for which funding is available.

Traditional agricultural research will carry on as before, and, as before, good results will regularly be forthcoming. But not at the rate, or of the innovative nature, that is clearly needed. How in all conscience, can the well-fed of the world, by turning what should be a choice into a global dictate, opt out of the new technologies that could provide the opportunity for all the world's people to be well-fed?

The Politics of Precaution: Genetically Modified Crops in Developing Countries

Robert L. Paarlberg
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2001, pages 9–11

Powerful new technologies often require governments to make new and unfamiliar policy choices. So it is with technologies for the genetic modification of agricultural crops, particularly in the developing world. This chapter introduces one method of classifying the most important policy choices governments in the developing world must make toward genetically modified (GM) crops and foods. Subsequent chap-

ters then use this classification scheme to examine and compare actual policy choices made in 1999–2000 by Kenya, Brazil, India, and China.

Policy choices toward GM crops and foods could be classified in many different ways. One approach would be to examine which institutions in society are permitted to control the new technology, and to consider in particular the issue of public versus private sector control. Another approach would be to classify how government decisions are made, whether by employing authoritarian or technocratic or democratic policy procedures. Yet another approach would be to ask who benefits from the new technology—for example, farmers or consumers, or rich versus poor. Here I employ a method of classification that struggles with a more fundamental problem: does policy toward the new technology tend to promote its use or to prevent its use? In the case of a technology as new and controversial as GM crops and foods, this promotion versus prevention question has to be faced before any of the more derivative policy questions come into play.

There are, of course, gradients between promotion and prevention. Here I shall describe a scale of four possible postures toward GM crops and foods overall. Policies designed to accelerate the spread of GM crop and food technologies within the borders of a nation I shall call "promotional." Policies that attempt to be neutral toward the new technology, intending neither to speed nor to slow its spread within the nation's borders, I shall call "permissive." Policies intended to slow the spread of GM crops and foods for various public reasons but without banning the technology entirely will be called "precautionary." Finally, governments might opt to block or ban entirely the spread of this new technology within their borders; this I shall label a "preventive" policy posture.

Governments can choose between being promotional, permissive, precautionary, or preventive in several separately important policy areas. Five such areas will be singled out in this study:

- Intellectual property rights. Governments everywhere must decide whether or not to grant within their borders intellectual property rights (IPRs)—such as patents or plant breeders' rights—to the inventors of GM crops. Developing-country governments seeking access to GM crop technologies may have to grant IPRs in some form to the private seed and biotechnology companies that have emerged as leading purveyors of the new technology. If no IPR protection is offered, the private companies might keep the technology away.

- Biosafety. When screening GM crops for safety to the biological environment, hurdles of varying heights can be imagined. Governments wishing to promote GM crop technologies within their borders could set the biosafety hurdle ex-

tremely low. Those wishing to prevent the planting of GM crops could set the hurdle impossibly high.

- Trade. Governments wishing to promote GM technology could encourage (or at least not restrict) the import of GM seeds into their country. Governments wishing to prevent adoptions of the technology could impose import bans or laborious case-by-case import approval procedures.

- Food safety and consumer choice. The planting of GM crops could be promoted through a food safety policy that draws no significant distinction between the GM variety of a food and its conventional counterpart, thereby requiring no separate consumer safety testing. Alternatively, the planting of GM food crops could be discouraged or blocked entirely through a policy that sets a much higher safety standard for GM foods, or perhaps requires complete segregation of GM from non-GM foods in commercial market channels.

- Public research investment policy. Developing-country governments interested in promoting GM technologies may have to invest their own treasury funds. They could use such funds as an alternative to depending on the private sector, instead developing appropriate GM crop varieties within their own national agricultural research systems and then using national extension services to spread those home-grown GM technologies to farmers. At the other extreme, governments wishing to block the technology could decide to prohibit public research on the genetic engineering of new plants or animals.

Because GM crop technologies are still so new explicit policy choices have not yet been made in all of these areas by some developing countries. The result, however, can be an implicit choice. For example, if a government's existing food testing or labeling policies have not been updated to take the presence of GM crops into account, the implication will be official acceptance of those crops as comparable to non-GM crops in their consumer safety aspects. Governments may also on occasion make choices toward GM crops with other issues in mind. In the area of intellectual property, for example, a government skeptical toward private companies might decide to deny IPRs within its borders to inventors of all new plant varieties—conventionally bred as well as genetically engineered. Alternatively, a government might decide to create a new national IPR system for plant breeders not specifically to promote GM crops but instead out of a larger international legal obligation within the World Trade Organization (WTO). The classification scheme offered here captures these unintended and derived policy choices toward GM crops, as well as those that were intended and GM-specific.

Saving Seeds: The Economics of Conserving Crop Genetic Resources Ex Situ in the Future Harvest Centres of the CGIAR

Bonwoo Koo, Philip G. Pardey, and Brian D. Wright, with Paula Bramel, Daniel Debouck, M. Eric Van Dusen, Michael T. Jackson, N. Kameswara Rao, Bent Skovmand, Suketoshi Taba, and Jan Valkoun
Wallingford, UK: CABI for the International Plant Genetic Resources Institute and IFPRI, 2004, pages 1–4

Genebanks are a very recent institutional innovation to conserve germplasm, the 'material that controls heredity' (Witt, 1985, p. 8). For most of agriculture's 10,000-year history it was farmers who saved seeds from one season for planting in the next. The idea of setting aside seeds from around the world in special facilities for global use by breeders and others in the near and distant future did not really take hold until the early 20th century. The credit for this idea and its implementation largely rests with the famous Russian biologist Nikolai Vavilov. During three decades of travel over five continents, he amassed the largest collection of species and strains of cultivated plants in the world (at that time) and developed theories on how to use this material for breeding improved varieties (Reznik and Vavilov 1997). Seed collections held by breeders and researchers have been expanded and organized into more comprehensive ex situ genebanks (meaning storage facilities 'away from the source') that focus on particular classes of crops.

Vavilov's principal concern was crop improvement, rather than conservation. Investment in long-term conservation is an even more recent phenomenon. Pistorius (1997) identifies the US National Seed Storage Laboratory (NSSL) at Fort Collins, Colorado, created in 1958, as the first such facility. Since then, a sizeable investment has been made in collecting and conserving landraces (farmer-developed varieties) and wild and weedy species of crops in genebanks around the world. Motivating these investments were concerns that the genetic basis of agriculture—whether for commercial or subsistence production—was narrowing globally for many agricultural crops with the advent of more genetically uniform but superior-performing varieties developed at an accelerating pace beginning in the 1960s.[1]

1. Concerns about 'genetic erosion' (loosely, a narrowing of the genetic resource base used by farmers or breeders for improving crop varieties) were raised by the outbreak of southern corn leaf blight in the USA in the 1970s, and were addressed by NRC (1972) and Harlan (1972), among others. However, the seriousness of this issue varies from crop to crop. NRC (1972) found common beans to be 'impressively uniform and impressively valuable', whereas Smale *et al.* (2002) conclude that 'the data are not consistent with the hypothesis that the genetic base of CIMMYT germplasm [of spring bread wheat] has tended to narrow over time'.

Recent estimates quantified existing global *ex situ* collections at over 6 million accessions in more than 1300 genebanks worldwide (FAO, 1998). About 10% of these accessions are maintained within the centres of the Consultative Group on International Agricultural Research (CGIAR), most of them as 'in trust' accessions for the international community under the auspices of the Food and Agriculture Organization of the United Nations (FAO).[2] Since the 1970s, the 11 genebanks maintained by the CGIAR (or CG for short) have become pivotal to the global conservation effort, currently holding over 660,000 accessions of crops (plant or seed samples) grown mainly by poor farmers (like cassava, millet, sorghum and cowpea), staple food crops consumed worldwide (like rice, wheat and maize) and tree species used in agroforestry systems. . . .

The number of modern, *ex situ* conservation facilities has grown over the past several decades, and the technology for storing germplasm has dramatically improved; but with the focus on performance enhancement and capacity expansion, key management questions have been overlooked. These include what and how much should be conserved; where should it be stored and regenerated when required; and how is conserved germplasm used and how should it be used?

These questions all have economic dimensions, although answering them with any precision is problematic.[3] First, estimating the marginal benefits of conserving each type of genebank accession is an important, but particularly difficult, element, in part because attributing an appropriate part of the agronomic improvement in a plant to the use of conserved germplasm is a daunting, if not intractable, inferential challenge (see, for example, Pardey *et al.,* 1996, 2002). Secondly many modern genebank facilities are so new that insufficient time has elapsed for breeders to establish a usable time series of realized gains attributable to their establishment. Beyond immediate agronomic values that are estimable in principle, germplasm also has value in terms of as yet unidentified future demand ('option value') and the sheer value of its very existence as opposed to extinction ('existence value').[4] Though

2. The CIGAR 'in-trust' agreement was signed in October 1994, wherein the CG centres agreed to hold so-called designated germplasm in trust for the international community under the auspices of the FAO. Designated material is made freely available for research and crop improvement purposes, provided germplasm recipients abide by a material transfer agreement in which they eschew intellectual property rights over the germplasm shipped from CG centres. For a succinct statement of the in-trust agreement and related material transfer agreements, see Fowler (2003).

3. Frankel *et al.* (2003a) offer some technical (non-economic) perspectives on many of these same issues.

4. Koo *et al.* (2003a) discuss option values in the context of improved seed varieties in China. See also Gollin *et al.* (2000), Koo and Wright (2000) and Zohrabian *et al.* (2003) for ideas on valuing and evaluating genetic resources used in crop improvement research.

methodologies do exist to assess the overall economic benefits from conserving seed, empirical results are bound to be imprecise.

The cost side, on the other hand, predominantly involves items that are at least estimable, in principle, from historical data relevant to existing genebank operations. If the total and marginal costs of the genebank operations are judged to be less than any reasonable lower-bound estimate of the corresponding benefits, then it may not be necessary to confront the challenge of precisely estimating the latter to establish the economic justification of the genebank operation. These rationales have motivated a series of detailed costing studies over the past several years, led by the International Food Policy Research Institute (IFPRI) in close collaboration with colleagues at five CGIAR genebanks.

The structure of conservation costs depends critically on: (i) the type of crops being conserved; (ii) institutional differences such as cost-sharing arrangements within each CG centre; and (iii) the local climate and general state of the infrastructure available to each genebank (such as electricity supplies, communications and international shipment options). For example, regenerating cross-pollinating crops (like maize, sorghum and pearl millet) or wild and weedy species is typically more complicated than regenerating self-pollinating cultivated species.[5] As demonstrated below vegetatively propagated species maintained as clones *in vitro* and in field genebanks are much more expensive to conserve than stored seeds. Besides these crop-specific aspects, differences in wage structures and the composition of labour (which are affected by local labour laws and practices) also have significant impacts on the overall costs. Moreover, if the local climate is inappropriate for regenerating some varieties, it may be necessary to plant them out at other locations or expend resources on means of climate modification (such as greenhouse structures). . . .

Germplasm conservation is a long-run proposition, more accurately described as a commitment 'in perpetuity'. Concerns over declining financial resources for *ex situ* genebanks have instigated interest in an independent and permanent funding mechanism;[7] the growing mismatch between short-term financial support and the long-term intent of the conservation effort validate the seriousness of these concerns. . . . Endowing a fund to support the *ex situ* conservation of genetic resources

5. It is crucial to regenerate material in ways that minimize the genetic drift from the planted to the harvested sample. In promiscuously outcrossing plants like maize, for example, the plant producing more pollen would tend to fertilize more flowers and so increase its share of seed samples after regeneration. Fairly elaborate procedures, such as hand-pollinating each plant and isolating the pollen of each plant by placing a cover over its tassels, are needed to prevent this.

7. Currently, the CG genebanks are financed from short-term (often year-by-year) pledges of support to the system and its centers by its members and from project funds with limited lifespans (sometimes 5 years, but often 3 years or less).

is like investing in land set aside to preserve biodiversity *in situ* (meaning 'at the source'). Both require an upfront injection of investment capital to ensure the maintenance of biological diversity over the long haul.

Slow Magic: Agricultural R&D a Century after Mendel

Philip G. Pardey and Nienke M. Beintema
IFPRI Food Policy Report, Washington, DC: IFPRI, 2001, pages 3–6, 22

Recent Public Research Trends

Worldwide, public investments in agricultural research nearly doubled, in inflation-adjusted terms, from an estimated $11.8 billion (1993 international dollars)[3] in 1976 to nearly $21.7 billion in 1995. . . .[4] Yet for many parts of the world, growth in spending during the 1990s slowed dramatically. In the rich countries, public investment grew just 0.2 percent annually between 1991 and 1996, compared with 2.2 percent per year during the 1980s. In Africa, there was no growth at all—the continuation of a longer-run trend, with more rapid growth in spending in the 1960s (a post-independence period of institution building for many African countries, underwritten with funds from the North)[5] gradually giving way to debt crises in the 1980s and curbs on government spending and waning donor support through the 1990s. In Asia, the 1990s figure was 4.4 percent, compared with 7.5 percent the previous decade. Growth slowed in the Middle East and North Africa as well.

China is an exception. Growth in spending during the first half of the 1990s rebounded from a period of lower growth during the last half of the 1980s.[6] Things look a little better in Latin America, too, with growth in spending of 2.9 percent per year from 1991 to 1996, following little or no growth during the dismal decade of the 1980s. But the recovery seems fragile and is not shared widely throughout

3. Unless otherwise stated, all data on research expenditures are reported in 1993 prices and in international dollars.

4. Wherever possible, we have used the internationally accepted statistical procedures and definitions developed by the OECD (1994) and UNESCO (1984) for compiling R&D statistics. We grouped our estimates into three major institutional categories: government agencies, agencies of higher education, and business enterprises. The latter category includes two subcategories of relevance for our study: private enterprises and nonprofit institutions. We have defined public agricultural research to include government agencies, agencies of higher education, and nonprofit institutions.

5. Pardey, Roseboom, and Beintema (1991).

6. Work underway by Fan, Qian, and Zhang (2001) points to continued growth in agricultural R&D spending in China during the latter part of the 1990s.

the region.[7] Public research in countries like Brazil and Colombia, which did better in the early 1990s, suffered cutbacks in the later part of the decade, and many of the poorer (and smaller) countries have failed to experience any sustained growth in funding for the past several decades.

The distribution of spending on agricultural research has shifted as well. In the 1990s, for the first time, developing countries as a group spent more than the developed countries on public agricultural research. Among the rich countries, $10.2 billion in public spending was concentrated in just a handful of countries. In 1995, the United States, Japan, France, and Germany accounted for two-thirds of this public research, about the same as two decades before. Just three developing countries—China, India, and Brazil—spent 44 percent of the developing world's public agricultural research money in 1995, up from 35 percent in the mid-1970s.

These regional totals mask even more variation among countries. For example, more than 40 percent of 19 African countries spent less than $20 million on agricultural R&D in 1991.[8] Only two countries (Kenya and South Africa) spent more than $100 million. Among 15 Latin American countries, four spent less than $10 million in 1995, while the two largest countries, Brazil and Mexico, spent about $900 million and $300 million, respectively.

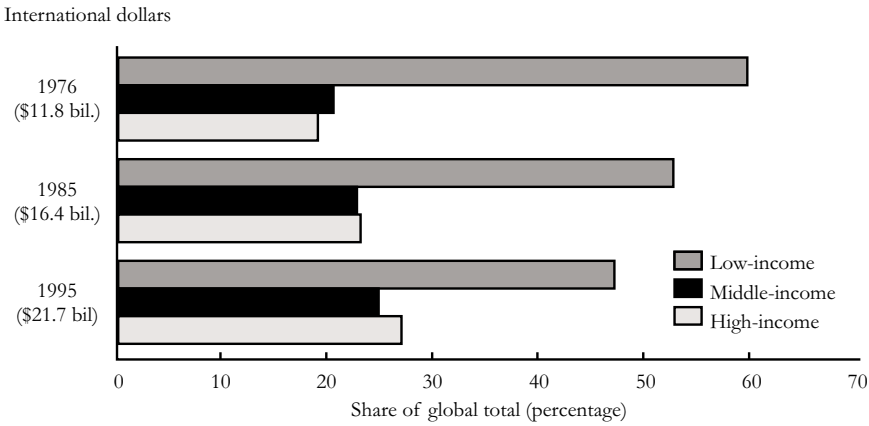
Geography is one way to group countries; another way is to group them according to per capita income. Figure 2 gives a breakdown of agricultural R&D spending for high-, middle-, and low-income countries. . . . Spending by low-income countries grew fastest, so their combined share of the global total increased from 19 percent in 1976 to 28 percent in the mid-1990s. However, this trend is deceiving, reflecting the comparatively rapid growth of India and China, two large countries whose developments dominate the group average. In fact, the low-income countries as a group, excluding China and India, lost some ground. Their share of global agricultural R&D spending dropped from 8.7 percent in 1986 to 8.3 percent in 1996.

At the beginning of a new century, public investment and institutional initiatives for agricultural R&D [research and development] in the South are waning and the South-North gap is no longer shrinking. Agricultural science spending, be it public or private, has slowed in many regions of the world, and for many countries within these regions. During the 1990s, public spending actually shrank in Africa and stalled in the rich countries, while many aid agencies reduced their support for agricultural R&D for Southern agriculture. Consequently, growth in the stock of pub-

7. Beintema and Pardey (2001).

8. Pardey, Roseboom, and Beintema (1997).

Figure 2 Public agricultural research spending by income class, 1976–95



SOURCE: See Table 1.

NOTES: See Table 1. Income classes are specified by the World Bank (1996).
low-income = <$726 per capita/year
middle-income = $726–8,955 per capita/year
high-income = >$8,955 per capita/year

licly generated knowledge in the North is slowing, thereby limiting the pool of science and technologies that can spill over to the South. It also has less relevance for the South now that much public research in rich countries is focused not on traditional agricultural production technologies but on local environmental and food-safety concerns and on the quality of foods preferred by richer people. Moreover, the slowdown of science in the South limits the potential of poor countries to develop locally relevant technologies and tap into Northern knowledge stocks.

The debate surrounding intellectual property rights and agricultural R&D must be placed in a longer-term framework. The role of the private sector in agricultural research is increasing, but private investment covers only a small subset of the needs and is mostly a complement, not a substitute, for continued public and other nonprofit research. For many developing countries, the performance of the latter is now hampered more by lack of funding than by issues related to intellectual property rights.

The social payoffs to investing in agricultural R&D have been high for rich and poor countries alike.[39] Although some think the easy gains have been made, with

39. Alston et al. (2000a).

diminished returns to more recent research, there is no evidence in the extensive impact assessment literature to bear this out. The estimated returns to agricultural R&D are as high now as they ever were, high enough to justify an even greater investment of public funds.

Reinvigorating support for Southern science is unquestionably the top priority. But funding alone is not sufficient to close the South-North gap. Developing effective public-private partnerships—certainly much easier said than done, but by no means impossible—is another requirement; making efficient and effective use of the dollars invested in Southern science is yet another. Getting the political commitment to deal seriously with these problems is tough, and tougher still because of the long-term nature of the commitment required. Science, especially for agriculture, is not a stop-start affair: a sizable and sustained effort is needed, beginning now and continuing for decades to come if the prospects for growth and development that science has to offer the South are to materialize. Unquestionably, another century is too long to wait.

Science and Poverty: An Interdisciplinary Assessment of the Impact of Agricultural Research

Ruth Meinzen-Dick, Michelle Adato, Lawrence Haddad, and Peter Hazell
IFPRI Food Policy Report, Washington, DC: IFPRI, 2004, pages 4–6

No agricultural technology will have an impact on poverty—either directly or indirectly—unless farmers adopt it. What makes farmers more likely to adopt a technology? What barriers exist to stop particular groups from benefiting directly from adopting technology?

The case studies showed that three main factors affected technology adoption:

- vulnerability—whether the technologies were expected to increase or decrease people's vulnerability to loss of income, bad health, natural disasters, and other factors;

- assets—whether farmers had the assets necessary for technology adoption—especially if they were poor; and

- institutions—whether institutions (such as agricultural extension services, government policies, nongovernmental organizations [NGOs], the private sector gender roles, markets for inputs and outputs, and so on) encouraged or discouraged adoption and represented the interests of poor people.

In each integrated case study many different factors were shown to have affected the uptake of new technologies. . . . Their diverse—and often qualitative—nature shows that the decision to adopt does not easily fit into a conventional econometric model. Asset holdings are clearly important, but so are factors relating to vulnerability and institutions; the latter factors fit much less easily than the former into the quantitative regression analyses often used in impact assessments. Not taking such social and institutional factors into account means missing out on valuable lessons about the suitability of new technologies in the future. Thus, all these aspects should be considered in detail before embarking on any program to design new technologies to benefit the poor.

To encourage the adoption of new technologies, pro-poor agricultural researchers must look beyond simply boosting productivity. Stable yields, for example, may actually be more important to farmers than higher but more variable yields (as in the Mexican case study . . .), as they make people less vulnerable economically. Therefore, by breeding new crop varieties—such as those that are resistant to drought, flooding, and pests—agricultural researchers are now working to reduce farmers' vulnerability to climatic and biological shocks.

Developers of improvement programs also need to take into account institutional factors that relate to vulnerability (which they do not always do). Having to invest in a new technology—by for example, buying inputs—can make farmers more vulnerable, because their precious cash resources (as well as their food security) are at risk if their crops fail due to an unexpected drought or food. This vulnerability will discourage farmers from adopting the technology. Therefore, they need new technologies that do not require investments in expensive inputs. Strengthening supporting institutions (such as those that give farmers access to effective crop insurance) will also encourage farmers to adopt beneficial technologies.

A lack of assets, such as land, education, or equipment (for example, water pumps), will also limit technology adoption. That means more attention needs to be paid to technologies that require few assets. For example, the modern rice varieties (MVs) used in the Bangladesh case study could be adopted on any size of landholding. Even tenant farmers can benefit from them as no long-term investments are needed.

Efforts also need to be made to lower the amount of land, education, or cash required to adopt a technology. For example, training materials that were understandable to those with low literacy meant that little education was needed to adopt soil fertility replenishment (SFR) technologies in Kenya.

Alternatively, substituting one asset for another can help the poor to adopt technologies. Labor for example, can sometimes compensate for a lack of land. This was the case in Kenya, where farmers cut shrubs from roadsides or other public lands, mulched them, and spread them on their very small maize fields to replenish soil

fertility. They did not need to devote their scarce land resources to growing shrubs for mulch. Pooling resources is another way forward and can allow even the landless to access opportunities otherwise beyond their reach. In Bangladesh, for example, landless women worked together to manage group fishponds.

Decisionmakers also need to recognize that technologies that build on assets that the poor already have are more likely to be adopted. Because poorer households in Bangladesh had more motivated (i.e., family) labor the adoption rates of MVs—which have high labor requirements—were much higher for farmers with small holdings than for those with relatively large farms.

Cultural characteristics were also found to influence adoption in many different ways, such as by making new technologies more attractive or by limiting people's ability to take advantage of them. For example, in many places women cannot move freely outside the home. This was the case in Bangladesh, which meant that women did not usually come into contact with new technologies or dissemination efforts. Such cultural factors can have a very powerful influence. In Mexico, the desire to participate in religious festivals, which is important for social status, drives poor farmers to harvest their maize early and sell the grain before the price reaches its maximum. In this situation, new maize varieties that can be harvested at different times would benefit the poor. Preferences for certain tastes and textures also affect the varieties people will adopt.

Clearly therefore, an understanding of local cultural practices and preferences is important if the poor are to benefit from agricultural research. These practices will affect who (e.g., women or men, elite or poor people) will adopt the new technologies. However, researchers also must bear in mind that culture changes over time and will often vary in response to the technologies introduced by the research itself.

Chapter 6

Managing Natural Resources

From Land and Water to Institutional Innovations

In the 1980s and 1990s, concern rose worldwide about whether human activity would exhaust or irreparably harm the Earth's resources. As a result, natural resources began to be seen not as limitless inputs into agricultural production, but as resources to be carefully managed. IFPRI had paid early attention to how institutions and incentives affect the management of natural resources that influence food and nutrition security (see excerpt from *Consequences of Deforestation for Women's Time Allocation, Agricultural Production, and Nutrition in Hill Areas of Nepal,* Shubh K. Kumar and David Hotchkiss, 1988).

One area in which IFPRI began to incorporate environmental concerns into its research program was in its examination of the prospects for less-favored lands, such as hillsides and drylands, where millions of poor people live. These areas have often been seen as having too little potential to make investment there worthwhile. IFPRI research has shown that, with the help of appropriate investments and technologies, these areas can be sustainably managed in a way that reduces both poverty and environmental damage (see excerpt from *Strategies for Sustainable Land Management and Poverty Reduction in Uganda*, Ephraim Nkonya et al., 2004). IFPRI also looked at the long-term implications of environmental problems, such as soil degradation, for food security and sustainable resource management more generally (see excerpt from *Soil Degradation: A Threat to Developing-Country Food Security by 2020?* Sara J. Scherr, 1999). Seminal work on agricultural intensification and the environment undertaken by scholars such as Mary Tiffen, Kevin Cleaver, Hans Ruthenberg, and Hans Binswanger, among others, had a strong influence on thinking at IFPRI and helped guide innovative empirical work, as have Ian Scoones's con-

tributions to understanding environmental policy processes and sustainable rural livelihoods in developing countries.

Water has been a major theme of research at IFPRI. Work on irrigation policy in the 1980s was followed by work on how best to allocate and manage this scarce resource so crucial to agricultural production. Researchers have considered the implications of water rights, water user associations, and water pricing schemes, among other things (see excerpt from *Negotiating Water Rights*, Bryan Randolph Bruns and Ruth S. Meinzen-Dick, eds., 2000). IFPRI researchers have also helped establish the importance of economic incentives in water allocation in developing countries. Over time IFPRI has extended its perspective to look at water issues more holistically. For example, what does water use in other sectors mean for water use and management in agriculture (see excerpt from *Institutional Reforms in Indian Irrigation*, Ashok Gulati, Ruth Meinzen-Dick, and K. V. Raju, 2005)? And what is the best way of managing water in entire river basins? Water has been incorporated into IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) to project how different policies and investments related to water will affect future food security (see excerpt from *World Water and Food to 2025: Dealing with Scarcity*, Mark W. Rosegrant, Ximing Cai, and Sarah A. Cline, 2002).

Researchers have come to understand that many environmental problems have their roots in poor people's lack of tenure over property (see excerpt from *Land Tenure and Natural Resource Management: A Comparative Study of Agrarian Communities in Asia and Africa*, Keijiro Otsuka and Frank Place, eds., 2001). Gershon Feder's work on land tenure in Thailand and its impact on productivity has been influential for the profession, including for the evolution of thought on related issues at IFPRI. Elinor Ostrom's work on local management of irrigation systems and forests has been instrumental in showing that the "tragedy of the commons" is not inevitable if there is effective local management and if the factors that contribute to such management are identified. Her innovative research contributions have had a large impact on research programs at IFPRI. To look carefully at collective action issues, IFPRI initiated CAPRi—the CGIAR System-wide Program on Collective Action and Property Rights—in 1995. As part of this program, IFPRI researchers and their partners study how property rights and collective action affect technology adoption, natural resource management, and poverty and derive policy recommendations not only for governments, but also for civil society organizations (see excerpt from *Innovation in Natural Resource Management: The Role of Property Rights and Collective Action in Developing Countries*, Ruth Meinzen-Dick, Anna Knox, Frank Place, and Brent Swallow, eds., 2002).

Consequences of Deforestation for Women's Time Allocation, Agricultural Production, and Nutrition in Hill Areas of Nepal

Shubh K. Kumar and David Hotchkiss
IFPRI Research Report 69, Washington, DC: IFPRI, 1988, pages 67–68

Results of this study suggest that deforestation has adverse effects on agricultural production, food consumption, and nutrition that occur as a result of the additional work loads entailed in the collection of essential forest production on which the households depend, primarily fuelwood, fodder, and grass. In the longer run, water availability for both household and irrigation purposes could also be affected. The adverse effects on irrigation potential will of course be far-reaching geographically.

Women, in particular, have a high and increasing work load as deforestation expands, and this burden reduces labor in agriculture. Limited availability of labor and low substitutability between women's and men's labor can lead to a much larger overall decline in labor input in agriculture with deforestation. This is a seldom acknowledged factor in the decreasing agricultural productivity of hill agriculture, where the high rate of out-migration has usually been interpreted as a sign of an underutilized work force, when instead it is the low return to labor in agriculture that encourages out-migration. This evidence indicates that deforestation is directly and indirectly linked with levels of food consumption and nutrition for the households.

The following observations have emerged from this study:

- Deforestation, which represents a 1 percent increase in time spent for collection of a unit of fuelwood, leads to a reduction in fuel consumption of 0.3 percent but an increase in the total time required for collection of 0.6 percent.[1]

- The sites in the study sample where deforestation is extensive require 75 percent more time spent for collection per load of fuelwood, which suggests a 45 percent increase in total collection time. With a similar response for other forest products that are collected on a regular basis, such as fodder and grass for animals, and assuming that men, women, and children increase their time in proportion to their existing time allocation, women would need an additional 1.13 hours per day to collect these products. This estimate is consistent with the increases in actual time spent by women.

1. All figures are based on quarterly surveys, which have been aggregated to represent time allocation on an annual basis.

- Estimation of the change in household labor supply to agriculture, given the above magnitude of deforestation, shows a reduction in women's field labor of about 1.5 hours per person per day. Further, this reduction is accompanied by a reduction in men's agricultural labor of about 0.8 hours per person per day. As a result, household labor per hectare decreases by about 40 percent in high deforestation areas. The small increase in wage labor that occurs does not compensate for the reduction in household labor input.

- Estimates of physical production functions show the significance of labor input in crop output. Women's labor has the highest marginal product for dry-season crops. On a seasonally adjusted basis, the dry season is also when more time has to be spent on collection of forest products. This suggests that there are losses in agricultural productivity and real income with time allocation patterns that accompany deforestation. This is likely to be only partly offset by higher seasonal out-migration and income from such employment.

- Food consumption, in terms of caloric consumption and the ratio of rice calories to cereal calories, is a significantly positive function of household income (the farm income component is the only statistically significant component) and food preparation time. Food preparation time, however, is a positive function of fuelwood used and a negative function of the total collection time, suggesting these factors may influence food consumption via less time spent on cooking and food preparation. This is in addition to the effect of deforestation on agricultural production and hence on household farm income.

- Preschool child nutrition is improved by raising household income, and it is lower in areas with higher levels of deforestation. An increase in household size and in children's work is also associated with inadequate nutrition of preschool children. Controlling for other household characteristics, the Tibeto-Burman ethnic groups have better child nutrition than other groups.

- An examination of the characteristics of the nutritionally at-risk households confirms that these are more likely to be labor constrained than land constrained, and they have lower levels of agricultural productivity.

The results clearly show that under current productivity, households continually need to expand cultivated area. To the extent that this contributes to deforestation, this expansion reduces household income, food consumption, and nutritional status. Under these circumstances, relying only on out-migration in these areas is un-

likely to improve living conditions or stem the environmental degradation through deforestation. It is also questionable whether reforestation efforts by themselves will suffice, though this would be a useful question to examine empirically. In the past, settlement schemes in the tarai have drawn a fair share of settlers from the hill areas. But if deforestation continues at the present scale, en masse movement of population from the hills may occur at some future point in time. It seems evident that there is a need to increase agricultural productivity, preferably on soils that are better endowed. This would contribute to improvements in household welfare and reduce deforestation.

Strategies for Sustainable Land Management and Poverty Reduction in Uganda

Ephraim Nkonya, John Pender, Pamela Jagger, Dick Sserunkuuma, Crammer Kaizzi, and Henry Ssali
IFPRI Research Report 133, Washington, DC: IFPRI, 2004, pages 107–111

The findings of this study demonstrate the trade-offs that are taking place as rural development and agricultural modernization proceed in Uganda. Market liberalization and investments in roads, education, technical assistance, and other developments are providing new opportunities for rural households, contributing to increased commercialization and specialization, nonfarm employment, and increased rural incomes. However, many of these changes are also reducing households' interest in labor-intensive land management practices, and although some are promoting the increased use of fertilizer and other inputs, high costs and limited returns to such inputs are limiting their application, resulting in continued low productivity in agriculture and worsening land degradation.

The findings of this study support continued strong investment in education as a primary means of reducing poverty in rural Uganda. However, this will likely not solve the problems of low agricultural productivity and soil erosion, and may contribute to these problems, as education increases opportunities outside of agriculture. Including the principles of sustainable agricultural production in educational curricula could help to minimize negative impacts or even have positive impacts on agricultural production and sustainable land management. Hence, the Plan for Modernization of Agriculture (PMA)'s provisions to introduce an agricultural syllabus in primary and secondary education is a step in the right direction toward addressing this problem (MAAIF and MFPED 2000). Agricultural training and extension programs appear to be contributing to improved agricultural productivity, but also to increased soil erosion in the highlands and to soil nutrient depletion. It

is imperative that such programs be intensive enough to promote adoption not only of yield-enhancing technologies, such as improved seeds, but also of soil fertility-restoring and conservation technologies. . . .

The impacts of NGO programs are also context-dependent, but also may involve trade-offs. For example, programs focusing on agriculture and environment in the lowlands are helping to reduce soil erosion but also appear to be reducing productivity, at least in the short term. Such programs appear to be more successful in improving production as well as reducing land degradation in the highlands, perhaps because soil and water conservation technologies can have more immediate impacts on production in steeply sloping highland areas, where soil moisture is more scarce (Shaxson 1988), or perhaps because the programs operating in the highlands are taking a more participatory and interactive approach than those operating elsewhere. More research is needed to better understand the reasons for the success or failure of such programs in different contexts and to achieve such "win-win" outcomes more broadly.

Given the ability of government training and extension programs to increase productivity and the ability of NGOs to reduce land degradation, "win-win" outcomes may be promoted by pursuing a greater degree of partnership between the different types of programs. . . .

Government efforts to improve market access also involve trade-offs. Access to markets contributes to the diversification of income into nonfarm activities, but also contributes to negative soil nutrient balances, at least in the near term. This trade-off presents a serious challenge for policymakers. Farmers in remote areas are likely to be faced with high agricultural marketing transaction costs that make it unprofitable to produce surplus for the market. Such farmers are therefore likely to remain in a vicious cycle of poverty, which poses an enormous challenge to policymakers and development planners. Obviously, it is imperative to improve the market access for farmers in remote areas to facilitate their integration in the agricultural market, which is needed to reduce their poverty. Achieving this poses the second challenge: farmers who have better access to markets are more likely to sell more crops and consequently to experience worse nutrient depletion on their land. Hence, governmental efforts to commercialize agriculture and improve the road network must be matched by increased efforts to address the problem of land degradation.

Reducing the cost of soil fertility management technologies, improving agricultural markets, and reducing the input/output price ratio will help to address this challenge. Other steps may be taken to reduce the price of fertilizers, such as facilitating input traders by training and offering them credit, and waiving some of the taxes levied on input trading businesses. As noted by IFDC (2001), there is also a need to increase trade between Ugandan and Kenyan input traders to benefit from

the economies of scale of the Kenyan fertilizer market. Farmer associations may also help reduce the transaction costs of inputs and outputs.

Additionally, the expensive inorganic fertilizer option needs to be complemented with cultural practices that are affordable, feasible, and compatible with local farming systems. For instance, our research found that farmers with more livestock have higher soil nutrient balances. However, when using organic material to complement inorganic fertilizer, the benefits of biomass transfer must be weighed against the cost of nutrient depletion at the source of the organic materials (Palm et al. 1997). The option of recycling organic material produced on the plot is limited by the inadequate production of organic material and competition with other uses. Incorporating high-quality legumes (such as *Mucuna pruriens*) and rhizobial inoculation may greatly improve nitrogen balances at a much lower cost (Kaizzi et al. 2002; Ndakidemi et al. 2002), but adoption may be limited in lower-potential areas where such cover crops are less effective (Kaizzi et al. 2002), or in densely populated areas where farmers are unable to devote land to cover crops or leguminous trees, even for one season (Gladwin et al. 2002; Place et al. 2002a).

Our research also shows that use of different land management practices is influenced by several factors that are not likely to occur in many agricultural domains simultaneously. This suggests the need to design land management technologies that are specific to an agro-ecological zone, type of crop, market access, and other factors influencing the choice of land management practices. Most of the current agricultural production technologies are released with blanket recommendations covering diverse biophysical and socioeconomic environments, which render them irrelevant in some areas (Bekunda et al. 2002). We also noted that farmers tend to complement their agricultural investments with improved land management practices, which implies the need for extension agents to promote a package of complementary technologies. This will help to overcome the problem of stepwise adoption and hence increase technology uptake and returns for investments on plots.

One of the strategies used to address rural poverty is to promote the production of crops that have high returns to farmers. It was interesting to observe that plots planted in bananas had higher crop values than most other crops. This suggests the need to increase research efforts into banana production, addressing the soil fertility, disease, and pest problems that are facing the crop in the central region of Uganda. Research in banana marketing and value addition is also needed to identify policies and strategies for developing the banana sector.

The promotion of livestock production linked to crop production appears to be a "win-win-win" strategy, contributing to higher agricultural production, higher income, and less soil nutrient depletion. Such favorable outcomes result from synergies between crop and livestock production in mixed crop-livestock systems

(McIntire et al. 1992; Staal et al. 2001). However, these findings are less relevant to the pastoral farming systems commonly found in the low-potential and fragile environments in the northeast and other parts of the cattle corridor. Land degradation related to overgrazing is a serious concern in these areas (Muhereza and Otim 2002; NEMA 2001), and care needs to be exercised when promoting livestock development to ensure that it does not contribute to overgrazing and land degradation in such areas. To the extent that households diversify to include livestock as well as crop production activities, this may also reduce their risk exposure. This has a bearing on the strategy of the Plan for Modernization of Agriculture (PMA) for commercializing agriculture, which is usually achieved by specialization. Even though specialization can increase crop value and income, it exposes farmers to production and price risks. These findings suggest that the PMA should encourage farmers to diversify their production portfolios to include livestock as well as crop production.

Participation in nonfarm activities also appears to lead to decreased nutrient depletion and higher values of crop production. Hence, promoting nonfarm development may be a "win-win" strategy, reducing land degradation while helping to reduce poverty. However, to increase the competitiveness of nonfarm products, farmers' skills in making them need to be increased through training in polytechnic and vocational schools based in rural areas.

Evidence from this study generally supports the Boserupian model of population induced agricultural intensification, but does not support the optimistic "more people—less erosion" hypothesis (Tiffen et al. 1994). Population pressure contributes to soil erosion and lower crop production in the highlands. Efforts to reduce population pressure in the highlands may thus produce "win-win" outcomes, helping to both increase agricultural productivity and reduce land degradation. In addition to education and family-planning efforts to reduce birth rates, education and vocational training programs can help people in the highlands to develop skills to enable them to migrate and find remunerative employment elsewhere.

We do not find evidence that access to credit is a major factor influencing land management, agricultural production, and incomes at present. This is likely due to the limited adoption of inputs and limited commercialization, and is likely to change as markets develop and use of inputs becomes more profitable. To avoid credit becoming a serious constraint to agricultural modernization in the future, efforts to develop rural finance institutions should continue, recognizing that they are needed to serve multiple purposes beyond financing agricultural inputs (for example, the need for a secure place for savings, financing nonfarm activities, consumption credit). To the extent that such institutions can develop a broad range of services and be profitable in the present environment, they will be better able to handle the demands for agricultural credit that develops in the process of agricultural modernization.

We do not find evidence of a poverty–land degradation trap, given that erosion does not depend significantly on asset ownership. Poverty has mixed impacts on agricultural productivity, depending on the type of assets considered: smaller farms obtain higher values of crop production per hectare, as do households with more livestock. These findings suggest that development of factor markets (for example, for land and livestock) can improve agricultural efficiency. Development of land markets can also help to reduce problems associated with land fragmentation, which reduces the adoption of high-value crops and labor-intensive, sustainable land management practices. Implementation of the provisions of the 1998 Land Act providing for conversion of *mailo* and customary land to freehold status could help facilitate the functioning of the land market.

Land tenure and land title were found to have limited impacts on agricultural production, land degradation, and income. This is because the most common forms of tenure are relatively secure and transferable, and access to credit is not a critical factor affecting agricultural production, as noted above. As agriculture becomes more commercialized, the demand for formal titles to increase access to formal credit is likely to increase, however.

In general, these results imply that there are few "win-win-win" opportunities to simultaneously increase production, raise household income, and reduce land degradation. Different instruments are needed to achieve the different objectives, and tradeoffs among these objectives must often be contemplated. Addressing these issues will require appropriate demand-driven investments in education, training and extension programs, NGO programs, improvements in road infrastructure, agricultural input marketing, creation and facilitation of nonfarm opportunities in rural areas, and the promotion of livestock production and other more remunerative livelihood activities. Just as no single solution exists to improve all outcomes simultaneously, different approaches are needed in different locations. There is no "one-size-fits-all" solution to the complex problems of small farmers in the diverse circumstances of Uganda.

Soil Degradation: A Threat to Developing-Country Food Security by 2020?

Sara J. Scherr
2020 Discussion Paper 27, Washington, DC: IFPRI, 1999, pages 9–11

Predicting Future Effects: Conceptual Challenges

Even with the best information on past, and current trends, three other central issues must be considered before predictions about future trends regarding soil degradation can be made with any confidence:

(1) To what extent is soil degradation reversible at an economically reasonable cost?;

(2) To what extent will farmers respond on their own to protect or rehabilitate their soils?; and

(3) To what extent will structural change in agricultural economies affect our reliance on currently degrading soil resources?

Reversibility of Soil Degradation

Where soil degradation is reversible at low-to-moderate economic cost (relative to agricultural product prices and land values), even significant degradation may result in little long-term economic loss. Prevention is not always cheaper than a cure. For example, farmers who cease to undertake soil protecting investments during prolonged periods of low food prices may resume those practices when prices rise. Farmers also may mine soil nutrients (soil capital) over a period of time in order to accumulate alternative forms of more economically valuable capital, but subsequently use that capital to rebuild soil resources. Land abandonment after prolonged soil degradation could serve to keep the land fallow long enough for it to recover key long-term productive attributes.

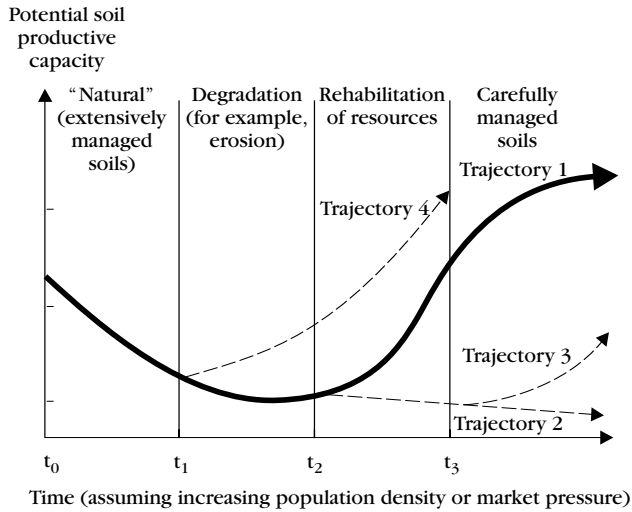
If on the other hand, degradation through lack of proper soil husbandry in the short term leads to permanent reductions in the soil's productive potential, strategies leading to degradation are less likely to be economically justifiable. What constitutes "irreversibility" is a matter of some debate among soil scientists due to inadequate research. Only nutrient depletion and imbalance and surface sealing and crusting can be rapidly and relatively cheaply reversed. . . . Many water, nutrient, and biological problems in soils can be reversed over 5–10 years through soil-building processes and field- or farm-scale investments and management changes. Some types of physical and chemical degradation, such as terrain deformation and salinization, are extremely difficult or costly to reverse.

The feasibility and cost of soil rehabilitation depend in part on soil type, production system, and severity of degradation. For many soil types, little is known about the effects of degradation or the thresholds for soil quality below which future investment in restoration is uneconomic.

Farmer Response to Soil Degradation

Historical evidence suggests that a linear extrapolation of current soil degradation trends will be a poor guide to future soil quality. Farmers depend upon the land for their livelihood. It is uncommon for them to be unaware of serious soil degradation

Figure 2 Innovation in soil resource management under population or market pressure



unless they are recent immigrants to a new agroecological zone, the process of degradation has not yet affected yields, or its cause is invisible (acidification, for example). We should expect, therefore, that farmers will respond to degradation with new land management or investment if they perceive a net benefit from doing so and can acquire or develop appropriate technology. Trajectory 1 in Figure 2 illustrates such a process of innovation, in which increasing pressure on soil resources over time initially leads to soil degradation, but farmers eventually respond by improving soil management practices and making investments to restore, maintain, or even ultimately *improve* the soil's productive potential. Empirical examples of such a process have been widely documented (Ruthenberg 1980; Templeton and Scherr 1997; Tiffen, Mortimore, and Gichuki 1994).

Farmers respond not only by making major conservation investments such as terrace construction on steep slopes, land-leveling in irrigated areas, land drainage, and revegetation of denuded landscapes, but also by using alternative crop mixes and cropping intensities; land-clearing and fallow practices; spatial patterns and niches of crop production; tillage and planting density and timing practices; agroforestry practices; vegetation management outside crop fields; crop-residue management; livestock population, species, and feeding practices; or farming implements. Farmers may modify the layout of farm paths, fences, windbreaks, and other

linear features or barriers in order to affect soil and water movement (Scherr et al. 1996).

The conservation community has discovered that farmers' decisions about conservation practices and investments are inextricably linked to production (Shaxson et al. 1997). If good land-husbandry practices are to be widely adopted, they must not only replenish soil resources, but also contribute to increased productivity and farm income in the short term (Sain and Barreto 1996; Partap and Watson 1994). Farmer willingness to invest in soil improvement is closely associated with the overall economic profitability of farming and an economic and policy environment that facilitates commercialization, reduces price risks, increases access to infrastructure, increases security of land access, and encourages technical innovation (see, for example, Clay, Reardon, and Kangasniemi 1998; Shiferas and Holden 1997; Hopkins, Delgado, and Gruhn 1994).

When farmers fail to take action (trajectory 2 in Figure 2) or delay taking action until significant, irreversible degradation has taken place (trajectory 3), it usually means that they lack knowledge about effective means for soil improvement; lack access to the farm resources, such as labor, capital, or inputs, needed to make the improvements (a particular concern for the poor); believe the economic contribution of the plot to their livelihood is marginal; expect low economic returns from available options for soil improvement; or are uncertain about reaping the longer-term benefits of soil improvement due to tenure insecurity or price or climate risks (Scherr and Hazell 1994). Under these conditions, targeted policy action is needed to slow or reverse soil degradation. Policy intervention may also be desirable to accelerate farmer response in situations where social benefits are greater than farmers' private benefits (trajectory 4 in Figure 2).

The trajectories of soil degradation and improvement vary considerably among different pathways of development. These variations result from differences in the soil resource base, demographic patterns, market integration, local institutions, and policy actions (Clay, Reardon, and Kangasniemi 1998; Scherr et al. 1996). Judicious use can be made of limited public investment resources to address soil degradation only if we are able to better predict when and how farmers will respond to degradation and intervention.

Structural Change in Agricultural Economy

Even if existing estimates of the economic effects of soil degradation in recent decades are correct, they cannot necessarily be extrapolated to 2020. There is no certainty that all of the developing world's soils currently under cultivation will constitute important resources for agricultural production in the decades ahead. Structural changes in global and national economies, trading patterns, and infrastructure development may make some soil resources much more important than others. Technological

breakthroughs may make some "problem" soils much more productive in the future, while unforeseen events may contaminate soils that are most productive at present. Thus, evaluation of future threats of degradation requires that we assess the likely future trends in the broader economy and their implications for soil management.

Negotiating Water Rights

Edited by Bryan Randolph Bruns and Ruth S. Meinzen-Dick
London: Intermediate Technology Development Group for IFPRI, 2000, pages 27–31

Understanding Rights

In this volume we look at water allocation as a negotiated process, not something that can be simply deduced from technical specifications, economic analysis, or legal exegesis. Negotiation involves interaction between different claimants, not unilateral decisions made in isolation. The process continues over time, not just in a single meeting. Negotiation is used here in a broad sense. It includes sitting around a table to craft an agreement, formal trading arrangements, as well as less visible struggles over access to water, as local people comply with or contest the ways in which state agencies or other users acquire and distribute water. It includes not only engaging in dialogue, but also abstention, obstruction, resistance, and sabotage (Colburn 1989; Scott 1985). Negotiation is a continuing process, influenced—but not fully determined—by changes in rules and laws. . . . Agreements may mark major milestones, but usually lead to further negotiation about how the agreement is to be worked out in detail, how to monitor compliance and respond to violations, and whether to revise agreements.

At the heart of this is the allocation process, which is defined as deciding who should receive how much water (Uphof 1986). Conceptually, allocation is distinct from the task of distribution, which is defined as delivering water in accordance with allocations. In practice, problems with allocation frequently surface during distribution, showing how far this may diverge from allocations formally specified by agency regulations or traditional procedures. These divergences may, in turn, become the basis for modifying the allocation. . . .

Property rights to any resource are much more than a title on paper: they are essentially a relationship between people that shapes the use of natural resources (F. von Benda-Beckmann 1995).[6] Different systems of water rights are not exclu-

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6. For evidence on the links between property rights and resource management, see Baland and Platteau 1996; Berkes 1986, 1987; Hanna and Munasinghe 1995; Kurien 1993.

sive, but overlapping: different sets of rules may apply at different places and times, or may be appealed to by different parties. A single user rarely has full 'ownership' rights to control, use, and dispose of the resource purely as she or he sees fit. Rather, it is useful to think of a bundle of rights, with different users and stakeholders having the right to use water for a certain purpose, or subject to various types of conditionality.[7]

Different rights may apply at different levels of the system . . . , with water in the rivers or main canals controlled by the state, water in the secondary distribution system below a certain turnout being common property of a group of users, and individuals having rights over water in tertiary systems or groundwater below their land. In this volume we are primarily concerned with rights at two levels: the rights of a group of users to water, and rights of individuals within the group.

Water rights are a basis for a claim on the resource. Water rights include formal rights embodied in official titles, permits and seasonal irrigation schedules, less formal rights based on customary patterns, and rights implicit in social norms and local practices. A customary pattern of receiving water for 12 hours a day during periods of shortage is seen by users as a water right just as valid as a permit specified in liters per second. Where a temporary brush dam allows water to flow through, downstream users may feel they have a right, which is violated when upstream users install a concrete dam to divert the entire flow. A norm that certain types of people cannot be denied access to water for drinking or watering animals may carry as much weight, in practice, as an abstraction right registered with a government agency.

There may be multiple bases for claims, even for the same resource. The two most widely recognized underlying bases for claims are based on ownership or possession of land along rivers, streams, or over aquifers (riparian rights),[8] and claims based on historic water usage (prior appropriation). These have received greatest attention in the literature on formal water rights, as they are widely found in England, Spain, and their former colonies (including the Americas and Australia). Scott and Coustalin (1995) show that even within England there have been shifts back and forth over time in the strength of each of these bases of claims. However, a myopic focus on only riparian and prior appropriation rights, or attempts to force all other types of water rights into one of these forms, has too often blinded researchers and policymakers to the variety of water rights. Membership in a community or group may provide sufficient basis for a claim on water, especially for domestic or livestock uses. Investment in water control infrastructure provides a basis for claims on the

7. Bromley (1991), Schlager and Ostrom (1992), and K. von Benda-Beckmann et al. (1997) discuss bundles or aspects of rights to land, fisheries, water, and other resources.

8. In many government-managed irrigation systems, especially in Asia, having land within designated irrigation command areas is what conveys rights to water.

water in farmer-managed irrigation systems, as well as in systems constructed and managed by the government.

These different bases for water rights have implications for management of the resource. For example, prior appropriation rights are often conditional upon 'beneficial use,' which means that those who hold rights have no incentive to reduce their water consumption, because that means giving up part of their right. Formal riparian rights typically limit the ability to transfer water to users in other locations. The development of tradable water rights, separating rights to water from rights to land and making them transferable, is fundamental for the emergence of water markets, which are receiving increasing policy attention in attempts to improve the efficiency of water allocation, as discussed in the final chapter.

Investment in water conveyance infrastructure serves as a basis for shares in the system in many farmer-managed irrigation systems. . . . Share systems developed through farmers' collective investments link rights and responsibilities. Members of a *subak, acequia,* or joint tubewell group share the cash and labor contributions required to keep the system functioning, often in direct proportion to their shares in the water (Yoder 1994). Over time, the shares may be sold or passed down from the system's original builders to their heirs. . . .

Reviewing the evidence from many farmer-managed irrigation systems, as well as systems with varying degrees of external intervention, Coward (1986) concludes that the process of investing together to build irrigation infrastructure creates strong bonds among farmers. These bonds form the social capital essential for the sustainable management of these systems. Thus the property rights created by collective action and held in common by the members provide a 'social glue' (Coward 1986, 1990).

Most external interventions to construct or 'improve' irrigation systems do not have as much initial user investment, nor do they provide users with such clear rights. Rights 'bestowed' on people may not be treated in the same manner, or create the same sense of individual and collective responsibility. Thus, Coward (1986) advocates indirect investment strategies for external intervention (for example, providing loans and technical assistance to user groups, who would then undertake the investments and the responsibility to pay for them). External interventions often erode existing rights, and either expand the rights of the state or strengthen new claimants to the resource. . . .

'Public,' i.e., government, investment (often with external donor funds), together with concerns over public trust, are often stated as reasons for state reluctance to define water rights for individual farmers or groups of users. Valid questions are raised about why some farmers should capture the benefits of state investment as well as a stronger share of water resources. However, even where governments build and operate large scale irrigation systems, these often turn out to be overlaid on ex-

isting local schemes, whose transformed institutions persist in powerfully influencing how water is distributed. Even in 'new' schemes serving previously unirrigated land, government regulations regarding water allocation may be more flouted than obeyed, as head-enders abstract more than their allotted share, local influentials exert power, villagers bribe agency personnel, farmers sabotage gates, and opportunists irrigate lands beyond the official command area (Chambers 1988; Wade 1987). Even where transfers of land are formally forbidden, fields, together with their accompanying water rights, are often rented, mortgaged, leased, and sold extralegally. . . . Therefore local customs and practice strongly influence water allocation even in 'government-managed' irrigation schemes.

While the state has a legitimate role in managing overall water resources, the failure of agencies to adequately discuss, negotiate, and reach consensus on how rights and responsibilities will be shared has serious repercussions for the sustainability of management improvements. . . . If outsiders have constructed the system and it is treated as public property, local users have little sense of responsibility for its upkeep. Many projects mention giving users a 'sense of ownership,' but this may not be enough without real ownership acknowledged by users and outsiders. Furthermore, ownership of only the tertiary distribution infrastructure (such as watercourses) has little value without upstream points that offer some control over water (Hunt 1990).

Rehabilitation or system improvement projects have often had unintended consequences for water rights. . . . Farmers in the existing scheme frequently oppose any development that takes water away from them, asserting a strong claim to water rights.

Institutional Reforms in Indian Irrigation

Ashok Gulati, Ruth Meinzen-Dick, and K. V. Raju
New Delhi: Sage Publications for IFPRI, 2005, pages 17–20

Problems of Indian Canal Irrigation

During the First Five-Year Plan (FYP), the Indian government invested 22 percent of total plan expenditures in irrigation. The substantial investments in developing irrigation were maintained through the various FYPs; but the relative importance of canal irrigation came down over time. As a result of this investment, overall, India has already created about 64 percent of the ultimate potential for irrigation: 89 million ha out of about 139.9 million ha from all sources, based on revised figures (CWC 1996). However, plan expenditure on irrigation as a percentage of total Plan expenditure on all sectors declined to below 10 percent in the 1980s and early 1990s. . . . The slowdown in irrigation investments, especially by the public sector,

is sometimes attributed to a response to relatively comfortable food situation in the country and declining world prices of grains, especially rice, as well as opposition to the displacement of people for irrigation dams and negative environmental effects of irrigation projects. On the other hand, the capital cost of creating irrigation potential through major and medium irrigation schemes increased from around Rs 40,000 per hectare of potential created during second half of 1970s to above Rs 190,000 per hectare of potential created during 1990s, at constant 1995–96 prices. . . . These rising capital costs combined with falling relative outlays on major and medium schemes have doubly affected the further development of these important sources of irrigation. As a result, the average annual irrigation potential created through major and medium schemes slowed down during the 1990s, falling from almost 1 million ha per annum (average) during the second half of 1970s to about 0.4 million ha per annum (average) during 1992–97.

The most severe problem facing Indian canal irrigation, however, is not so much the slowdown in its growth, but the rapid deterioration of systems that have already been created.

Maintenance is being woefully neglected, leading to poor capacity utilization,[1] rising incidence of water-logging and salinity,[2] and lowering of water use efficiency. On the whole the growth of irrigated agriculture is threatening to become less sustainable—environmentally as well as financially.

During the 1980s, the slowdown in the growth of canal irrigation did not cause a major problem, as groundwater development, particularly through private investment, picked up the slack. The proportion of groundwater currently exploited is more than that of surface water, especially from major and medium schemes. Over time, minor irrigation in India (comprising groundwater and other surface irrigation schemes covering less than 2,000 ha) has in fact become "major" in size. By the end of 1996–97 it irrigated about 56.5 million ha out of total potential created (PC) of 89.3 million ha.[3] Because individually-controlled groundwater irrigation could be closely matched to crop needs, the productivity effects of groundwater irrigation were even greater than a comparable area of surface irrigation, which has highlighted the deficiencies of major and medium canal systems. However, there are signs that this, too, is becoming unsustainable.

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1. The irrigation potential actually utilized is only about 85 percent of the potential created by major and medium irrigation schemes.

2. According to the Eight Five-Year Plan (1992–97), a total of 17.61 million ha of irrigated area is suffering from problems such as waterlogging (8.53 million ha) alkalinity (3.58 million ha), and salinity and sandy area (5.5 million ha). The estimates of waterlogging and salinity show a wide variation depending upon how they have been defined and estimated by various expert committees and authors.

3. CWC (1998) gives the anticipated figure of 90.8 million ha potential created by the end of 1996–97.

First, surface irrigation systems provide a major source of groundwater recharge and without canals or tanks there will be less groundwater (Dhawan 1997). Many areas are already experiencing serious problems with groundwater overdraft, leading to lower water tables that cause some wells to go out of production and the remaining to have higher pumping costs. Furthermore, there are problems in providing energy (electricity or diesel) for groundwater lifting. Many electricity grids are stretched beyond capacity, and groundwater is as dependent on these grids for reliability as surface irrigation is on the operation of main canals. Thus, groundwater will not fully replace effective canal irrigation systems.

What is responsible for this state of affairs in Indian canal irrigation? Analyses have usually focused on part or all of a "vicious circle" . . . in which low irrigation charges lead to underfunding of operations and maintenance (O&M), which leads to poor system performance, causing farmer dissatisfaction, which prompts even lower farmer payments for irrigation (e.g., Groenfeldt et al. 1998; Peter 2001; World Bank 1993).

It is clear that what farmers pay directly as irrigation charges does not begin to cover the full cost of irrigation development. The level of the fees has been kept low relative to both full cost recovery and farmers' incomes. Nominal water rates for canal irrigation in most states are revised only after long intervals, and that too after considerable political interference. For example, the water rates prevailing in 1996 in several states in India are the same that prevailed in early 1980s. In Tamil Nadu, the rates are the same since 1974, in West Bengal since 1977, and so on. In real terms, due to inflation, these rates have become very low. In most of the states they form less than 2 percent of the value of output on irrigated plots, compared to the recommendations of Irrigation Commission of 1972 (India 1972) to charge 5 to 12 percent of the gross value of irrigated output.

Not only do irrigation charges not pay back the investment in infrastructure, in most states they do not even cover existing O&M charges, and the recovery rate has been declining. By the mid-1990s, the revenue collected from water charges at the all-India level was less than 10 percent of the total O&M expenses, compared to 78 percent during 1974–76 (India 1996). There are states like Bihar where the expenditure for collecting the water rates is higher than the revenue collected (Bhatia 1989)! If revenue collected from water charges is to cover full O&M charges of irrigation projects, revenues will have to be raised several times.[4]

There is also evidence that current levels of O&M funding are not adequate for sustained management of the systems. As the irrigation systems expanded, provid-

4. Based on the calculation of O&M expenditure of Rs 310 per hectare and a recovery of Rs 50 per hectare, as noted in the Vaidyanathan Committee Report (India 1992).

ing sufficient money for the upkeep of the larger infrastructure became more difficult and expensive. O&M budgets were stretched thin. Because salaries remained fixed (or growing) costs, "establishment" has consumed a larger share of the O&M budget, leaving less for actual works.

Signs of improper operations and inadequate upkeep of systems are plentiful. Canals are silted up or eroded, and breach. Water is unevenly distributed between head and tail of distributaries, minors, and even field channels, with tail-enders often receiving no water, while areas adjacent to the canals are becoming waterlogged. Where water is supplied, timings are often unreliable. The contrast between public surface systems, over which farmers have little control, and private groundwater systems that provide water virtually on demand, makes the situation more acute.

Although farmers spend considerable amounts to invest in private wells and pump groundwater, they have not been willing to pay as much for the less adequate service from surface systems. Those who do not receive irrigation "opt out" of paying, driving cost recovery lower still, thus feeding into a vicious circle of poor maintenance and growing financial crisis in Indian canal irrigation.

While parts of this analysis are certainly accurate, it is not complete or fully accurate. First, it assumes a structural relationship between fees and O&M funding that does not, in fact, exist. It is only in the context of fiscal deficits and declining indirect revenue from irrigation that low irrigation charges have become a serious factor in underfunding O&M. Moreover, it is not clear that more funding would necessarily improve performance because of the incentive structure within irrigation agencies. Finally, most analyses have neglected the role of farmers' political opposition to irrigation fees (which stems, in part, from dissatisfaction with services as well as from populist appeals by politicians).

World Water and Food to 2025: Dealing with Scarcity

Mark W. Rosegrant, Ximing Cai, and Sarah A. Cline
Washington, DC: IFPRI and the International Water Management Institute, 2002, pages 199–206

The various scenarios explored in this book point to three broad strategies that could address the challenge posed by the increasing water scarcity for food production:

1) Increasing the supply of water for irrigation, domestic, and industrial purposes through investment in infrastructure;

2) Conserving water and improving the efficiency of water use in existing systems through water management and policy reform; and

3) Improving crop productivity per unit of water and land through integrated water management and agricultural research and policy efforts, including crop breeding and water management for rainfed agriculture.

Investment in Infrastructure and Water Supply

Although the financial, environmental, and social costs are high for new water supply projects, the selective expansion of water supply capacities, including storage and withdrawal capacities, is still necessary in some regions, especially in developing countries. Storage and water distribution systems such as water lift projects and canals are particularly needed for Sub-Saharan Africa (SSA), some countries in South and Southeast Asia (such as India, Bangladesh, and Viet Nam), and some countries in Latin America. In Bangladesh, storage is needed to reduce the high variance in water supply reliability. Infrastructure constraints will cause water shortages of as much as 60–70 percent in some basins in western and northwestern India after 2015, especially because of insufficient reservoir storage, and the same problem may occur in some basins in south and east India where internal rainfall distribution is uneven. Latin American countries such as Mexico and Argentina will require more storage for intra and interyear regulation after 2010. Thus, hard infrastructure investment has a role to play in the future in some regions but a reduced one compared with past trends, when dam-building and expansion of irrigated area drove rapid increases in irrigated area and crop yields particularly in developing countries.

New investments are increasingly expensive and politically sensitive, however, and appear to have relatively low payoff. Still, some of the increasing demand for water must be met from carefully selected, economically efficient development of new water, both through impoundment of surface water and sustainable exploitation of groundwater resources, and through expansion in the development of nontraditional water sources.[1] Future construction of irrigation and water supply projects will require balanced development approaches that are acceptable to diverse constituencies. The full social, economic, and environmental costs of development must be considered, but so must the costs of failure to develop new water sources. Project design must ensure comprehensive accounting of full costs and benefits, including not only irrigation benefits but also health, household water use, and catch-

1. . . . Nontraditional water sources such as desalination of salt water and brackish water are highly unlikely to make a large contribution to the global water supply over the next several decades. Even an extremely high 20 percent growth in production of desalinated water per year would only account for 1.5 percent of water withdrawal by 2025. Desalination will play an important role in alleviating local water shortages, but even with declining production costs, desalination growth will primarily provide drinking water in coastal regions of countries that are both highly water scarce and relatively wealthy.

ment improvement benefits. Of utmost importance is improved design and implementation of compensation programs for those who are displaced or negatively affected by water projects.

Sustainable development of groundwater resources also offers significant opportunities for many countries and regions where groundwater extraction remains below natural recharge, including southern China; central, western, and eastern SSA; much of Southeast Asia; and localized regions elsewhere. Groundwater irrigation is more flexible than surface water irrigation and can be used in conjunction with surface water to improve water use efficiency. Conjunctive use of surface and groundwater could be expanded significantly by (1) using wells for supplemental irrigation when canal water is inadequate or unreliable to reduce moisture stress and maximize irrigated crop yields; (2) pumping groundwater into canals to augment the canal water resources, lower the water table, and reduce salinity; and (3) viewing a canal command and its imbedded tubewells as an integrated system thereby optimizing joint use of canal and groundwater resources (Oweis and Hachum 2001; Frederiksen, Berkof and Barber 1993). But care must be taken in any expansion of groundwater because the actual extent of groundwater storage and recharge is poorly understood in most developing countries. In many regions, increased investment in exploration and evaluation of aquifer properties such as geometry boundary and hydraulic characteristics, and recharge rates (including spatial and temporal variability) would have high payoff.

Water Management and Policy Reform

Our results show that the most promising avenue for addressing water shortfalls into the future is water management and incentive policy reform to enhance the efficiency of existing water use, supported by infrastructure investment to modernize and upgrade existing irrigation and water delivery systems. As is shown in this book, feasible improvements in basin-scale irrigation water use efficiency can compensate —on a global scale—for reduced irrigation resulting from (1) phasing out groundwater overdraft worldwide; (2) increasing committed environmental flows; (3) raising water prices for agricultural use; and (4) reducing irrigated area development. Further, improving irrigation water use efficiency is shown to be an effective measure for increasing water productivity. In severely water-scarce basins, however, relatively little room exists for improving water use efficiency and food production and farm incomes could fall significantly if water for irrigation is transferred to other uses. In these basins, governments will need to compensate for the negative impact of growing water scarcity on agriculture by alternative means, such as investing in agriculture to obtain more rapid growth in crop yields, promoting the diversification of farming into less water-intensive crops, and diversifying the economy to reduce the economic role of agriculture over time.

The institutional, technical, and financial feasibility of significant improvements in river basin efficiency in specific river basins requires site-specific research and analysis. Basin efficiency depends on improvements in water-saving technologies and in the institutions governing water allocation, water rights, and water quality. In the industrial sector in developing countries, the amount of water used to produce a given amount of output is far higher than in developed countries. Industrial water recycling could be a major source of water savings in many countries, however. Many industrial water users may be able to decrease their water use by at least 50 percent through water recycling methods (Beekman 1998). Cooling water accounts for more than half the industrial water used and has been one of the major sources for water recycling. Greater adoption of technology for re-circulation of cooling water in developing country factories would reduce the amount of water needed in many industrial processes. In many cases the water can then be decontaminated and used again for other purposes such as cleaning or landscape irrigation (Beekman 1998). Progress has been made in urban areas of some water-scarce developing countries. In Beijing, for example, the rate of water recycling increased from 61 percent in 1980 to 72 percent in 1985; and between 1977 and 1991, total industrial water use declined steadily while output increased by 44 percent in real terms (Nickum 1994). Aggressive adoption of such recycling technology could be encouraged by regulations on allowable industrial water discharge and increased prices for water.

In the domestic water sector as well, considerable potential exists for improving water use efficiency. This may include anything from leak detection and repair in municipal systems to installation of low flow showerheads and low water or waterless toilets. It is sometimes argued that water savings from domestic water consumption are not possible because the fraction of water withdrawn actually consumed is small, and most of the water "lost" from systems is reused elsewhere. But a reduction in withdrawals directly saves consumptive use of water in coastal cities—which account for a significant share of the developing (and developed) world's population—where water withdrawn is lost to the oceans. Reduced water withdrawals, which reduce water reuse, also improve water quality which effectively increases water supply by preventing a proportion of water from reaching such poor quality that it cannot be reused. Reducing withdrawals also generates economic benefits from reduced water treatment and recycling costs as it flows through the river basin (Gleick et al. 2002; Rosegrant 1997).

Reuse of domestic wastewater also has the potential to save freshwater and improve basin efficiency. Treated wastewater can be used for a variety of nonpotable purposes including landscape and recreational irrigation, maintaining urban stream flows and wetlands, and toilet flushing. Other important uses can include wastewater-fed aquaculture and the irrigation of agricultural and forest crops, which can

be beneficial in fertilizing crops with wastewater nutrients, reducing overall amounts of chemical fertilizer used and reduce the need for additional pollution control. Shuval (1990) points to the possible positive economic effects of wastewater reuse for agricultural irrigation by assisting in (water and nutrient) resource conservation, and helping to reduce environmental pollution. Although the reuse of reclaimed wastewater for irrigation has potential benefits, great caution is needed to ensure that water quality is acceptable and that poor quality water is not used to irrigate food for human consumption (particularly those foods that are eaten raw). The rate of expansion of treated wastewater reuse will depend on the quality of the wastewater, public acceptance, and cost-effectiveness. Given the relatively high cost of wastewater treatment, it is likely that treated wastewater could contribute an important share of agricultural water supply only in arid regions where the cost of new water supplies has become very high; nonagricultural uses of treated wastewater are likely to grow faster for the foreseeable future.

Improvements in the irrigation sector to increase water use efficiency must be made at the technical, managerial, and institutional levels. Technical improvements include advanced irrigation systems such as drip irrigation, sprinklers, conjunctive use of surface and groundwater, and precision agriculture, such as computer monitoring of crop water demand. Managerial improvements can include the adoption of demand-based irrigation scheduling systems and improved equipment maintenance. Institutional improvements may involve establishing effective water user associations and water rights, the introduction of water pricing, and improvements in the legal environment for water allocation.

Key to inducing higher water efficiency gains in all sectors is introducing market (or market-style) incentives into water use decision-making. Incentive prices for water could have a major impact on water withdrawals and consumptive use in irrigation and urban water uses, thus freeing water for environmental use. . . . Even though the water price elasticity of demand is quite low for irrigation, increasing water prices from the low levels prevailing in most countries generates substantial water savings because the total amount of water used in irrigation is so high. The results show that significant water savings are also possible from domestic and industrial uses. A large backlog of water-saving technology for industry in developing countries could come into play with the right incentives. Water savings through incentive policies could provide a significant increase in water for environmental uses. In most regions, the reduction of irrigation water supply through high prices could be balanced with increased irrigation water use efficiency at the basin scale, eliminating the negative impact of high prices on food security.

Nevertheless, implementing policies to increase water prices is politically difficult and could have negative impacts on poor consumers and farmers if badly designed or implemented. But in the domestic and industrial sectors, improving both

efficiency and equity through increased water prices is feasible and would provide incentives for conservation, cover the costs of delivery and generate adequate revenues to finance the needed growth in supplies and expanded coverage of clean piped water. Generalized subsidies should be replaced with subsidies targeted to the poor; other policies, such as increasing block tariff, could help to ensure water availability to low-income users without direct subsidies. This type of tariff structure has a very low per unit price for water up to a specified volume, after which users pay a higher price for volumetric blocks up to the highest level of consumption. In this way, households that use more water cross subsidize low-income users.

The design of effective and equitable water pricing for agriculture is more difficult. Imposing large increases in administered water prices does not work. High water prices are likely to reduce farm incomes severely (Rosegrant et al. 2000; Perry 2001; Löfgren 1996). Moreover, in existing irrigation systems, the prevailing (formal or informal) water rights significantly increase the value of irrigated land. Water rights holders correctly perceive the imposition of water prices, or an increase in existing prices, as expropriation of those rights, reducing the value of land in established irrigation farms. Attempts to establish or increase water prices are thus met with strong opposition from irrigators (Rosegrant and Binswanger 1994). Finally, implementation of water prices at the farm level is difficult because, with irrigation in much of the developing world consisting of large systems that serve many small farmers, measuring and monitoring deliveries to large numbers of end users—as would be required to charge by volume of water use—is too costly.

Despite these difficulties, it is feasible to design and implement water pricing systems based on water rights that would introduce incentives for efficient water use, recover at least O&M costs, and at the same time protect and even increase farm incomes. For example, a "charge-subsidy" scheme (Pezzey 1992) would establish incentives to use water efficiently without reducing farm incomes and appears to be politically and administratively feasible. A base water right would be established at major turnouts to water user groups or privately run irrigation sub-units (rights could be assigned directly to individual irrigators where administratively feasible). The user group would be responsible for internal water allocation. Subsequently, the base water right would be set based on historical allocation—but likely somewhat lower than the historical allocation in water-scarce basins. A fixed base charge would be applied to this quantity sufficient to cover O&M and longer term asset replacement (depreciation) costs. For demand greater than the base water right, users would be charged an efficiency price equal to the value of water in alternative uses; for demand below the base right, the same price would be paid to the water user.

The establishment of base water rights would increase the political feasibility of water pricing by formalizing existing water rights rather than being seen as an ex-

propriation of these rights. With efficiency prices paid only on marginal demand above or below the base right, nonpunitive incentives are introduced. Reliance on water user associations to manage water "below the turnout" improves local accountability transparency and the flexibility of water allocation. Information costs would be reduced because local irrigators with expert knowledge of the value of water would bear the costs and generate the necessary information on the value and opportunity costs of water below major turnouts. Reform of water pricing policy in developing countries faces many technical, administrative, and political constraints, but with increasing water scarcity and declining financial resources available for irrigation and water resource development, reform of water pricing is essential. For both urban and agricultural water, innovative and pragmatic water pricing reform that introduces incentives for efficient use and enhances cost recovery while improving equity in water allocation is feasible. Agricultural water pricing reform that establishes water rights for users, such as suggested above, would be particularly beneficial, protecting farmers against capricious changes in water allocation, ensuring that they benefit from more efficient water use, and in the longer term providing a basis for water trading among farmers and across sectors, further enhancing water use efficiency.

Crop Productivity and Rainfed Agriculture

Rainfed agriculture emerges from the analysis as a potential key to sustainable development of water and food. . . . Improved water management and crop productivity in rainfed areas would relieve considerable pressure on irrigated agriculture and on water resources; however, this would be contingent on increased investment in research and technology transfer for rainfed areas.

Water harvesting has the potential in some regions to improve rainfed crop yields, and could provide farmers with improved water availability and increased soil fertility in some local and regional ecosystems, as well as environmental benefits through reduced soil erosion. However, greater involvement of farmers from the planning stages and the use of farmers for maintenance and data collection and provision of appropriate educational and extension support are still needed to expand the contribution of water harvesting.

The rate of investment in crop breeding targeted to rainfed environments is crucial to future crop yield growth. Strong progress has been made in breeding for enhanced crop yields in rainfed areas, even in more marginal rainfed environments. Continued application of conventional breeding and recent developments in nonconventional breeding offer considerable potential for improving cereal yield growth in rainfed environments. Cereal yield growth in rainfed areas could be further improved by extending research both downstream to farmers and upstream to the use

of tools derived from biotechnology to assist conventional breeding, and, if concerns over risks can be solved, to the use of transgenic breeding.

Higher priority for agricultural extension services and access to markets, credit, and input supplies should be given in rainfed areas because successful development of rainfed areas is likely to be more complex than in high-potential irrigated areas given their relative lack of access to infrastructure and markets, and their more difficult and variable agroclimatic environments. Progress may also be slower than in the early Green Revolution because new approaches will need to be developed for specific environments and tested on a small scale prior to broad dissemination. Investment in rainfed areas, policy reform, and transfer of technology such as water harvesting, will therefore require stronger partnerships between agricultural researchers and other agents of change, including local organizations, farmers, community leaders, NGOs [nongovernmental organizations], national policymakers, and donors.

Land Tenure and Natural Resource Management: A Comparative Study of Agrarian Communities in Asia and Africa

Edited by Keijiro Otsuka and Frank Place
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2001, pages 359 and 374–377

Property Rights Institutions and Arrangements

Agricultural Land. Property rights institutions are largely favorable or moving in the right direction to provide proper incentives for efficient natural resource management. It is particularly encouraging that tree planting is facilitated in the different customary systems because with the reduction in forest and woodland, there is an increased need for tree products to be produced on agricultural land. There are a few noteworthy exceptions and areas for improvement, however. First, some traditional tenure arrangements, for example, customary tenure in Uganda and matrilineal land tenure in Malawi, appear to provide suboptimal incentives for some types of agricultural investment, though not for short-term inputs. However, these systems have been found to be evolving toward greater individualization, and we believe that indirect policies, such as the promotion of profitable agricultural opportunities and encouragement of more efficient markets, will be effective in hastening this evolution.

Second, we continue to observe that, despite some positive developments, women have inferior rights to resources while at the same time are expected to be the primary users and managers of the resources. Unfortunately, this study was neither

designed nor able to address this issue clearly. Although it seems reasonable that improved management will take place when there is a closer match between those who control and those who use resources (for example, women may plant more trees for fuelwood than men), direct intervention in gender-based property rights policy has proved to be extremely difficult.

One final observation concerns the emergence of more formal private tenure systems. We found that in Uganda and Malawi, households are legally entitled to convert their tenure from customary systems to private through the acquisition of a leasehold with the state. To date, very few households in customary lands have opted for this, and those that have are generally the more elite. There is no doubt that the demand for leasehold is rather low. Nonetheless, one should expect that the twin forces of commercialization and individualization of land rights will lead to a more widespread demand for titling over time by smallholder farmers. Although many titling programs have failed largely owing to prematurity of implementation, they have been found to be popular and sustainable in areas of high market and property rights development such as central Kenya (Migot-Adholla, Place, and Oluoch-Kosura 1993). We believe that land titling programs will become feasible once communal land tenure institutions have become sufficiently individualized. If land is collectively owned, land titling programs aiming at the establishment of private rights will create conflicts among family members, thereby leading to tenure insecurity rather than security.

Forests and Tree Plantations. In contrast to the case of agricultural land, there are ample opportunities for changes in property rights institutions to improve the efficiency of forest and woodland management. The most ineffective and often inappropriate land ownership system is state ownership. This is evidenced by enhanced forest management effort in Vietnam when the use rights of state forests have been transferred to individual farmers. Except for the protection of biodiversity or other uniquely national objectives, the ownership of forests by the state is highly questionable. Communal tenure systems in all the study sites have also largely been unable to prevent massive conversion and degradation of forest and woodland resources. Common property arrangements have been relatively more successful, and many examples are found in Nepal and Japan. To date, governments have invested relatively heavily in agricultural technology development to raise the profitability of agriculture while leaving much of the institutional development to nongovernmental organizations. Certainly, much more effort is needed in developing or strengthening local institutions to manage forest resources better.

It must be clearly recognized that a common property forest regime is effective when predominant forest resources are minor forest products, whereas high-value tree production is less amenable to community management. Thus, the incentive

system under social forestry projects needs to be redesigned. In particular, the system of equal benefit sharing should be replaced by systems that provide appropriate incentives to individual farmers to manage timber trees and other valuable products, for example, granting complete tree ownership rights to individual community members. The element of community management, however, should be maintained for protection of trees. It is also important to provide profit incentives to grow and manage timber trees by promoting marketing of harvested trees.

Development and Dissemination of Agricultural and Agroforestry Technologies

A major policy implication is that given the existence of strong incentives to manage agroforestry plots on sloping lands under the communal ownership, it makes sense to develop and disseminate profitable agroforestry systems, through such means as the development of improved germplasm of commercial trees, improving techniques for propagating useful tree germplasm, improving the flow of information on these new technologies, and, finally, providing proper incentives for germplasm delivery systems to develop. To date, however, research and development on agroforestry technologies, particularly on commercial trees, have been grossly inadequate relative to more traditional annual crops.

In addition, there are wide areas of barren land, which used to be planted to coffee, cocoa, and other tree crops, for which research on sustainable tree management needs to be carried out. The establishment of profitable agroforestry systems will contribute significantly to the reduction of poverty by enhancing the efficiency of farming in poverty-stricken marginal areas. It will also contribute to the prevention of soil erosion and the creation of tree biomass. Moreover, profitable agroforestry can help to strengthen individual land rights where they are weak. Thus, the development of agroforestry is expected to be conducive to both efficiency and equity from both the private and social viewpoints.

To prevent excessive degradation of natural resources, however, it is also necessary to reduce the flow of migrants to marginal areas containing the remaining forests and woodlands. Focusing only on technologies for the marginal areas may attract more migrants. Thus, technology development and transfer need to be strengthened in the more favorable, but highly populated, source areas of migration. Specialized food production may well have a comparative advantage in these areas, and this could be facilitated by improved varieties coupled with access to credit and fertilizer inputs, as was realized in Asia during the Green Revolution (David and Otsuka 1994; Otsuka 2000).

The small areas of uncultivated but arable land that remain will continue to face strong pressure from rural populations seeking agricultural land. Where agriculture is the dominant land use, it will be called on to produce many of the basic forest and woodland products and services formerly obtained from outside the farm.

The remaining forests and woodlands should therefore be used strategically for products and services that are demanded by villagers or society but that cannot be efficiently produced on agricultural land or be substituted for with purchases from the market. For example, it is wasteful for communities or governments to set aside land for the growing of building poles, which are more efficiently grown by farmers. Instead, forestry efforts may be concentrated on the production of public goods such as biodiversity.

Market Development and Other Policy Issues

Market development is critical to generate the degree of intensification required to enable rural people to uplift themselves from poverty without mining their surrounding resources. Increased expenditure for rural road construction is a key component of such development. This point is well understood by policymakers. It must be also clearly understood that although the development of roads may accelerate deforestation by enhancing the profitability of timber harvesting, it will also accelerate the development of agroforestry and timber plantations where primary forests have already been cleared. Further, product market development is found to foster factor market development and will increase the demand for individualization of land rights. Thus, we argue that this is a vital strategy in improving natural resource management.

Our findings also strongly show that reducing population growth rates would help to mitigate against deforestation. Most countries are working to reduce population growth rates through improved family planning. However, the effects of these will only be long term; one can still expect a large number of new families to demand land in the next few decades. As indicated earlier, in the short term, governments should work more closely to strengthen local institutions so that they can more effectively respond to increased population, especially where in-migration is significant. In the longer run, the effect of population growth on forest and woodland resources can be greatly alleviated by increasing employment opportunities in the nonagricultural sector.

According to the results from our study sites, there is much less reason to focus on other policy areas. For example, little deforestation was found to be linked to timber trade and logging, except in state-owned areas. Thus, changes in export regulations and exchange rates would not have made much difference (such policy changes may have affected tree cover on agricultural land, however). Similarly, we have not found that local rural demand for fuelwood and other wood products has played a key role in depleting the remaining woodlands, except in such land-scarce economies as Nepal. Therefore, energy policy reform is equally not likely to have a sizable impact on resource degradation in most of our study sites. However, in areas where urban demand for fuelwood and charcoal is unusually high, there may be

scope for energy policy change, even though our study did not attempt to quantify the rural-urban links.

Innovation in Natural Resource Management: The Role of Property Rights and Collective Action in Developing Countries

Edited by Ruth Meinzen-Dick, Anna Knox, Frank Place, and Brent Swallow
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 2002, pages 12–15

The technologies people use play a fundamental role in determining how fast agricultural productivity grows and in shaping how that growth affects the poor and the condition of natural resources. As a result substantial investments have been made in research to improve agricultural technologies, from new crop varieties to natural resource management practices. Improved agricultural and natural resource technologies are of little value, however, unless farmers judge them to be appropriate and subsequently adopt them. Many factors constrain farmers' technology choices, but the lack of secure property rights is one common and important barrier to adoption, particularly for longer-term investments in things like tree crops and improvements to natural resources. For technologies and natural resource management practices that require farmers to make joint decisions and cooperate in implementing them, inadequate and ineffective institutions for managing collective activity can also be a constraint to adoption.

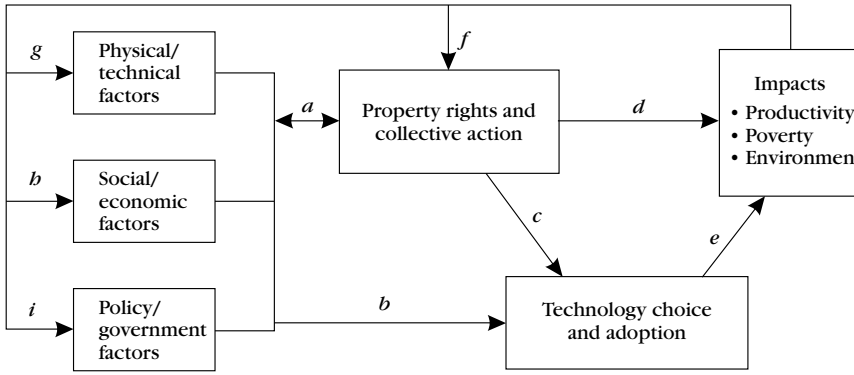
Property rights and collective action (PRCA) are important in determining who benefits from productivity increases, both directly by determining who can reap the benefits of improvements in productivity and indirectly through their effects on land markets, access to credit, and the like. PRCA also affects the way farmers manage their natural resources, hence the longer-term sustainability of their farming systems and the state of the environment.

The links between technology adoption and PRCA are best understood in a dynamic rather than static context. Besides the effects that PRCA introduces, technological change and the resulting changes in agricultural productivity, poverty, and the environment can redefine underlying economic and social forces and induce changes in PRCA institutions themselves. This process of evolutionary change leads to a dynamic interplay between PRCA and technology adoption. . . .

A Conceptual Framework

Figure 2.1 . . . [shows] three important relationships . . . : (1) how PRCA and other factors condition technology adoption; (2) how PRCA affects the impact of new technology on agricultural productivity, poverty, and the environment; and (3) how

Figure 2.1 Conceptual framework: Links between property rights and collective action and technological change



technological change and its impacts on productivity, poverty, and the environment modify existing PRCA relationships.

PRCA and Technology Adoption

The empirical literature has identified a number of variables as important constraints to technology adoption. These variables include:

- lack of or inadequate *infrastructure and information* to enable acquisition of technological inputs, marketing of output, and knowledge regarding the returns from adoption;

- *environmental and price risk,* whereby risk-averse and low-wealth farmers are reluctant to adopt because of their need to stabilize income and consumption streams and to protect scarce assets;

- *low wealth and lack of access to credit,* which limit people's ability to finance the acquisition and maintenance of technologies;

- *labor bottlenecks,* resulting from higher labor requirements that new technologies often introduce and seasonal peaks that may overlap with other agricultural activities;

- *price policies* that discriminate against agriculture and thereby lower incentives for adoption of capital- or cash-intensive technologies; and

- *other conditioning factors,* such as agroecological conditions, institutions, cultural norms, and power structures that render technologies unsuitable for particular environments.

Some studies also identify PRCA as an important variable, but they usually define it narrowly in terms of tenure security. Many studies, for example, evaluate whether share tenancy contracts lead to different farmer adoption behavior than fixed rental contracts, or compare investments by farmers on owner-operated parcels to those on rented or borrowed land. But as one moves from, for instance, Green Revolution technologies that yield quick returns to farmers to technologies with longer maturation periods (such as trees) or that involve cooperation between farmers (such as watershed development), then more complex measures of PRCA become relevant. . . .

In Figure 2.1, PRCA *directly* affects technology adoption (arrow *c* going from the PRCA box to the technology choice box). But PRCA also has *indirect* impacts on technology adoption through its interactions with the other factors mentioned in conditioning technology adoption. Figure 2.1 groups these other factors into three categories: physical/technical factors such as agroclimatic conditions (including risk) and infrastructure; social and economic factors including human capital, information, economic risk, social networks, wealth, credit availability, labor patterns, and social norms; and policy and government factors such as pricing policies or legislation regarding resource use. Each of these factors is assumed to have a direct impact on technology adoption (arrow *b* extending directly from the factor boxes to the technology choice box). Each factor also has an indirect impact by interacting with the PRCA arrangements that exist. We hypothesize a two-way mapping (arrow *a* linking the factor boxes with the PRCA box). Going from left to right, the factors themselves influence the types of PRCA that exist. For example, population pressures may stimulate the emergence of more privatized forms of land tenure, which may in turn reorient technological choices toward smaller-scale technologies that can be better managed by families and individuals. . . . Going from right to left, PRCA helps shape the other constraints. For example, forcible sedentarization of pastoral populations may expose them to greater environmental and food security risks, causing them to take up crop technologies and reduce their stock numbers.

PRCA and Technology Impact

The right-hand side of Figure 2.1 shows that technology adoption has a direct impact on agricultural productivity, poverty, and environmental outcomes (arrow *e*). PRCA also conditions these impacts, either directly (arrow *d*) or indirectly (arrows *c* and *e*).

Technological Change and Induced Changes in PRCA

The dynamism of PRCA and technology linkages is underscored by the effect of technological change and productivity, poverty, and the environment outcomes on the economic and social conditions that in turn shape PRCA arrangements. The induced innovation model (Boserup 1965) predicts that institutions will evolve to meet the changing needs of communities. For example, productivity increases or commercial opportunities arising from technology adoption can change relative factor prices and scarcities leading to pressures to change existing PRCA relationships. In West Africa the introduction of cocoa crops and taxation by Europeans resulted in the evolution of tenancy arrangements as well as separation of rights to trees versus land to accommodate migrating cocoa farmers (Bruce 1988). In a more general context, North (1992) describes how institutions respond to increased technical specialization and impersonalization of markets. This kind of feedback is represented by arrow *f* in Figure 2.1. But technological change can also have feedback effects on other factors that condition PRCA and technology adoption, which amount to an indirect impact on PRCA (represented by arrows *g, h,* and *i* leading to *a*).

Essay

Food Security for All—Including the Hundreds of Millions Left Behind in the MDG Scenario

Just Faaland
IFPRI Director General, 1990–92

Over the past three decades IFPRI has amassed an impressive body of research and been a prominent source of analysis of policy options for effective food production and food security. It has produced valuable case studies of food distribution systems dealing with famine and hunger resulting from natural and manmade crises, as well as from the ill fortunes of the inevitable losers in the national and international market adjustments toward higher efficiency and growth. IFPRI research has also provided analytical and operational insights on international efforts to meet the challenges of HIV/AIDS and other devastating plagues. Armed with its analytical insights, IFPRI has been a frontline advocate of stronger efforts, nationally and internationally, to combat the scourge of hunger and malnutrition. The 2020 Vision exercise bears testimony to IFPRI's successes in its advocacy role. In this essay, I propose that IFPRI take on a new challenge in its research and advocacy in support of global food and nutrition security.

IFPRI contributed richly to the process that led up to decisions reached at the 1996 World Food Summit and to the elaboration of the now broadly accepted United Nations Millennium Development Goals (MDGs). No doubt, IFPRI will be an active and constructive participant in reviewing the world's progress in reducing the extent of food deprivation. Yet clearly, even if the MDGs are fully achieved by 2015, endemic poverty and hunger on a massive scale will remain. In 10 years' time, the world will be a good deal richer, yet even then hundreds of millions will be unable to meet their most basic needs.

The current number of around 800 million hungry and malnourished will have been cut by at best one quarter, to perhaps 600 million people, all exposed to life-threatening and debilitating food insecurity.

As a follow-up to the Millennium Declaration, a set of voluntary guidelines has been formulated to help realize the right to food security for all. Here the approach to freedom from hunger highlights four elements (Guideline 2.4):

1. direct and immediate measures to ensure access to adequate food as part of a social safety net;

2. investment in productive activities and projects to improve the livelihood of the poor and hungry in a sustainable manner;

3. the development of appropriate institutions, functioning markets, a conducive legal and regulatory framework; and

4. access to employment, productive resources, and appropriate services.

Policy analysis by IFPRI and others has contributed decisively to a consensus on how to combat hunger and poverty through growth and development —that is, through actions described in items 2, 3, and 4. This consensus stands in stark contrast to the attention given to direct and immediate measures and safety nets (item 1). The overall foreign aid needed to underpin the achievement of the MDGs, essentially through effective growth, is set at an additional US$50 billion or more a year, and national and international plans of action are built on the premise that this amount will be realized. Yet the building of safety nets for those who do not share in the fruits of development is left vague, with repeated variations of general statements such as "states should consider, to the extent that resources permit, establishing and maintaining social safety and food safety nets to protect those who are unable to provide for themselves" (Guideline 14.1).

In a world that prides itself on being committed to food security for all, this is a cavalier position to take with regard to a "residual" of hundreds of millions of poor and hungry among us. IFPRI has both the intellectual capacity and professional authority to be a major participant in setting the agenda for a future where food security will be a reality, not only for those who are successfully integrated in the production process and the market economy, but also for "those who are unable to provide for themselves."

The time has come for the food and development research community—with IFPRI as a pioneer and central actor—to assess the challenge of meeting the basic food needs of the hundreds of millions of "residual" hungry and malnourished people. In order to provide food security for (practically) all, income and food transfer programs need to be launched, supported, and maintained until all households can effectively gain their food entitlements as active participants in the economy. For some developing countries, the need for such transfers is massive today and will remain so for decades. Moreover, the provision of such transfers must be designed and implemented in support of, not at the cost of, efforts to strengthen growth and efficiency in the economy.

Research on past experience and on strategic options for intervention can throw light on what it would take to reach food security for all by 2015, or more realistically, 2020:

- What types of policies and actions would be effective?
- What types and levels of inescapable leakages and inefficiencies would occur?
- What additional resources would be required?
- What role would international transfers have to play?
- What might be the institutional framework through which national and international efforts can be mobilized and channeled?
- What impact would a successful transformation of the unmet food needs of "the residual" into effective demand have on the food production system (and the environment) and on market forces in other sectors?

My challenge to IFPRI is to supplement its successful work on enhancing food security through improvements in the market economy with a direct focus on meeting the needs of "the residual." I urge IFPRI to adopt this focus in its research strategy and operational work program, as well as in its advocacy role.

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Chapter 7

Assuring Household Access to Food

From Subsidies to Safety Nets and Insurance

Assuring access to food has been a recurrent theme in IFPRI's research portfolio since the establishment of the Institute. Its work on this topic has evolved over time, from an initial focus on food subsidies toward a broader perspective on safety nets, social protection, and insurance. While drawing on the work of many researchers (including Jere Behrman, Ravi Kanbur, Michael Lipton, Simon Maxwell, Martin Ravallion, T. N. Srinivasan, and John Strauss), IFPRI's program of work has been strongly influenced by Amartya Sen's analysis of the causal factors underlying famines—the interplay of external shocks, household endowments, prices, and public transfers—and by work by Sen and Jean Drèze on the scope for appropriate public action to eliminate hunger.

With this background, IFPRI's policy research on safety nets and social protection has been shaped partly by dominant concerns of the era and partly by its own efforts to push forward in areas of emerging research. In the 1970s, 1980s, and early 1990s, IFPRI's work in this area had three principal strands: food subsidies, famine relief, and insurance.

In the 1970s food subsidies were seen as an important means of guaranteeing access to food by poor households. Yet in country after country they were significant drains on scarce public resources while being relatively poorly targeted. Particularly in the 1970s—when more than half of IFPRI's research reports focused on this topic—IFPRI undertook research on the effectiveness of food subsidies (see excerpts from *Food Security: An Insurance Approach*, Panos Konandreas, Barbara Huddleston, and Virabongsa Ramangkura, 1978; and *Food Subsidies in Developing Countries: Costs, Benefits, and Policy Options*, Per Pinstrup-Andersen, ed., 1988).

The second strand of research focused on understanding famines and improving mechanisms to mitigate the pernicious effects of droughts and floods. These issues took on renewed prominence in the 1980s and 1990s following the tragic famines in Ethiopia, the severe droughts in Southern Africa in 1991–92, and the floods in Bangladesh in 1998 (see excerpts from *Famine in Africa: Causes, Responses, and Prevention*, Joachim von Braun, Tesfaye Teklu, and Patrick Webb, 1999; and *Out of the Shadow of Famine: Evolving Food Markets and Food Policy in Bangladesh*, Raisuddin Ahmed, Steve Haggblade, and Tawfiq-e-Elahi Chowdhury, eds., 2000).

The third strand focused on improving food security through indirect policies, such as insuring the income streams of the poor, protecting and enhancing the assets of the poor, and providing public employment programs for the poor. IFPRI took on these issues in the 1980s and 1990s (see excerpts from *Crop Insurance for Agricultural Development: Issues and Experience*, Peter Hazell, Carlos Pomareda, and Alberto Valdés, eds., 1986; and *Employment for Poverty Reduction and Food Security*, Joachim von Braun, ed., 1995). These issues have now returned to the policy agenda in many developing countries, in the form of, for instance, schemes for scaling up employment programs for the poor in India and crop insurance programs in China and elsewhere.

In the mid- to late 1990s, IFPRI researchers and others shifted their attention to innovative approaches to social protection. Work in the past 10 years has addressed several aspects of social protection. First, to be effective, social protection interventions need to take account of gender and other intrahousehold dynamics, as discussed in the 1997 book *Intrahousehold Resource Allocation in Developing Countries: Models, Methods, and Policy* (Lawrence Haddad, John Hoddinott, and Harold Alderman, eds.), excerpted in Chapter 8. Second, careful attention to targeting—both in the methods chosen and in the way they are implemented—is vital if social protection interventions are to be effective. Such considerations are of considerable interest to policymakers (see excerpt from *Targeting of Transfers in Developing Countries: Review of Lessons and Experience*, David Coady, Margaret Grosh, and John Hoddinott, 2004). A third strand of research focused on the effectiveness of programs such as conditional cash transfers that sought to ensure minimum levels of food consumption for poor people while also investing in the human capital of subsequent generations. This research was informed by IFPRI's research on gender and the allocation of resources within households, and it stressed the value of directing interventions to particular household members. An innovative feature of this work was increased use of qualitative research methods to understand the social and cultural factors that explain programs' outcomes and impacts. The excerpt from *PROGRESA and Its Impacts on the Welfare of Rural Households in Mexico* (Emmanuel Skoufias, 2005) illustrates IFPRI's ongoing work in this area.

Food Security: An Insurance Approach

Panos Konandreas, Barbara Huddleston, and Virabongsa Ramangkura
IFPRI Research Report 4, Washington, DC: IFPRI, 1978, pages 13–14

This paper suggests an approach by which the international community can contribute to the food security of food deficit, developing countries without having to create large buffer stocks and stabilize world grain prices. The international community is considering an agreement which would establish minimum and maximum indicator prices for wheat, and use buffer stocks to defend them. But important differences among major participants about commodity coverage and the use of production adjustment and trade policy measures make agreement unlikely. A more acceptable alternative may be a scheme based on insurance principles specifically designed to assist food deficit, developing countries. The objective of such a scheme would be to permit developing countries to stabilize cereal consumption within a range of projected demand at a relatively stable cost.

Two alternative insurance schemes were evaluated for sixty-five food deficit, developing countries for the period 1978 to 1982: a purely compensatory financing mechanism, and a financing mechanism combined with a physical wheat reserve. In the latter case, stocks would be released only during very high-price years (price above $200 per metric ton (MT) or $5.45 per bushel of wheat) and only to countries experiencing a production shortfall of more than 5 percent during those years. On the basis of present market conditions it was assumed that a physical reserve could be acquired from this year's crop at the prevailing price. Reserve levels of 4, 8, 12, 16, and 20 million tons were considered. Five years was considered a reasonable period for making realistic statistical estimates. An agreement could be negotiated for a five-year period, but the anticipated duration would have to be considerably longer for the scheme to operate effectively.

Compensation from the scheme would be permitted whenever a developing country's cereal import bill exceeded a specified percentage of the trend import bill (e.g., 110, 120, or 130 percent of trend). The consumption level defended by the scheme at a given year depends on a country's cereal production during that year. Thus, if its domestic production shortfall is more than 5 percent below trend, the country's actual bill would be calculated for the quantity of imports that would maintain 95 percent of projected demand. If the shortfall is between 95 and 100 percent of trend production, consumption would be maintained at the same percentage of projected demand. Finally, if production exceeded trend; consumption would be maintained at 100 percent of projected demand. These rules would ensure that each country could maintain a consumption level between 95 and 100 percent of projected demand in all years, depending on the performance of its own cereal

production. However, consumption is not restricted to the guaranteed level. A country can maintain its own supplementary reserves and/or allocate additional foreign exchange to food imports if it wishes to support a higher consumption level.

Because of the sharp fluctuations in domestic production in many developing countries, there would be at least some countries eligible for compensation each year. Once a country's domestic production for a given crop year was known and enough information was available to permit an estimate of the expected world market price, the probable cost of import requirements could be estimated. Funds could then be made available to eligible countries. Some mechanism would have to be devised to tie these funds to the purchase of the specified quantity of grains for food consumption. Since in most years the world price would not be high enough to trigger release of grain from the reserve, the assistance to eligible countries would be in the form of compensatory financing. The wheat reserve would be drawn upon when world market prices exceeded the release price, and would be used only to compensate for production shortfalls of 5 percent or more below trend production in those years. This released grain would be valued at the prevailing world price, and the amount subtracted from the total compensation for which each country is eligible. The remainder of the payments due to countries would be provided through compensatory financing. In the event that production shortfalls and/or price increases were so extreme that resources would be exhausted before meeting the requirements of all eligible countries, the consumption level defended by the scheme would be reduced for each country and the additional consumption adjustments necessary would be shared proportionately by all participating countries.

The scheme is least costly with a grain reserve of about 8 million tons; with a reserve of about 16 million tons the cost is equal to that of a scheme operating solely as a compensatory financing mechanism. However, the differences between total expected costs at various reserve levels are so slight that they have no practical significance as a measure for deciding which alternative is preferable. More important is the effect of the reserve on the distribution of the cost of the scheme: the larger the grain reserve held in the system, the lower the probability of very high cost. Consequently, for a given level of funding, the larger the grain reserve, the greater the probability of achieving the objectives of the scheme. In addition, a larger grain reserve provides a higher and more equitable probability over the years of covering production shortfalls of 5 percent or more below trend production during high-price years. For these reasons if a grain reserve was established in conjunction with a compensatory financing mechanism, 20 million tons of grain would be the suggested reserve level for developing countries.

In addition to these technical considerations, a scheme with both funds and stocks has the advantage of providing a supply guarantee to back up the financial insurance, and is likely to be preferred by potential developed country contributors.

Without a physical reserve, the additional purchasing power acquired by developing countries could, in periods of particularly short supply, pressure developed countries to make politically unacceptable adjustments in their own domestic consumption or cause the scheme to fail because of the imposition of export controls. The physical reserve could also provide an outlet for surplus stocks which tend to accumulate in certain exporting countries.

Food Subsidies in Developing Countries: Costs, Benefits, and Policy Options

Edited by Per Pinstrup-Andersen
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1988, pages 334–339

Improving the Cost Effectiveness of Food Subsidies

Program Design and Implementation

The magnitudes of benefits and costs, the way they are distributed, and the extent to which goals are met vary among programs and are influenced by program design and implementation. Modifications of existing programs may improve their performance. However, for such modifications to be successful, program goals must be clearly specified. Pursuing rationing or price stabilization goals efficiently may require programs that are different from those needed to assure efficient income transfers. Similarly, if the goal is to improve nutrition rather than to transfer income, the most cost-effective program design may be different.

Many existing programs and policies have changed over time, from being primarily public distribution schemes aimed at assuring households access to certain rations of basic staples at fixed prices to much more costly food-linked income transfer programs. In some cases, the transition has been by default rather than through a change in policy goals and has been caused by an inability to increase the prices of food rations at the same rate as the price increases in the open market.

Targeting

Household targeting is a key element in achieving income transfer or nutrition goals at reduced costs. Although targeting conflicts with rationing goals if these are interpreted to include all households, targeting is compatible with rationing goals that include only the poor. Modifications in food subsidy programs toward targeting would be likely to reduce fiscal and economic costs, but they would also result in economic losses for nontarget households and therefore incur political opposition. The design and implementation of programs to reach target households and to exclude nontarget households are extremely difficult. The difficulties are due to political and logistical factors as well as to insufficient information. Nontarget households

will oppose successful targeting, in some cases to the point of threatening political and social stability. Furthermore, administrative costs of operating subsidy and transfer programs increase with increasing targeting. This is of particular concern in those developing countries where trained manpower is scarce.

Thus for the above reasons, perfect targeting should not be attempted. There is a point beyond which increases in administrative costs, including the cost of identification of target households, exceed the savings from further reducing benefit leakage to nontarget households. Furthermore, as a program gets more narrowly targeted, the risk of excluding target households increases due to insufficient information. Finally, a program narrowly targeted on the poor is likely to have little political support in all but the most enlightened societies and—if implemented—may have a short life, as exemplified by the Colombian food stamp program.

Ideally, household targeting would be based on incomes of households adjusted for size and composition. However, reliable estimates of household incomes are not usually available, and efforts to obtain and periodically update such estimates would be extremely expensive and often impossible. Furthermore, households may move in and out of poverty or may need support only during certain periods. Therefore, flexibility as well as an exit criterion may be needed. Nevertheless, income and assets may be used to exclude the highest income groups.

. . . A larger number of other targeting mechanisms have been tried, some with success and others not. These include geographical targeting, targeting by the nutritional status of household members or by employment status, targeting by subsidizing inferior commodities or inferior qualities, and targeting in certain periods of the year where seasonal fluctuations severely limit the ability to acquire sufficient food. The most appropriate choice among the various targeting approaches depends on the particular circumstances within which subsidies are introduced. As a general rule, however, targeting approaches that contradict household behavior the least—for example, subsidies on less preferred foods—are most likely to be successful. Lack of success in targeting or high costs of targeting are frequently due to the desire and ability of nontarget households to circumvent targeting efforts. Removing their desire to do so would cut targeting costs.

In some cases, targeting may result in a stigma on certain population groups. This may lead to societal divisions and social and political instability, particularly if the target group tends to belong primarily to a distinct ethnic group.

Governments may consider targeting subsidy costs as an alternative to targeting subsidy benefits. The generation of revenues to cover subsidy costs through excise taxes on luxury goods and services is one example of such an approach; progressive income taxes is another. However, it is not clear that targeting costs is easier than targeting benefits.

The cost of implicit food subsidies are usually targeted on producers. While . . . efforts to maintain consumer subsidies through artificially low producer prices may

entail high economic costs, selective procurement need not. Government procurement of food from farmers at prices below free-market prices need not reduce incomes to the producer sector if the lower prices are passed on to low-income consumers in the form of a highly targeted food price subsidy and if the procured quantity is a small part of the quantity produced by a particular farmer. This is so because the scheme will result in an overall demand increase and in compensation to producers through higher prices for the quantity sold in the free market.

If such procurement is limited to large producers, small ones would benefit from the price increases without having to contribute to the cost of the subsidies. In the absence of changes in foreign trade of the commodity, the net result would be a transfer from high-income (nontarget) consumers to low-income (target) consumers and small producers. Whether large producers would lose or gain would depend on the price response among consumers and producers. Studies of the Indian procurement scheme for foodgrains . . . indicate that producers as well as low-income consumers may gain, at least in the short run, and that significant improvements in income distribution may be obtained with only small losses in economic efficiency if the subsidy scheme is effectively targeted on the poor rather than on most urban consumers, as is currently the case.

Distribution

Results from the work reported in this book indicate that private sector distribution of subsidized food can be very cost effective, often more than public distribution. Food stamps that may be redeemed in private stores are an obvious example. Even when the subsidy is embodied in a lower price for a certain commodity ration, it is unlikely that a separate public distribution network can operate at a lower cost or a lower degree of corruption and program abuse. Private distribution has been successfully used in a number of countries, including the Philippines and Egypt, at a relatively low cost. Household food security goals may not be fully achieved through private distribution in countries where a strong competitive market is absent or where the risk of political or social instability is high, but in most countries, investing in marketing infrastructure and activities to improve competition among marketing agents appears to be a more efficient strategy than maintaining a public sector food distribution network. Promoting small-scale private sector retailing, improving transportation, and investing in other private sector marketing activities are particularly promising because, in addition to being cost effective and reducing concentration of food marketing in the hands of a few, such a strategy will accelerate entrepreneurship and income generation among the poor.

Program Choice

The cost effectiveness of food subsidy programs may also be improved by a careful choice of program type. The two most common types are food stamps and price

subsidies for specific rations or for unlimited quantities. The transfer effects of price subsidies for inframarginal rations would not be expected to differ greatly from food stamps for a given household. However, the degree to which rationing goals are achieved may vary greatly between the two program types. The critical issue is whether the household is assured a certain physical quantity at a fixed price or a certain monetary transfer. In the former, recipient households are assured a constant transfer in real terms, whereas in the latter, price fluctuations and increases in open-market prices may erode the real purchasing power of the transfer (but will reduce real fiscal costs), as illustrated by the food stamp program in Sri Lanka. In theory, the difference between the two programs could be eliminated if the ration price or the nominal value of food stamps was increased as fast as the open-market price. However, inaction by the government would result in increasing fiscal costs and constant or increasing benefits to the recipients of the ration price but decreasing benefits and fiscal costs for food stamps users.

The issue of appropriate adjustments in subsidized food prices and the effect on rationing and income transfers is particularly important during periods of devaluation of the local currency or of rapid food price increases in the international market. Maintaining fixed nominal prices for food staples in the face of devaluation and rapidly increasing domestic prices may result in large and unsustainable increases in the cost of food subsidies. On the other hand, if sharp increases in domestic prices are fully reflected in the price of basic staples, the poor may experience hardships that are economically and politically unsustainable. Social unrest caused at least in part by increasing food prices in a number of countries during the recent past illustrates this point.

Recent efforts to solve foreign debt and deficit-spending problems have included devaluation, higher agricultural prices, and reductions in spending on food subsidies and social programs in a number of countries. In some cases, it appears that the poor have borne a disproportionally large share of the burden of economic adjustment. Although these measures may be necessary to solve immediate foreign exchange problems and may result in accelerated long-term economic growth and employment, short-term implications for the poor may be such that compensatory measures are needed. Targeted food subsidies may be a cost-effective means for providing such compensation. Before such measures are designed, it is important to clarify which consumer groups the government wishes to compensate and whether such compensation will meet the stated goals.

Food price subsidies are but one of many ways in which governments may increase the purchasing power of the poor and compensate for losses in real incomes caused by needed adjustments or by an inappropriate development strategy. Tied or untied cash transfers as well as food transfers are available policy measures. Untied cash transfers tend to be less palatable politically than transfers linked to food, such

as food stamps, targeted food price subsidies, and food supplementation schemes. Political resistance to programs directly aimed at a reduction in starvation and malnutrition is likely to be much less severe than political resistance to cash transfers, even when the former results in transfer of real income that is partially or fully fungible, such as most food stamp programs. Cash transfer programs are also very difficult to implement, and the cost of the necessary control measures to avoid fraud and excessive leakage to nontarget groups is likely to be high. Self-targeting, which may be possible if food subsidies are aimed at less desired foods, is not possible for cash transfers. Another argument that favors food transfers over cash transfers is that food subsidy and direct feeding schemes reduce food prices relative to other commodity prices and thus contribute to a substitution of food for nonfoods, which would not occur as a result of a direct income transfer. This argument holds true only if food becomes cheaper at the margin.

There is some evidence that the marginal propensity to consume food is higher for real incomes originating from food subsidy programs or direct feeding schemes than from cash transfers. The reason is probably to be found in differing preferences of household members and the relation between source of income and household budget control.

Finally, in comparing cash and food transfer schemes, it should be recognized that food may be available from foreign aid at a cost to governments considerably below its market value, thus making food-related transfer less expensive. In some cases, such food aid can be monetized by the recipient governments, while in many others, donor restrictions prohibit monetization.

In attempts to reduce leakages to nontarget households and to focus more sharply on improved nutrition, some countries have opted for food supplements or direct feeding of individuals deficient in calories and protein, usually children and pregnant and lactating women. School lunch programs and feeding of preschool children in health and nutrition clinics are examples of direct feeding. Such programs may assure that leakages to nontargeted households are small. However, intrahousehold leakages will occur through reductions in the allocation of food to target individuals. Furthermore, households may reduce food acquisition from other sources.

If nutritional improvement is the sole goal of a food subsidy program, its cost effectiveness is likely to be highest if combined with an integrated primary health care program, which may include growth monitoring, nutrition education, vaccinations, and various preventive and curative health measures. Malnutrition is likely to be caused by a set of factors, only some of which will be affected by a food subsidy per se. Therefore, since the effect of changing one factor—for example, purchasing power—depends on changing other factors—for example, anorexia caused by diarrhea, or low budget allocation to food due to poor nutrition knowledge—a

combined program is likely to be more cost effective than a food subsidy program per se. Such an approach may also be used to identify target households through, for example, growth monitoring at the health center or in the homes.

An integrated approach implies a risk of overloading the primary health care system. Therefore, it is important that a sufficient addition be made to the resources available to the system. Furthermore, private retailers rather than the primary health care system should be charged with distribution of the subsidized food. This may be implemented by distributing food stamps to target households at health centers.

Famine in Africa: Causes, Responses, and Prevention

Joachim von Braun, Tesfaye Teklu, and Patrick Webb
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1999,
pages 177–185

Comprehensive Policy and Program Action

Famine relief and prevention do not rely solely on optimizing the effectiveness of individual programs, but on combining program components to generate positive multiplier effects. The range of instruments for relief and prevention is broad. Successful policies and programs have been implemented in countries unable to overcome short-term famine risks. These need to be scaled up in order to achieve a more broad-based impact.

The development of rural financial markets and agricultural technology (for both food and export crops) and the dissemination of assets and information remain fundamental for overcoming famine risks. Developing agricultural research and extension facilities is therefore central to long-term famine prevention. Isolated technology promotion and implementation programs cannot solve the problems of larger famine-prone countries. Such programs must be allied with, and indeed protected by, appropriate and timely public actions that involve emergency feeding, health intervention, and income transfers.

In other words, the public capacity and public will to intervene on behalf of disadvantaged people are both crucial to the ability of individuals to cope with the human catastrophe of famine. Some countries are indisputably better equipped to cope than others; the latter will continue to be categorized as "famine prone" until certain crucial investment and institutional decisions are made.

Institutional and Organizational Needs

Famine prevention and relief requires an appropriate institutional framework. That is, national laws, international codes of conduct, and systems for response to famine

need to be appropriately formulated. The question of "what ought to be done?" must be supplanted by "who should do it and how?" if the prevention of famine is to be successful. It appears that a consensus is developing on the "what" question, but there is much less agreement on the "who" and the "how."

Famine prevention and mitigation policy has a great deal of experience to build upon. The colonial famine programs in Rhodesia and Sudan, for instance, were influenced by earlier experiences from India (Shepherd 1988; Iliffe 1990). In India, detailed famine-related legislation was enacted during the second quarter of the last century. These laws (derived in part from even earlier experiences in England and Ireland) focused on early identification of the risks of famine, the provision of employment and public works schemes for those who could work, and food distribution to those unable to work (Drèze 1988; Webb 1997).

The legal and administrative measures operative in Sudan between 1920 and 1956 were instrumental in preventing major famines. They were applied "almost 50 times in different areas of Sudan" during this period (Pearson 1986). Preventative measures became routine features of famine administration (Shepherd 1988). However, such experiences can also be forgotten; between the mid-1950s and the early 1980s, there were no special institutions that handled famine prevention or relief efforts in Sudan, and coherent action was replaced by improvisation. The Indian and the historical Rhodesian and Sudanese experiences therefore remain relevant for famine-prone countries in Africa today.

Famine mitigation and prevention is ever more dependent on the close alliance of local, national, and international relief systems. The means of relief (but not the methods of prevention) have evolved since the end of the Cold War due to the changing nature of emergencies. At the international level, the famine mitigation system is dominated by donor organizations that have different options for providing their assistance. In addition, the general public's contributions to international NGOs [nongovernmental organizations] and the Red Cross have become sizable: recent voluntary contributions channeled by NGOs were about US$2 billion per year (Reutlinger and del Castillo 1993). . . .

The international system of famine relief has changed during the early 1990s in response to new political circumstances and public pressures. More recent innovations include efforts to streamline UN relief-response capabilities (FAO 1996), reorganizing national and supranational donor organizations (the establishment of the European Community Humanitarian Office [ECHO] in 1992 is one such example), and strengthening the role of international NGOs in certain conflict-prone regions where the United Nations or bilateral agencies have difficulties operating. In Ethiopia, for instance, about 80 percent of the relief assistance provided from 1985-91 in government-held areas and areas controlled by the Eritrean and Tigrayan liberation movements was channeled through NGOs, or some combination of

NGOs, UN agencies, the Ethiopian government, and liberation organizations (UNEPPG 1989b; Borton 1993).

Within each system there is competition and complementarity, both of which have been underutilized. For each crisis, there are specific characteristics that have to be understood in order to take full advantage of the available relief system. Only with a thorough analysis of these characteristics can a choice of policy instruments be made. Assessment of the famine relief mechanisms used will then depend on how well the systems responded to the short-term crisis as well as laid the groundwork for future developmental improvements.

Local Action and NGOs

The assumption that famine gives rise to generosity only in the industrialized West is misplaced. . . . Local collective action persists in many famine-prone countries (Swift 1993), but displacement, refugee flows, and urbanization have reduced its coverage and relevance. . . .

In addition to local action, however, extracommunity NGOs also attempt to mobilize help for distressed communities. In Ethiopia, grassroots initiatives were directed in part by church organizations and in part by regional drought committees. The churches (Baptist, Catholic, Lutheran, Orthodox, and others) were largely coordinated in their relief activities by the Christian Relief and Development Organization, a body comprising over 50 groups. Their apolitical role in distributing food behind lines of conflict was central to successful famine relief efforts during the 1980s (Minear 1988). During 1985, they served as a grassroots outlet for donations from overseas as well as from philanthropic organizations in Addis Ababa. Regional relief committees, on the other hand, were set up under the aegis of local party officials to organize care for destitute migrants as well as to collect voluntary contributions and a famine tax (levied on all peasant associations) for relief activities. Comparable community and local actions were pursued in Sudan, built around locally based voluntary organizations and traditional leadership structures. The implication is that international and government agencies should better identify the existence, strengths, and weaknesses of local initiatives in order to not undermine them; ideally, local actions should be integrated into larger institutional arrangements.

For instance, in Ethiopia in May 1985 there were 48 NGOs operating relief projects. These engaged in activities ranging from relief measures to developmental programs. During the famine, the most common care operations were medical and feeding programs (intensive and supplementary feeding, and dry-ration distribution). However, when the peak of a crisis is over, NGOs are often faced with the question of where to redirect their efforts. The answer for most usually is to go from relief to rehabilitation. This raises questions about long-term dependency relationships between beneficiary populations and local NGOs (Curtis, Hubbard, and

Shepherd 1988; Elizabeth 1988). Additionally, the working relationships between international and local NGOs do not always function to everyone's satisfaction (Abdel Ati 1993). It should be evident, however, that continued NGO presence in the field can be crucial to successful aid programs in crisis conditions.

The complex role of NGOs has emerged within the "permanent [state of] emergency" that exists in the countries of the Horn of Africa (Duffield 1993). NGOs clearly are necessary to supplement governmental and international actions during a crisis, but their potential to prevent future crises or enable rehabilitation afterward is limited. Some critics suggest that in specific settings—such as the Red Sea Province of Sudan—NGOs have made no efforts to create an environment conducive to sustained developmental action. Additionally, by refraining from becoming involved in infrastructural projects, their lack of support for local NGOs, and failing to mobilize the traditional organizational systems of local groups, NGOs have planted their own seeds of destruction (Abdel Ati 1993).

Government Interventions

When famines occur, governments are often blamed for not predicting the crisis and providing timely intervention (Gill 1986; Jackson 1990). Some of this blame is often colored by political bias, but the point has merit. Without adequate investment in information gathering and analysis, and in the mobilization of resources for rapid response, famines cannot be adequately dealt with. This applies to the international relief and development community as well as to national governments (Penrose 1987; Fraser 1988).

A generalized answer to the question of whether governments should set up one specific agency or organization to handle famine relief has not been found. Famine-prone countries have often set up specific agencies to deal with such operations. In Ethiopia, the RRC (renamed the Disaster Preparedness and Prevention Committee) is the agency with principal responsibility for operations in the realm of drought and food shortages. Founded in 1974, the RRC was set up to monitor and alleviate the effects of the 1973/74 drought. Its mandate was to provide relief in the worst-affected regions by acting as the central clearing house for all aid activity. Sudan similarly set up an RRC in the mid-1980s which, however, never evolved to the caliber of the Ethiopian model. Country circumstances may argue for or against an RRC-type organization. Countries with a decentralized government might use an arrangement that emphasizes a stronger role of local entities, or might channel all activities through the central ministries, as the circumstances warrant. It's easier to generalize governments' roles in famine mitigation than to identify the specifics of appropriate organizational structures.

The underpinnings of famine mitigation and prevention policies require a legal base. To prevent political influence from hampering famine mitigation efforts,

emergency-code legislation (of the Indian kind) should be institutionalized. Such legislation should define three areas of public responsibility: (1) authority and ability to record and diagnose distress signals and to alert appropriate institutions of the danger, (2) development of the local institutional capacity to organize an effective response to such alerts, and (3) design of explicit targeting strategies to cover population groups most at risk. Successful implementation of such legislation requires strong political, financial, and technical empowerment of local government structures. These structures should also bear primary responsibility for the management of regional emergency food stocks.

There is a need for early warning of famine crises, both nationally and internationally. Improvements in early-warning capabilities, however, have limited value if they do not result in timely and effective response.

One of government's roles is to coordinate and integrate administrative bodies, to provide strong administrative linkages between institutions that can identify a problem and those whose responsibility it should be to prevent and, if necessary, remedy that problem. The prepositioning of response measures, combined with monitoring of preventative measures, is essential in alleviating the distress caused by famine. Botswana's experience of coordinating and integrating different food security action-including employment programs with mainstream public institutions provides an example.

What will be most effective in providing sustained famine relief is to tie the health care systems to the food security systems of government. A strong health care system is a necessity for public action under any circumstances, not just from a famine prevention perspective. Health systems tend to fall apart under famine conditions, as happened in Sudan in the mid-1980s (de Waal 1989; Teklu, von Braun, and Zaki 1991). Not only does better health directly affect child nutrition . . . , it facilitates coping with consumption fluctuations. Also, a strong health care system can be a powerful tool for managing relief operations more effectively, especially for children' and mothers.

International Actions

The international donor community has played a critical role in the public response to famine in Africa. . . . The key players in this effort operate through multilateral and bilateral agencies and through NGOs. The inability of states to cope with famine within their own borders has repeatedly led them to seek external assistance. Providing aid to countries with a weak central authority, such as Somalia, is a relatively new challenge, but the probability of such interventions being needed in the future is high. One of the largest internationally guided relief operations, Sudan's Operation Lifeline, revealed the limits of international action when there is a lack of government cooperation, as in Somalia in 1993 and in Sudan in 1998.

Because the severity of famines and their effects is becoming more intense, international awareness has intensified as well. Evidence of this can be seen in opinion and goal-setting meetings, such as the World Summit for Children (1989) prepared by UNICEF; the International Conference on Nutrition (1992) hosted by FAO/WHO; as well as the World Food Summit (1996) prepared by FAO. Each of these efforts stimulated public opinion and led to some country-level actions. Their common problem has been a lack of independent follow-up and related monitoring and evaluation.

Along with greater awareness of the problem, there has been more international response to deal with it, primarily under the auspices of UN organizations. Considerable strides in dealing with famine conditions have been made in the 1980s, but the UN system has found it difficult to establish one strong organization to end hunger. A number of UN groups feel they have a mandate in this field, and this has had the effect of each of them providing only partial responses or working in specific regions. Although the tasks of famine prevention and reducing malnutrition remain complex and certainly require a similarly complex international action network, this cannot be said for the task of famine mitigation, where a strong international organizational setup is long overdue. Famines in many African countries today are the direct result of conflict and oppression. The international capability to address these issues must be strengthened in order to provide realistic aid to those most vulnerable. . . . A different legal code, including the rethinking of states' rights versus citizens' rights may be required.

Out of the Shadow of Famine: Evolving Food Markets and Food Policy in Bangladesh

Edited by Raisuddin Ahmed, Steven Haggblade, and Tawfiq-e-Elahi Chowdhury
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Recent Reforms

In the long run Bangladesh's food markets and food policy have been buffeted by two powerful and often unpredictable exogenous forces: the weather and food-aid donors. Floods and poor harvests have scuttled major reform—for instance, the aborted abolition of the Food Department in 1955. In other cases meteorological forces have stimulated a surge in public distribution, as with the foods of 1987 and 1988 and the drought of 1979. Donors, because they supplied 50 to 75 percent of public food resources, were a driving force in the buildup of the ration system. Later

they played a key role in reorienting offtake to rural-focused targeted distribution. Ultimately, through their long-term policy conditions, donors helped erode ration subsidies as they plotted the demise of the very system their early inflows had nourished and sustained through its formative years.

In the early 1990s, as so often in the past, these forces played a key role in initiating and sustaining reform. But surprisingly, given past history, these reforms took place immediately after Bangladesh's worst flood in 100 years, the 1988 flood.[2] In this case well-functioning grain markets, an immediate bounce in boro season production, and timely targeted public food distribution contained what in earlier decades would have been a major natural calamity. Close on the heels of this flood was abnormally low rainfall in 1992. This situation raised serious concern because, historically, droughts have proven more devastating than floods: insufficient rainfall compromises Bangladesh's largest rice crop, rainfed aman. But recently expanded HYV technology provided unanticipated drought insurance when late-season irrigation of the aman crop converted a potentially devastating drought into an all-time record aman harvest. Containment of these natural shocks inspired confidence in the growing flexibility and responsiveness of foodgrain markets. Donors likewise helped set the stage for reform by adhering to their long-term plan to reduce ration subsidies.

Rapid structural change in Bangladesh's foodgrain production and markets laid the foundation for a major restructuring of government food policy in the early 1990s. New HYV foodgrain technology, for both rice and wheat, became available in Bangladesh in the mid-1970s. After 10 years of steady expansion, adoption surged perceptibly in the second half of the 1980s following liberalization in key agricultural input markets—fertilizer and irrigation equipment. The sudden widespread availability of these inputs triggered a dramatic boost in the use of irrigated HYVs in foodgrain production, particularly in dry-season irrigated rice. Coupled with sustained investment in key rural infrastructure, such as electricity, telephones, and roads, this buildup of foodgrain production made possible a marketing revolution of far greater scale. While foodgrain production increased from 8 million tons in 1962 to 18 million tons in 1992, quantities marketed increased by a factor of six. This increased production was realized almost entirely through increased productivity without substantial increase in the planted area under rice, particularly after 1975/76. Due to sequential, patchwork adoption, regional trade flows and price

2. In 1998 another devastating flood hit Bangladesh, one as severe as the 1988 "flood of the century." In spite of early media speculation that another famine was unavoidable, large-scale private rice imports from India of more than 2 million tons, together with increased public offtake, ensured foodgrain availabilities and avoided any death from starvation.

seasonality changed. In addition, the number of private rice traders mushroomed. Increased foodgrain production in excess of population growth, growing urbanization, shifting preferences for wheat, and intractable poverty all contributed to a steady softening in real rice prices.

Simultaneously, sustained by long-term donor conditions, gradually rising offtake prices from government ration channels climbed upward to meet the falling market price. By eroding the incentives of millions of ration cardholders to draw rations, the fall in rice prices in the early 1990s played a key role in making rapid downsizing possible. Like the twin blades of a pair of scissors, the falling market price combined with a rising ration price to cut the ration subsidy from the system. . . . This subsidy erosion, gradual at first and then dramatic in the late 1980s and early 1990s, effectively neutralized 15 million ration recipients, the largest potential opposition to downsizing the enormous public flood distribution system.

Spurred by reduced government resources and a softening foreign aid environment, an opportunistic coalition of government reformers seized this favorable moment to launch a series of rapid downsizing moves. In short order, from December 1991 through August 1993, they abolished the major ration channels, reduced domestic rice procurement, and liberalized foreign trade in foodgrains. Even with a change in government, two subsequent bad harvests (1994/95 and 1995/96), and two major crises (the drought of 1997 and the flood of 1998), downsizing and liberalization have been sustained.

Today, Bangladesh's public food system looks considerably different from the way it looked a decade ago. Ration channels, the centerpiece of the system since the 1950s, have been dismantled. Only essential priorities, the outlet serving the army and police, continues to draw rations of any significance. Instead, the system focuses on a small open market sales outlet and a tightly targeted set of distribution programs aimed at vulnerable groups. Government procurement has shrunk apace. Moreover, the rapid private sector response to import liberalization means that, for the first time in five decades, private sector foodgrain imports exceeded the government's imports.

Crop Insurance for Agricultural Development: Issues and Experience

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Risk is an important consideration in agriculture. Yield and price risks induce farmers to allocate their resources conservatively. Farmers pursue more diversified cropping patterns than is socially optimal, and they are sometimes reluctant to adopt

improved technologies because of the increased risks associated with their use. In many regions there is also the risk of widespread catastrophic losses because of drought, flood, hail, pest, or other natural disasters. Such catastrophes can seriously set back farm development, they can lead to difficult welfare problems for farmers and other agriculturally dependent households, and they can cause widespread defaulting on loans from agricultural development banks.

Traditionally, farmers have learned to cope with risks through various management practices. Risk can be reduced through prudent husbandry techniques and through appropriate choice of cropping patterns. Strategies such as storage, credit, and off-farm employment can also help minimize the effects of serious crop losses when they occur. Rural institutions have also evolved to help farmers manage risks. Some land-tenure systems, such as sharecropping, provide a risk-sharing device between landlord and tenant. Rural moneylenders can also help tide farmers over from poor years to good, as can kin support and extended family systems. In industrialized countries, market institutions often exist whereby agricultural risks can be spread to other sectors of the economy. These include efficient credit markets, some types of insurance, and, sometimes, commodity futures markets. Such institutions are much more rudimentary in developing countries.

These practices and institutions can reduce risks for farmers, but they never fully remove them. The question of whether governments should intervene and provide comprehensive multiple-risk crop insurance for farmers is therefore a relevant one. Many governments do this (for example, the United States, Japan, Mexico, Brazil, and Costa Rica), and on a global basis, many hundreds of millions of dollars are spent each year on the public subsidization of crop insurance schemes. Recent years have also seen a growing interest in crop insurance in developing countries in Asia and Latin America, and by international agencies such as the Food and Agricultural Organization, the United Nations Conference on Trade and Development, and the Inter-American Institute for Cooperation on Agriculture.

In this book, we have tried to put crop insurance in perspective as one of several policy instruments for managing agricultural risks. It is a special purpose instrument—it addresses only yield risks. Therefore, it is only relevant when yield risks, and particularly the possibility of disastrous yields, are the predominant source of income variability. Even then, alternative policies may still be more effective or cheaper. For example, efficient credit markets could provide most of the same benefits to farmers as crop insurance, particularly if credit is also offered for consumption purposes and repayment can be deferred in disaster years. Small-scale farmers and landless workers may also be more effectively assisted in years of natural catastrophes through food subsidy schemes or food-for-work programs.

In theory, crop insurance is an efficient way of spreading risks among farmers, among regions, across sectors of the economy, and over time. Expectations of its benefits include improved farm resource allocation and higher farm incomes, larger

national supplies of important food crops, and the improved performance of agricultural development banks. In developing countries, expectations that crop insurance enhances technological innovation are particularly prevalent. Multiple-risk crop insurance is also often perceived as being one of the few politically and administratively feasible ways of selectively assisting rural families in times of distress. Also, unlike many other government relief programs, the compensation provided is a purchased right of the insured. It is not a government handout and there is less uncertainty attached to its dispensation.

Crop insurance has also proved attractive to agricultural development banks, particularly when it is tied to farm credit on a compulsory basis. In the event of an insured disaster, the indemnity is paid directly to the bank to cancel the farmer's debt. From the bank's point of view, this is an effective way to reduce loan defaults and thus protect its capital assets. The farmer, however, often perceives insurance as another cost attached to the loan; the insurance premium is simply added to the interest rate.

In practice, multiple-risk crop insurance has proved disappointing, and it has fulfilled few of its supposed objectives. A key factor is that the administration costs are generally too high relative to the benefits in risk reduction that farmers or banks receive. Typically, these costs average about 6 percent of the value of coverage, which is very high compared to normal administration costs for life insurance of about 1 to 1.5 percent. Given also that an actuarially fair premium for all-risk crop insurance is generally between 5 and 15 percent, then farmers would have to pay premiums of between 10 and 20 percent if insurance is to be self-financing. At this cost, it is not surprising that farmers have proved unwilling to purchase all-risk crop insurance voluntarily. It should also be remembered that crop insurance only covers part of the yield risks, and it makes no contribution at all toward reducing many of the other price, resource, and health risks confronting a farmer. In many cases, these other types of risk are much more important in destabilizing farm income.

The cost of multiple-risk crop insurance tends to be particularly high in developing countries. Large numbers of small farms and a wide diversity of agricultural practices greatly adds to administration and inspection costs. Poor data on actuarial risks and a lack of skilled personnel also hamper the writing and enforcement of sound contracts.

More generally, multiple-risk crop insurance is expensive because of moral hazard problems. Moral hazard arises when farmers fail to take reasonable precautions against crop losses because they can rely on yield compensation from the insurer. For example, farmers may fail to protect insured crops with adequate amounts of pesticides. They may even decide to use less fertilizer and other inputs that affect yield. These actions increase the risk confronting the insurer, and they do so in a way that is not usually allowed for in the actuarial calculations upon which the premium is based. As a result, the insurer must either incur higher administration costs by undertaking more frequent inspections of farm practices or risk unfavorable loss

ratios (the ratio of indemnities to premiums). Either way, the insurer will eventually have to increase the average premium rate charged.

To make multiple-risk crop insurance viable, many governments have been willing to subsidize it. Of the larger schemes, public subsidies range from a low of 25 percent of indemnities in the United States, to 50 and 80 percent, respectively, of total payments in Brazil and Mexico. Subsidies of these magnitudes cannot be justified on purely economic grounds. Analyses of the Mexican and Japanese crop insurance programs show that there is a substantial net social loss from the subsidies. Given that such subsidies could be diverted to more productive public investments, publicly supported crop insurance programs are likely to be quite costly for most developing countries. The problem is aggravated by the scarcity of skilled manpower in such countries and the cost of its diversion to insurance activities.

That governments do subsidize crop insurance suggests other objectives than narrowly economic ones. Crop insurance provides relief to rural families in times of need. Several governments also use crop insurance subsidies as a means to transfer income to farmers. Both welfare objectives are faulted by the observation that crop insurance mostly benefits the large-scale and more prosperous farmers, particularly when it is tied to agricultural credit. More carefully targeted relief measures, such as food for work, might prove more cost effective in attaining welfare goals.

Governments have also facilitated multiple-risk crop insurance through legislation that makes it compulsory and by providing reinsurance. But even when it is heavily subsidized, many farmers are unwilling to purchase multiple-risk crop insurance on a voluntary basis. These are often the lower-risk farmers who have less need for insurance or are unwilling to pay premiums based on average risk levels. If these farmers do not purchase insurance, then the insurer must charge higher premium rates, thereby making insurance unattractive for other farmers, too. Compulsory insurance solves this problem of adverse selection, but it effectively means that lower-risk farmers subsidize higher-risk farmers. A better alternative is to tailor premium rates to individual farm risks, but this is rarely feasible given existing data and would be very costly to administer.

Government-provided reinsurance may be essential in the early stages of development of an insurance program if it is to survive major catastrophes or a run of bad years. However, government reinsurance often introduces a moral hazard problem with the insurer. As long as the government is committed to making up any shortfalls in indemnity payments, there is little incentive for the insurer to pursue sound portfolio management or to rigorously inspect crop damage.

Overall, the findings in this book are not encouraging for crop insurance, and governments would be well advised to look carefully before embarking on large and costly multiple-risk crop insurance programs. Some lessons emerge, though, as to how crop insurance might be made more cost effective in assisting farmers.

Insured risks should be restricted to natural hazards such as hail, flood, and hurricane damage. Such risks avoid the problem of moral hazard, and they can be easily monitored and the damage assessed at reasonable cost. Much of the data necessary for actuarial calculations are also often available from local weather stations, and the risks can be evaluated at a regional level rather than the farm level. However, the Japanese experience suggests that indemnity payments must still be tailored to losses at the farm rather than the regional level.

The administrative costs of crop insurance can also be reduced through better management. Most programs are not managed efficiently, either in allocating personnel and physical resources or in selecting the insurance portfolio and managing financial reserves. These inefficiencies are in large part a result of the blanket guarantee for financial solvency provided by governments to public insurers. Mixed-capital ventures or farmer-owned cooperatives might offer more viable institutional alternatives to public programs. Governments should also seek to transfer their reinsurance functions to the international insurance market once insurance programs are well established. However, the managerial discipline that this can invoke should not be impeded by excessive government regulations on the insurance portfolio or by continued easy access to public funds when serious losses occur.

Administrative costs might also be reduced through new approaches to crop insurance. Insurance based on homogeneous areas rather than on individual farms has not fared well, but logical extensions to the area approach, such as regional hail or rainfall lotteries, have yet to be explored. Schemes of these kinds could be very cost effective, but they would obviously be far less effective in matching indemnities to the needs of individual farmers. Nevertheless, they might provide a satisfactory degree of co-variation between indemnities and income shortfalls for a large part of the rural populace. However, such insurance should not be compulsory.

Finally, there is considerable scope for the development of other types of risk-specific insurance for farmers in developing countries. These might include accident and life insurance, theft insurance for livestock and machines, fire insurance for buildings, and so forth. These types of insurance are best provided by the private sector, but government has a key role to play in improving the policy and legislative climate for the development of such private contracts.

Employment for Poverty Reduction and Food Security

Edited by Joachim von Braun
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Key Elements in the Design and Implementation of Employment Programs

Certain elements of program design are of key significance in achieving program effectiveness in reducing poverty. Employment programs aimed at reducing poverty

can succeed only to the extent that they, first, reach the poor, and, second, actually benefit the poor. One essential element of program design, therefore, is the means of targeting the poor. . . .

A second essential element involves the design of benefits, such as improved short-term food security or the generation of assets that ensure future food security. Two other important features of employment programs that will also be discussed are adequate technical and managerial training of the personnel responsible for implementing the programs and the need for broader criteria for program evaluation.

Reaching the Poor. Targeting the root causes of poverty may be as important to reducing poverty over the long term as is the direct targeting of the poor themselves over the short term. Root causes of poverty that can be remedied by labor-intensive public works programs include weak infrastructure (roads, lack of piped water) and a degraded natural resource base. . . .

The poor can be targeted directly if programs are located in regions where absolute poverty is concentrated. The effect is enhanced if labor movement is unrestricted. Within poor regions, it may be economically efficient to invest in programs that yield high returns and produce public goods. Examples of such investments might be the infrastructure and resource improvement activities mentioned above. The Chinese programs have adopted this approach successfully. . . .

The poor may be targeted directly, yet not administratively, through the setting of low wage rates. . . . The potential and limitations of this approach are addressed from different perspectives in the various national cases studied. Wage rates in publicly funded employment programs for poverty reduction should ensure food security but little more in order to ensure optimal use of program resources and broad coverage of the poor. This approach is exemplified in the programs in Maharashtra, India, in Bangladesh, and in Niger. . . . A food-security-insuring wage rate may actually be above market wage rates during crises when labor markets collapse (in a famine, for example). The level at which such a self-targeting wage level should be set depends on the local conditions regarding opportunity costs of time. Any implementing organization must be able to monitor changing circumstances and adjust wage rates accordingly. Nevertheless, program participation should allow minimum basic needs to be met.

One issue with this wage-based targeting approach is that optimal wage rates often tend to be below typical minimum wage rates set by governments. Minimum wage rate policy needs to be reviewed in this context; such policy must not undermine the potential for the self-targeting of employment programs of the poor. A legal framework within which such wage adjustments can take place is critical for ensuring that those who are employed at a certain point in time do not have a stronger say about the wage rate than those who are not involved in the program at any given

time, but are close to the threshold for being attracted to it under changing circumstances, for instance, when the opportunity cost of time diminishes in a drought. As much as possible, an employment guarantee should be aimed for at the level of the food-security-insuring wage rate. Of course, skilled labor is needed in labor-intensive public works programs, too, and must be remunerated at market wage rates appropriate to the levels of the skills involved.

Employment programs open to everyone have attracted a greater proportion of poor women than typically found in any other employment in the same countries or locations. Such programs have the capability of empowering women through off-farm, outside-of-the home employment. . . .

Child labor, however, remains a critical issue, not just direct employment in programs, but also when home tasks are shifted to children because adult household members are absorbed in employment programs. . . . Child-labor problems need to be addressed with explicit incentives for education that work in the short run. Such strong incentives need to be developed alongside employment programs.

Benefiting the Poor: Relief versus Generation of Assets? In general, the mobilization of labor without creating assets, that is, "workfare" or "make-work" projects that keep workers busy but produce nothing of value, as a form of welfare appears neither economically convincing nor politically feasible. Labor-intensive employment programs should serve the dual function of short-term relief and longer-term asset creation. In order to meet these two aims, employment programs must be flexible enough to respond to changes in the labor market, that is, to expand their activities in the event of sudden crises. In order to realize their full potential for providing short-term food security, employment programs need a flexible response capability, especially in crises. The advantages of quick response have been proven in Maharashtra, India, for example. . . .

Employment programs that provide workfare, that is, which disregard the asset-generation component, are generally undesirable. A correct economic judgment concerning them, however, depends upon the appropriate point of reference; for instance, in crises, this option may be preferable to distress migration and famine feeding camps. Experience in East Africa during famine supports the judicious use of a workfare design in crises. . . . However, workfare should not be considered a viable option for dealing with chronic food insecurity and poverty. . . .

Training Needs and Evaluation Problems. The ability to generate high-quality assets presupposes technical training of the supervisory staff at work sites and of the staff responsible for planning the asset-generation component of the program. . . . It also requires management training. Often, unfortunately, both the technical and the managerial capabilities of labor-intensive public works programs tend to be too

weak to handle their respective tasks. In particular, programs that are created outside mainstream government-run public works programs seem to suffer from inadequate training. The long-standing training initiatives of the ILO for labor-based technologies, for example, have strengthened the capabilities of organizations implementing employment programs. . . .

The approach to evaluation leaves much to be desired in many of the reviewed programs. Often, labor-intensive public works programs are criticized because the assets they create are not sustainable. Generally speaking, the dual purpose of employment programs (that is, asset creation and short-term poverty reduction) leads to unrealistically high expectations. The implementation of labor-intensive public works entails the acceptance of real trade-offs between such short and long-term goals.

Accordingly, evaluations of these programs must consider how well they have met their designated goals and succeeded compared to program alternatives. In addition, evaluations must take into account the time frame of the respective program's goals. For instance, an evaluation would have to be considered flawed if it criticized a program that had been implemented in a crisis with a short-term focus on food security for its failure to generate lasting assets of perfect quality with a high internal rate of return of say, some infrastructure.

It would be equally inappropriate to assess a program's effectiveness over the short term when the program's objectives were designed to be met over the medium or long term. The indirect effects of employment programs can also be quite substantial over the short term—but these effects can easily be overlooked in evaluations. Improvements in rural infrastructure, for example, can spur growth in agriculture, as was the case in Bangladesh. . . . Employment programs that accompany and support institutional change can also have significant, indirect effects. The study from China demonstrates how the monetization of commodities in labor-intensive public works programs boosted the growth of the rural cash economy and led to greater integration of markets. The programs in both Bangladesh and China had a wide variety of developmental effects. This suggests that evaluations based solely on the short-term, direct effects of projects can be myopic and lead to the undervaluation of the real benefit of such programs.

Another potential indirect effect of public employment programs that should not be overlooked in program evaluation is the stimulation of private-sector activities. In Niger . . . and in Bangladesh . . . , the private sector played a significant role in the implementation of employment programs. Such involvement can stimulate the development of growth and skills in the private sector, especially if companies enter areas of activity that have traditionally been the exclusive domain of the state (such as the development of infrastructure). Private-sector involvement can subsequently strengthen the overall competitiveness of the economy and open up new

areas of private-sector activity. Such stimulation would be a significant positive effect of employment programs.

Evaluations must also take into account large seasonal fluctuations, which can offset or entirely reverse the accomplishments of employment programs. . . . For example, dramatic changes in the opportunity costs of labor, as in Niger . . . , could adversely affect program performance. Seasonal adjustment of employment programs is, of course, critical in such environments, but may increase overhead costs. Evaluations should, in general, consider a broader set of criteria and, in particular, take into account the institutional changes fostered by employment programs.

Targeting of Transfers in Developing Countries: Review of Lessons and Experience

David Coady, Margaret Grosh, and John Hoddinott
Washington, DC: World Bank and IFPRI, 2004, pages 83–86

What Can We Say about the Effectiveness of Targeting?

. . . Targeting is a means toward the end, which is poverty reduction. Assessing the effectiveness of targeting is an exercise in assessing one component of antipoverty interventions. It should not be confused with an assessment of all impacts of targeted interventions on welfare, which is beyond the scope of this book. Programs may have other objectives than transferring money to the poorest households, and these objectives might involve a tradeoff with targeting performance. For example, social funds may be primarily concerned with creating community infrastructure and with building local capacity and social capital. That they show somewhat less progressive targeting outcomes than some of the purer transfer programs studied is not to say that they are bad policy. It does suggest that policy makers who are thinking about intervention choices must consider the whole set of strengths and weaknesses of programs in making their decisions.

Mindful of these caveats, we seek to convey five core messages about targeting effectiveness:

- *Targeting can work* . . . Across all programs for which we could obtain information on targeting performance, we find that the median program provides—approximately 25 percent—more resources to the poor than would random allocations. The best programs we found were able to concentrate a high level of resources on poor individuals and households. Argentina's *Trabajar* public works program, the best program in this regard, was able to transfer 80 percent of program benefits to the poorest quintile. The best 10 performers

deliver to the poor two to four times the share of benefits that they would get with random allocations. Progressive allocations were possible in all country settings, in countries at markedly different income levels and in most types of programs.

- . . . *but it doesn't always.* The state of the art as practiced around the world is highly variable. While median performance was good, in approximately 25 percent of cases, targeting was regressive so that a random allocation of resources would have provided a greater share of benefits to the poor. With the exception of targeting based on a work requirement, every method contained at least one example of a regressive program.

- *There is no clearly preferred method for all types of programs or all country contexts.* In our sample of programs, 80 percent of the variability in targeting performance was due to differences within targeting methods and only 20 percent due to differences *across* methods.

- *A weak ranking of outcomes achieved by different mechanisms was possible.* Interventions that use means testing, geographic targeting, and self selection based on a work requirement are all associated with an increased share of benefits going to the bottom two quintiles relative to targeting that uses self-selection based on consumption. Proxy means testing, community-based selection of individuals, and demographic targeting to children show good results on average but with considerable variation. Demographic targeting to the elderly community bidding, and self-selection based on consumption show limited potential for good targeting. This ranking cannot be taken as a blanket preference for one method over another. It does not consider cost and feasibility constraints. Furthermore, our regression results should be considered as showing correlations rather than causal relations because targeting methods are themselves choices.

- *Implementation matters tremendously to outcomes.* Some, but by no means all, of the variability was explainable by country context. Targeting performance improved with country income levels (the proxy for implementation capacity), the extent to which governments are held accountable for their actions, and the degree of inequality. Generally using more targeting methods produced better targeting. Unobserved factors, however, explained much of the differences in targeting success. There remains great potential for improvements in the design and implementation of targeting methods. If programs with poor targeting success were brought up to median, the mean performance indicator would rise from 1.38 to 1.53.

What Can We Say about the Implementation of Targeting Methods?

A recurring theme in this book is that the quality of implementation matters tremendously to the targeting outcome. . . . It is important to reiterate that there is no clear recipe for how to target. For this reason, it is important for policy makers and program staff to understand a great deal about the details of the different methods and variations in their application. . . .

. . . Some common crosscutting themes that emerge from [this book] include:

- Increased creativity diligence, and/or administrative budget should be able to reduce errors of exclusion in all of the programs with which the authors are well familiar.

- Improved administration—streamlined procedures, better manuals, more training, more attention to quality control, adequate staff and equipment—often appears to be justified. This is a general judgment or hypothesis based on our qualitative reading of the cases, since cost data are so scarce. In a significant number of cases, there appear to be unexploited economies of scale because the single program is small and/or because structures could be but are not shared over several programs.

To make these generic points concrete, we recast them in the form of six questions. Program managers can use them to review programs for opportunities to improve implementation and targeting performance.

1. *Are there simple administrative changes that would improve targeting performance? Would they be cost-effective?* For example, would a better public communications scheme be worthwhile? More staff power or transport budget for visits to poor villages or neighborhoods? Translation of materials or employment of staff fluent in nonofficial languages? Stricter enforcement of rules? A change in eligibility thresholds? Simplifying required paperwork?

2. *What administrative change would lower private costs? Social costs? Would such a change be cost-effective?* For example, is there a way to reduce the number of visits applicants must make to apply for benefits, or the waiting times or transport costs for all transactions? Can who is receiving benefits be kept confidential?

3. *How could the program's administration be improved, either by lowering costs or raising quality? Would such a change be cost-effective?* For example, would the program improve with better operational manuals, streamlined forms, more staff training, more equipment, a better computer system, redeployment or

release of some staff, consolidation of overheads, or specific support functions with other programs?

4. *Could the targeting mechanism be used by other programs that are not doing so? Why aren't they? Would the program be better served by a different mechanism?* For example, could various programs define eligibility based on a single means test or proxy means test, thereby spreading the administrative cost over a wider base? Chile and Colombia have applied this principal to good effect in their proxy means testing systems, but most pure means tests are done on a program-by-program basis. Similarly once a country has developed a poverty map, it can be used for targeting several programs. Are some programs using the "wrong" tool?

5. *Is the technical basis used consistent with "good international practice"?* For example, are the databases and statistical analyses underlying the proxy means test and poverty map sound? Are the measures of welfare used in the means test reasonable?

6. *How good is the monitoring and evaluation system?* Is there a regular management information system to track enrollment, delivery of benefits, and all the components of costs? When was the last assessment of the distributional performance undertaken? Have private transactions costs been assessed? When was the last beneficiary assessment? Has there been a full impact evaluation? How complete were these evaluations? Was the program or its implementation adjusted after the evaluations were done?

PROGRESA and Its Impacts on the Welfare of Rural Households in Mexico

Emmanuel Skoufias
IFPRI Research Report 139, Washington, DC: IFPRI, 2005, pages ix–xiii

PROGRESA is one of the major programs of the Mexican government aimed at developing the human capital of poor households. Targeting its benefits directly to the population in extreme poverty in rural areas, PROGRESA aims to alleviate current and future poverty levels through cash transfers to mothers in households. The cash transfers provided are conditioned on regular school attendance and visits to health care centers. At the end of 1999, PROGRESA covered approximately 2.6 million families, representing one ninth of all families in Mexico; the beneficiaries comprised about 40 percent of all rural families. At that time, the program operated in almost 50,000 localities in more than 2,000 municipalities and 31states.

PROGRESA's budget of approximately US$777 million in 1999 was equivalent to 0.2 percent of Mexico's gross domestic product (GDP). . . .

The following are some key highlights beginning to emerge from IFPRI's evaluation of the impact of PROGRESA on its target group, Mexico's rural poor:

- After three years poor children in rural areas of Mexico where PROGRESA is currently operating are more likely to enroll in school. Mexico's primary school children typically maintain a primary school enrollment rate of 93 percent but generally begin dropping out of school after completing the sixth grade. Enrollment rates in general witness another steep decline as children transition to senior high school. Research reveals that PROGRESA has had the largest impact on children who enter secondary school and represents a percentage increase of enrollment of more than 20 percent for girls and 10 percent for boys. The research revealed that much of the positive impact on enrollment is attributable to increasing continuation rates rather than on getting children who were out of school to return.

- The accumulated effect of increased schooling from grades 1-9 suggests that the program can be expected to increase educational attainment for the poor by 0.66 years of additional schooling by grade 9 (0.72 years of additional schooling for girls, 0.64 years for boys). Given that the average 18-year-old youth typically achieved 6.2 years of completed schooling, PROGRESA effectively can be expected to increase educational attainment of poor Mexican rural children by 10 percent.

- Improved livelihood security for the poor depends on improving early childhood health care. Frequency and duration of illness have profound effects on the development and productivity of populations. The IFPRI analysis indicates that improved nutrition and preventive health care in PROGRESA areas have made younger children more robust against illness. Specifically, PROGRESA children one to five years of age have a 12 percent lower incidence of illness than non-PROGRESA children.

- Adult PROGRESA beneficiaries on average have 19 percent fewer days of difficulty with daily activities, 17 percent fewer days incapacitated by illness, 22 percent fewer days in bed, and are able to walk about 7 percent longer than nonbeneficiaries.

- In January 1996, more than a year before PROGRESA began, average visits to health clinics were identical in PROGRESA and non-PROGRESA localities. In 1998, the first full year in which PROGRESA was operational in all treatment

localities, visit rates in PROGRESA areas were shown to grow faster than in non-PROGRESA areas.

- PROGRESA increased the number of first visits in the first trimester of pregnancy by about 8 percent. This shift to early prenatal care significantly reduced the number of first visits in the second and third trimesters of pregnancy. This positive change in behavior is documented to have a significant improvement in the health of infants and pregnant mothers.

- In 1999, median food expenditures were 13 percent higher in PROGRESA households when compared with control households. This increase was driven largely by higher expenditures on fruit, vegetables, meats, and animal products. By November 1999, median caloric acquisition had risen by 10.6 percent. Beneficiaries felt that since the initiation of PROGRESA, poor households are eating better.

- The nutrition of preschool children is of considerable importance not only because of concern over their immediate welfare, but also because their nutrition in the formative stages of life is widely perceived to have a substantial and persistent impact on their physical and mental development and on their health status as adults. Stunting—low height-for-age—is a major form of protein-energy malnutrition. In 1998, survey results indicated that 44 percent of 12- to 36-month-old children in PROGRESA regions were stunted.

- Data suggest that PROGRESA has had a significant impact on increasing child growth and in reducing the probability of child stunting; an increase of 16 percent in mean growth rate per year (corresponding to 1 cm) for children who received treatment in the critical 12- to 36-month age range.

- The analysis suggests that PROGRESA may be having a fairly substantial effect on lifetime productivity and potential earnings of currently small children in poor households. IFPRI estimates that the impact from the nutritional supplements alone and their effect on productivity into adulthood could account for a 2.9 percent increase in lifetime earnings.

- The administrative costs employed in getting transfers to poor households appear to be small relative to the costs incurred in previous programs and for targeted programs in other countries. According to the program cost analysis, for every 100 pesos allocated to the program, 8.9 pesos are "absorbed" by adminis-

tration costs. Dropping household targeting would reduce program costs from 8.9 pesos to 6.2 pesos per 100 pesos transferred, while dropping conditioning would reduce the program costs from 8.9 pesos to 6.6 pesos per 100 pesos transferred. Dropping both would reduce these costs to 3.9 pesos per 100 pesos transferred.

One of the most important contributions of IFPRI's evaluation of PROGRESA has been the continuation of the program in spite of the historic change in the government of Mexico in the 2000 elections. The overwhelming (and unprecedented) evidence that a poverty alleviation program shows strong signs of having a significant impact on the welfare and human capital investment of poor rural families in Mexico has contributed to the decision of the Fox administration to continue with the program and to expand its coverage in the poor urban areas of the country after some improvements in the design of the program.

The majority of the improvements in the design of PROGRESA (renamed Oportunidades by the Fox administration) were based on findings of the evaluation of PROGRESA that revealed areas of needed improvements in some of the structural components and the operation of the program. For example, the evaluation revealed a larger program impact only on the schooling attendance of children of secondary school age. This suggests that it would be preferable to reorient the funds from primary school to families with children of secondary school age. Oportunidades did exactly that by extending the benefits of the program to children attending high school (preparatoria) rather than just junior high school, as it was in the earlier PROGRESA. Also, initially the award of PROGRESA's educational benefits was conditional on regular school attendance but not performance. Oportunidades improved on this design feature by linking benefits to performance, such as granting bonuses to encourage successful completion of a grade, or linking benefits with participation in other programs. For example, the creation of a related program, Jovenes con Oportunidades, aims to create income generating opportunities for poor households through preferential access to microcredit, housing improvements, adult education, and social insurance.

Yet in spite of these improvements in the program, the evaluation findings suggest that some issues remain to be resolved. For example, the program was found to have no measurable impact on the achievement test scores of children in beneficiary localities or on their regular school attendance. This implies that if the program is to have a significant effect on the human capital of children, more attention needs to be directed to the quality of education provided in schools. Enrolling in and attending school regularly are only necessary conditions for the improvement of children's human capital. Finally, it is also important to find ways to maintain and improve the quality of the information provided in the *pláticas.*

Essay

Future Challenges and Opportunities for IFPRI: A Personal Perspective

Per Pinstrup-Andersen
IFPRI Director General, 1992–2002

IFPRI has made great contributions in the past and is poised to make even greater contributions in the future. IFPRI will also, however, be faced with challenges and difficult decisions. Given that my close association with IFPRI during 17 of the past 25 years will bias any attempt to assess past contributions, I will focus here on the future challenges and opportunities.

Let me begin with the opportunities for enhanced impact. I will not attempt to provide an exhaustive list of research priorities for the future but merely mention some of the research opportunities I find most promising. New knowledge of the kind IFPRI can generate is urgently needed to guide globalization—including agricultural trade and technology flows—for the benefit of the poor. Institutional innovation to provide such guidance at the international and national levels is not keeping up with globalization, partly because of lack of knowledge. Leaving the direction and nature of globalization to be determined solely by the market is not likely to capture potential benefits for the poor. Similarly, a better understanding of how national policies in both developing and developed countries can help guide globalization for the benefit of the poor is in short supply. Helping to fill these knowledge gaps presents an opportunity for IFPRI to enhance its impact on the alleviation of poverty, hunger, and malnutrition.

More knowledge is also needed to help governments use the opportunities presented by modern biological science and developments in information and communication technology. Policymakers need better information on how best to combine fiscal policies and research and technology policies

to benefit the poor. In fact, I would argue that research on technology policy should be the mainstay of IFPRI's research, partly because it is supported by the CGIAR and partly because it will continue to be an important area for policy research because technology keeps advancing so rapidly.

Policy research on rural markets and infrastructure offers large potential payoffs. Some such research may be best undertaken within a comprehensive food supply chain perspective, taking into account the rapidly changing role of the consumer as a market and political agent and the increasing concentration in both wholesale and retail markets. We urgently need a better understanding of the policy options open to governments to deal with the rapidly changing structure of farming and the future of the small farmer. As part of such research, more knowledge is needed on how to expand rural employment and add value to agricultural commodities. In the context of markets and infrastructure, there is a need for research that takes a comprehensive look at investments in public goods, how responsibilities for the creation of such goods are best divided among government, civil society, and the private sector, and what investments are needed to support privatization of markets and to achieve the Millennium Development Goals.

Research to better understand policy decisionmaking and research that integrates ethics into economic analyses offer new opportunities for IFPRI to enhance the relevance and impact of its research. Such work could also shed new light on why governments do not follow up on commitments to reduce poverty, hunger, and malnutrition and how such commitments could be taken seriously in the future. Merely calling it "lack of political will" is not good enough. We must try to understand why policymakers do what they do.

Last but not least, I want to stress the importance of more research on how government policy can best assure sustainable management of natural resources while at the same time increasing efficiency in the use of water and soil to meet future food demands. More research is needed to identify acceptable trade-offs between poverty reduction and sustainable management of natural resources as well as win-win propositions.

Let me now turn to some of the challenges I believe IFPRI will face. In my opinion, the most difficult challenge will be to protect a solid research agenda based on producing international public goods from pressures to shift to location-specific, development project-based consulting, for which funds will be readily available. Most development assistance agencies place a high premium on urgency and prefer to fund short-term analyses and projects, with quick and location-specific payoffs. Investments in research that may have a

higher payoff, a greater spillover to countries other than those where the research is done, and a longer time span between the beginning of the research and expected payoff is likely to be of less interest. There is also a dearth of understanding of the need for policy research. In fact, some would argue that policy research is an oxymoron. You can do research or policy, but policy does not require research. Others argue that lack of knowledge is not the reason for bad policies. Policymakers who have the will to do the right thing have the knowledge to do it, the argument goes. The best way for IFPRI to deal with this challenge is to produce research results that demonstrate that better knowledge results in more enlightened policies—in other words, excellent and relevant research.

IFPRI will be faced with several other important challenges for which decisions need to be made. Should IFPRI's research move from the positive to the normative arena to make the research results more relevant for policymakers? In my opinion, some movement in that direction would add value to IFPRI's research. Or, if that is believed to result in excessive loss of perceived credibility and objectivity, at least show several scenarios and policy options based on ethical, economic, and political considerations instead of a sole focus on efficiency and utility maximization. Trade-offs between economic growth and poverty alleviation should not be rejected a priori. Related to this point is the question of whether IFPRI should be a neutral provider of research results or whether it should also participate in the debate and advocacy. I believe IFPRI should bring to bear on the debate any knowledge it has generated to enlighten the debate and decisionmaking. Although some normative elements should be considered, IFPRI should be careful not to get into advocacy-based ideological positions, aside from the ideology that less poverty, hunger, malnutrition, and exploitation of natural resources is better than more.

How multidisciplinary should the research teams be? Should research on economic policies be left to economists? I do not believe so, but I do believe that economists should continue to play the lead role. Should IFPRI limit its research to that which can be done by means of quantitative methods, or should quantitative and qualitative methods both be employed? I vote for the latter. Describing the world only in terms of the variables that can be put into a quantitative model may be expedient, but it may produce irrelevant results. Is IFPRI's comparative advantage limited to microeconomic and aggregate analysis, leaving macroeconomic and trade analysis to others? In my opinion, macroeconomic and trade analysis should be an integral part of IFPRI's portfolio on markets and globalization. As one of the Future Harvest centers, how

closely should IFPRI's research be linked to biological research on agriculture, forestry, and fishery? I believe IFPRI should assure that its research contributes to the mandate of the Consultative Group on International Agricultural Research (CGIAR); the interaction between policy and technology is critical for the success of both.

I have no doubt that IFPRI will continue to be an important player in efforts to alleviate poverty, hunger, and malnutrition and maintain sustainability in natural resource management. I am proud to have been associated with such a great organization.

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Chapter 8

Nutrition and Health

From Intrahousehold Processes to HIV/AIDS and Nutrient Deficiencies

In the 1980s Director General Per Pinstrup-Andersen initiated a strong research program on food consumption and nutrition policy at IFPRI, with innovative conceptual work on the determinants of food availability, access, and intake as well as on nutrition. Policy can effectively intervene at all of these stages. This research resulted in a host of innovative evaluations of policy interventions, including those with experimental designs. Explicit participation of target groups and food policy practitioners was and is an element in many of the research programs. In many instances the research partners included United Nations agencies such as UNICEF and the World Food Programme (WFP), as well as nongovernmental organizations (NGOs).

Initially, food security and nutrition work at IFPRI focused on the links between nutrition and agriculture (see excerpt from *Linkages between Agriculture and Nutrition: Implications for Policy and Research*, Eileen Kennedy and Howarth E. Bouis, 1993). More recently it has shifted to a broader perspective on the links between agriculture and health. Whereas research on nutrition and health once centered on concerns about lack of food in terms of quantity, over time researchers extended their interest to the problem of poor-quality diets. In the early 1990s, nutritionists elsewhere explored the fetal origins of disease—the "Barker hypothesis" postulated that nutritional insults during critical periods of gestation and early infancy, followed by relative affluence, increase the risk of noncommunicable diseases in adulthood. The work of Reynaldo Martorell, among others, has also made a major contribution to an understanding of the long-term effects of early childhood nutrition on people's physical and educational capacities and economic output. Research at IFPRI now incorporates the recognition that "hidden hunger," or deficiency of

micronutrients such as iron, zinc, and vitamin A, is one of the most important nutrition problems in the world, affecting children's growth, immunity, development, and survival, as well as women's reproductive performance and all adults' work capacity.

IFPRI researchers have done a great deal of work assessing the causes of food and nutrition insecurity, from poverty to women's status to childcare practices (see excerpts from *Poverty, Household Food Security, and Nutrition in Rural Pakistan*, Harold Alderman and Marito Garcia, 1993; and *Explaining Child Malnutrition in Developing Countries: A Cross-Country Analysis*, Lisa C. Smith and Lawrence Haddad, 2000). IFPRI has also examined available evidence of the potential contribution of agriculture and food-based solutions to reducing micronutrient malnutrition in young children (see excerpt from *Can Food-Based Strategies Help Reduce Vitamin A and Iron Deficiencies? A Review of Recent Evidence,* Marie Ruel, 2001). Following pioneers of work on diet and nutrition transitions, including Barry Popkin, IFPRI researchers have begun to study issues of overnutrition in developing countries—that is, excess energy intake that leads to rapid rises in obesity and noncommunicable diseases (see excerpt from *The Double Burden of Malnutrition in Asia: Causes, Consequences, and Solutions*, Stuart Gillespie and Lawrence J. Haddad, 2003).

One persistent finding from this research has been that gender plays an important role in determining the food security and nutrition of household members. In the past decade or so, IFPRI has invested heavily in research on gender, revealing much about how it affects child nutrition in particular (see excerpts from *Intrahousehold Resource Allocation in Developing Countries: Models, Methods, and Policy*, Lawrence Haddad, John Hoddinott, and Harold Alderman, eds., 1997; and *The Importance of Women's Status for Child Nutrition in Developing Countries*, Lisa C. Smith et al., 2003).

Beginning in the 1980s, the HIV/AIDS epidemic emerged as an obstacle to agricultural and rural development in some developing countries, as well as to food and nutrition security. Building on the groundbreaking work of Tony Barnett, Alan Whiteside, Gabriel Rugalema, and others, IFPRI has in recent years studied the interactions between HIV/AIDS and food and nutrition security and recommended actions for responding to the crisis (see excerpt from *HIV/AIDS and Food and Nutrition Security: From Evidence to Action*, Stuart Gillespie and Suneetha Kadiyala, 2005).

Finally, IFPRI's longtime work on the problem of micronutrient deficiencies led to studies of the potential for biofortifying staple food crops. Biofortification, a complementary approach to food fortification, involves breeding nutrients like iron, vitamin A, and zinc directly into the crops that are prevalent in the diets of poor people. Biofortified foods may be able to improve the nutritional status of poor people without requiring a change in their behavior or imposing high recurring costs

(see excerpt from *Alleviating Malnutrition through Agriculture in Bangladesh: Biofortification and Diversification as Sustainable Solutions*, Nanna Roos et al., 2004). Ultimately, this work led to the emergence of HarvestPlus, a Challenge Program of the Consultative Group on International Agricultural Research (CGIAR) co-led by IFPRI and the International Center for Tropical Agriculture (CIAT).

Linkages between Agriculture and Nutrition: Implications for Policy and Research

Eileen Kennedy and Howarth E. Bouis
Washington, DC: IFPRI, 1993, pages 2–4

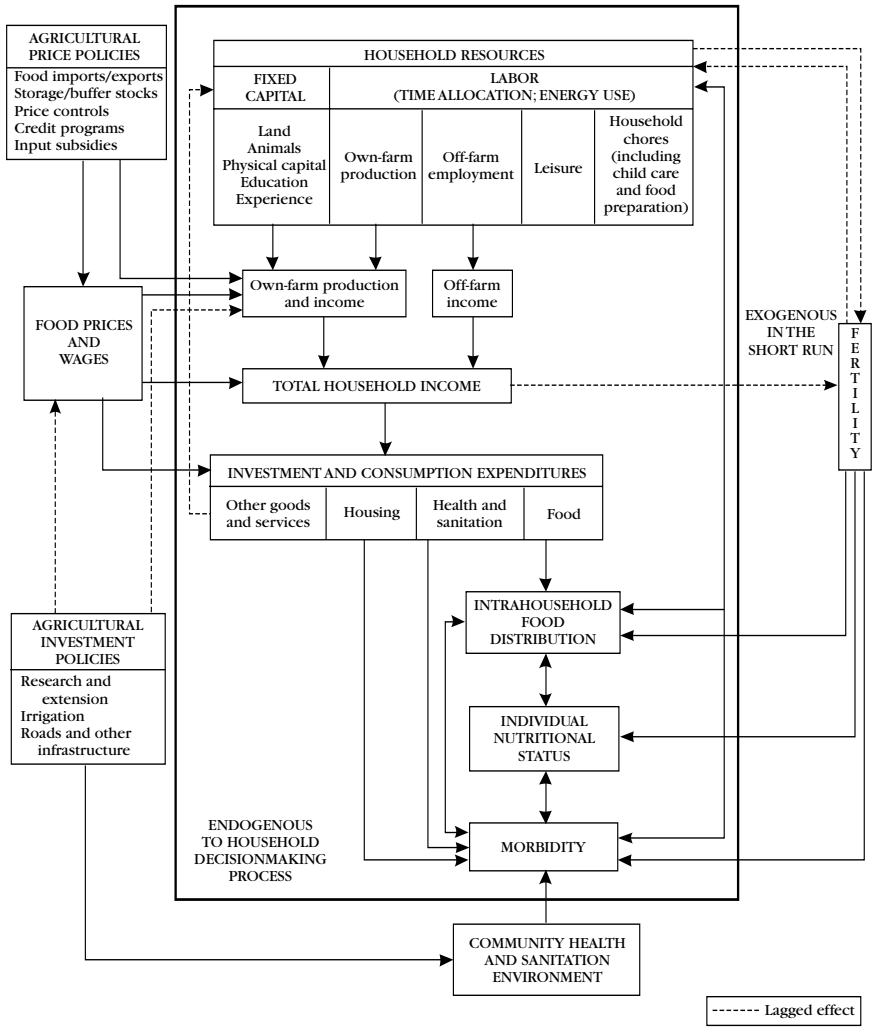
There are three main pathways through which agricultural policies and programs influence the nutritional status of individuals: (1) increased incomes and lower food prices, which permit increased food consumption; (2) effects on the health and sanitation environment at the household and community levels, which may increase or reduce morbidity; and (3) effects on time-allocation patterns, particularly of mothers, which may increase or reduce time spent on nurturing activities—time that is often related to women's control over household income and is an important determinant of women's nutritional status. These three pathways have been identified in other theme papers for the International Conference on Nutrition, but not in relation to how agricultural policy influences one or more of these determinants of health and nutritional status.

At the top of Figure 1, the household has a fixed amount of time and capital that it must decide to allocate among various income-generating activities, given exogenous prices for consumer goods and production inputs and outputs, with the objective of maximizing the well-being of individual household members through consumption expenditures, leisure time, and better nutrition. Depending on how those resources are allocated to own-farm production activities and off-farm employment, a certain amount of cash and in-kind income is generated that can then be spent on various consumption items. One of the primary linkages is food expenditures: how they increase with higher incomes, the extent to which nutrient availability is enhanced by these extra food expenditures at the household level, and how these nutrients are distributed among various household members. Finally, as shown at the bottom of Figure 1, nutrient intakes are an important determinant of nutritional status.

However, nutrient intakes are not the only link through which household allocation decisions affect nutritional status. Morbidity is an important determinant of appetite and of how well nutrients are absorbed by the body. The household that earns less income because it allocates more time to food preparation and child care could enjoy better nutrition, because of reduced morbidity, than if it had earned extra income and spent more for food. Other links between production and nutrition should be added to the diagram, but that would result in a diagram much too crowded to be helpful.[2]

2. More detailed information on each of these links, for example the links between a mother's nutritional status during pregnancy and breast-feeding and her infant's nutritional status, is contained in von Braun and Kenney (1986).

Figure 1 Agricultural policies, household resource allocation, and nutrition



Unfortunately, the complexity of these interrelationships went unrecognized or was ignored in the past, which led to simplistic policy recommendations. An implicit assumption during the early dissemination of modern cereal varieties—often dubbed the "green revolution" technologies—was that increasing yields was a sufficient condition for improving nutritional status (Harriss 1987); most policymakers believed that inadequate food supply was the major cause of malnutrition. Thus, much of the early emphasis in developing agricultural technologies was placed on increasing national-level food supplies via increased agricultural production.

Achieving a sufficient food supply is indeed one part of a strategy to ensure household food security (von Braun et al. 1992). But while food availability at the national, regional, or local village level is one factor that can influence household-level food availability, it is not necessarily the most important. For example, it is common to have 20–30 percent of a country's population consuming less than 80 percent of caloric requirements even though national-level food availability is at or greater than 100 percent (World Bank 1986). It is the household's ability to obtain food when it needs it that is critical in ensuring household food security; to the extent that technological change in agriculture increases access to food (through higher incomes or lower food prices or both), household food security will improve.

Poverty, Household Food Security, and Nutrition in Rural Pakistan

Harold Alderman and Marito Garcia
IFPRI Research Report 96, Washington, DC: IFPRI, 1993, pages 1–2

Managing food security in a predominantly rural economy such as Pakistan's requires an understanding not only of how agricultural policies affect food supply and incomes but also of how households acquire food and cope with insecurity. Many economists regard income as the main indicator of welfare, but other planners maintain that food consumption, health, and nutrition of household members are also important in defining a household's standard of living. The main concern of this research is to trace the pathways from economic and social policies to food security and, ultimately, to nutrition. In effect, the report considers how income is best converted into nutritional well-being. Snapshot approaches—those that look at one point in time—have various uses in understanding these processes but are limited in that they do not reveal anything about the actual dynamics of poverty and food security and their consequences for nutrition and health. This report addresses these concerns by looking at longitudinal data for a three-year period, 1986–89, and analyzing the fluctuations in incomes, consumption, savings, nutrition, and health-seeking behavior of 800 households in five districts in rural Pakistan.

Although the sample households are all located in rural areas, their sources of livelihood are not strictly agricultural. Diverse sources of income other than crops and livestock are found, including artisan work, village crafts, operation of public conveyances, and different forms of trading activities. Moreover, many households receive substantial remittances from household members working in large Pakistani cities such as Karachi or abroad (the Middle East, for example). Together, nonfarm income accounts for nearly 45 percent of total income, including transfers such as remittances pensions. Much of the rural nonfarm income is from self-employment, unskilled labor, or business activities such as production of inputs or processing of

agricultural output and therefore is a natural outgrowth of crop and livestock productivity. Hence, strategies for rural development should involve a much broader array of policies than agricultural development per se, including the broadening of credit to nonfarm enterprises, improvement of infrastructure, and expansion of rural education.

Income inequality is quite high in the rural areas. An overall Gini coefficient (a measure of income inequality) of 0.40 is calculated for these populations, compared with 0.75 when landownership is used as a measure of wealth. Of the five sources of rural income—agriculture, livestock, nonfarm, rental, and transfers—agricultural income accounts for the largest share of overall income inequality. On the other hand, income from livestock and nonfarm sources helps decrease income inequality. These findings indicate that policies that seek to promote livestock development and to attract nonfarm investments in rural areas are likely to promote better distribution of income in Pakistan.

Fluctuations in income, even over the relatively short three-year period, were considerable. Weather, illness, and decline in remittances from abroad were among the reasons. This study finds that a moderate share of income fluctuation is explained by district variables and a far greater share by village-level variables. Consumption risks in these households were only partially mitigated by sharing through family networks. Savings played a major role in smoothing consumption. Income risks were also reduced by diversification of income sources.

On average, 70 percent of a short-run increase in income is either saved or used to pay off debt, and even low-income households manage to save half, although net physical savings of only about 10 percent are attained because the rest is usually channeled to repayment of debt. Surprisingly, in these rural settings, households use formal financial instruments such as bank savings accounts to channel half of the remittances from family members abroad. Remittances are mostly saved and the rest (about 30 percent) are channeled into physical property, mostly, for housing and physical improvements.

According to this study, fluctuations in income do not translate into fluctuations in calorie intakes in the rural households, however. No evidence of seasonality in consumption is detected in 12 separate observations. Even the shift from eating rice to wheat, which occurs in some areas because their harvest times are different, does not affect total calorie intakes. The households surveyed for this study generally have a higher calorie supply per capita than in most parts of South Asia. They cope with seasonal lows and higher food prices through savings, including storage of grains. Credit—mostly from the informal sector, such as friends, relatives, and local stores—helps maintain a fairly constant expenditure level.

Calorie-income elasticities in the sample households ranging from 0.12 to 0.39 imply that it would take, on average, about a 30 percent rise in income to achieve a 10 percent rise in calorie consumption. Thus, underconsumption of calories in

the poorest households is unlikely to disappear in the normal course of economic development. The study, however also finds that food expenditure elasticities are 1.5–2.0 times higher than calorie elasticities, indicating that as household incomes increase, diets are diversified with higher-quality foods, not necessarily with larger quantities of food.

Other policies to attain higher levels of food security need to be found. One possibility is investment in the education of women, who play a critical role in determining household food acquisition patterns. Education of women is found to be a key factor in achieving better nutrition. Educating women to at least the primary level is likely to be nearly three times more effective than increasing incomes by 10 percent. Clearly, public investments in education for women will have a very high payoff.

But this study also finds that increases in calories will not automatically translate into better nutrition and health in children unless the high rates of infection are addressed. The low association between calorie intake and child nutrition found in many past studies was primarily due to the failure to consider the interaction between diet and disease. In an environment such as the rural area in this report, where disease is widespread, the role of infection is often magnified. Diarrhea and illness strongly determine the nutritional status of the preschoolers.

The nutritional status modeling in this study indicates that critical community services—including health services, sanitation, village water supply, and public drainage systems—are necessary to stem the spread of infectious diseases. Public health programs that reduce illness, such as immunization, or those that encourage prenatal care are important instruments for influencing nutrition. However, the mere physical presence of the services in a community is not enough: quality of services is equally important. For the most part, households cannot provide these services from their own resources. Support from the government for the provision of such critical community services is essential.

Explaining Child Malnutrition in Developing Countries: A Cross-Country Analysis

Lisa C. Smith and Lawrence Haddad
IFPRI Research Report 111, Washington, DC: IFPRI, 2000, pages xi–xiii

Developing countries have made great strides in reducing child malnutrition over the past few decades. The prevalence of underweight children under five years of age in the developing countries was 46.5 percent in 1970. By 1995 it had dropped to 31 percent (167 million children), indicating that while past progress has been substantial, it still has a long way to go. This research draws on the experience of

63 countries during 1970–96 (1) to shed light on some of the main causes of child malnutrition, (2) to project how many children are likely to be malnourished in the year 2020 given current trends, and (3) to identify priority actions for reducing malnutrition most quickly in the coming decades.

The determinants of child malnutrition can be divided into three levels of causality: immediate, underlying, and basic. The immediate determinants are dietary intake and health status. They are influenced by three underlying determinants, on which this report focuses: food security, care for mothers and children, and health environment quality. Four explanatory variables represent these concepts: per capita national food availability (for food security), women's education and women's status relative to men's (for both food security and care), and safe water access (for health environment quality). The report also examines the role of two basic determinants that influence child malnutrition through their effects on the underlying determinants. These are economic resource availabilities and the political environment. The explanatory variables representing these two factors are per capita national income and democracy.

Of the explanatory variables that represent the underlying determinants, women's education is found to have the strongest impact on child malnutrition. It is followed closely in strength of impact by per capita food availability. As the amount of food available per person increases, however, its power to reduce child malnutrition weakens. Women's status relative to men's and the quality of a country's health environment also strongly affect child malnutrition. For the developing countries as a whole, however, these two factors do not have as strong an influence as women's education and per capita food availability.

Per capita national income and democracy are both important factors influencing child malnutrition. Per capita national incomes reduce malnutrition by increasing public and private investment in all of the underlying-determinant variables. Democracy affects child malnutrition at least partially through improvements in safe water access and increases in per capita food availability.

One of the limitations of the study is that it is unable to consider the effects of food security or poverty on child malnutrition because sufficient data are lacking. However, it should be recognized that having enough food available per person at a national level is a necessary but not sufficient condition for that country to achieve food security; households must also be able to access available food in order to achieve adequate nutrient intakes for their children on a sustainable basis. Similarly, increases in the amount of income available per person are a necessary but not sufficient condition for reducing poverty. How the available income is distributed among a country's population is also important.

As a result of the strong influence of women's education and the substantial progress made in increasing it, women's education is estimated to be responsible for

almost 43 percent of the total reduction in child malnutrition that took place from 1970 to 1995. Improvements in per capita food availability have contributed about 26 percent to the reduction, health environment improvements 19 percent. Because there was little improvement in women's status relative to men's over the 25 years, its contribution—while still substantial—was the lowest (about 12 percent). Through improvements in the underlying-determinant variables, increases in per capita national income have made a very large contribution—roughly 50 percent of the total reduction in the prevalence of child malnutrition during 1970–95. While increases in democracy have great potential for reducing child malnutrition, no progress has been made in this area for the developing countries as a whole, and therefore it has made no contribution.

If current trends continue, the prevalence of child malnutrition is projected to remain high in the year 2020, with roughly 20 percent of all developing-country children under age five, or 140 million children, malnourished. South Asia and Sub-Saharan Africa will remain the regions with the highest child malnutrition rates. The absolute numbers of malnourished children in Sub-Saharan Africa are expected to be *higher* in 2020 than they were in 1995. A sharp regional shift in the location of child malnutrition is projected: South Asia's share of the total number of malnourished children will fall from approximately 51 percent to 47 percent, but Sub-Saharan Africa's share will rise from 19 percent to near 35 percent.

However, the future does not have to look like the past. The findings of this report indicate that significant progress can be made toward reducing child malnutrition through accelerated actions in sectors that have not been the traditional focus of nutrition interventions. Increased investments in women's education, in raising food supplies (or reducing population growth), in measures that improve women's status relative to men's, and in health environments should be an integral part of strategies for reducing children's malnutrition in the future. These investments should be seen as complements to more direct nutrition interventions, such as breast-feeding promotion and nutrition education.

A key message of the report is that any comprehensive strategy for resolving the problem of child malnutrition must include actions to address both its underlying and basic causes. If national incomes and democracy are not improved, on the one hand, the resources and political will necessary to increase investment in health environments, women's education, women's relative status, and food availability will not be forthcoming. On the other hand, if national incomes and democracy improve, but additional resources are not directed toward improving the underlying determinants, the improvements will make little difference.

Given resource constraints and the costs of alternative interventions, how should policymakers prioritize investments to reduce child malnutrition most quickly? The

investments that should receive priority will differ by geographical area because they differ in (1) the relative strength of the determinants' effects and (2) the current progress in reaching the determinants' desired levels. The top priorities in each developing region, based on consideration of these two criteria, vary greatly.

In Sub-Saharan Africa and South Asia—the regions with the highest rates of child malnutrition—improvements in per capita food availability and women's education offer the best hope for future reductions in child malnutrition. An additional secondary priority for South Asia is promotion of women's status relative to men's. In East Asia, the Near East and North Africa, and Latin America and the Caribbean, the primary priority is women's education and a second priority is women's status relative to men's. Additional priorities are food availability for East Asia and health environment improvements for Latin America and the Caribbean. To maintain the necessary resource base and political will for these investments, investments in national income growth and democratic development must be accelerated as well.

Can Food-Based Strategies Help Reduce Vitamin A and Iron Deficiencies? A Review of Recent Evidence

Marie T. Ruel
Food Policy Review 5, Washington, DC: IFPRI, 2001, pages xiii–xv

Throughout the developing world, poor people subsist on diets consisting of staple foods such as rice or maize and little else. The lack of diversity in the foods they eat often leads to micronutrient deficiencies. Lack of iron, which causes anemia, is the most common deficiency in the world. Iron deficiency is harmful at all ages, but it especially affects women of reproductive age and children. Vitamin A deficiency impairs growth, development, vision, and immune systems, and in severe cases can lead to blindness and death. Almost one-third of children in developing countries are affected to some degree by vitamin A deficiency and many more are iron deficient.

Micronutrient deficiencies can be addressed by distributing vitamin and mineral supplements, by fortifying foods, or through food-based strategies, which attempt to modify people's diets. Food-based strategies can increase the amount of vitamin A and iron available for body functions by (1) increasing the production and availability of foods high in these nutrients, (2) increasing consumption of these foods through nutrition education programs to change eating behavior, (3) making vitamin A and iron more easily absorbed by the body (more bioavailable), and (4) by breeding new varieties of plants that contain larger amounts and more bioavailable micronutrients.

This report reviews a number of recently published studies of food-based interventions to reduce vitamin A and iron deficiencies in developing countries. It summarizes the current state of knowledge and identifies the lessons learned and the research gaps that remain.

Vitamin A is available from animal sources in the form of retinol and from dark green, leafy vegetables and yellow and orange noncitrus fruits and vegetables in the form of provitamin A carotenoids. Vitamin A from plant sources is less easily absorbed and utilized by the human body—it is less bioavailable—than the vitamin A coming from animal products. In developing countries, most of the vitamin A consumed comes from plant sources and thus is in a less bioavailable form. Moreover, vitamin A from plant sources is usually found in large amounts in only a few fruits and vegetables, many of which are highly seasonal. This means that low-income populations may suffer from both chronic mild-to-moderate vitamin A deficiency and severe seasonal deficiencies.

Iron can also be obtained from both animal and plant sources. Iron from plants (nonheme iron) is less bioavailable than iron from flesh foods (heme iron) such as meat, fish, and poultry. Heme iron is highly bioavailable (15–35 percent is absorbed), whereas iron from plant sources (nonheme) is absorbed much less easily (only 2–20 percent is absorbed). The main reason for the lower absorption of iron from plant sources is that nonheme iron is affected by compounds present in plant foods that inhibit iron absorption. The most potent inhibitor of nonheme iron absorption is phytic acid, which is present in large quantities in most cereals and legumes—often the main staple foods in populations with scarce resources.

This review shows that increasing the availability of foods rich in vitamin A and iron by encouraging households to tend home gardens and to raise small animals and fish is a popular approach. Increasingly the food-based strategies combine a variety of intervention components. A key to success appears to be the inclusion of a strong nutrition education and behavior change intervention. For example, strategies to promote increased production of micronutrient-rich foods are more effective when combined with a nutrition education intervention, which ensures that increased household food supply and income translates into improved dietary quality.

Proper processing and storage of plant products, in order to retain vitamins and minerals and to extend the time when fruits and vegetables are available—through drying, for example—are other ways to boost consumption of essential nutrients yearround. Cooking in iron pots can increase iron intake. Eating certain combinations of foods together—such as citrus fruits rich in vitamin C and iron-containing cereals and legumes—helps increase the absorption of iron from plant staples. Conversely not ingesting substances that are known to inhibit absorption with meals, such as coffee and tea, may increase the bioavailability of iron from plant sources. All of these strategies are well documented and are even part of the cultural back-

ground of some populations from developing countries, but large-scale, community trials documenting their effectiveness are surprisingly few. Plant breeding approaches, which hold great promise for contributing to the fight against micronutrient deficiency are still at an early stage of development, and their efficacy and effectiveness have to be demonstrated.

Although the technologies and strategies examined in this review potentially address many concerns about the intake and bioavailability of vitamin A and iron among impoverished populations, enormous information gaps still exist concerning the efficacy and the effectiveness of most of the strategies reviewed, even approaches as popular as home gardening promotion. Significant progress has been achieved in the past 10 years in the design and implementation of food-based approaches, particularly the new generation of projects that integrate production, nutrition education, and behavioral change strategies. Yet, little has been done to assess the impact of these combined strategies on the diets and nutritional status of at-risk populations. In the end, the same question posed in reviews published decades ago remains: what can food-based interventions to control vitamin A and iron deficiency really achieve? Food-based approaches are an essential part of the long-term global strategy to alleviate micronutrient deficiencies, but their real potential has not been explored adequately.

The Double Burden of Malnutrition in Asia: Causes, Consequences, and Solutions

Stuart Gillespie and Lawrence J. Haddad
New Delhi: Sage Publications, 2003, pages 189–190

In the previous chapters we described the magnitude, causes, and consequences of the main forms of malnutrition in Asia, followed by an analysis of what can and should be done to address the problem of malnutrition in the region. Action has to be guided by the nature of the problem. It must also be guided by the extent of administrative and physical infrastructure, its outreach, and the extent of various elements of local capacity. These, then, can allow flows of resources to help support nutrition activities at the local level. It may be useful to consider the construction of typologies to help prioritize actions at both direct and indirect levels. Such a typology could be created along two dimensions: the nature of the problem and the capacity in each country to address it.

For very poor regions with extremely limited human, economic, and organizational infrastructure, the very first priority will be to establish accessible and relevant preventive and curative health care, and to ensure access to adequate food. One step above this minimal level of community or government resources and

infrastructure (for example, in most of the South Asian countries in the lower-low-income bracket), community-based nutrition programs represent an affordable priority. Such countries generally have levels of nutritional deprivation that warrant direct forms of action. Moreover such programs have a role to play whether or not the underlying trend is one of nutritional improvement. Underlying trends are too slow to combat malnutrition in Asia within an acceptable time-frame (ACC/SCN-IFPRI 2000). An analogy can be drawn with public health measures, which are still essential even when health conditions are improving. Overnutrition is less of an immediate, visible concern for these countries currently although the long-term chronic disease risks imposed by low birth weight provide even greater justification for a particular focus on adolescents and young women in these countries.

In upper-low-income countries (such as the PRC, Indonesia, and Sri Lanka), nutrition programs are more feasible, but not so widely needed because the problem is usually less prevalent or severe. The social and regional targeting of well-organized, efficient programs becomes an increasingly important consideration. Nutrition programs in this group may also have important beneficial interactions (through human capital formation) with growth.

In middle-income countries (for instance, Malaysia, the Philippines, and Thailand), direct programs aimed at undernutrition eventually merge with social welfare and health services. They may not be such a priority for the whole country but will need to be targeted to reduce disparity where it exists and buffer any social groups marginalized during the growth process. As countries industrialize, food becomes more accessible, health care improves and becomes more extensive, and social welfare and services and legislation become relatively more important; all these may serve to buffer vulnerable groups nutritionally during economic shocks.

In middle-income countries, wherever the economic potential exists to do something about malnutrition, an overriding concern is often equity—both regional and social. Overnutrition is more of a public health problem in these countries, to the extent that program approaches aimed at improving the diet and increasing exercise need piloting. In some cases, for example, small island states such as the Republic of the Fiji Islands and Tonga, overnutrition, not undernutrition, is the dominant public health problem.

A few indirect activities to address undernutrition can be undertaken at lower levels of capacity such as HIV prevention, safe water access, greater access to primary and secondary education for girls, and agricultural price policies that do not discriminate against micronutrient-rich foods. At higher levels of capacity, safety net programs that are flexible can be introduced. To address overnutrition, food price policy must be explored, while higher levels of capacity will be needed to instigate meaningful health insurance and enforceable legislation for food processing standards.

Intrahousehold Resource Allocation in Developing Countries: Models, Methods, and Policy

Edited by Lawrence Haddad, John Hoddinott, and Harold Alderman
Baltimore, Md.: Johns Hopkins University Press for IFPRI, 1997, pages 275–277

The costs of neglecting the process of intrahousehold resource allocation are often high. This is a categorical statement, not a statement about adopting or rejecting any particular model or class of models. It suggests that the process of policy analysis should begin with the following questions: How do individuals form family units? What norms govern the functioning of family units? How are these rules revised as circumstances change? . . .

Resource allocation processes are complex, and no single approach can be expected to be valid in all cultures or for all policy questions. Indeed a few caveats to policymakers are included here: just as ignoring intrahousehold allocation can result in errors, miscalculations will occasionally arise from basing actions on an incomplete understanding. However, whether or not they are understood, intrahousehold allocation processes occur in many spheres of action. There should be no reason why errors from ignoring intrahousehold processes are *inherently* less dangerous than errors from acting on the basis of the limited information given. . . .

Policy and Modeling of Intrahousehold Resource Allocation

Whereas many of the chapters in this book explore alternatives to unitary models of the household, others indicate that this challenge has encouraged researchers to broaden the applications of this model. Consider, for example, the choice of instruments to use for poverty alleviation. Under a welfarist approach to poverty alleviation, lump-sum transfers are generally more efficient than price subsidies, if decisionmaking is unitary. Under a nonwelfarist scenario, with unitary decisionmaking, the efficiency of transfers holds when planners' objectives (weights on individual welfare) match those of the household (Tobin 1970), although Ross (1988) illustrates how such differences of objectives can make in-kind transfers efficient interventions. If the two sets of preferences do not match—possibly because of some externalities in investments or because policymakers (or a subset) have a different preference for female survival than do some households in the society at large—then there is still a range of interventions in wage and price policy that may be used in the context of unitary decisionmaking to shift household allocation closer to social objectives.

Much of the literature on gender discrimination in health and schooling can be viewed in this context. For example, the findings of Rosenzweig and Schultz (1982) imply an impact on female child survival if credible policies can be found to narrow male-female wage gaps. Similarly, Duraisamy and Malathy (1991), Gertler

and Glewwe (1992), Alderman et al. (1996), and Alderman and Gertler (Chapter 14, this volume) imply roles for price policy in health and schooling allocation across boys and girls without a need to shift relative control of income. These are cases in which . . . individual prices can be identified or plausibly proposed.

If, however, household allocation is collective, it makes little sense to discuss a match between the preferences of the planners and those of the household; under this model, households may have behaviors, but they do not have a common preference. In a technical sense, interventions that aim to shift budget allocations merely weigh individuals' utility differently than does the household head. However, from a practical standpoint, it may not be useful to focus on the preference of one individual for, say, investment in children; only under rather special circumstances do the preferences of a single individual determine resource allocation. Welfarist objectives are more difficult to determine in the absence of a "standard" household utility function. Thus the current inability to distinguish between alternative collective models limits exact measurement of the welfare effects of policy.

However, this situation does not prohibit identification of four areas of policy in which neglect of the decisionmaking process could have serious consequences in terms of policy failure:

1. Different models predict different effects of public transfers made to the household. The unitary model predicts that the impact of such transfers is unaffected by the identity of the recipient, whereas collective models suggest that the identity of the recipient will change purchasing patterns.

2. Not only is the identity of the recipient important when the government is considering transfers, the response of nonrecipients must also be considered. The nature of interactions between household members will determine whether public transfers are mitigated or enhanced by changes in private income-sharing behavior, as shown in the second set of examples given later in this section. Unitary as well as collective models treat this topic; the range of issues and predictions, however, differs across models.

3. In addition to predicting that the impact of transfers is neutral with respect to which household member is the recipient, household models that presume information sharing and joint production imply that the response to many other policy initiatives will be recipient independent. This presumption gives rise to two potential policy failures: (1) the nonadoption of particular policies that appear beneficial in the aggregate and (2) unintended costs arising from policies that are adopted.

4. The unitary model depicts as impotent a number of policy initiatives that neither directly affect the technology of production nor affect household preferences, but which may have a major impact on allocation decisions. For example, laws on property rights within marriage and upon inheritance as well as the efficacy of enforcement may have long policy handles, as predicted under some models of intrahousehold allocation.

The Importance of Women's Status for Child Nutrition in Developing Countries

Lisa C. Smith, Usha Ramakrishnan, Aida Ndiaye, Lawrence Haddad, and Reynaldo Martorell
IFPRI Research Report 131, Washington, DC: IFPRI, 2003, pages xi–xii

Malnutrition affects one out of every three preschool-age children living in developing countries. This disturbing, yet preventable, state of affairs causes untold suffering and, given its wide scale, presents a major obstacle to the development process. Volumes have been written about the causes of child malnutrition and the means of reducing it. But the role of women's social status in determining their children's nutritional health has gone largely unnoticed until recently. This study explores the relationship between women's status and children's nutrition in three developing regions: South Asia, Sub-Saharan Africa, and Latin America and the Caribbean.

The study defines women's status as women's power relative to men. Women with low status tend to have weaker control over household resources, tighter time constraints, less access to information and health services, poorer mental health, and lower self-esteem. These factors are thought to be closely tied to women's own nutritional status and the quality of care they receive, and, in turn, to children's birth weights and the quality of care they receive.

The study sets out to answer three main questions: First, is women's status an important determinant of child nutritional status in the three study regions? Second, if so, what are the pathways through which it operates? And finally, why is South Asia's child malnutrition rate so much higher than Sub-Saharan Africa's? To answer these questions, this report brings together Demographic and Health Survey data on 117,242 children under three years of age from 36 developing countries. It uses two measures of women's status: women's decisionmaking power relative to that of their male partners and the degree of equality between women and men in their communities.

The empirical results leave no doubt that higher women's status has a significant, positive effect on children's nutritional status in all three regions. Further, they

confirm that women's status impacts child nutrition because women with higher status have better nutritional status themselves, are better cared for, and provide higher quality care to their children. However, the strength of influence of women's status and the pathways through which it influences child nutrition differ considerably across regions.

In South Asia, increases in women's status have a strong influence on both the long- and short-term nutritional status of children, leading to reductions in both stunting and wasting. The human costs of women's lower status in the region are high. The study estimates that if women and men had equal status, the under-three child underweight rate would drop by approximately 13 percentage points, meaning 13.4 million fewer malnourished children in this age group alone. As women's status improves in the region, so does the quality of the pathways through which it influences child nutrition. The pathways identified by the study are women's nutritional status (as measured by body mass index [BMI]), prenatal and birthing care for women, complementary feeding practices for children, treatment of illness and immunization of children, and the quality of substitute child caretakers. In Sub-Saharan Africa too, women's status and the long- and short-term nutritional status of children are linked. If women and men enjoyed equal status, child malnutrition in the region would decrease by nearly 3 percentage points—a reduction of 1.7 million malnourished children under three. The pathways to this judicious outcome are largely the same as those in South Asia, except that higher women's status improves child nutrition only for women with very little relative decisionmaking power and has no influence on treatment of child illness. Latin America and the Caribbean exhibits a different pattern from that of South Asia and Sub-Saharan Africa. Women's status has a positive effect only on children's short-term nutritional status and only in those households in which women's relative decisionmaking power is very low. Women's status has a distinctly negative influence on their BMI in this region, where weight gain is an emerging public health problem. The effect probably reflects the greater tendency among higher status women to "weight watch" and likely does not threaten children's nutritional status. The pathways connecting women's status and children's nutrition include prenatal and birthing care for women, feeding frequency, immunization, and quality of substitute caretakers.

Among the developing-country regions, South Asia's particularly high child malnutrition rate has remained a puzzle. South Asia trails even Sub-Saharan Africa, despite surpassing that region's record on many of the determinants of child nutritional status—national income, democracy, food supplies, health services, and education. The study indicates that three broad socioeconomic factors help explain this "Asian Enigma": women's status, sanitation, and urbanization. Women's status makes by far the greatest contribution to the regional gap in children's nutritional

status. It plays this role not only because it is lower in South Asia than in Sub-Saharan Africa but mainly because its positive impact is stronger in South Asia—making its costs in terms of child malnutrition far higher in that region.

The implication of the study's empirical results is clear: in the interest of sustainably improving the nutritional status of children, women's status should be improved in all regions. Doing so is especially urgent for South Asia, followed by Sub-Saharan Africa. Accomplishing this task requires policies that eradicate gender discrimination and policies that reduce power inequalities between women and men by proactively promoting catch-up for women. Examples include enabling women to gain access to new resources, implementing cash transfer programs that promote girls' education and health care, introducing technologies that save household labor, subsidizing child care for working parents, and initiating programs to improve the nutritional status of adolescent girls and young women. In communities that resist shifts in the power balance between genders, policies can mitigate the negative effects of the imbalance, rather than addressing it directly. Targeting health services to communities where women's status is low is one example of this indirect approach. The study also warns that improving women's status can lead to reduced breastfeeding, which is harmful to child nutrition. Efforts to improve women's status, therefore, must be accompanied by efforts to protect, support, and promote breastfeeding.

This research shows unequivocally that making a decision at the policy level to improve women's status produces significant benefits. Not only does a woman's own nutritional status improve but so too does the nutritional status of her young children. Raising women's status today is a powerful force for improving the health, longevity, mental and physical capacity, and productivity of the next generation of young adults.

HIV/AIDS and Food and Nutrition Security: From Evidence to Action

Stuart Gillespie and Suneetha Kadiyala
IFPRI Food Policy Review 7, Washington, DC: IFPRI, 2005, pages 3–6, 45–48

Defining Concepts and Mapping Interactions

Food security here refers to physical and economic access to food of sufficient quality and quantity. Food security is necessary but of itself insufficient, for ensuring nutrition security. *Nutrition security* is achieved for a household when secure access to food is coupled with a sanitary environment, adequate health services, and adequate

care to ensure a healthy life for all household members. *Hunger*[1] is another related term, but because food-provisioning capacities are being undermined in ways that may not yet be manifest as hunger, we focus here on the broader concepts of food and nutrition security.

HIV/AIDS and food and nutrition insecurity are becoming increasingly entwined in a vicious cycle, with food insecurity heightening *susceptibility* to HIV exposure and infection, and HIV/AIDS in turn heightening *vulnerability* to food insecurity (Loevinsohn and Gillespie 2003a). To better understand these interactions at different levels so that they may be effectively addressed, we need to map them.

Three useful maps can be drawn, corresponding to the different levels of interaction. First, societal-level interactions can be represented by Figure 1, which, from left to right, shows the waves of determinants of HIV infection from macro to micro levels, and the subsequent waves of impacts from micro to macro.

The top left quadrant shows various factors that condition *susceptibility* to the HIV virus at different levels. Susceptibility has two components:

- the chance of being *exposed* to the virus, which in turn relates to a person's risk environment and the *riskiness* of her/his behaviors (both of which may be related), and

- the chance of being *infected* with the virus once exposed.

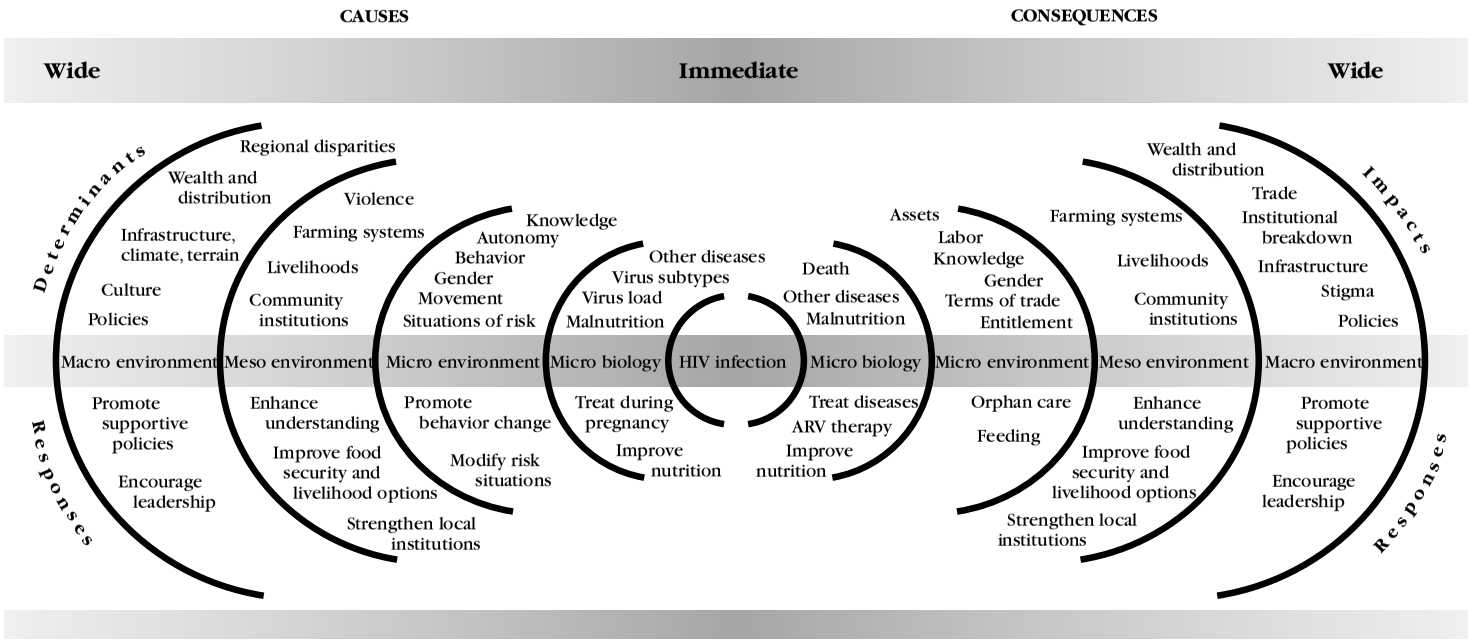
Resistance is the ability of an individual to proactively avoid infection by HIV. Some of the main strategies for promoting resistance can be seen in the bottom left quadrant.

The epicenter of Figure 1 is HIV infection in an individual. Following HIV infection, we can see in the top right quadrant the various sources and levels of *vulnerability* to AIDS-related impacts. These impacts are not one-time events but processes, often hidden and gradual but potentially very destructive. *Resilience* bears a similar relation to vulnerability as resistance does to susceptibility: it refers in particular to the active responses (shown in the bottom right quadrant) that enable people to avoid the worst consequences of AIDS at different levels, or to recover faster to a level accepted as normal (Loevinsohn and Gillespie 2003a).

A vicious cycle begins when impact waves later become causal waves. One extreme example is transactional sex. Because of her husband's illness or death from

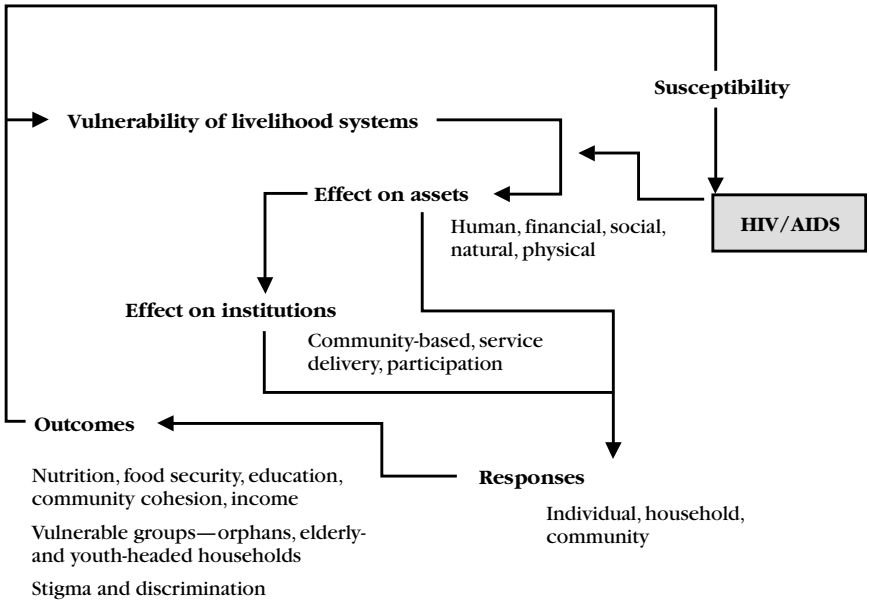
1. The hungry are a subset of the food-insecure, who in turn are a subset of the nutrition-insecure. Some of the food-insecure are not currently hungry, although they are at risk of becoming so because of their uncertain access to food. Moreover, some of the nutrition-insecure are not food-insecure, as their condition may result from deficits in the health- and care-related determinants of nutrition security.

Figure 1 HIV/AIDS determinants, impacts, and responses



Source: Loevinsohn and Gillespie 2003a.

Figure 2 Understanding HIV/AIDS in the context of people's livelihoods



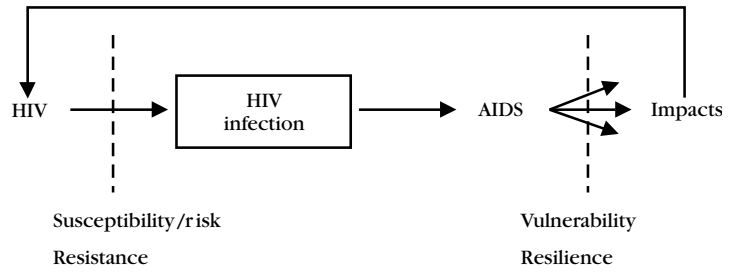
Source: Adapted from TANGO International 2002.

AIDS, a woman may be forced to trade sex for cash to feed her children. By doing so she drastically increases the risk of becoming infected herself. Thus some of the main impacts may also themselves increase risk, and some of the main mitigation responses may also prevent future infection.

The second map (Figure 2) focuses on the level of household and community interactions, again showing susceptibility and vulnerability forming a cycle. In a sense this map is an elaboration of the dynamics at the micro and meso levels of Figure 1. It is essentially an adaptation of the Sustainable Livelihoods framework (Carney 1998), which shows how HIV/AIDS affects, and is affected by livelihoods. The risks people face of contracting HIV will be governed partly by the susceptibility of the livelihood system on which they depend. The effect of HIV/AIDS on assets and institutions is a measure of vulnerability. These effects will determine the strategic responses that households adopt to deal with this threat. Such responses in turn will have outcomes—nutrition and food security among them—that will themselves condition future susceptibility and vulnerability. . . .

One tool to help move from understanding to responding is the HIV/AIDS lens, developed by Loevinsohn and Gillespie (2003a) in the context of the emerg-

Figure 5 A bifocal lens



ing RENEWAL initiative (www.ifpri.org/renewal).[3] This approach incorporates the concepts described above, the generic map in Figure 1, and the current state of knowledge of the interactions between food and nutrition security and HIV/AIDS in any given situation. The lens is designed to support reflection on how a particular situation or particular policy may be increasing or reducing the risks people face either of contracting HIV or of suffering severe consequences from AIDS-linked illness and death. It thus helps clarify options for response.

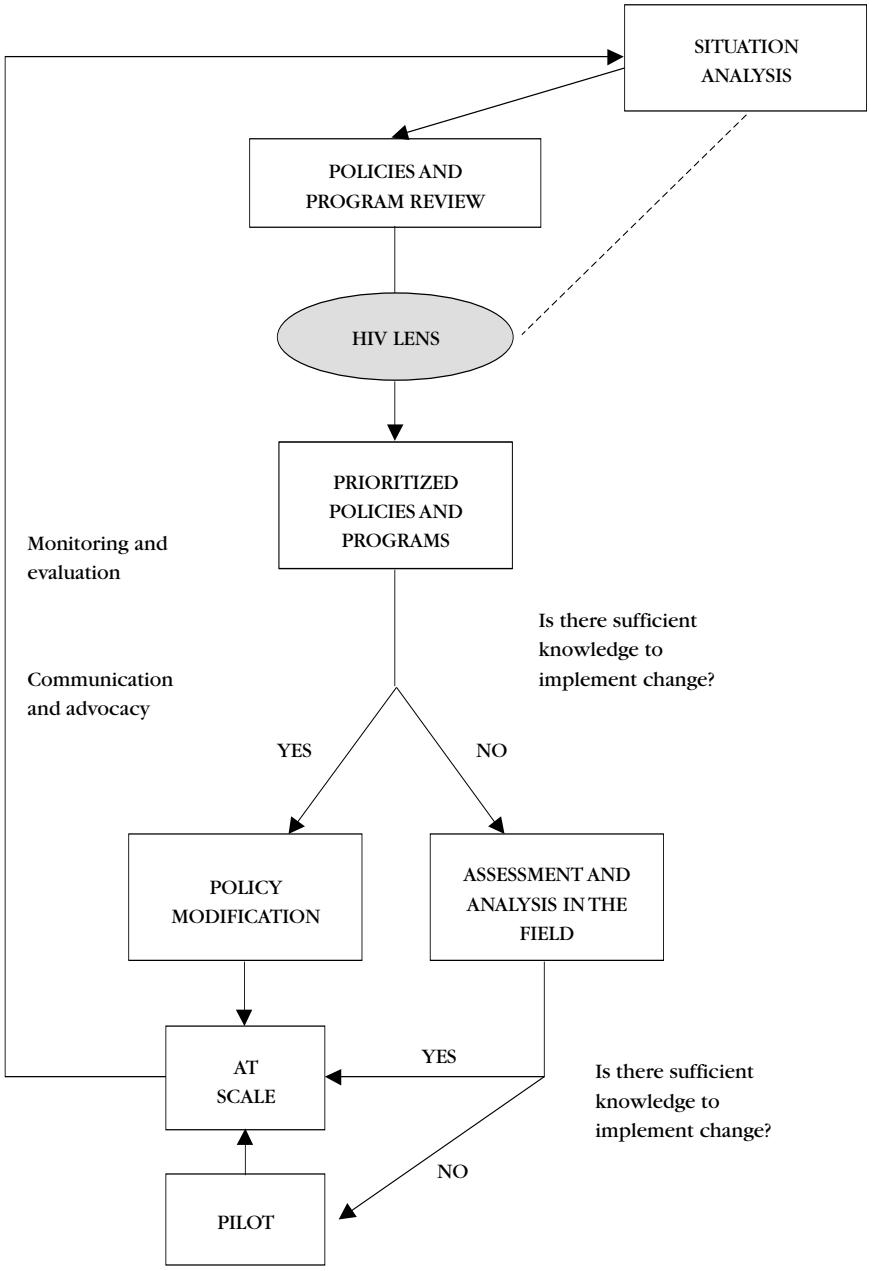
The lens is bifocal in the sense that it focuses on both the upstream factors of susceptibility and resistance and the downstream factors of vulnerability and resilience (see Figure 5, which is essentially a simplification of Figure 1). It may be used internally within the workplace, or externally on policies and programs. It can help reveal trade-offs as well as positive-sum solutions, and it is both context-specific and dynamic: it can evolve over time, as our knowledge of these interactions develops.

A process for using the lens to re-view food and nutrition policies is illustrated in Figure 6. First, HIV/AIDS and food and nutrition security are analyzed to summarize what is known about the nature and extent of their interactions and what forms of institutional response currently exist. This analysis helps construct the lens. Second, key policies and programs are reviewed in terms of their potential contribution—positive or negative—to HIV/AIDS prevention and mitigation. This review may be carried out in workshops, by the researchers, program managers, or policymakers responsible for them, with outside facilitation and the involvement of key stakeholders. Participants ask questions that focus on two issues:

Prevention. How might this policy or program be increasing people's susceptibility (or resistance) to HIV infection?

3. Much of this section derives from Loevinsohn and Gillespie 2003a.

Figure 6 Using an HIV/AIDS lens to improve policy



Mitigation. How might this policy or program be increasing people's vulnerability (or resilience) to the impacts of AIDS?

The result of this review will be a list of policies and programs prioritized according to their potential positive or negative contribution to HIV/AIDS prevention and mitigation. Depending on the state of existing knowledge, further field-level evidence may be required prior to policy modification, or enough may be known to take action. Action research in the field involves gathering quantitative and qualitative evidence on whether the policy or program is helping or hindering affected households in avoiding HIV risks and dealing with AIDS impacts. Subsequently the policy or program may be modified, drawing on the results of these field assessments, with changes made across a spectrum ranging from changing nothing to changing everything (that is, stopping the existing program and initiating a new one). Different aspects of a program—the what, how, who, and where—may need to change. In some cases, the changes can be made at full scale, whereas others may have to be tested with pilot programs. Whatever changes are made, it is critically important to monitor the effects of the revised policies and use the results to refine the lens.

The lens is flexible and adaptive: it may be used in different ways by a range of actors, not just policymakers. At the community level, the lens can also be used to reveal options for relevant responses.

Given the interactions between food and nutrition insecurity and HIV/AIDS, it will also be important for a food and nutrition lens to be applied to HIV-specific programming.

Alleviating Malnutrition through Agriculture in Bangladesh: Biofortification and Diversification as Sustainable Solutions

Nanna Roos, Howarth E. Bouis, Nazmul Hassan, and Khandaker Aminul Kabir
Washington, DC: IFPRI, 2004, pages 136–138

Advantages of Biofortification

Commercial fortification of foods is an intervention familiar to us all. Minerals and vitamins are added to a particular food vehicle during processing, well after the food has left the farm and before it is distributed through various marketing channels for consumer purchase and consumption. Is it possible to get the plants themselves to do the work of fortification, an intervention strategy that may be referred to as *biofortification?* What are the inherent comparative advantages of such an approach?

First, biofortification is cost-effective. Once the plants are developed and being grown by farmers, there are no costs year in and year out to buy the fortificants

and add them to the food supply during processing. Second, biofortification is sustainable. Once the investment has been made in developing and disseminating the nutritionally improved crops, farmers will be driven by a profit incentive to continue to produce these crops. In fact, this strategy has the potential to significantly improve agricultural productivity. Moreover, monitoring and maintenance costs are low and are not dependent on political will or availability of public funds. Third, biofortification can make an impact in relatively remote rural areas where food staples do not enter the marketing system or where processing facilities are relatively small and widely dispersed. To be successful, the biofortification strategy must address three fundamental issues: Can commonly eaten food-staple crops, such as rice in Bangladesh, be developed that fortify their seeds with essential minerals and vitamins? Can farmers be induced to grow such varieties? If so, would this result in a significant improvement in human nutrition at a lower cost than that of existing nutrition interventions?

Farmers' Acceptance of Fortified Seeds

Recent research has shown that trace minerals are essential in helping plants resist disease and other environmental stresses. Mineral-rich seeds produce more seedlings, they survive better, and their initial growth is more rapid. Ultimately yields are higher, particularly in soils "deficient" in trace minerals under dry-season conditions. The mineral-efficient varieties are more drought resistant and so require less water, and because of their more efficient uptake of existing trace minerals, these varieties require fewer chemical inputs. Thus, the new seeds can be expected to be environmentally beneficial as well.

Cost-Effectiveness

Although the costs of vitamin A pills are low an often-quoted cost of vitamin A supplementation that includes the costs of delivery is 50 cents per person per year. If 1 in 12.5 persons receives supplements in Bangladesh (10 million children receive supplements out of a population of 130 million), this costs $5 million per year, or $50 million over 10 years. An often-quoted cost of iron fortification is 10 cents per person per year. If a particular food vehicle is to be fortified, which would reach 40 percent of the total, but untargeted, population (50 million people receiving the fortified food), the total cost is again $5 million annually or $50 million over 10 years. In absolute terms, these may seem to be large amounts of money but they are very worthwhile investments and are quite small percentages of the total economic activity of Bangladesh. Nevertheless, in contrast, investments in plant breeding research are far lower. The total budget of BRRI is about $3.5 million per year, a fraction of which could be devoted to breeding for nutritional quality. Development of iron- and zinc-dense germplasm at a central location such as IRRI in the Philippines

might cost $10–15 million over 10 years. Bangladesh and other rice-eating countries could benefit greatly from such centrally located research. Moreover, benefits are sustainable at low maintenance costs—benefits from breeding advances.

Although plant breeding involves comparatively long lead times before it can have an appreciable impact, a significant start has been made. The pace of progress in the years ahead will depend to a significant extent on the acceptance and support that [this] non-traditional approach receives from the plant breeding and human nutrition communities. After a onetime investment is made to develop seeds that fortify themselves, recurrent costs are low. In the case of increased trace-mineral density we anticipate no required behavioral change on the part of consumers. Indeed, the strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members, including women and children, most of whom are at risk for micro-nutrient malnutrition. Moreover, as a consequence of the predominance of food staples in the diets of the poor, this strategy implicitly targets low-income households. Not only does plant breeding hold great promise for making a significant, low-cost, and sustainable contribution to reducing micronutrient, particularly mineral, deficiencies in humans; it also may well have important spin-off effects for increasing farm productivity in developing countries in an environmentally beneficial way.

Essay

Research at IFPRI: A Retrospective, Bird's-Eye View

Nurul Islam

Over the past three decades, IFPRI has made significant strides in implementing a wide-ranging research program and making important contributions to knowledge about food policy issues and policymakers' understanding of these issues. These contributions have been widely acclaimed by researchers and policymakers in both developing countries and the international development community.

My assignment in this review is to explore whether a few of these achievements have fallen short of expectations or whether there are important areas of research that have been neglected or not carried out to the desired extent. This is a difficult, daunting task. So I here make a tentative attempt to look back in order to learn from past experience and face the challenges of the future.

At the outset, it is necessary to emphasize a few caveats. First, this is far from a comprehensive review of all areas of IFPRI's past and current research program. I am familiar with and have interest in some areas of research more than in others. Therefore, my comments and observations are selective, shaped partly by my interests and preferences. Second, this is a broad-brush, bird's-eye view rather than a "worm's-eye view" and therefore does not constitute a detailed, systematic view of methodology, content, and research findings. Third, limitations of or gaps in past research that may be evident today—with hindsight—were not readily perceived at the time when research

I have greatly benefited from comments and suggestions by colleagues at IFPRI, including Mark Rosegrant, Akhter Ahmed, Manohar Sharma, Samuel Morley, Marc Cohen, David Orden, and Klaus von Grebmer.

was undertaken. With the passage of time, a few earlier gaps were filled and improvements subsequently made.

IFPRI's research program—its content and priorities—are defined by its vision of a world free of hunger and malnutrition and its mission to provide policy solutions that reduce hunger and malnutrition and address major emerging issues affecting food security, with an emphasis on those that help the greatest number of people in deepest need. It may be interesting to review how IFPRI's mission was conceived in its early years. Established in the aftermath of the world food crisis in 1974, IFPRI stated its mission as the surveillance of the current food situation and, in the light of emerging problems, the identification of policies to sustainably improve productivity, food availability, and the nutritional status of all peoples, especially low-income people in developing countries. The basic thrust of the mission seemed to be the same as now, though its formulation has been refined and elaborated over the years in the light of changing circumstances.

Within this broad mandate, a number of factors have influenced the actual research agenda: priorities of individual developing countries as identified in the course of IFPRI's consultations and interactions with them; interests, fields of specialization, and capabilities of IFPRI researchers; the availability of donor financing for specific research projects, determined in turn by donors' preferences with respect to research subjects and countries; the need to cooperate with other research centers of the Consultative Group on International Agricultural Research (CGIAR) relating to their areas of specialization; and new challenges and issues, worldwide or in specific regions, ranging from HIV/AIDS, biosafety, and biodiversity to biotechnology and climate change. The relative importance of all of these interrelated factors varies over time and over research topics and is not always easy to pinpoint.

Any set of comments on IFPRI's research program must take into account the factors listed. Some have questioned whether faced with new and expanding demands from different stakeholders, IFPRI has been extending the reach of its research program too fast and spreading itself too thin. In this view, the growth of IFPRI's research program may make it difficult to engage enough core researchers on every subject to ensure efficiency and economies of scale and thus in time may detract from the quality of its research output. This is not an easy question to answer; any compromise between contending considerations is unlikely to be perfect.

The rationale of any research effort may be considered to include two aspects: first, to test an old hypothesis with a new set of data and reconfirm

the old hypothesis, especially where there have been doubts or questions about its validity; and second, to formulate a new hypothesis and then collect or assess a set of data to test the validity of the hypothesis for the first time. It seems that IFPRI researchers have not always clearly distinguished between the two aspects of their research. As a consequence, the research results have not in all cases been put clearly in the context of what is already known on the subject and what the net value addition made by new research is. These possible lacunae may particularly be relevant in the context of IFPRI's additional responsibility of stating clearly the new policy implications of their research results.

Research on Direct Poverty-Reducing Policies

IFPRI's research on direct poverty-alleviating measures includes work on microcredit, public employment schemes, and other safety net measures. Research on microcredit has delved deep into its impact on the nutrition and food security of the poor, including consumption smoothing and income enhancement. A few additional aspects of microcredit, such as financial sustainability of microcredit institutions, their noncredit functions such as empowerment of rural women, and the consequences of their concentration on financing nonfarm activities, may not have received due attention. Whereas lessons have been drawn on the basis of a number of case studies of microcredit institutions modeled on the Grameen Bank, an in-depth comparison with other institutional models (such as that in Indonesia) has been neglected. This neglect could have been the unintended consequence of the historical concentration of microcredit research in one division of IFPRI.

Moreover, microcredit has not been examined within a comparative framework of such poverty-reducing measures as public employment schemes for the poor or social safety nets. The costs and benefits of alternative schemes, as well as their complementarities and substitutability, are worth investigation. Public employment schemes or public works programs under various institutional and financing arrangements have proliferated in developing countries in recent years. Although IFPRI's poverty research, apart from that on various safety nets, has widened in a variety of other directions such as micronutrients, obesity, and intrahousehold issues, public employment schemes have not received the attention they deserve. In the early 1980s and 1990s, one or two large-scale detailed surveys were conducted, and in one survey a large number of hypotheses were tested. Unfortunately, not much work on

labor markets and poverty followed after this initial research on public employment schemes, although in the 1990s more and more of the poor became labor dependent, and it might have been useful if IFPRI had moved into that field.

The conditional cash or food transfers linked to education and health appear to seek to achieve directly two targets with one instrument. It is not clear why using one instrument for two targets—(1) poverty reduction/nutrition improvements and (2) increased school enrollment or improved health status—is more efficient than using two independent policy instruments. The issue is not whether conditional cash or food transfers have beneficial side effects on poverty, but whether alternative, more cost-effective measures can be devised to promote health and education. After all, cash or food transfers as incentives to stimulate demand for education or health deal with only one of many measures needed to create demand for and provide supply of health and education facilities. Has the second-best option of one instrument for two objectives been chosen because the first-best option is not feasible?

Two issues of relevance in the context of poverty research are (1) the role of conflict—civil wars and the like—in contributing to famine and hindering efforts to combat famine and (2) analysis of entitlement failure vis-à-vis lack of food availability—concepts introduced by Amartya Sen (the Nobel laureate) in his study of famine and food deprivation in the early 1980s. The interrelation between conflict and famine or food deprivation has several aspects: dislocation of food production, damage to infrastructure for food distribution, and denial of food supplies by one group or region to the other or by food-exporting or donor countries to unfriendly or adversary countries. IFPRI research in the past paid insufficient attention to these factors—a shortcoming that is being overcome in recent years.

Whether food shortage or lack of purchasing power (food entitlement) is the main cause of famine has been the subject of debate for some time. Sen, on the basis of his study of a few past famines, argues that the lack of entitlement rather than the lack of available food is the principal cause of famine in poor countries. It is arguable whether IFPRI should have taken a more active role in elaborating the various aspects, sometimes controversial, of the entitlement versus food availability hypotheses and their implications for the choice of preventive and corrective measures in the context of famines and large-scale food deprivations. In the light of IFPRI's current emphasis on the political economy of food policy, it seems that Sen's other hypothesis regarding the relationship between democracy and press freedom, on the one hand, and long-

term endemic hunger and short-term famine/"entitlement" failure, on the other, may need further analysis, evaluation, and empirical investigation.

Rural Public Investment, Poverty, and the Nonfarm Sector

The comparative impact of growth-promoting versus direct poverty-reducing measures on the reduction of poverty has been a subject of considerable interest and controversy. A recent IFPRI study of public investment in India finds that investment in rural roads and agricultural research has an impact on rural poverty reduction several times larger than that of direct poverty-alleviating measures such as public employment programs and rural credit focused on the poor. In fact, it finds that the direct poverty-oriented measures have a lower impact on poverty reduction than all other growth-augmenting expenditures, including education. This finding is especially relevant in the context of IFPRI's current emphasis on research on the elements of a pro-poor growth strategy. It raises two additional questions. First, should the results of the study of public investment be reexamined and elaborated with new data and with improved or alternative methodologies? Second, should the micro studies on poverty-reducing measures be expanded to include a comparison with growth-promoting measures?

Although the importance of IFPRI's early work on intersectoral linkages was widely recognized, IFPRI research on the rural nonfarm sector appeared to have lost momentum midway. In the early years, a few micro studies on rural intersectoral linkages focused on analyzing and quantifying the consumption linkages—that is, the rural farm sector's demand for rural nonfarm consumption goods. One or two highly aggregative macro studies, however, investigated input-output linkages and intersectoral capital flows between agricultural and nonagricultural sectors without distinguishing between rural farm and nonfarm sectors, the main thrust of the micro studies. Other aspects of the rural nonfarm sector require careful examination. An expanding rural nonfarm sector enables withdrawal of labor from farms and relieves the pressure on land. It halts or reverses declining farm size or fragmentation of holdings and provides scope for technological innovations that require economies of scale and mechanization. And it contributes to increased agricultural productivity. These are important issues in heavily populated countries. Moreover, there are linkages between rural farm or nonfarm and urban sectors. Growth in farm income generates demand for urban consumption goods,

which often replace traditional rural handicrafts. The rural nonfarm sector distributes urban goods, provides inputs to urban industries, and assembles their outputs. There are circumstances in which farm-nonfarm linkages within the rural economy itself may be weak. Under unfavorable agroecological circumstances, such as adverse topology or climate for agriculture, rural nonfarm activities linked to the urban sector may provide the only opportunities for employment and income. One hopes that research on these issues would receive serious attention. In fact, most recently, micro studies on urban-rural linkages have started to receive attention in IFPRI's research program.

Markets and Institutions

In the study of rural markets and institutions, much research effort has been devoted to public and private agencies and institutions, but the role of nongovernmental organizations (NGOs), both national and international, has not received the attention it deserves. It is time for research into their wide, multifaceted role. They play a role not only in research, extension, education, training, and marketing, but also in the provision of essential rural services such as health, education, women's empowerment, and economic participation. Moreover, in view of IFPRI's recent program of research on governance, the watchdog functions of NGOs in monitoring and evaluating public sector services, as well as in raising awareness and mobilizing public opinion, deserve special attention.

IFPRI research has concentrated on markets for output and intermediate inputs to the exclusion of land and labor markets, which have implications for efficiency, equity, and poverty in rural areas. In fact, the study of the rural labor market, wages, employment, and labor migration would reveal yet another aspect of rural-urban linkages. Research on agricultural finance, apart from microcredit for the nonfarm sector, was initiated a decade ago at IFPRI by a review and analysis of this subject. This line of research was not pursued subsequently through further detailed analysis or country case studies. This lack of follow-up could have occurred because the study of these subjects was an overworked area of research by other institutions and researchers and IFPRI could not add much value. This issue may require reexamination.

Trade Policy Research

During the 1980s, IFPRI did pioneering and important research on trade and exchange rate policies of developing countries. An innovative work in this re-

spect was the analysis and quantification of discrimination against agriculture resulting from a combination of such policies. This work was based on partial equilibrium analysis. IFPRI's subsequent research on the same subject based on computable general equilibrium (CGE) models for the 1990s, incorporating intersectoral and economywide interactions, arrived at results different from those of the partial equilibrium analysis undertaken during the 1980s. Discrimination against agriculture estimated by the CGE model was found to be smaller than that based on the partial equilibrium analysis. The partial equilibrium analysis was judged to have overestimated the indirect impact of industrial protectionism and the extent of exchange rate disequilibrium. The controversy cannot be resolved, however, without applying the CGE models to the same data, the same period, and the same countries used by the earlier analysis. The underlying circumstances had changed by the 1990s when both industrial protectionism and exchange rate overvaluation had declined, in some cases significantly, since the 1980s. A comparative study to test the relative implications of the two approaches was not undertaken.

In trade policy research, a number of CGE modeling exercises have examined the consequences of trade liberalization regionally among developing countries and globally, including some nonmodeling work on the outstanding issues under consideration in the World Trade Organization (WTO) negotiation process. Yet a few topical issues should have earlier received greater attention. One is an empirical analysis of the magnitude, pattern, and prospects of agricultural trade between developing countries (both within and between regions). Some work on this issue was done more than a decade ago; it has not been updated. This research may include an analysis of the impact of liberalization of agricultural trade among developing countries worldwide. What are, for example, the implications of high-income developing countries' providing free or preferential market access to the poorest developing countries?

Second, it would have been useful for IFPRI to pursue a detailed analysis of the nature and extent of the separate and differential treatment for developing countries in the WTO agreement. Should the differential treatment be agreement-specific or applied across all areas? Should it be for all developing countries or for only a few? Is it possible to suggest criteria for such distinctions that will be widely acceptable?

Third, does reducing agricultural subsidies in developed countries bring greater welfare gains to developing countries than reducing tariffs? Do political economy considerations make it difficult to reduce tariffs in developed countries without reducing subsidies? Do the prevailing preferential schemes

for developing countries make tariff reduction less valuable than subsidy reduction? What is the differential impact of subsidy reduction in developed countries on different groups of developing countries? Are there losers among them? If so, how are they to be compensated?

Fourth, although estimates of domestic subsidies and producers' subsidies in developing countries are important for understanding the combined impact of an array of domestic policies on agricultural trade, many other organizations, including the Food and Agriculture Organization of the United Nations (FAO), have had the major responsibility for this work. IFPRI's work in this context could have added value by (1) improving on the methodology followed by FAO and other researchers and (2) demonstrating the usefulness of the improved methodology by means of one or two case studies. As for the WTO approach to this subject, much controversy exists about the extent to which "green box" measures—now excluded from subsidy reduction commitment under WTO—are in fact trade distorting. IFPRI research on this subject could have helped clarify the issue, contributed toward the resolution of the controversy, and been useful to the developing countries in their negotiations in the WTO forum.

Fifth, in view of the increasing importance attached to nontraditional exports, especially horticultural exports, are not detailed case studies of how the sanitary-phytosanitary (SPS) regulations of various developed countries affect the exports of developing countries a matter of priority? The SPS regulations in both high-income developing and developed countries are getting more restrictive in terms of their range, intensity, and the strictness of their enforcement. To what extent is the international community helping the poorer developing countries to develop the capacity to meet such requirements?

In IFPRI's considerable research on trade and aid for agricultural development, it appears that an important gap is the analysis of external remittances—that is, remittances of earnings of migrants, mostly rural, from poorer developing countries working overseas in both developed and high-income developing countries. This source of external funds is increasing in importance in many developing countries. More than a decade and a half ago IFPRI undertook one or two country case studies of remittances, covering only a few questions. But the magnitude of the phenomenon was then rather small. Since then the landscape has changed significantly, issues to be investigated have proliferated, and the techniques of analysis have greatly improved. Remittances not only have macroeconomic and exchange rate implications with consequences for the agricultural sector, but also have direct impact on consumption, invest-

ment, growth, income distribution, and poverty. To whom do the remittances accrue—the poor or nonpoor in the rural areas? How are they utilized—for consumption or investment? If they are invested, what are the areas and types of investment? How are the investments distributed between farm and the nonfarm activities? What is the impact on the employment and wages of the rural poor?

Research Methodology

IFPRI has made pioneering contributions to the methodological aspects of CGE analysis, including model structures and estimation techniques. These innovations are of use in other areas of research besides food policy research. Whether the IFPRI research program keeps the appropriate balance between the two approaches—partial equilibrium versus CGE models—depends on the nature of topics for which one method is considered more appropriate than the other. This is a judgment best left to the discretion of the researchers.

Most modeling approaches, even the partial equilibrium analysis in some cases, involve often arbitrary assumptions regarding the structure of equations and parameters. And estimation techniques require data that are frequently not available. The data requirements and the complexity of the CGE models and their estimation, including intersectoral and economywide interrelations, are greater than in partial equilibrium models. To overcome such constraints, modelers resort to assumptions regarding structural equations and their parameters, often borrowed or indirectly estimated from other sources to a greater extent in CGE models than in partial equilibrium models. These models often are black boxes whose implications are not always transparent to readers, whether nonspecialists or economists and policymakers.

In view of the uncertainty regarding the structural equations and the assumed or estimated parameters, researchers frequently carry out sensitivity analysis to obtain a range of results on the basis of different assumptions, yielding a range of estimates. With the very efficient computational facilities currently available, it is relatively easy and inexpensive to generate multiple scenarios with alternative assumptions. Thus, there is a temptation to use CGE models frequently to produce quantitative results. This practice has tended to create a sense of false precision in many cases, without much effort to validate the results.

The wider the range of quantitative estimates, however, the more they become broad orders of magnitude, mainly indicating directions of change.

This fact adds to the challenge of communicating results from the models to nonspecialists and policymakers, who are eager to obtain a unique set rather than a wide range of quantitative estimates, unless an arbitrary choice (mainly intuitive) is made among the range of estimates. This phenomenon highlights the urgent need to devise a better method for validating the models.

To the extent that the results of CGE and similar modeling exercises have been intuitively obvious and yield estimates of only broad orders of magnitude that can also be obtained by less complex and data-intensive quantitative tools of analysis, it would have been worth considering whether the returns from CGE analysis were high enough to justify its use. It could also be argued, however, that CGE models are useful if policymakers insist on quantitative estimates and make their own choice among the range of results. The results can help them advocate more strongly for their chosen policy by referring to expert advice based on sophisticated models. And a CGE model may be especially valuable for policy analysis and advocacy if it yields results that are not intuitively obvious. For example, an export tax on a food crop designed to benefit poor consumers by reducing the domestic price for the crop may end up hurting the poor by (1) reducing the incomes of poor, small farmers and thus (2) reducing their demand for urban and rural goods and the income of the unskilled poor labor employed in their production. It would have been useful to extend and use these models to estimate the dynamic adjustment to policy changes. This would have helped illuminate the process and time pattern of adjustment over time.

IFPRI's flagship model (the International Model for Policy Analysis of Agricultural Commodities and Trade—IMPACT) has made projections on a wide variety of food and agricultural commodities and sectors based on different assumptions regarding technological change, supply of inputs like water supply and irrigation, and trade liberalization. This approach, through partial equilibrium, has faced a few of the same difficulties and limitations as CGE models, on a smaller scale. Three suggestions may be made in this context. It may have enhanced the value of the projections to the research community if the structural equations, estimation of parameters, and the data used in the model were explained in greater detail, probably in supplementary documents. This would have allowed their review and examination by other researchers and analysts and enriched or helped sharpen and update the model. To illustrate, one of the projections of the IMPACT model, widely used by the researchers and policymakers, is the one related to child undernutrition. The variables determining this projection needed further elaboration. Cur-

rently, they are assumed to be per capita calorie availability, ratio of male to female life expectancy, and access to clean water. But a 2003 IFPRI study by Lisa Smith and colleagues suggests that women's status is an important variable in determining child undernutrition.[1] This study greatly expanded the examination of women's status and decisionmaking power in terms of multiple indicators. To explain undernutrition, it also included other variables such as a household's assets and income, sanitation, and the nature of drinking water supply. It would have been useful for the IMPACT model to follow the lead of the Smith study and link child undernutrition to the other variables and outcomes by a suitable structural equation or detailed reduced-form equation. It may also be worth exploring how to link the CGE models to the IMPACT model in order to generate more disaggregate effects of policies.

Second, it would have been helpful to conduct a comparative review and analysis of various projection models such as those used by IFPRI, the U.S. Agency for International Development (USAID), FAO, the World Bank, and others, with respect to their data, structure, estimation methodology, and results. In 1995, in the early days of the IMPACT model, IFPRI carried out such an exercise. But a more recent study of this kind would have given useful information about why and to what extent outcomes of the same set of policies vary across different models and provided for an exchange of experience and learning from each other.

Third, in the context of a comparative review, it would have been worthwhile for IFPRI to examine the results of the different models in light of actual developments. Does the fact that projections can better predict global results rather than regional or country or commodity results detract from the value of such projections?

An important issue relevant to the future of world food supply is water scarcity. This issue is included in the model. The emphasis in IFPRI research has been on analyzing and devising appropriate incentives and institutional arrangements for the efficient use of water, especially in agriculture, in addition to policies for conservation and water harvesting. Another important area of research, however, concerns transborder water flows and the possibility of intercountry cooperation for augmenting and sharing water resources. This issue affects many countries in all regions of the developing world and is of

1. Lisa C. Smith, Usha Ramakrishnan, Aida Ndiaye, Lawrence Haddad, and Reynaldo Martorell, *The Importance of Women's Status for Child Nutrition in Developing Countries,* Research Report 131 (Washington, DC: IFPRI, 2003).

special significance in the poorer countries in Africa and Asia. IFPRI did some preliminary, rather limited, research on this topic in the Mekong River Basin, but this effort was not extended into a broader research program. IFPRI could have begun with a review and analysis of the outstanding issues, including possibilities of transborder water sharing in selected regions—for example, in South Asia, where various research groups have done some work on different aspects.

In conclusion, my remarks cover only a few aspects of IFPRI's past and current research, which includes multiple types of specialization and a wide range of expertise. In fact, the researchers themselves frequently know best the limitations of their own research. One observer in a quick review can seldom penetrate all the aspects of a research program—data, methodologies, and results—unless substantial time and effort are devoted to such a review. Moreover, it is always comparatively easy to point out the gaps in research or identify shortcomings, if any, of research that has already been undertaken. IFPRI undertakes such an exercise periodically through external reviews and annually through internal reviews.

My comments and observations would probably be contested by the researchers and rightfully so. The purpose of this review would be amply served if it helps stimulate debates and discussions among researchers and decisionmakers.

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Chapter 9

Conclusions and Looking Ahead

IFPRI in the Coming Decade

Joachim von Braun

The enormous changes that have taken place in the world's food and agricultural situation in the past 30 years, and the accelerating pace of those changes, suggest that the next three decades are also likely to bring many new developments, making it imperative for IFPRI to carefully plot its course.

Alternative Futures and Uncertainties

Some of the changes the world will face seem predictable. Within the next generation, it is likely that the world's population will reach about 9 billion; that the world will transform from a village to a city in terms of where the majority of people live; that natural resource stress will accelerate with implications for the world's water, soils, and biodiversity as well as for weather and climate; and that technological innovations will continue to grow by leaps and bounds (but access to them will not necessarily grow at the same pace). Global-level integration may be more and more combined with decentralized local government. All of these changes are fundamental for agricultural development, poverty reduction, food and nutrition security, and health.

Other changes that we cannot guess at may occur. If we look back, it would have been hard to foresee at the time when IFPRI was founded that the Cold War would end within one and a half decades, that China would embark on a path of unparalleled growth and development, that an information technology revolution would sweep the world, or that HIV/AIDS would kill more than 20 million people and devastate entire communities and countries, particularly in Sub-Saharan Africa.

Though improvements have taken place in some countries, hunger and malnutrition in the developing world remain persistently high and the rate of progress

has slowed considerably. At the same time, obesity is growing in a number of developing countries, sometimes even coexisting with malnutrition within the same families and communities. The magnitude and consequences of "hidden hunger," or micronutrient deficiencies, are coming to the fore and demanding innovative and sustained solutions. With diets changing around the world and the retail industry with supermarkets growing in importance, it is not yet clear what the longer-term outcomes for health and nutrition will be and what the chances will be for small farmers to benefit from high-value agriculture. Global health crises may continue to pose significant threats to food security and nutrition and may even accelerate in a more crowded world.

Globalization, considered today a key part of how the world's economies and societies operate, cannot be taken for granted. Misguided policies and national self-interest remain a main threat to development. Can we exclude scenarios—where, for instance, infectious diseases lead to the closing of national borders—that would undermine globalization and even reverse it in coming decades, including positive global responses to risk, to poverty, and to opportunities in science? Agriculture and food, which are very much globalized through trade, science, and resource linkages, would be affected immediately, accelerating global crises.

Policy Processes

A framework for understanding the process of policymaking has to recognize that politicians and civil servants engage in complicated political bargaining and act under the influence of their own perceptions, ideologies, predilections, and professional biases, as well as in response to interest groups. IFPRI research is particularly useful in getting issues on the table, evaluating the options (*ex ante*), and assessing the policy impact (*ex post*) for learning. IFPRI and its collaborators can exert influence primarily by providing information to politicians and other actors who call for policy change and who design and implement policy. IFPRI is aware that policy is often formulated with a short-term perspective, but short-term policy impact that may not be sustainable does not drive IFPRI's agenda. Often, there are substantial gaps between stated policy (such as a commitment to increase government spending on agriculture and rural development) and the actual implementation. This problem is an area for IFPRI research, and one that IFPRI's policy communications must address.

New Technologies and Institutions

New technologies are continually coming on line, and although these technological advances offer the promise of advancing food consumption, nutrition, and

health improvements, research is needed to identify appropriate policies and institutional innovations. As a partner within the CGIAR system, IFPRI is well connected to technology research and must be responsive to the challenges technology poses for policy, such as the challenge of adjusting regulatory frameworks for new technologies and the challenge of facilitating technological change that serves development and poverty reduction. In addition to addressing technologies, policy research is needed to contribute to institutional innovations that can overcome the causes of poverty.

Vision, Mission, Priorities

Although IFPRI believes it is vital to look into the future, its research agenda is not subject to change on the basis of highly speculative developments. IFPRI continues to give careful consideration to how it can best meet the challenges it will face in the coming decade. IFPRI's vision is a world free of hunger and malnutrition. IFPRI's mission is to provide policy solutions that cut hunger and malnutrition. In line with these, we have articulated a set of priorities for our research program based on four criteria. First, the work program must conform to IFPRI's mission to provide policy solutions that reduce hunger and malnutrition. Second, research and outreach should address emerging issues that affect food security, nutrition, and poverty most directly. Third, research, capacity-strengthening, and policy communications activities should be based on IFPRI's dynamic comparative advantage to produce results applicable to many countries—that is, international public goods. And fourth, stakeholders and partners should be consulted to identify food policy research that all parties believe will help develop policies to reduce hunger and malnutrition. Based on these criteria, and following continuous dialogues with our partners and stakeholders, we are committed to pursuing research, capacity strengthening, and policy communications on 13 themes that address the functioning of the global food system, global and national food system governance, and food system innovation (see Box 1). Most of the themes are linked and will be pursued not in isolation but as parts of an integrated research program at IFPRI.

In recognition of the need to reinvigorate the international community's focus on reducing poverty and ending hunger, the member states of the United Nations in 2000 agreed on eight Millennium Development Goals (MDGs)—specific, measurable targets to be met by 2015 that will make definite improvements in the lives of the world's poor and hungry people. The MDGs represent a significant revision of the fundamental paradigm of development thinking and have become an important focal point for food security and development policy. Achieving the MDG of cutting hunger in half by 2015 will be especially challenging. One thing is clear: this goal will not be achieved through business as usual. Research is needed

Box 1: Research Themes at IFPRI[1]

I. *Global food system functioning:* Policies that address constraints to achieving food and nutrition security and support more efficient functioning of the global food, nutrition, and agriculture system (such policies enhance inclusion of low-income countries, improve the food and nutrition security of poor people, and sustainably manage natural resources)
   1. Global food situation and scenarios of policy risks and opportunities
   2. Globalization, retail food industries, and trade negotiations related to food and agriculture
   3. Managing natural resources of particular importance to food, nutrition, and agriculture
   4. Food systems in disaster prevention and relief, and rebuilding after crises

II. *Global and national food system governance:* Policies improving global and national governance, political participation, and institutions for propoor food, agriculture, and natural resource management systems
   5. Governance structures and policy processes in food and agriculture: the role of the state, the private sector, and civil society
   6. Food and water safety policies
   7. Policies addressing hidden hunger, enhanced food and diet quality for poor people, and the nutrition transition in developing countries
   8. Policies and interventions for sustainable poverty reduction and nutrition improvement
   9. Cross-cutting research on country and regional food, nutrition, and agricultural strategies

III. *Food system innovations:* Policies to foster scientific and institutional innovation and technology use for the benefit of poor people in developing countries, and development of related comprehensive food and agriculture strategies
   10. Food- and nutrition-related science and technology policy serving poor people
   11. The future of smallholder farming in efficient and equitable food systems
   12. Urban-rural linkages and nonfarm rural development in efficient and equitable food systems
   13. Knowledge systems and innovation

1. See further details in IFPRI's strategy at www.ifpri.org.

on how to accelerate this sluggish progress in eliminating hunger in a food-rich world.

Changing Clientele

Another factor in IFPRI's future role may be its changing clientele. Central government authority in making food policy is becoming more diffuse, and many more actors will be involved. Given the likely growth in the number of actors engaged in food policy, IFPRI expects that over the next decade its clients will include provincial governments in large developing countries, private sector associations, nongovernmental organizations (NGOs), regional organizations, and foundations, in addition to national governments in developing countries (its traditional clients). Pro-poor public-private partnerships will play more significant roles in food, nutrition, and agriculture action areas.

IFPRI is also aware that it faces a changing cast of competitors as new actors enter the field of food policy research and analysis. Through engagement and constructive collaboration with these groups and by building on the contributions of other leading researchers around the world, we have the potential to make real breakthroughs in advancing food and nutrition security.

Concluding Remarks

As changes occur on the world stage, IFPRI must continue to adhere to its comparative advantage, which lies in its ability to respond to demands for high-quality research, to take ideas and lessons from one part of the world and apply them elsewhere, to provide international public goods, to offer a wide set of skills, and to remain an independent voice, understanding itself as part of a much larger policy research community.

Our goals are to remain a trusted global research center that provides the knowledge needed for food and nutrition policy serving poor people and to be a source of in-depth understanding of the linkages between research and policy change. We plan to respond quickly to changing conditions—if they seem of importance for the poor—and to opportunities for designing improved food policy serving low-income countries and to boldly and independently communicate findings based on sound analysis, even when they are controversial.

We are convinced that it is possible to reduce, and even eliminate, hunger and malnutrition in the next generation, and we will continue to play our part in promoting a world of food and nutrition security for all.

Appendix 1

Peer-Reviewed IFPRI Publications, 1975–2005

IFPRI Books

- *Agricultural change and rural poverty: Variations on a theme by Dharm Narain,* John W. Mellor and Gunvant M. Desai (eds.), published by Johns Hopkins University Press for IFPRI, 1985
- *Crop insurance for agricultural development: Issues and experience*, Peter Hazell, Carlos Pomareda, and Alberto Valdés, published by Johns Hopkins University Press for IFPRI, 1986
- *Accelerating food production in Sub-Saharan Africa*, John W. Mellor, Christopher L. Delgado, and M. J. Blackie (eds.), published by Johns Hopkins University Press for IFPRI, 1987
- *Food subsidies in developing countries: Costs, benefits, and policy options*, Per Pinstrup-Andersen (ed.), published by Johns Hopkins University Press for IFPRI, 1988
- *Agricultural price policy for developing countries*, John W. Mellor and Raisuddin Ahmed (eds.), published by Johns Hopkins University Press for IFPRI, 1988
- *Seasonal variability in Third World agriculture: The consequences for food security,* David E. Sahn, published by Johns Hopkins University Press for IFPRI, 1989
- *Variability in grain yields: Implications for agricultural research and policy in developing countries*, Jock R. Anderson and Peter B. R. Hazell, published by Johns Hopkins University Press for IFPRI, 1989
- *The Green Revolution reconsidered: The impact of high-yielding rice varieties in South India*, Peter B. R. Hazell and C. Ramasamy, published by Johns Hopkins University Press for IFPRI, 1991
- *The political economy of food and nutrition policies*, Per Pinstrup-Andersen, published by Johns Hopkins University Press for IFPRI, 1993

- *Agricultural commercialization, economic development, and nutrition*, Joachim von Braun and Eileen T. Kennedy (eds.), published by Johns Hopkins University Press for IFPRI, 1994
- *Agriculture on the road to industrialization*, John W. Mellor (ed.), published by Johns Hopkins University Press for IFPRI, 1995
- *Sustainability, growth, and poverty alleviation: A policy and agroecological perspective*, Stephen A. Vosti and Thomas A. Reardon (eds.), published by Johns Hopkins University Press for IFPRI, 1997
- *Intrahousehold resource allocation in developing countries: Models, methods, and policy*, Lawrence Haddad, John Hoddinott, and Harold Alderman (eds.), published by Johns Hopkins University Press for IFPRI, 1997
- *Paying for agricultural productivity*, Julian M. Alston, Philip G. Pardey, and Vincent H. Smith (eds.), published by Johns Hopkins University Press for IFPRI, 1997
- *Famine in Africa: Causes, responses, and prevention*, Joachim von Braun, Tesfaye Teklu, and Patrick Webb, published by Johns Hopkins University Press for IFPRI, 1999
- *Out of the shadow of famine: Evolving food markets and food policy in Bangladesh*, Raisuddin Ahmed, Steve Haggblade, and Tawfiq-e-Elahi (eds.), published by Johns Hopkins University Press for IFPRI, 2000
- *Who will be fed in the 21st century?: Challenges for science and policy*, Keith Wiebe, Nicole Ballenger, Per Pinstrup-Andersen (eds.), 2001
- *Global food projections to 2020: Emerging trends and alternative futures*, Mark W. Rosegrant, Michael S. Paisner, Siet Meijer, and Julie Witcover, 2001
- *The unfinished agenda: Perspectives on overcoming hunger, poverty, and environmental degradation*, Per Pinstrup-Andersen and Rajul Pandya-Lorch (eds.), 2001
- *Seeds of contention: World hunger and the global controversy over genetically modified crops*, Per Pinstrup-Andersen and Ebbe Schiøler, published by Johns Hopkins University Press for IFPRI, 2001
- *The future of food: Biotechnology markets and policies in an international setting*, Philip Pardey (ed.), published by Johns Hopkins University Press for IFPRI, 2001
- *The politics of precaution: Genetically modified crops in developing countries*, Robert L. Paarlberg, published by Johns Hopkins University Press for IFPRI, 2001
- *Land tenure and natural resource management: A comparative study of agrarian communities in Asia and Africa*, Keijiro Otsuka and Frank Place (eds.), published by Johns Hopkins University Press for IFPRI, 2001
- *Agricultural science policy: Changing global agendas*, Julian M. Alston, Philip G. Pardey, and Michael J. Taylor, published by Johns Hopkins University Press for IFPRI, 2001

- *The triangle of microfinance: Financial sustainability, outreach, and impact,* Manfred Zeller and Richard L. Meyer (eds.), published by Johns Hopkins University Press for IFPRI, 2002
- *Innovation in natural resource management: The role of property rights and collective action in developing countries*, Ruth Meinzen-Dick, Anna Knox, Frank Place, and Brent Swallow (eds.), published by Johns Hopkins University Press for IFPRI, 2002
- *Six billion and counting: Population growth and food security in the 21st century*, Klaus M. Leisinger, Karin M. Schmitt, and Rajul Pandya-Lorch, 2002
- *Reforming agricultural markets in Africa: Achievements and challenges*, Mylène Kherallah, Christopher L. Delgado, Eleni Z. Gabre-Madhin, Nicholas Minot, and Michael Johnson, published by Johns Hopkins University Press for IFPRI, 2002
- *Ending hunger in our lifetime: Food security and globalization*, C. Ford Runge, Benjamin Senauer, Philip G. Pardey, and Mark W. Rosegrant, published by Johns Hopkins University Press for IFPRI, 2003
- *Household decisions, gender, and development: A synthesis of recent research*, Agnes R. Quisumbing (ed.), 2003
- *Land and schooling: Transferring wealth across generations*, Agnes R. Quisumbing, Jonna P. Estudillo, and Keijiro Otsuka, published by Johns Hopkins University Press for IFPRI, 2003
- *Fish to 2020: Supply and demand in changing global markets*, Christopher L. Delgado, Nikolas Wada, Mark W. Rosegrant, Siet Meijer, and Mahfuzuddin Ahmed, copublished with the WorldFish Center, 2003
- *What's economics worth?: Valuing policy research*, Philip G. Pardey and Vincent H. Smith (eds.), published by Johns Hopkins University Press for IFPRI, 2004
- *Biotechnology, agriculture, and food security in Southern Africa*, Steven Were Omamo and Klaus von Grebmer (eds.), published with the Food, Agriculture, and Natural Resources Policy Network (FANRPAN), 2005

Collaborative Publications

- *Science under scarcity: Principles and practice for agricultural research evaluation and priority setting*, Julian M. Alston, George W. Norton, and Philip G. Pardey, book published in cooperation with the International Service for National Agricultural Research, CAB International (CABi) Publishing, 1995
- *4th report on the world nutrition situation: Nutrition throughout the life cycle*, published in collaboration with the United Nations Administrative Committee on Coordination, Subcommittee on Nutrition (ACC/SCN), 2000

- *Attacking the double burden of malnutrition in Asia and the Pacific*, Stuart R. Gillespie and Lawrence Haddad, ADB Nutrition and Development Series No. 4, book copublished with the Asian Development Bank Press, 2001
- *World water and food to 2025: Dealing with scarcity*, Mark W. Rosegrant, Ximing Cai, and Sarah A. Cline, book copublished with the International Water Management Institute (IWMI), 2002
- *From social assistance to social development: Targeted education subsidies in developing countries*, Samuel A. Morley and David Coady, book copublished with Center for Global Development, 2003
- *The double burden of malnutrition in Asia: Causes, consequences, and solutions*, Stuart Gillespie and Lawrence J. Haddad, book published by Sage Publications, 2003
- *The 1998 floods and beyond: Towards comprehensive food security in Bangladesh*, Paul A. Dorosh, Carlo del Ninno, and Quazi Shahabuddin (eds.), published in collaboration with University Press Limited, 2004
- *Targeting of transfers in developing countries: Review of lessons and experience*, David Coady, Margaret Grosh, and John Hoddinott, World Bank Regional and Sectoral Studies, book copublished with the World Bank, 2004
- *Institutional reforms in Indian irrigation*, Ashok Gulati, Ruth Meinzen-Dick, and K. V. Raju, book published by Sage Publications, 2005

Research Reports

1. *Meeting food needs in the developing world: The location and magnitude of the task in the next decade*, 1976
2. *Recent and prospective developments in food consumption: Some policy issues*, 1977
3. *Food needs of developing countries: Projections of production and consumption to 1990*, 1977
4. *Food security: An insurance approach*, Panos A. Konandreas, Barbara Huddleston, and Virabongsa Ramangkura, 1978
5. *Impact of subsidized rice on food consumption and nutrition in Kerala*, Shubh K. Kumar, 1979
6. *Intersectoral factor mobility and agricultural growth*, Yair Mundlak, 1979
7. *Public distribution of foodgrains in Kerala: Income distribution implications and effectiveness*, P. S. (Poykayil Simon) George, 1979
8. *Foodgrain supply, distribution, and consumption policies within a dual pricing mechanism: A case study of Bangladesh,* Raisuddin Ahmed, 1979
9. *Brazil's minimum price policy and the agricultural sector of northeast Brazil*, Roger W. Fox, 1979

10. *Investment and input requirements for accelerating food production in low-income countries by 1990*, Peter A. Oram, Juan Antonio Zapata, George Alibaruho, and Shyamal Roy, 1979
11. *Rapid food production growth in selected developing countries: A comparative analysis of underlying trends, 1961–76*, Kenneth Leroy Bachman and Leonardo A. Paulino, 1979
12. *Two analyses of Indian foodgrain production and consumption data*, J. S. Sarma, Shyamal Roy, and P. S. (Poykayil Simon) George, 1979
13. *The impact of public foodgrain distribution on food consumption and welfare in Sri Lanka*, James D. Gavan and Indrani Sri Chandrasekera, 1979
14. *Developed-country agricultural policies and developing-country food supplies: The case of wheat*, Timothy Josling, 1980
15. *Food production in the People's Republic of China*, Anthony M. Tang and Bruce Stone, 1980
17. *Agricultural research policy in Nigeria*, Francis Sulemanu Idachaba, 1980
18. *The economics of the international stockholding of wheat*, Daniel T. Morrow, 1980
19. *A comparative study of FAO and USDA data on production, area, and trade of major food staples*, Leonardo A. Paulino and Shen Sheng Tseng, 1980
20. *Impact of irrigation and labor availability on multiple cropping: a case study of India*, Dharm Narain and Shyamal Roy, 1980
21. *Agricultural protection in OECD countries: Its cost to less-developed countries*, Alberto Valdés and Joachim A. Zietz, 1980
22. *Estimates of Soviet grain imports in 1980–85: Alternative approaches*, Padma Desai, 1981
23. *Government expenditures on agriculture in Latin America*, Victor Jorge Elías, 1981
24. *The effects of exchange rates and commercial policy on agricultural incentives in Colombia, 1953–1978*, Jorge García García, 1981
25. *Instability in Indian agriculture in the context of the new technology*, Shakuntla Mehra, 1981
26. *Food security in the Sahel: Variable import levy, grain reserves, and foreign exchange assistance*, John McIntire, 1981
27. *Agricultural price policies under complex socioeconomic and natural constraints: The case of Bangladesh*, Raisuddin Ahmed, 1981
28. *Growth and equity: Policies and implementation in Indian agriculture*, J. S. Sarma, 1981
29. *Government policy and food imports: The case of wheat in Egypt*, Grant McDonald Scobie, 1981

30. *Instability in Indian foodgrain production*, Peter B. R. Hazell, 1982
31. *Sustaining rapid growth in India's fertilizer consumption: A perspective based on composition of use*, Gunvant M. Desai, 1982
32. *Food consumption parameters for Brazil and their application to food policy*, Cheryl Williamson Gray, 1982
33. *Agricultural growth and industrial performance in India*, C. Rangarajan, 1982
34. *Egypt's food subsidy and rationing system: A description*, Harold Alderman, Joachim von Braun, and Sakr Ahmed Sakr, 1982
35. *Policy options for the grain economy of the European Community: Implications for developing countries*, Ulrich Koester, 1982
36. *Agriculture and economic growth in an open economy: The case of Argentina*, Domingo Cavallo and Yair Mundlak, 1982
37. *Service provision and rural development in India: A study of Miryalguda Taluka*, Sudhir Wanmali, 1983
38. *Policy modeling of a dual grain market: The case of wheat in India*, Raj Krishna and Ajay Chhibber, 1983
39. *The world rice market: Structure, conduct, and performance*, Ammar Siamwalla and Stephen Haykin, 1983
40. *Food subsidies in Egypt: Their impact on foreign exchange and trade*, Grant McDonald Scobie, 1983
41. *Rural growth linkages: Household expenditure patterns in Malaysia and Nigeria*, Peter B. R. Hazell and Ailsa Roell, 1983
42. *The effects of food price and subsidy policies on Egyptian agriculture*, Joachim von Braun and Hartwig de Haen, 1983
43. *Closing the cereals gap with trade and food aid*, Barbara Huddleston, 1984
44. *Constraints on Kenya's food and beverage exports*, Michael Schluter, 1984
45. *The effects of the Egyptian food ration and subsidy system on income distribution and consumption*, Harold Alderman and Joachim von Braun, 1984
46. *The effects of income distribution and nutrition of alternative rice price policies in Thailand*, Prasarn Trairatvorakul, 1984
47. *Evolving food gaps in the Middle East/North Africa: Prospects and policy implications*, Nabil Khaldi, 1984
48. *Rural household use of services: A study of Miryalguda Taluka, India*, Sudhir Wanmali, 1985
49. *Livestock products in the Third World: Past trends and projections to 1990 and 2000*, J. S. Sarma and Patrick Yeung, 1985
50. *Government expenditures on agriculture and agricultural growth in Latin America*, Victor Jorge Elías, 1985
51. *Determinants of agricultural policies in the United States and the European Community*, Michel Petit, 1985

52. *Food in the Third World: Past trends and projections to 2000*, Leonardo A. Paulino, 1986
53. *Regional cooperation to improve food security in southern and eastern African countries*, Ulrich Koester, 1986
54. *Weather and grain yields in the Soviet Union*, Padma Desai, 1986
55. *The effects of trade and exchange rate policies on agriculture in Nigeria,* T. Ademola Oyejide, 1986
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59. *Production incentives in Philippine agriculture: Effects of trade and exchange rate policies*, Romeo M. Bautista, 1987
60. *Population policy and individual choice: A theoretical investigation*, Marc Nerlove, Assaf Razin, and Efraim Sadka, 1987
61. *The pilot food price subsidy scheme in the Philippines: Its impact on income, food consumption, and nutritional status*, Marito Garcia and Per Pinstrup-Andersen, 1987
62. *Agricultural research in Nepal: Resource allocation, structure, and incentives*, Ram P. Yadav, 1987
63. *Income and nutritional effects of the commercialization of agriculture in southwestern Kenya*, Eileen T. Kennedy and Bruce Cogill, 1987
64. *Cooperative dairy development in Karnataka, India: An assessment*, Harold Alderman, 1987
65. *Credit for alleviation of rural poverty: The Grameen Bank in Bangladesh*, Mahabub Hossain, 1988
66. *The Brazilian wheat policy: Its costs, benefits, and effects on food consumption*, Geraldo M. Calegar and G. Edward (George Edward) Schuh, 1988
67. *Nature and impact of the Green Revolution in Bangladesh*, Mahabub Hossain, 1988
68. *Coffee boom, government expenditure, and agricultural prices: The Colombian experience*, Jorge García García and Gabriel Montes Llamas, 1988
69. *Consequences of deforestation for women's time allocation, agricultural production, and nutrition in hill areas of Nepal*, Shubh K. Kumar and David Hotchkiss, 1988
70. *Agriculture in the GATT: An analysis of alternative approaches to reform*, Joachim A. Zietz and Alberto Valdés, 1988
71. *Storage, trade, and price policy under production instability: Maize in Kenya*, Thomas C. Pinckney, 1988

72. *Rice price fluctuation and an approach to price stabilization in Bangladesh*, Raisuddin Ahmed and Andrew Bernard, 1989
73. *Nontraditional export crops in Guatemala : Effects on production, consumption, and nutrition*, Joachim von Braun, David Hotckiss, and Maarten D. C. Immink, 1989
74. *Food production in a land-surplus, labor-scarce economy: The Zairian Basin*, Tshikala B. Tshibaka, 1989
75. *Irrigation technology and commercialization of rice in The Gambia: Effects on income and nutrition*, Joachim von Braun, Detlev Puetz, and Patrick Webb, 1989
76. *Agriculture and economic growth in Argentina, 1913–84,* Yair Mundlak, Domingo Cavallo, and Roberto Domenech, 1989
77. *The demand for public storage of wheat in Pakistan*, Thomas C. Pinckney, 1989
78. *The effects of sugarcane production on food security, health, and nutrition in Kenya: A longitudinal analysis*, Eileen T. Kennedy, 1989
79. *Effects of agricultural commercialization on land tenure, household resource allocation, and nutrition in the Philippines*, Howarth E. Bouis and Lawrence James Haddad, 1990
80. *Horticultural exports of developing countries: Past performances, future prospects, and policy issues*, Nurul Islam, 1990
81. *Production and consumption of foodgrains in India: Implications of accelerated economic growth and poverty alleviation*, J. S. Sarma and Vasant P. Gandhi, 1990
82. *Agricultural growth and structural changes in the Punjab economy: An input-output analysis*, G. S. Bhalla, G. K. Chadha, S. P. Kashyap, and R. K. Sharma, 1990
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