

Agriculture and Achieving The Millennium Development Goals

Agriculture and Rural Development Department



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Contents

ACRONYMS AND ABBREVIATIONS v

EXECUTIVE SUMMARY vii

1

Introduction 1

2

Perspectives on the Role of Agriculture in Meeting the Millennium Development Goals 3

- MDG 1—Eradicate Extreme Poverty and Hunger 5
 - Poverty Reduction Through Agriculture-Led Economic Growth* 7
 - Agriculture's Contribution to Food and Nutrition Security* 8
- MDG 2—Achieve Universal Primary Education 9
- MDG 3—Promote Gender Equality and Empower Women 10
- MDG 4—Reduce Child Mortality 10
- MDG 5—Improve Maternal Health 12
- MDG 6—Combat HIV/AIDS, Malaria, and Other Diseases 13
- MDG 7—Ensure Environmental Sustainability 13
- MDG 8—Develop a Global Partnership for Development 15

3

Alternative Scenarios to 2015: Prospect and Policies for Meeting the MDGs on Poverty 19

- Country-Level Assessment of Selected MDGs: Ethiopia and Zambia 19
 - Ethiopia: Agriculture-Led Growth and* 22
 - Zambia: Facing the Challenge of the Millennium Development Goals—The Role of Agriculture* 29
 - Conclusions* 34
- Global Quantified Assessment of Selected MDG
 - Targets: IMPACT-WATER 36
 - Results* 41
 - Implications for Investment* 46
 - Conclusions* 48

4	Global trends and Emerging Issues in Meeting the MDGs: a Trade, Macroeconomic, and Policy Perspective	49
	Policy Actions and Their Impacts on the MDGs	49
	Trade Policies	50
	<i>Policies of Developed Countries</i>	50
	<i>Policies of Developing Countries</i>	52
	<i>Policies in Development Assistance: The Case of Food Aid</i>	53
	<i>Macroeconomic Reforms and National Government Infrastructure Investments</i>	54
	<i>Importance of Rural Infrastructure</i>	55
	<i>On Public Investment and Infrastructure</i>	58
	The Role of the Private Sector in Supporting Agriculture to Meet the MDGs	58
	<i>The Rural Nonfarm Private Sector</i>	60
	<i>Effective Legal, Regulatory, and Institutional Environments</i>	61
	<i>Private-Public Partnerships and Investment Synergies: The Case of Water and Agricultural Research</i>	61
	<i>The Role of Foreign Direct Private Investment</i>	65
	<i>The Role of Governance Structures in Agriculture for Achieving the MDGs</i>	65
	Conclusion	67
5	Conclusions	69
	ENDNOTES	75
	REFERENCES	77
	Appendix 1. The Millennium Development Goals, Targets, and Indicators	81
	Appendix 2. IMPACT-WATER Developing Countries and Region	84

Figures

- 2.1 Proportion of Population Living on Less than \$1 Per Day (PPP), Most Recent Estimates **4**
- 2.2 Agriculture Value Added, as a Percentage of GNP, 2001 **4**
- 2.3 Progress in Attaining MDG 1 Targets for Poverty and Undernourishment, by Region (Trend Lines Based on Recent Performance and Targets for 2015) **5**
- 2.4 Child Malnutrition by Urban or Rural Residence, Stunting (Low Height for Age) Prevalence Among Preschoolers, Surveys Since 1999 **6**
- 2.5 Prevalence of Undernourishment—Proportion of the Population Unable to Acquire Sufficient Calories to Meet their Daily Caloric Requirements, 2003 Estimate **8**
- 2.6 Child Mortality by Urban or Rural Residence, Surveys Since 1999 **11**
- 2.7 Estimated Prevalence of Iron Deficiency Anemia in Women Aged 15 to 49, 2004 **12**

- 3.1 Poverty Rate in Ethiopia Under Different Growth Scenarios **29**
- 3.2 Poverty Reduction Under the Current Growth Path (2001–2050) **32**
- 3.3 Per-Capita Kilocalorie Availability in 1995 and Projections to 2015, Baseline and MDG Scenarios **43**
- 3.4 Child Malnutrition, Developing Countries, 1995, 2015 Baseline, 2015 MDG Scenario, and 2015 Target **43**
- 3.5 Child Malnutrition, Developing Country Regions, 2015 Baseline, 2015 MDG Scenario, and 2015 Target **44**
- 3.6 Number of People Without Access to an Improved Water Source, 1995, and Projected 2015 Baseline and MDG Scenarios **46**
- 3.7 Cost Estimates for Implementing the Baseline and MDG Scenario, 2015, Developing Countries **47**

- 4.1 Changes in Paved Roads, Telephone Lines, and Electricity Production Over Time, Selected Regions **57**
- 4.2 Sample of Public-Private Investment Arrangements **62**

Tables

- 2.1 Summary of Links Between the Agricultural Sector and the Millennium Development Goals, Principally at Household Level **18**

- 3.1 Comparison of Poverty Across Selected African Countries **20**
- 3.2 Poverty Lines in the Country Case Studies **20**
- 3.3 Economic and Demographic Indicators, 2001 **21**
- 3.4 Average Trends Across Countries, 1991–2001 Averages **21**
- 3.5 Cereal Production in Selected African Countries **22**
- 3.6 Growth and Poverty Reduction Under Agricultural Growth Options **24**
- 3.7 Poverty in Zambia During the 1990s **31**

3.8	Growth and Poverty Reduction Under the Alternative Zambian Growth Scenarios (2001–2015)	35
3.9	Child Malnutrition Estimates (Underweight), 1990 and 1995, with 2015 MDG Indicator Target	38
3.10	Access to Safe Drinking Water, 1990 and 1995, with 2015 MDG Target Indicator and 2015 IMPACT-WATER Baseline Estimates	39
3.11	Parameters for Developing Countries, Baseline and MDG Scenarios	41
3.12	Income Growth Requirements for Baseline and MDG Scenarios, 1995–2015	42
3.13	Southeast Asia, Share of Malnourished Preschool Children, 1995, and 2015 Baseline, MDG Scenario, and Indicator Target	45
4.1	Latin America and the Caribbean: Main Features of Changes in Agricultural Policies	55
4.2	Possible Scenario Regarding Financing Sources for Agriculture under NEPAD	64

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Acronyms and Abbreviations

ACC/SCN	Administrative Committee on Coordination/ Subcommittee on Nutrition
AfDB	African Development Bank
AIARD	Association for International Agriculture and Rural Development
BRI	Bank Rakyat Indonesia
CBOs	Community-Based Organizations
CPI	Corruption Perceptions Index 2004
EC	European Commission
EPRDF	Ethiopia Peoples' Revolutionary Democratic Front
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistical Database
FDI	Foreign Direct Investment
GATT	General Agreement on Trade and Tariffs
GDP	Gross Domestic Product
GNP	Gross National Product
HIPC	Heavily Indebted Poor Countries
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IFAD	International Fund for Agricultural Development
MAAIF	Plan for Modernization of Agriculture
MDGs	Millennium Development Goals
MPED	Poverty Eradication Action Plan
MIGA	Multilateral Investment Guarantee Agency
MOFED	Ministry of Finance and Economic Development
MOPED	Ministry of Planning and Economic Development
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
PPP	Purchasing Power Parity
PRSP	Poverty Reduction Strategy Papers
NEPAD	New Partnership for Africa's Development
UN	United Nations

UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations Children's Fund
SAPs	Structural Adjustment Programs
WANA	West Asia and North Africa
WFP	World Food Program
WHO	World Health Organization
WTO	World Trade Organization

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Executive Summary

Relationship Between Agriculture and the Millennium Development Goals

In 2000 the member states of the United Nations adopted the Millennium Declaration as a renewed commitment to human development. The Declaration includes eight Millennium Development Goals (MDGs), each with quantified targets, to motivate the international community and provide an accountability mechanism for actions taken to enable millions of poor people to improve their livelihoods. The MDGs are as follows:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), malaria, and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development.

About 70 percent of the MDGs' target group live in rural areas, particularly in Asia and Africa, and for most of the rural poor agriculture is a critical component in the successful attainment of the MDGs. Even though structural transformations are important in the longer term, more immediate gains in poor households' welfare can be achieved through agriculture, which can help the poor overcome some of the critical constraints they now face in meeting their basic needs. Thus, a necessary component in meeting the MDGs by 2015 in many parts of the world is a more productive and profitable agricultural sector.

While the linkage with agriculture is particularly strong for the first MDG, or MDG 1—halving by 2015 the proportion of those suffering from extreme poverty and hunger—all MDGs have direct or indirect linkages with agriculture. Agriculture contributes to MDG 1 through agriculture-led economic growth and through improved nutrition. In low-income countries economic growth, which enables increased employment and rising wages, is the only means by which the poor will be able to satisfy their needs sustainably.

MDG 2, on universal education, has the most indirect linkage to agriculture. A more dynamic agricultural sector will change the

assessment of economic returns to educating children, compared to the returns from keeping children out of school to work in household (agricultural) enterprises. Agriculture contributes to MDG 3 directly through the empowerment of women farmers and indirectly through reduction of the time burden on women for domestic tasks. Agriculture contributes to reduced child mortality (MDG 4) indirectly by increasing diversity of food production and making more resources available to manage childhood illnesses. Agriculture directly helps improve maternal health (MDG 5) through more diversified food production and higher-quality diets, and indirectly through increased incomes and, thus, reduced time burdens on women. Agriculture also directly helps to combat HIV/AIDS, malaria, and other diseases (MDG 6) through higher-quality diets, and indirectly by providing additional income that can be devoted to health services. Agriculture practices can be both direct causes of and important solutions to environmental degradation (MDG 7). More productive agricultural technologies allow the withdrawal of agriculture from marginal, sensitive environments. Developing a global partnership for development (MDG 8) will help maintain the steady increase in agricultural trade and significant increases in development assistance offered to the agricultural sector, increases that help sustain the benefits from agriculture in the longer term.

Agriculture and MDG 1: Country-Level Analysis for Ethiopia and Zambia

Compared with other regions of the developing world, Sub-Saharan Africa faces the largest challenge in terms of meeting MDG 1. In 2001, about 47 percent of the population was living below the international poverty line. Agriculture will be the primary means of addressing this challenge, as 65 percent of the people in the region derive their livelihoods from the sector. However, the contribution that agriculture can make in achieving the MDGs in this region depends on the particular constraints and opportunities prevailing within each of the countries.

In this report, Ethiopia and Zambia, with rural poverty rates of 45 percent and 86 percent, respectively, are analyzed according to the level and type of agricultural growth required to meet the MDGs

based on alternative development scenarios from economy-wide models. Ethiopia is a predominantly subsistence economy with agriculture contributing 52 percent to GDP and with almost 85 percent of the population living in rural areas. Productivity in the sector is low, due to frequent droughts, limited input use, and poor infrastructure. In contrast, mining traditionally has dominated economic growth in Zambia, which in turn has marginalized the country's agricultural sector. Zambia has both a higher proportion of its population living below the poverty line and a higher concentration of individuals at the low end of the income distribution.

Model results for Ethiopia show that if the country stays on a business-as-usual growth path, poverty will increase by another 10 million people, and food security will be compromised even further. The largest impact on poverty and food security can be achieved through a focus on growth in staple crops, which today account for 65 percent of agricultural value added as well as most smallholder employment. Rapid growth in the livestock sector has the most significant effect on overall economic growth but has a relatively smaller poverty alleviation effect. Very rapid growth in the nontraditional-export sector fuels total economic growth as well, but has little impact on rural poverty levels. Accelerated growth in all three sectors would help slash the poverty rate by 16 percentage points to 27 percent by 2015. The simulated growth in staple food production could be achieved through a doubling of the irrigation area by 2015, and by improving the efficiency of fertilizer use combined with enhanced seed use. Moreover, as more than 50 percent of the poor live in food-deficit areas where the availability of food staples per household is half the national average, market access and market development need to be integral parts of a national agricultural development strategy. Enhanced market access, chiefly through large investments in improved and extended road networks, would reduce the national poverty rate to 22.7 percent, and thus help Ethiopia reach the MDG 1 target.

In Zambia, the poverty rate under business-as-usual growth would still be 68 percent by 2015, only 7 percentage points lower than the current poverty rate of 75 percent. Annual GDP growth of 8.8 percent would be required to halve poverty by 2015. Although agriculture accounts for only

25 percent of GDP, it is still the main source of livelihood for most of the country's population, including the majority of Zambia's poor who live in rural areas where the incidence and severity of poverty is greatest. More rapid productivity growth under the Agriculture-Led Growth Scenario would lead to higher sectoral growth for both staples and export crops. Under a focus on nonagricultural growth, rural households would benefit from increased demand in urban areas, but the overall effect on poverty would be relatively small. Agricultural processing within the manufacturing sector, however, does in fact represent a potential area for growth and poverty reduction. Within the Agriculture-Led Growth Scenario, a Staples-Led Growth Scenario combined with poor market access would again have little impact on poverty among small-scale farm households. An Export-Crop-Led Growth Scenario would favor rural medium-scale households due to market and credit constraints for the rural poor.

Agriculture and MDG 1: Regional Analyses with a Focus on Child Malnutrition

Malnutrition affects nearly one-third of all children under five years of age in developing countries—174 million children in 1990. More than half of childhood deaths are associated with underweight, and malnourished children who survive into adulthood are more likely to suffer from chronic illness and disability, and have a higher probability of reduced physical and intellectual productivity. The IMPACT-WATER model is used to project the proportion of malnourished children under business-as-usual and an alternative MDG scenario that attempts to close the gap between the MDG target rate of childhood malnutrition and business-as-usual outcomes. The gap is closed through growth in agriculture as well as complementary investments in social sectors, and special attention is given to those countries and regions least likely to reduce malnutrition significantly by other means. Under business-as-usual, the developing-country level of childhood malnutrition is still 24 percent by 2015, down from 30 percent in 1990. Regions least likely to reach the MDG target indicator on halving childhood malnutrition are Sub-Saharan Africa, where the number of malnourished children has increased over the last 30 years, South Asia, where substantial progress

was made, but from very high levels, and parts of Southeast Asia. Levels in West Asia and North Africa are comparatively low, but have remained virtually unchanged over the last 30 years.

The MDG scenario combines two broad courses for improving food security and reducing poverty in developing regions: the first way is through broad-based and rapid agricultural productivity and economic growth to increase effective incomes, effective food demand, and food availability; and the second is through investments in education, social services, and health (proxied in the model by female secondary enrollment rates, the female-male ratio of life expectancy at birth, and access to clean water).

The changes in agricultural and complementary social indicators result in a reduction in total child malnutrition from 24 percent under business-as-usual in 2015 to 17 percent under the MDG scenario, a reduction from 131 million children to 91 million children. Under the MDG scenario, to bring developing countries, particularly South Asia and Sub-Saharan Africa, within reach of the pre-school malnutrition target indicator, total investments in agricultural and supporting sectors during 1995–2015 will have to increase by \$161 billion* based on IMPACT-WATER calculations. The three main areas of investment for the MDG scenario in percentage terms are rural roads, irrigation, and education. Together these three areas will require \$403 billion between 1995 and 2015 to achieve the rapid reductions in childhood malnutrition simulated under the MDG scenario. Agricultural research investments account for \$109 billion, and \$78 billion of investments are required toward increasing access to safe water. Due to the long lags in the generation of impacts from agricultural research, increases in research expenditures—even beginning now—will have relatively small impacts on crop yields by 2015. Increased investments in agricultural research are likely to be essential to meet crop and animal production needs beyond 2015, however. Other investments, such as roads and irrigation, have significant lags in impact as well, so implementing the investment portfolio required for the MDG scenario will require very rapid action. As relatively high levels of access to clean drinking water are already achieved in the baseline scenario, only \$15 billion in investments are added for the MDG scenario; these investments have virtually no lag period in becoming effective.

Role of Trade, Policies, and Governance Systems

In addition to the targeted investments required to help agriculture achieve its potential contribution for the MDGs, policies and governance systems need to be supportive for agriculture to achieve maximum impact.

Supportive systems and policies include trade and domestic support policies for agriculture in developed and developing countries, macro-economic reform and public-sector infrastructure and other investments, the role of the private sector and public-private partnerships, and general good governance.

Price support policies and border protection of wealthy Organization for Economic Co-operation and Development (OECD) countries, valued at hundreds of billions of dollars each year, cause harm to agriculture in developing countries. Removal of OECD protection could boost rural value added in low- and middle-income countries by \$60 billion per year. The increase in world prices from removal of OECD protection would lead to larger agricultural production in developing countries. An important area for developing countries to increase participation in international markets is through the buildup of capacity to produce for exacting standards of importing markets. Developing countries themselves retain substantial trade barriers and have varying requirements regarding agriculture liberalization, due to differences in trade specialization and needs of net food imports. When developing countries join in agricultural trade liberalization, they can achieve overall welfare gains of \$20 billion annually, twice the gains in national welfare compared to reforms in the developed countries only. Overall, a successful conclusion for agriculture in the World Trade Organization Doha Development Round trade negotiations can make an important contribution to achieving the MDGs, by establishing sustainable positive incentives for agricultural production among developing countries.

Food aid is another component of international transactions that directly and indirectly affects rural poverty in a globalized agricultural economy and therefore could have a significant impact in achieving the MDG targets. While the provision of aid in the form of food is not the optimal form for development assistance, donors would probably not provide equivalent cash development assis-

tance in place of food if existing food-aid programs were terminated. Thus, attention needs to focus on how its effectiveness can be maximized and potential harms mitigated.

Infrastructure is of particular concern as one of the key inputs entering into the “production function” of the MDGs and the achievement of many of the MDG targets, from poverty reduction to environmental sustainability targets. In Sub-Saharan Africa in particular, a lack of adequate infrastructure, typically attributed to geography and poor initial conditions, clearly impedes more productive agriculture. Achieving the health and education MDGs will require more than health and education interventions; in particular, infrastructure services have a crucial role to play. Piped water is crucial to reduce diarrhea in young children, while electricity allows for more hours of studying and road access promotes easier establishment of schools and higher attendance. Where the government believes that service should be provided beyond what a well-functioning market will offer, subsidies may be justified to promote additional investment to achieve these government goals.

To improve the effectiveness of public investment, increased coordination at the country, regional, and donor levels is necessary because the linkages and complementarities of infrastructure investment have often not been realized. Moreover, the traditional approach of top-to-bottom infrastructure development has to be changed to a more demand-driven approach. Finally, the impediments to efficient markets in rural areas need to be addressed through regulatory reforms in order to increase the availability and effectiveness of resources to address the real access gap in these areas.

Public intervention alone is not sufficient to deliver the services and investments required to achieve the MDGs. To alleviate rural poverty in developing countries, the private sector can contribute to economic growth through job creation both on and off farm. The private sector also has an important role in supporting timely and efficient credit availability to fuel agricultural development and growth. Finally, the private rural nonfarm sector is an important engine for rural development. In Asia, for example, the rural nonfarm economy accounts for 20–50 percent of total rural employment and 30–60 percent of total rural income.

Private financing of investment and MDGs may be explored as a general way to ensure availability of basic services, particularly as the official development assistance or aid for the water and other sectors has declined in recent years. Financing options should also include income redistribution and tax efforts in China, India, and other poor countries to co-finance the MDGs.

Foreign direct investment (FDI) and other long-term, relatively stable investments have a significant impact on agricultural and overall economic growth. However, the impact of this investment on hunger and poverty may be limited. Little of this investment goes directly into agriculture or rural areas. Moreover, FDI is largely concentrated in just a few countries.

Ideally, the public and private sectors complement each other, with the government providing an appropriate enabling environment for private initiatives to develop. Public-private partnerships are an important way to increase financial, human, and social capital in rural areas. Partnerships can include publicly provided training for small- and medium-scale enterprises, partnerships in education, agricultural research, the provision of information and communication technologies, the expansion of rural infrastructure including roads, and the development of rural industrial clusters. Moreover, through partnerships, public research institutions can gain access to advanced scientific knowledge and technologies held by the private sector, mechanisms for developing, processing, marketing, and distributing final products to farmers and consumers, and financial resources that are increasingly difficult to obtain. In the area of agricultural research, however, a sustained public role in funding agricultural research will be essential, particularly for crops and regions that are unlikely to be served by the private sector, such as those in less favorable environments.

Good governance is typically defined under the terms of accountability, transparency, predictability, and participation. These principles are only meaningful and supportive of agricultural development toward achieving the MDGs if adequate institutional and social structures are available. Countries with a good governance structure and adequate institutions tend to ensure political and economic stability, possess reasonable state capacity, enforce property rights and contracts, provide sufficient public goods, and limit government corruption and predation. Conversely, countries with

poor governance and poor institutions typically have poor public services, including those for agricultural extension and research, and have particularly poor social services like water provision and education. Good governance can be built through the development of social capital, particularly in rural areas, where participation by individuals in social networks increases the availability of information and lowers its cost, helps enforce property rights, and reduces opportunistic behavior in natural resource use—thus supporting all MDGs.

Effective community-based organizations, such as farmer associations or cooperatives, water user groups, and farm and other microcredit and lending groups can improve governance, for example, by educating and sensitizing the public about their rights and entitlements under public programs; by acting as a conduit to the government for public opinion and local experience; by influencing local agricultural development policies; and by helping government and donors fashion a more effective development strategy through strengthening institutions, staff training, and improving management capacity. At a higher level, donor countries and international aid agencies should focus their resources on those countries where good or improving governance structures will ensure that the rural poor are reached. Finally, at the international level, enhanced governance and commitment could help bring about improvements in the global trade and environmental agendas. Progress in the trade agenda will come from regarding the needs of the poorest countries, including enhanced access to both agricultural and other markets; progress in the global environmental agenda will come from the gains of developing countries from enhanced environmental standards, including protection of remaining biodiversity in these countries, or from participating in and gaining from climate mitigation policies.

Conclusions

Given that the majority of poor people live in rural areas or rely on agriculture, and that agriculture paves the way for economic growth in the poorer nations, agricultural and rural development will underlie progress on the broad array of economic and social indicators emphasized by the MDGs. The most effective strategy for making steady, sustainable progress toward the MDGs is to serve all the goals in an integrated way. However, each goal

will need a well-defined package of technologies and services for success at the field level.

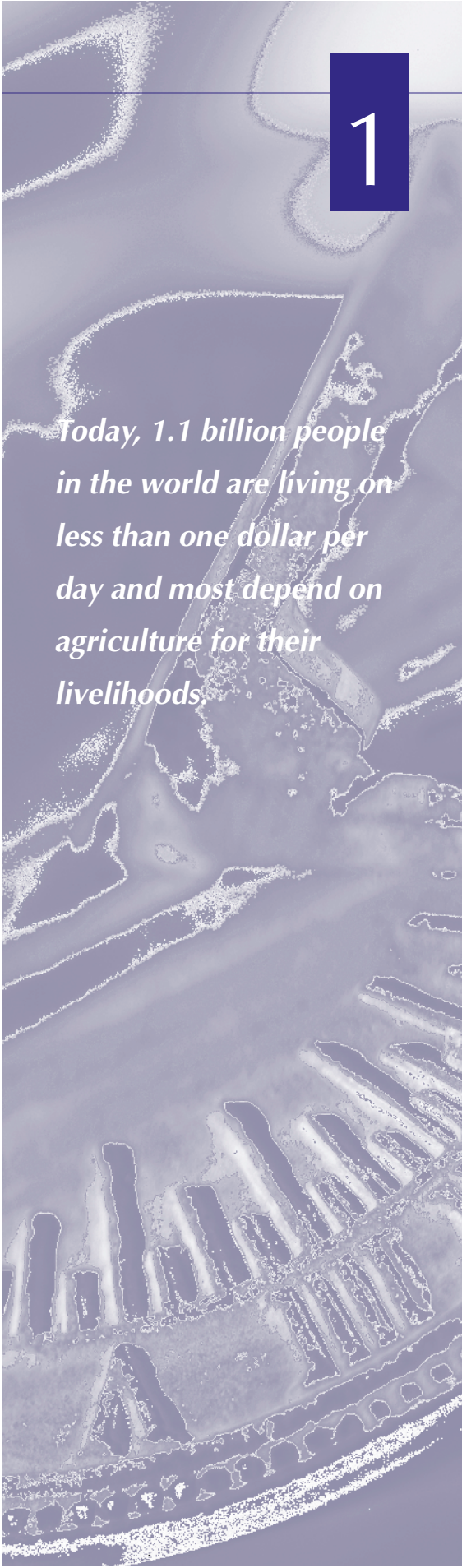
Of the eight Millennium Development Goals, the first goal is the one whose attainment most clearly involves the agricultural sector: The poor around the globe are disproportionately farmers and herders, and, perversely, the hungry also most commonly find their livelihoods through agriculture. By increasing food availability and incomes and contributing to asset diversity and economic growth, higher agricultural productivity and supportive pro-poor policies allow people to break out of the poverty-hunger-malnutrition trap. As the country-level model simulations revealed, broad-based agricultural growth is the key for decreasing poverty and increasing growth in Sub-Saharan Africa. A global assessment of Target 2 of MDG 1 (halving child malnutrition levels) shows that the combination of agricultural and economic growth together with larger investments in social sectors, including health and education, can substantially narrow the gap between the business-as-usual outcomes for 2015—24 percent of developing-country preschool children malnourished—and the target indicator—15 percent children malnourished—to reach 17 percent. However, the outcome varies significantly by country and region. Latin America, West Asia and North Africa, and China will, on average, likely get close to the target indicator by 2015, even under business-as-usual; however, the likelihood that Sub-Saharan Africa and South Asia will come close to their respective target rates is much smaller. The total increase in investments estimated is \$161 billion in agricultural and supporting sectors during 1995–2015. In addition to these investments, significant policy and governance reform is required.

To achieve faster agriculture-based growth rates, there must be in place favorable macro-economic and trade policies, good infrastructure, and access to credit, land, and markets. These conditions create level playing fields and give farmers incentives to adopt new and sustainable technologies and diversify production into higher-value crops, actions that raise incomes and lift households out of poverty. An improved domestic regulatory framework would intensify competition among suppliers of essential inputs, such as seeds and fertilizer. In addition, the elimination of trade barriers for agricultural products, especially the high-value-added products, would encourage a

greater number of private entrepreneurs to explore opportunities in agribusiness. A healthy market and private sector would provide value-added, skilled work to the landless poor and generate multiple livelihood opportunities in both the farm and nonfarm sectors. Other important reforms in the trade area include the elimination of export subsidies; the move toward measures that support income instead of stimulating production in developed countries, and the reform of the international and national governance of food aid programs.

As the financing requirements for realizing the MDGs are substantial, the private sector is increasingly called upon to fill investment gaps. Its complementary and supporting role in the provision of basic services in water, land, health, and other infrastructure development that is lacking in most developing countries cannot be ignored. It will take a particular kind of private-sector involvement to generate the necessary economic transformations. Private entrepreneurs are now increasingly held to environmental, social, and corporate governance principles that stress sustainable business practices and adherence to labor standards. Without these standards and practices, the private sector and disadvantaged groups cannot mutually benefit from consumer, employment, and entrepreneurial activities. Government agencies in developing countries urgently need to revisit the legal, regulatory, political, and institutional framework in agriculture, research, extension, and industrial sectors to facilitate private-sector involvement. Moreover, both the private and public sectors must foster private-public-sector partnerships and cultivate this relationship with the end objective of addressing the MDGs. Moreover, to allow the agriculture sector to develop its full potential for achieving the MDGs, the share of ODA spent on agriculture needs to increase significantly.

It is a promising development that the review of progress—and lack thereof—in achieving the MDGs has reached global attention. Calls for accountability and action that have real impact on people are growing because of that attention. Policy action and increased investment in the critical arenas of sustainable agriculture productivity and food and nutrition security will be essential for responding effectively and responsibly to reach the Millennium Development Goals.



Today, 1.1 billion people in the world are living on less than one dollar per day and most depend on agriculture for their livelihoods.

Today, 1.1 billion people in the world are living on less than \$1* per day—430 million in South Asia, 325 million in Sub-Saharan Africa, 260 million in East Asia and the Pacific, and 55 million in Latin America (World Bank 2004a). Although in aggregate, human material conditions have improved greatly over the past century, the continued daily deprivation of the basic needs of millions of people testifies to the fact that the global challenge of human development is far from met. Too many children around the world today lead lives characterized by hunger, illness, and, all too often, early death.

In order to establish a renewed commitment to human development, in 2000 the member states of the United Nations adopted the Millennium Declaration. Emerging from the Millennium Summit, the declaration recommits the community of nations to a broad range of steps to lead to a “more peaceful, prosperous and just world” and “to free our fellow men, women and children from the abject and dehumanizing conditions of extreme poverty . . . to making the right to development a reality for everyone and to freeing the entire human race from want.” In contrast to previous global policy statements, the Millennium Declaration also established eight goals—the Millennium Development Goals (MDGs)—each with quantified targets, to motivate the international community and provide a mechanism for accountability in undertaking action to enable millions of poor people to live lives of dignity, free from extreme want.

The goals are:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), malaria, and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development.

For each goal, one or more targets have been set, most for 2015, using 1990 as a benchmark. The goals, targets, and specific indicators are described in Appendix 1 of this document.

Since the Millennium Summit, the MDGs have come to serve as key objectives in guiding the planning and implementation of a broad

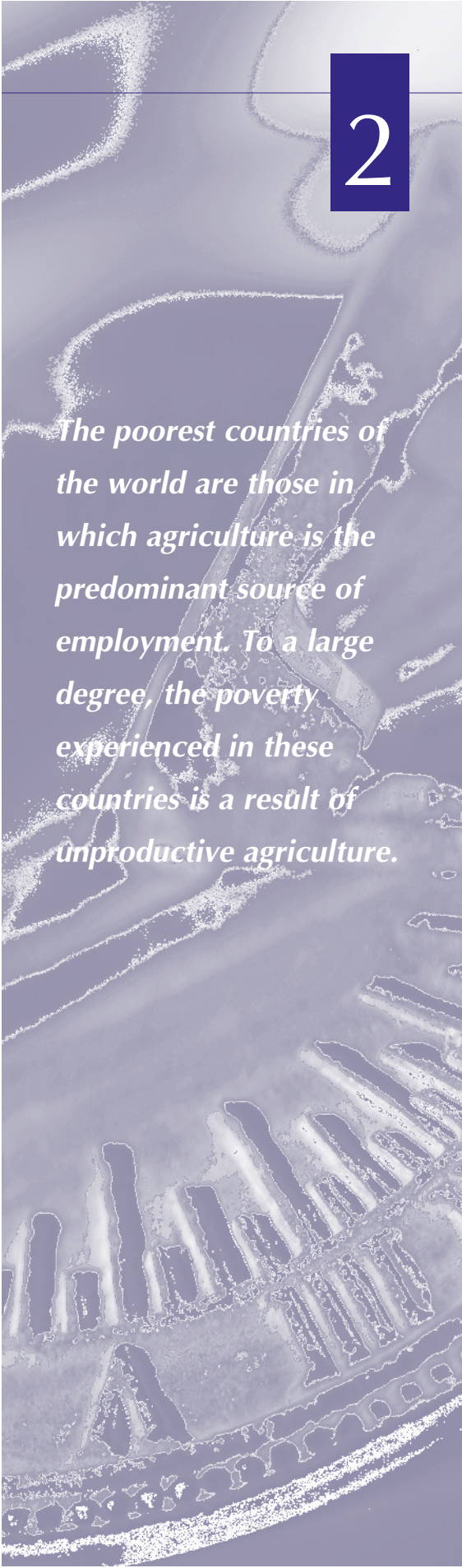
*All dollar amounts are U.S. dollars.

range of global and national development efforts. Progress toward the attainment of the MDG targets is being monitored, and policies and programs are being modified to bring about the changes needed to attain those targets.

The vast majority of people whose lives need to change the most, in order to attain the targets specified in the MDGs, depend on agriculture for their livelihoods. Coming up with strategic options for assisting these individuals and their households is a necessary component for improving global performance in meeting the MDGs. However, there are little or no diagnostics of the direct and indirect links between the MDGs and agriculture. Moreover, some of the indirect effects will come about through broad, economy-wide processes, while others, particularly those operating at the household and community level, will be felt more immediately. Additionally, cause-and-effect relationships between the agricultural sector and the MDGs are not all one way. While the agricultural sector provides critical inputs for attaining the MDG targets, the broad improvements in

human capital needed to reach those targets will also result in a considerably more productive and resilient agricultural sector. There is, therefore, a need to undertake a critical review of the pathways by which agriculture can contribute directly or indirectly to attaining the MDGs.

Following an explanation of the MDGs and a discussion of their progress to date, we assess goal-by-goal the potential contributions of agriculture to achieving the MDGs in the second chapter. The third chapter examines more closely how the targets of MDG 1 can be achieved in Sub-Saharan Africa (Ethiopia and Zambia), and how agricultural and economic growth, together with larger investments in social sectors including health and education, can substantially narrow the gap between business-as-usual and MDG outcomes for Target 2 of MDG 1 (halving child malnutrition levels). This report then examines how trade and macroeconomic policies for agriculture can improve the attainment of the MDGs, particularly the goal of halving poverty. The final section sets out some conclusions.



The poorest countries of the world are those in which agriculture is the predominant source of employment. To a large degree, the poverty experienced in these countries is a result of unproductive agriculture.

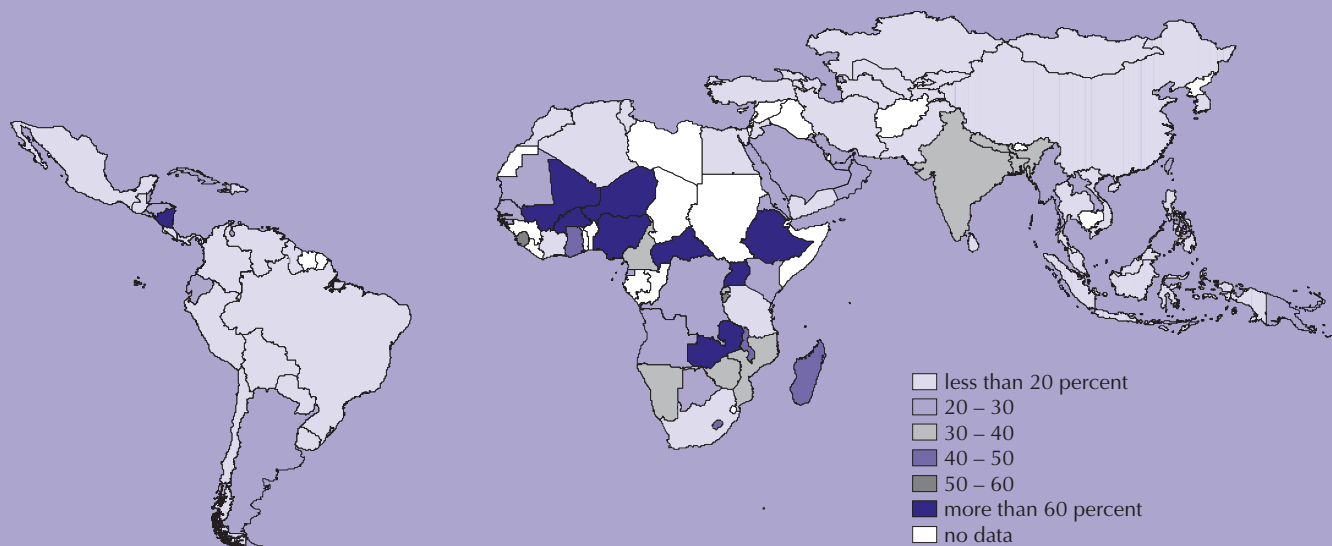
Perspectives on the Role of Agriculture in Meeting the Millennium Development Goals

About 70 percent of those living on less than \$1 a day live in rural areas (World Bank 2002).¹ For the majority of the poor in the world, agriculture is a critical component in the successful attainment of the MDGs. Although the rural poor pursue a range of strategies to assure their livelihoods, the dominant strategy is food production through cropping or raising livestock.² The vast majority of people whose lives need to change the most to attain the targets specified in the MDGs are farmers and herders. The material well-being of these individuals and households is dependent upon the productivity of their cropping and livestock husbandry activities. As shown in figure 2.1 the poorest countries of the world are also those in which agriculture is the predominant sector of employment. To a large degree, the poverty experienced in these countries is a product of unproductive agriculture. Moreover, the dominance of agriculture in the economies of the poorest countries (as shown in figure 2.2) often is more a reflection of a poorly performing economy in which subsistence agriculture is serving as a safety net of last resort for populations with limited economic options, rather than as an effective engine of economic growth. Although in the longer term a broad transformation and diversification of rural economies away from a strong dependence on agriculture is desirable, more immediate gains in the welfare of poor households are most likely to come through the poor overcoming some of the critical constraints they now face in meeting their basic needs through agriculture. Thus, a necessary component in meeting the MDGs by 2015 in many parts of the world is a more productive and profitable agricultural sector.

In this chapter, we will make a broad assessment on an MDG-by-MDG basis to consider how more productive agricultural activities and a more vibrant agricultural sector in general might significantly advance a country's efforts to attain each MDG. How might improved agricultural performance at household, community, and economy-wide levels bring progress toward the MDGs? A summary of the discussion on how the agricultural sector can contribute to the attainment of the MDGs, as well as how, in turn, progress in attaining the MDGs can animate the agricultural sector is provided in table 2.1 at the end of this chapter.

Direct and indirect effects need to be distinguished. We will pay more attention to those MDGs that are directly influenced by agricultural activities—most notably, MDG 1, halving by 2015 the proportion of those suffering from extreme poverty and from hunger. Moreover, some of the indirect effects will come about through broad economy-

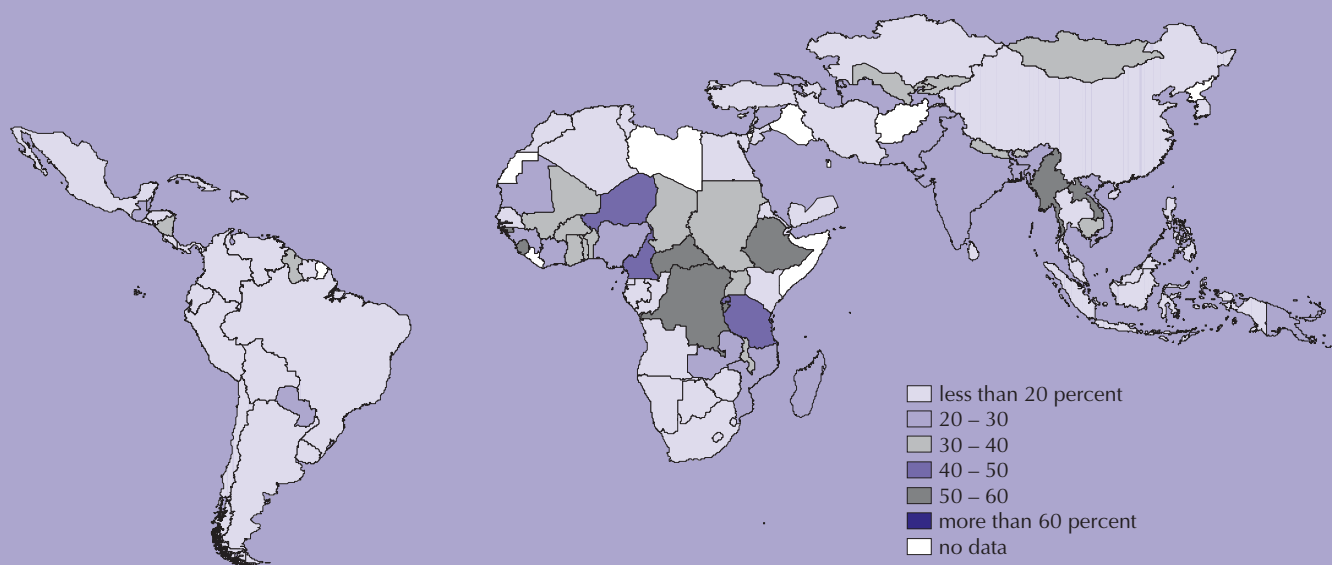
Figure 2.1 Proportion of Population Living on Less than \$1 Per Day (PPP), Most Recent Estimates



Source: World Bank (2003).

Note: PPP = purchasing power parity.

Figure 2.2 Agriculture Value Added, as a Percentage of GNP, 2001



Source: World Bank (2003).

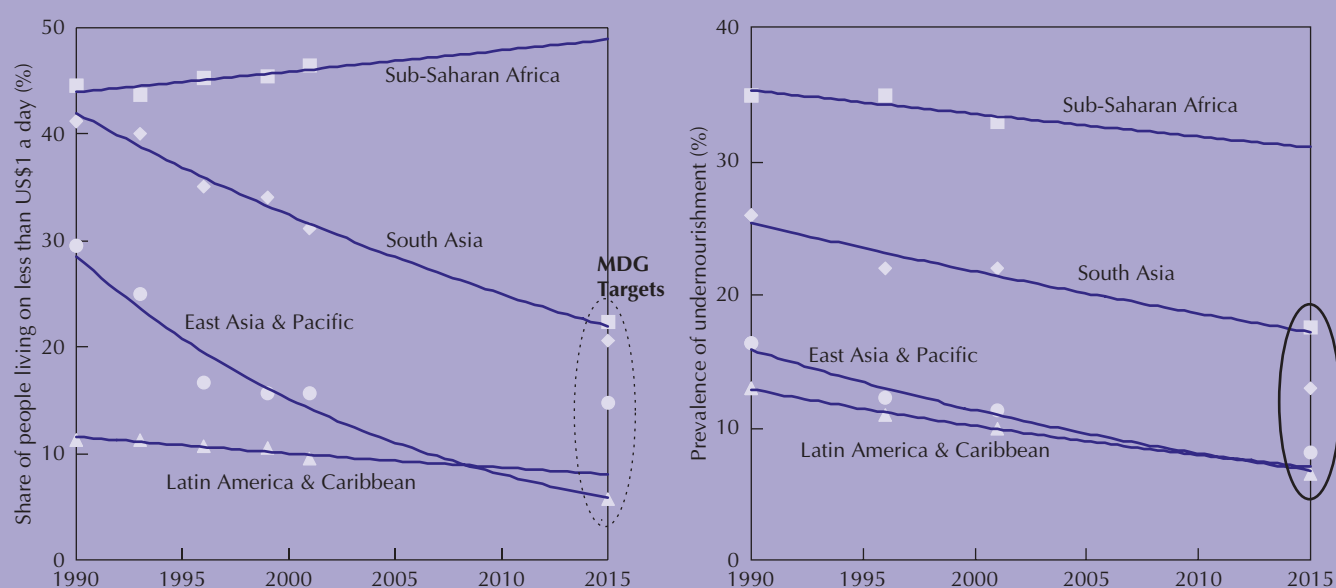
wide processes across sectors, while others, particularly those operating at the household and community levels, will be more immediately felt. Of course, for the more localized indirect effects of agriculture to contribute effectively to achieving the MDGs, such effects must be spread widely throughout the rural population. Additionally, cause-and-effect relationships between the agricultural sector and the MDGs are not all one way. While the agricultural sector provides critical inputs to attaining the MDG targets, the broad improvements in human capital needed to reach those targets will also provide an important foundation from which a considerably more productive and resilient agricultural sector can be developed. Finally, while most MDG targets are complementary, some might actually involve tradeoffs. For example, enhanced access to improved drinking water sources might collide, in some regions, with the goal of reduced hunger through increased irrigated agriculture. Similarly, several indicators of MDG 7, ensuring environmental sustainability, might well be adversely affected by efforts aimed at increasing agricultural and economic development that are important for the achievement of MDG 1.

MDG 1—ERADICATE EXTREME POVERTY AND HUNGER

Progress in meeting the targets of the first MDG is encouraging in East Asia, generally adequate in South Asia and Latin America, but disturbingly poor in Sub-Saharan Africa. Based on the simple trend line shown in figure 2.3, the prevalence of dollar-a-day poverty in East Asia in 2015 should be considerably less than the 50 percent reduction from 1990 levels. In Latin America and South Asia, poverty rates should be close to the targets, if slightly above.

However, for Sub-Saharan Africa, the proportion of the population living on less than \$1 per day in 2015 is quite likely to have increased from that of the reference year 1990. The regional trends in reduction of undernutrition, while all moving downward, are not as clear-cut as the trends in poverty. The undernutrition target is quite likely to be met in East Asia and in Latin America (see also the global assessment of childhood malnutrition in chapter 4). However, in both South Asia and Sub-Saharan Africa, undernutrition will likely remain at levels considerably above the targets for

Figure 2.3 Progress in Attaining MDG 1 Targets for Poverty and Undernourishment, by Region
(Trend Lines Based on Recent Performance and Targets for 2015)



Source: World Bank (2004b) (left), and FAO (2003) (right).

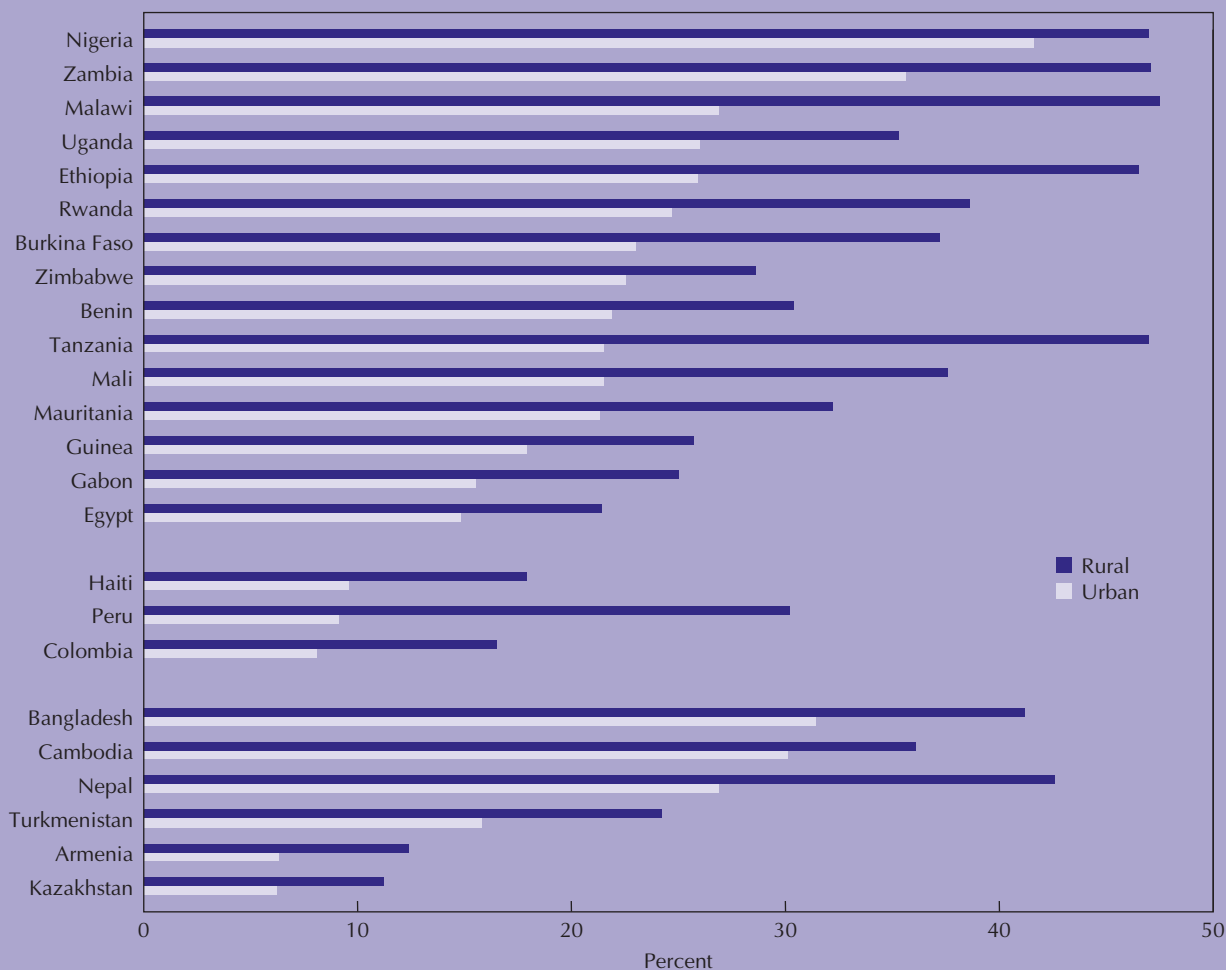
2015. Indeed, in Sub-Saharan Africa, using recent performance as a guide, little progress in reducing undernutrition will have been made.

We have already observed that poverty has a strong rural and, hence, agricultural dimension: Approximately 70 percent of the world's poor live in rural areas and primarily pursue agriculture-based livelihood strategies. Hunger is endemic in most rural areas of the developing world. Consequently, as shown in figure 2.4, malnutrition levels are consistently higher in rural areas than in urban zones.

Improving the productivity of and the economic returns of agriculture for farming households will have immediate effects in eradicating extreme poverty and reducing hunger. First, through the

market, increased agricultural income will directly improve both household consumption levels today, and household asset levels to improve production and better weather economic shocks in the future. Increased food production will lead to real reductions in food prices, which will improve the purchasing power of the poor throughout the economy, whether they are engaged in agriculture or some other sector. More important, agriculture can serve as the basis for broad pro-poor economic growth to bring about permanent reductions in poverty. Second, with complementary nutritional factors in place, both subsistence farming households and those purchasing food in local markets will enjoy immediate physiological benefits from increased

Figure 2.4 Child Malnutrition by Urban or Rural Residence, Stunting (Low Height for Age) Prevalence Among Preschoolers, Surveys Since 1999



Source: ORC/Macro, 2004. MEASURE DHS+ STATcompiler. <http://www.measuredhs.com>. Most recent survey. Accessed May 2004.

food production. As the first MDG is the one in which the impact of a more dynamic agricultural sector will be felt most directly, we will discuss in more detail these two issues—poverty reduction through agriculture-led economic growth and improved nutrition through agriculture.

Poverty Reduction Through Agriculture-Led Economic Growth

Income redistribution and economic growth are the two economic mechanisms for reducing poverty. While redistribution is a viable option to address poverty in many parts of the developed world, in the developing countries of the world with large segments of populations unable to meet their basic needs, income redistribution policies are unlikely to have much effect on general welfare levels. There are simply insufficient resources in such economies to assure the basic needs of all. In these countries, higher economic productivity—that is, economic growth enabling increased employment and rising wages—is the only means by which the poor will be able to satisfy their needs sustainably.

For both long-developed countries and for the handful of more recently developed countries, significant increases in agricultural productivity were a critical early step in building sustained economic growth. Initial growth in staple food production by the small-scale, labor-intensive agricultural sector through the use of improved technologies resulted in reduced food prices, increased real wages, and, consequently, lower poverty. Reduced food prices enabled greater access to food, resulting in better nutrition for the general work force while also freeing up additional household resources from food to other expenditures, including productive investments. In rural areas, investments initially went into cash crop production and agricultural processing activities, but, as the economy grew, rural nonfarm and urban activities became increasingly profitable. As this process of economic transformation advanced, the agricultural sector tended to play a decreasing role in sustaining economic growth.³ Movement of labor out of the agricultural sector occurs as employment opportunities in other economic sectors grow. Depending on rural population growth, larger-scale commercial enterprises may become more characteristic of the agricultural sector.

There is considerable empirical evidence that demonstrates the significant contribution that growth in agricultural productivity can make to

reducing poverty. A recent cross-country analysis by Thirtle and others (2002) found that, at the national level, a 1 percent increase in agricultural yields decreases the percentage of population living on less than \$1 per day by 0.64 to 0.91 percent, with a slightly higher reduction for the countries in Africa. Notably, in analyzing the effect of growth in the manufacturing and service sectors on poverty, no significant change in poverty was associated with growth in these sectors.

This description of the process is necessarily simplistic and ignores a broad range of potential impediments to agriculture-led economic growth. One of the most critical of these at present is low prices for staple food crops globally, due to the success of the Green Revolution (as well as high levels of subsidies in the developed world). As a consequence, it now is difficult to generate profits through staple food crop production even at high levels of productivity, particularly for smallholders who are unable to achieve economies of scale in their production. Increasingly, in order to obtain an adequate return from their efforts in agriculture, farmers need to diversify their production into high-value, but knowledge-demanding, specialized crops. Similarly, agriculture cannot be expected to be an engine of economic growth for those countries that have no comparative advantage for agricultural production or face significant barriers to producing for global markets. Many of the drier inland countries of Africa face important challenges in this regard.

The initial distribution of agricultural assets in the economy is also a critical feature in whether or not agriculture-led growth will reduce poverty. Where land ownership is concentrated, as most notably in parts of Latin America, such economic development is unlikely to reduce poverty greatly (Timmer 2003). In contrast, in most of Africa and many parts of Asia where the poor continue to have access to land, agriculture-led growth should lead to significant reductions in poverty. Finally, where significant movement of the population out of rural areas to the cities and out of agriculture into urban-based economic sectors has already occurred, as in many of the middle-income countries of the developing world, there is little potential for the agriculture sector to catalyze broad economic growth and reduce poverty. In these countries, poverty reduction efforts should focus on the industrial and service sectors, while not ignoring the key role that agriculture plays in their rural economies.

While these caveats are important to recognize in tailoring economic development strategies, nevertheless, such a process of agricultural growth has proven in the past to be a common means by which to spur broad-based pro-poor economic growth. Yet, for the poorest countries, the process of small-scale agriculture-led economic growth leading to strong economies and minimal poverty will not occur by 2015, the target date for most of the MDG targets. For these countries, the relevant time frame is one of decades and generations. However, a process of building sustained economic growth requires that productivity increases in agriculture be achieved in the early stages. Moreover, the benefits of the initial steps of agricultural productivity increases accrue primarily to the farmers and herders, among whom the poor are concentrated. By pursuing such an economic growth strategy within the context of the MDGs, we can achieve both the significant improvements in well-being that the MDGs seek to promote, and lay the foundation for the sustainable economic transformations needed to attain, in the longer term, the broader aim of the Millennium Declaration of “freeing the entire human race from want.”

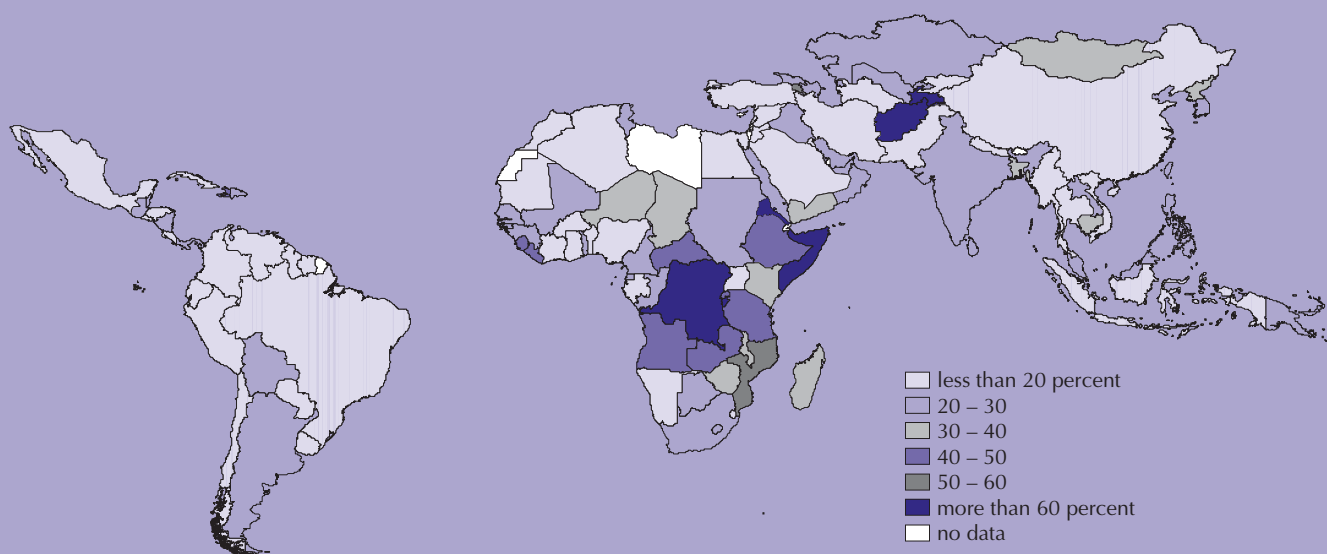
Only a few countries have dramatically reduced poverty and achieved rapid economic growth with-

out significantly increasing the productivity of the agricultural sector. However, agricultural productivity gains alone are not sufficient to bring about sustained economic growth. No country has been able to sharply reduce poverty only through agricultural strategies. Institution building in the agricultural sector and parallel developments in other sectors of the economy are needed to transform the foundational contributions from the agricultural sector into sustained broad economic growth in the economy. Agricultural strategies alone will not lead to success. However, the converse also applies: For the poorest countries, economic growth and sustained poverty reduction are unlikely to be achieved without initially stimulating sustained agricultural production growth.

Agriculture's Contribution to Food and Nutrition Security

The indicators for the second target of the first MDG include the reduction by half between 1990 and 2015 of the prevalence of underweight (low-weight-for-age) children and the proportion of the population whose food intake falls below the minimum level of dietary energy requirements (undernutrition). As shown in figure 2.5, the levels of under-

Figure 2.5 Prevalence of Undernourishment—Proportion of the Population Unable to Acquire Sufficient Calories to Meet their Daily Caloric Requirements, 2003 Estimates



Source: FAO (2003).

nutrition are high throughout the developing world, and particularly in many of the countries in which agriculture is also the dominant livelihood. To attain the MDG 1 second-target goals, food and nutrition security needs to be enhanced for the poor. A household is food secure if it can reliably gain access to food in sufficient quantity and quality for all household members to enjoy a healthy and active life. It is possible, however, for individuals in food-secure households to have deficient or unbalanced diets. Nutrition security is achieved when secure access to sufficient, safe, and nutritious food is coupled with a sanitary environment, adequate health services, and knowledgeable care to ensure a healthy and active life for all household members.

Clearly, food and nutrition security is closely tied to agricultural productivity. Increased food production increases local food availability. Higher production from one's own farm or herds increases one's access to food and enhances household food security. The nutritional quality of the food produced is also an important consideration in reducing malnutrition, particularly for households who acquire most of their food from their own fields and herds. For food purchasers, higher production generally means lower food prices and access to a greater quantity of food in the market for a given income level. Particularly in South Asia and Africa, the most potent force for reducing malnutrition is raising food availability through increased agricultural productivity, as well as trade (Smith and Haddad 2000, p. 84).

Many countries, particularly in Eastern and Central Africa, are characterized by a declining or slowly growing food crop sector and very low purchasing power. While stable access to food through the market requires that the food marketing system is effective in supplying food while also benefiting those who have food to sell, the systems in these countries are unable to provide effective markets. People living on less than \$1 per day are unable to pay the prices necessary to import all of the staple food they require.

Consequently, if hunger is to be addressed effectively, a range of complementary actions are needed in addition to those aimed at enhancing crop and livestock production. An important component of these actions is the agriculture-led economic growth described previously, whereby real incomes and access to food are increased. However, a host of other institutional factors must be addressed, as well as several cross-sectoral challenges. The latter are particularly the case in going beyond food secu-

urity to attain nutrition security. To reduce malnutrition in a comprehensive manner, agricultural strategies must be implemented as part of a broader set of actions that involve the health, water and sanitation, and education sectors (see also chapter 5).

Of the eight MDG goals, the first is the one whose attainment most clearly involves the agricultural sector: The poor around the globe are disproportionately farmers and herders, and, perversely, the hungry and undernourished also most commonly find their livelihoods through agriculture. The impact that a dynamic agricultural sector will have on the attainment of the other seven goals is less direct. Nonetheless, important gains in achieving these goals can be made through explicit attention to agriculture. We now consider these other MDGs.

MDG 2—ACHIEVE UNIVERSAL PRIMARY EDUCATION

Primarily in an indirect fashion, investments in agriculture will advance progress toward attaining by 2015 the goal of enabling children everywhere, boys and girls alike, to complete primary school. Higher productivity in agriculture leading to higher incomes will enable either the use of hired labor for agricultural operations or the use of labor-saving technologies in place of the labor of school-age children in farming households. However, a critical component of this equation is the value that farmers perceive that they or their children will obtain by sending their children to school. These benefits are to a large degree determined by the vibrancy of the economy and the extent to which the higher economic capacities of trained individuals are rewarded. In stagnant economies and particularly in rural areas where the range of employment opportunities is narrow, perceived returns of education commonly are judged to be significantly less than the opportunity costs associated with keeping a child in school, and so unable to work full time in the family's agricultural enterprise. The broad-based agriculture-led growth discussed earlier is necessary to alter the outcome obtained by farming households making this comparison.

Such a pattern of growth, particularly as it extends to the nonfarm and urban sectors, will demand increasingly skilled labor, and will increase the returns of investment in the schooling of one's children. Moreover, the relationship between increased educational attainment and a more active

agricultural sector runs both ways. The agricultural sector in most poor countries is unlikely to continue to expand for very long on the basis of productivity increases of staple food crops alone. Increasingly, the sector will have to turn to the production of high-value cash crops that usually have quite specific production and marketing requirements. Meeting the requirements to engage profitably in their production requires a better-trained work force. As this sector of the local agricultural economy develops, the returns of providing basic education to one's children become considerably more compelling.

MDG 3—PROMOTE GENDER EQUALITY AND EMPOWER WOMEN

Throughout the developing world, women are farmers and find their principal productive activities in agriculture. Considerable research shows that when men and women are able to use agricultural inputs at equal levels of intensity, women are equally effective as men in profitably engaging in agriculture, being responsive to changing market conditions in the suite of crops they produce, and effectively utilizing new technologies (Quisumbing 2003). Agriculture provides key contributions to the economic empowerment of women.

Moreover, the relationship between agriculture and the empowerment of women works both ways. A dynamic agricultural sector that offers broad welfare benefits can be expected to emerge only when women are given the opportunity to participate profitably in the sector. Where they have security in their access to productive resources and control of their agricultural production—that is, where women farmers are empowered to achieve their full economic potential within agriculture—the welfare effects of a productive agricultural sector can exceed the simple economic productivity measures for the sector. The economic empowerment of women both in agricultural production and in other economic spheres can be expected to advance significantly efforts to attain several of the MDGs.

Several of the MDGs are directly determined by the extent to which sufficient resources are provided to children as they develop and grow. The immediate provision of these resources—health care, feeding, life skills training, and so on—is inherently a gendered task. In most societies, women are the principal caregivers within the household.

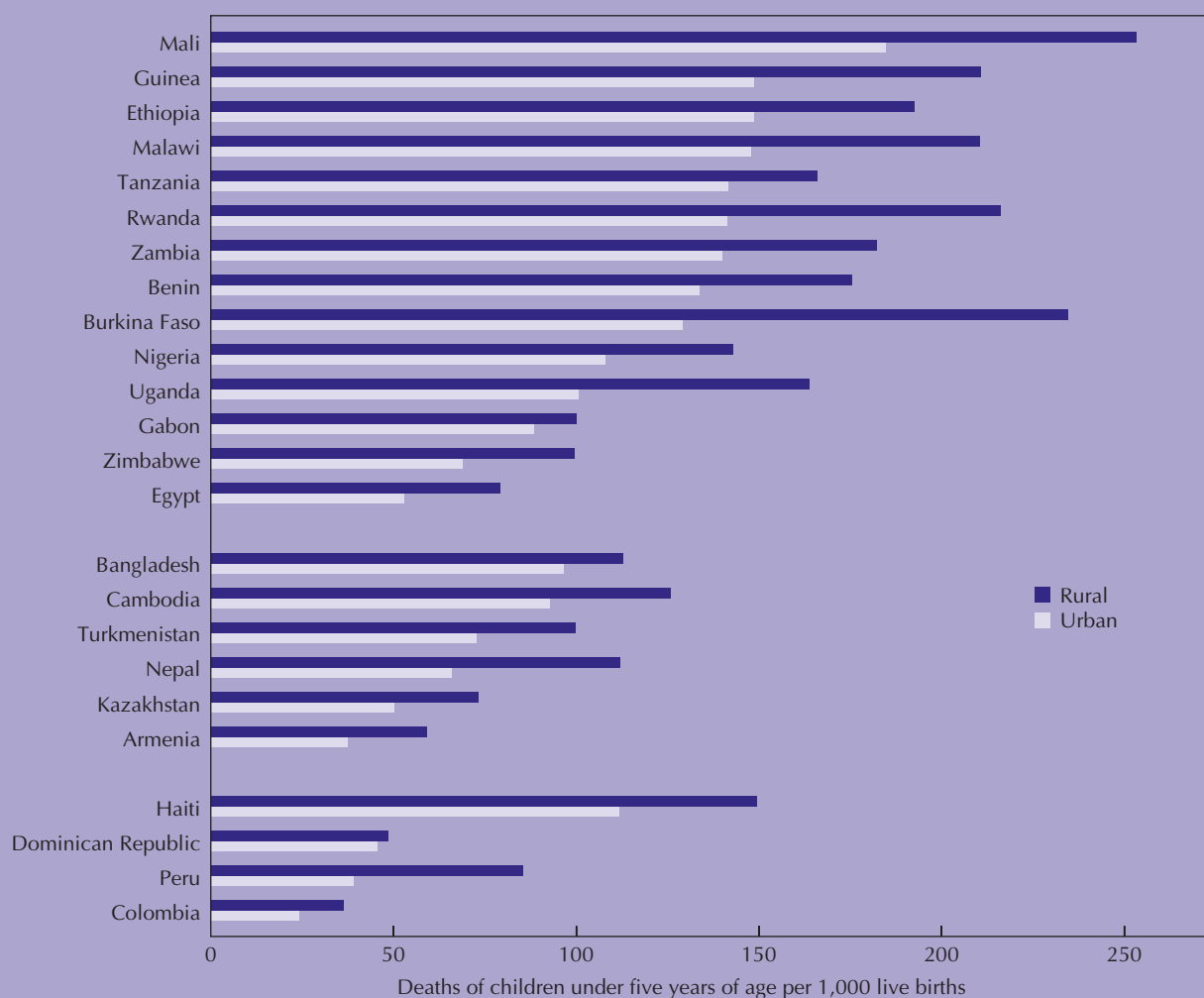
This being the case, if the benefits of a dynamic agriculture sector are to result in sustained improvements in the direct determinants of welfare—income, health, education, among others—it is necessary that women have an important role in determining how the fruits of their agricultural activities are used.

There is considerable empirical evidence of the importance of improving the status of women for improved general welfare. For example, in a broad cross-country analysis, Smith and others (2003) found that women's decision-making power relative to men's was significantly associated with improved nutritional status of their children. They conclude that sustainably improving nutritional status requires proactive efforts to improve the status of women, particularly in South Asia, but also in Sub-Saharan Africa. The authors suggest programs that will enable women to gain access to new resources and promote girls' education and health care, subsidize childcare for working parents, and improve the nutritional status of adolescent girls and young women.

Moreover, regarding agriculture in particular, an important dimension in the empowerment of rural women is alleviating the labor burdens they experience so that they can adequately provide for their children's needs. Domestic time demands upon women are greater than for men. Agricultural technology developed with close attention to alleviating some of the labor constraints experienced by rural women has the potential to improve not only the well-being of the woman farmer, but also of others in her household who are dependent upon her care.

MDG 4—REDUCE CHILD MORTALITY

The linkages between agriculture and child mortality are indirect but strong. Agriculture is a critical component in assuring food and nutrition security. As was described earlier, levels of child malnutrition are significantly higher in rural areas than in urban areas. It is estimated that 45–55 percent of all child deaths are due to malnutrition exacerbating the negative effects of disease on a child's health (Pelletier and others 1994). As a consequence of poor nutrition security in rural areas, mortality rates for children under five years of age are significantly higher among rural children than for their urban counterparts (figure 2.6). Poor nutrition secu-

Figure 2.6 Child Mortality by Urban or Rural Residence, Surveys Since 1999

Source: ORC/Macro, 2004. MEASURE DHS+ STATcompiler. <http://www.measuredhs.com>. Most recent survey. Accessed May 2004.

rity is poor food security coupled with poor access to quality health services, lower general knowledge of proper feeding and management of childhood illnesses, poor sanitation, and unprotected water sources.

A productive rural economy offering sufficient employment and rising wages is a necessary component in any effort to reliably and durably reduce the number of children dying in a rural community. Consumption poverty is an important part of the explanation for why child mortality rates are so high in many parts of the developing world. If efforts to attain MDG 1 by following a broad-based, agriculture-led strategy of economic growth bear fruit, we should see a parallel decline in child mortality rates.

However, poverty does not fully account for child mortality. Care is also a critical element in reducing child deaths. As women are the primary caregivers, MDG 3 is relevant here. Time and knowledge are both critical constraints in this regard. Women need to have the time and the knowledge to appropriately meet the survival needs of their children. Education, both the formal education sought through MDG 2 and informal education from peers and public health services, must be provided to a child's parents so parents can take appropriate action to assure the child's potential to live a healthy and active life.

The economy-wide effects of a dynamic agricultural sector can help reduce child mortality, because

more funding will be available for the public provision of medical care, health-care facilities, sanitation and clean water, and public health interventions. While one should not expect that agriculture-led economic growth necessarily will quickly provide economic surpluses that can be invested in this way, making the investments needed to reduce the number of children who suffer and die must be a priority as surpluses are generated in the economy.

MDG 5—IMPROVE MATERNAL HEALTH

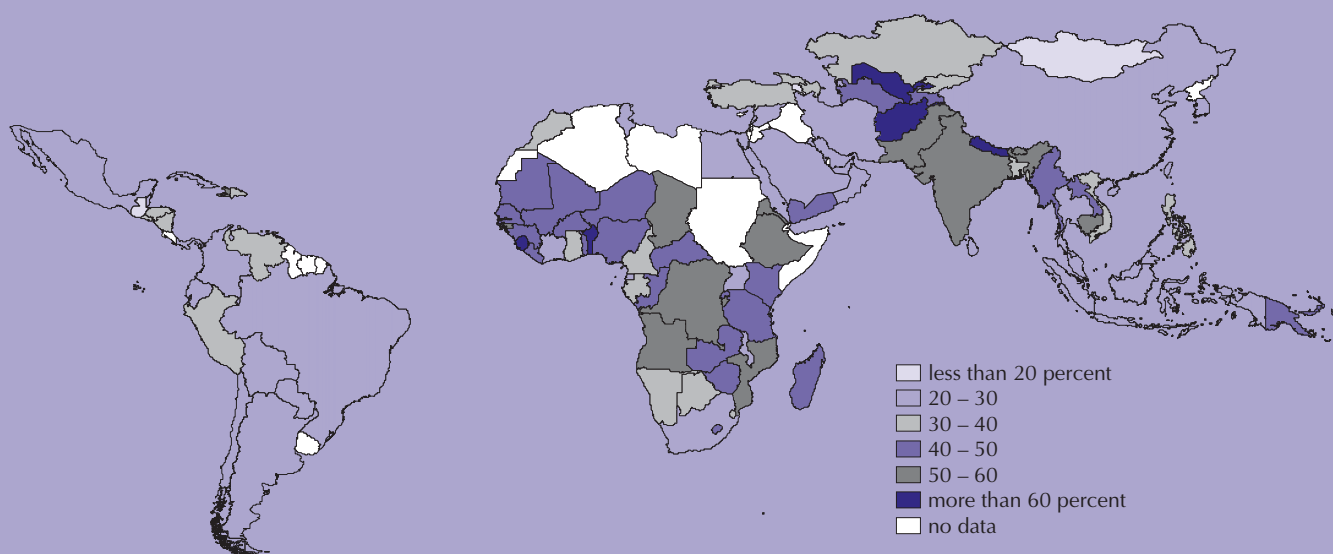
Agriculture can contribute to the goal of reducing maternal mortality in a way similar to its contribution to attaining the previous three goals. Insofar as agriculture can contribute to the economic empowerment of women and enable them to participate better in decision making in their households and communities, women will have greater ability to pay attention to their own physical well-being and have access to increased resources to assure their own good health.

Agriculture can contribute to improved maternal health in another way. For the most part, the quality of the food produced by farmers is assumed to be irrelevant to how agricultural activities affect

broad nutrition security. Yet, agriculture has considerable potential to directly improve maternal health by improving the diets of both rural and urban women, as well as the other household members for whom they are responsible. Micronutrient deficiencies are particularly severe among young children and women. Among women, the health effects of such deficiencies, particularly of dietary iron, are most pronounced during pregnancy, at birth, and in the months following birth. As shown in figure 2.7, the spatial pattern of the prevalence of iron deficiency anemia at the national level parallels similar patterns of poverty and malnutrition. It is estimated that more than 65,000 women die annually due to severe anemia.

By increasing the micronutrient content of food crops, deficiencies among women and children should decline, and maternal and child mortality rates drop. With this goal in mind, a global, interdisciplinary research program within the Consultative Group for International Agricultural Research seeks to increase the nutrient density of many global staple food crops, particularly by increasing the levels of bio-available iron, zinc, and vitamin A that the crops contain. Although this research effort is just beginning, if such traits can be bred into high-yielding varieties that enjoy wide consumer accept-

Figure 2.7 Estimated Prevalence of Iron Deficiency Anemia in Women Aged 15 to 49, Most Recent Estimates



Source: Micronutrient Initiative & UNICEF (2004).

ability, farmers would be able to offer a direct, low-cost, and sustainable way to improve the nutritional status of millions around the world and, in particular, improve maternal health.

MDG 6—COMBAT HIV/AIDS, MALARIA, AND OTHER DISEASES

Efforts made to reduce child and maternal mortality levels to which agriculture contributes will also contribute to effectively combating HIV/AIDS, malaria, and other diseases. Although the indicators for this goal deal very little with agriculture, and the direct links between agriculture and these health issues are not immediate, they are important nonetheless. For agricultural households, as for all households, the productivity of their economic activities is an important determinant of whether people live in an environment that allows them to enjoy a healthy and active life and can acquire the health care required to do so.

However, a newly dynamic agricultural sector also has the potential to radically alter the disease environment in a region. For example, wage-labor migration associated with agriculture may expose populations to new diseases, increasing the health burdens they bear. Changes in local water management for irrigation may alter local disease ecologies, particularly for malaria and water-borne diseases. New health challenges likely will emerge with an evolving agricultural sector. The resources of the agriculture sector, particularly in the public sphere through extension services, can be used in a coordinated fashion with those of the health sector to address such issues.

The agricultural sector has an important role in addressing the important challenge to human development of HIV. Of the 25 countries in the world with an adult HIV infection level above 5 percent in 2001, all except two have predominantly rural populations. The long and fatal pathway of chronic illness with HIV infection, particularly in young adults, severely compromises the welfare of farming households. Loss of labor power and farming knowledge, and increasing nutritional requirements as the disease progresses, are among the most salient effects within the household (AIARD 2003). Professional agriculturalists—researchers and extension workers in particular—must tailor their work to assist such households to better meet the particular farming challenges they face. Households that are able to modify their practices

appropriately to maintain sufficient levels of productivity in their agricultural activities will be better able to cope with the burdens of caring for HIV-positive members. Agricultural support service staff, working in close coordination with staff from the health and education sectors, have a role to play in stopping the transmission of HIV in farming communities. However, the challenges in accomplishing this are immense.

Moreover, the agricultural economy as a whole suffers from a heightened incidence of HIV infection. Declining aggregate agricultural productivity will result from insufficient labor as farmers and herders fall ill or must devote their time to household members who are ill. Savings will be depleted to meet increased health care costs and, consequently, needed inputs for profitable agricultural production will be inaccessible to many farming households. Any economic gains that might have been made by the sector will be negated. In a rural population ravaged by HIV, there is little scope for agriculture providing the lead in building strong economic growth. Although agricultural practices can be modified and support services provided to increase the resilience of farming households suffering from HIV/AIDS and strengthen households threatened by the disease, the scope of the epidemic is such that it poses a major threat to the already tenuous welfare of the poorest, most agriculturally dependent populations.

MDG 7—ENSURE ENVIRONMENTAL SUSTAINABILITY

This goal covers a broad sweep—biodiversity, critical natural habitats, energy use and global climate change, unsafe water and poor sanitation, and urban slums. Agriculture is implicated both as a means to effectively address many of these problems, and as a source of and a contributory factor to the problems that MDG 7 was formulated to address. It is unlikely that one can develop the agricultural sector in such a manner that only benefits and no negative externalities accrue. In this light, a judicious, comprehensive, and participatory assessment of the environmental costs and benefits must be undertaken in the planning process for any agricultural development efforts.

A productive agricultural sector will reduce pressure on and contribute to ensuring environmental

sustainability in most of the areas considered by MDG 7. In particular:

- Productive agriculture requires less land per unit yield, leaving marginal agricultural lands to other uses, including forests and other critical habitats.
- Proper agricultural policies will allow the full costs of agricultural technologies, including their costs for the environment, to be considered as they are being used. Policies that induce transparent assessment of these costs will, for example, reduce the scope for excessive nutrient runoff from agriculture, provide incentives for efficient energy and water use in the sector, and enable the ecologically sustainable use of a range of technologies, including pesticides and genetically modified organisms.
- As agriculture is inherently an organic, carbon-based enterprise, the sector is a potentially important component in any systems established to manage global carbon stocks.
- A dynamic agricultural sector fostering broad-based economic growth, as with any economic expansion, should provide additional public revenue to enable greater levels of public provision of safe drinking water and improved sanitation. Increasingly productive and profitable farmers in many developing countries will be able more and more to provide these amenities privately for their own households. Moreover, water infrastructure in agriculture, whether for irrigation or flood control, will also have important applications for the provision of safe water and adequate sanitation, particularly in small-scale agricultural systems.
- Population pressures in urban slums will be alleviated to a significant degree if profitable agricultural systems are developed in the rural hinterlands. Although broad agriculture-led economic growth should lead in time to a significant movement of workers out of rural, agricultural occupations and into the manufacturing and service sectors located predominantly in urban centers, such migration will be of a different quality than that most commonly seen at present. Today what is frequently observed is an unproductive agricultural sector that forces many farmers and herders to search for employment in urban centers that are only marginally more attractive in terms of economic opportunity. Moreover, enhanced

urban agriculture can contribute to the income growth and nutritional status of slum dwellers.

However, agriculture can also exacerbate environmental degradation, fuel perverse rural-to-urban migration, and deepen poverty. For example:

- Agricultural expansion is a principal factor contributing to tropical deforestation and increasing global levels of atmospheric carbon dioxide. The underlying causes for agricultural expansion are case dependent. Sometimes expansion arises from accelerated growth in the agricultural sector (capital-driven), and at other times from poverty as poor farmers seek land with which to meet their basic needs (Geist and Lambin 2002). Agriculture-led economic growth in itself is not environmentally benign.
- A stagnant agricultural sector with low productivity and profitability will result in the unsustainable use of natural resources for agriculture. Most commonly this is seen in the mining of soil fertility down to a base state in which cereal yields, even under suitable agro-climatological conditions and adequate labor inputs, attain only a few hundred kilograms per hectare. Such environmental exploitation in agriculture can take many other forms, affecting a broad range of the components of local ecosystems.
- Poverty can actually increase due to the expansion of the agricultural sector of the economy if the distribution of agricultural assets—land, in particular—is skewed. If agricultural expansion is accomplished in a manner in which capital substitutes for labor and little growth in employment occurs, aggregate welfare will be little improved. Moreover, further consolidation of land may occur, resulting in greater pressures on the rural poor to migrate to urban slums.

With appropriate regulatory institutions in place to safeguard the benefits that society as a whole draws from the environment, an emergent agricultural sector need not lead to environmental degradation. The underlying driving force for environmental degradation through agricultural expansion and the harmful use of farming technologies is frequently poverty, rather than factors inherent to agriculture itself. If farmers realize personal economic benefits and also recognize the

social benefits from environmental protection, they will respond to these incentives and employ environmentally sustainable production techniques. However, sustainable agricultural practices must be profitable for this to happen. Whether or not this is the case depends on the vibrancy of agriculture within the overall economy.

MDG 8—DEVELOP A GLOBAL PARTNERSHIP FOR DEVELOPMENT

Although extremely broad in scope, the final MDG has important implications for agriculture. There are several areas where agriculture can contribute to efforts aimed at achieving the targets set.

First, it is under this goal that an open, rule-based, predictable, nondiscriminatory trading and financial system is called for. Given the demonstrable centrality of the agricultural sector to people whose conditions of life must change if the MDGs are to be attained, agriculture should be among the focus sectors of initial efforts in this area. Global agricultural trade must be harmonized and rationalized in a manner that includes consideration of the special needs of poor agricultural producers and how they might derive maximum benefit from such trade.

However, even with attention to these important aspects, the poverty impact of globalized agricultural trade remains unclear. Such trade will often exclude the smallholder farmer and herder, as it requires knowledge, capital, and quality assurance levels, as well as access to marketing networks that most smallholder producers cannot attain on their own. Smallholders may be uncompetitive and unable to participate in many of the most profitable subsectors under a wholly free-trade system. Establishing appropriate institutions is necessary to enable broad welfare gains to be achieved through trade. These issues will be addressed further in chapter 4's discussion of trade and macroeconomic policies.

Second, the Heavily Indebted Poor Countries (HIPC) initiative contributes to the targets under this goal. Poverty Reduction Strategy Papers (PRSP) have been prepared by many of the HIPC countries to demonstrate to their development partners how the funds made available through debt relief would be used to reduce poverty. The PRSPs potentially are a very effective means by which progress can be made in achieving the MDGs. It is critical that the framework within which these PRSPs are devel-

oped provide due and relatively detailed attention to the economic foundation for most of the poor people at whom they are targeted—agriculture. Most current PRSPs highlight the need for broad-based economic growth, and such growth is typically one of the four or five “pillars” of most PRSPs. Moreover, agriculture is frequently noted as being the most important livelihood for the poor and is prioritized as a key economic sector.

However, the means by which agriculture will lead to broad-based economic growth is frequently left unspecified in the documents. Indeed, a key criticism of the implementation of the PRSPs has been that social expenditures tend to be given priority over the investments, particularly in the agricultural sector, that would accelerate economic growth (Gautam 2003). Given the MDG's strong social focus, they perversely provide additional justification for countries privileging social expenditures to the neglect of investments that would lead to sustainable pro-poor economic growth. A more balanced expenditure pattern is needed. In most HIPC countries that have prepared PRSPs, considerably more effort must go into framing the mechanisms by which agriculture will bring about the desired improvements in welfare. For example, Uganda has developed the relatively detailed Plan for Modernization of Agriculture (MAAIF & MFPED 2000) as the principal cross-sectoral economic development strategy emerging from the Poverty Eradication Action Plan (MFPED 2000), Uganda's Poverty Reduction Strategy Paper. Many more HIPC countries need to do likewise.

Measures are currently being undertaken to reorient the mechanisms for the delivery of bilateral and multilateral official development assistance to be consistent with efforts to achieve the MDGs. MDG 8 specifies several related to official development assistance. The sectoral allocation of such assistance is not specified in these targets. However, clearly this is not a tangential issue. If agriculture is to be effective in broadly improving the human condition, particularly that of rural residents, considerably greater levels of resources need to be made available to agricultural development. Currently, levels of assistance to agriculture, as well as budgetary allocations by governments themselves, are inadequate.

For example, the Comprehensive Africa Agriculture Development Programme strategy of the New Partnership for Africa's Development (NEPAD) proposes investments of \$251 billion over the period 2002 to 2015, or just under \$18 billion per

year, to reduce the incidence of hunger and raise farm output (NEPAD 2002). Such a budget faces some stark constraints. Notably, estimated total annual government expenditures on agriculture in Africa in the late 1990s were roughly \$6.2 billion (FAO 2001; World Bank 2003). Moreover, through the 1990s the major bilateral and multilateral donors annually committed globally only about \$8 billion to agriculture, broadly defined (FAO/IFAD/WFP 2002). The agricultural development needs of Africa alone cannot be met under current levels of official development assistance, and the human needs that could be met through agriculture extend much beyond Africa alone. If the poor of the world are primarily farmers and herders and we want to see sharp improvements in their well-being in the near term by 2015, then important gains can be made if we start with where they are currently

earning their livelihoods—in agriculture. Donor priorities should reflect this basic element of the global poverty profile.

Finally, the roots of deficient agricultural development found in so many poor countries often lies in power relationships in which the welfare of the population is not served, resulting in poor governance, political and social weakness, and adverse incentives. Although the agricultural sector is not blameless, such problems do not lie fundamentally within the agricultural sector, but are reflective of broader destructive processes within national political economies. The incentives for bringing about an active agricultural sector are not there because of these other problems. Little progress in attaining the Millennium Development Goals or in vitalizing agriculture can be anticipated in countries that are unable to confront these issues.

Table 2.1 Summary of Links Between the Agricultural Sector and the Millennium Development Goals, Principally at Household Level

Goal	Direct	Indirect	Nature of Relationship	Complementary Requirements
1. Eradicate extreme poverty and hunger.	<ul style="list-style-type: none"> Increased food production increased food consumption for subsistence farming households. More diverse food production higher-quality diets. <p>For farming households:</p> <ul style="list-style-type: none"> Increased production increased income through markets increased consumption and household assets. <p>For nonagricultural households:</p> <ul style="list-style-type: none"> Increased production reduced prices for agricultural products increased consumption or reduction in share of income spent on food. 	<ul style="list-style-type: none"> For both farming and nonfarming households, increased income increased capital investments in existing economic activities or diversification into other sectors enhanced welfare and increasing household economic resiliency. 	<ul style="list-style-type: none"> Two-way, quite strong, generally positive. Less hunger more productive workers in agriculture. Less poverty more investment in agriculture. 	<ul style="list-style-type: none"> Suitable agricultural production technologies available. Relatively equitable distribution of farmland across the population. Efficient, widespread rural markets that are linked to regional and international trade circuits. Knowledge on proper diet and nutritional care. Sanitation and health services available.

(continued)

Table 2.1 Summary of Links Between the Agricultural Sector and the Millennium Development Goals, Principally at Household Level (Continued)

Goal	Direct	Indirect	Nature of Relationship	Complementary Requirements
2. Achieve universal primary education.	<ul style="list-style-type: none"> • Few. 	<ul style="list-style-type: none"> • More dynamic agricultural sector will change assessments of the economic returns to educating one's children compared to returns of keeping children out of school to work in household agricultural enterprises. 	<ul style="list-style-type: none"> • Two-way, principally indirect. • Possibly some negative ramifications if increased returns from agriculture can be achieved using child labor or higher skills are not required. 	<ul style="list-style-type: none"> • Increased returns to skilled labor in agriculture. • Primary schools with adequate quality of instruction are accessible.
3. Promote gender equality and empower women.	<ul style="list-style-type: none"> • Increasingly profitable agriculture • potential to economically empower women farmers. 	<ul style="list-style-type: none"> • Broader economic improvements through dynamic agriculture • increased public expenditures on water and sanitation, health, energy sectors • reduced time burden on women for domestic tasks. 	<ul style="list-style-type: none"> • Two-way. • Increased willingness of women to invest in agriculture • more dynamic agricultural sector. • Possibly negative ramifications if more dynamic agricultural sector • increased male domination of agricultural activities. 	<ul style="list-style-type: none"> • Security of female access to agricultural resources. • Secure female control over own agricultural output.
4. Reduce child mortality.	<ul style="list-style-type: none"> • Few. 	<ul style="list-style-type: none"> • More diverse food production • better nutrition • increased child survival. • More dynamic agricultural sector • increased income • more resources available to manage childhood illnesses. 	<ul style="list-style-type: none"> • Principally one-way. 	<ul style="list-style-type: none"> • Knowledge of proper diet and nutritional care. • Accessible and effective health services.
5. Improve maternal health.	<ul style="list-style-type: none"> • More diverse food production • higher-quality diets • improved health. 	<ul style="list-style-type: none"> • Primarily through same mechanisms as MDG 3 on empowerment of women. 	<ul style="list-style-type: none"> • Two-way, but not strong. • Improved maternal health will result in more productive agricultural labor, both from women and from their children. 	<ul style="list-style-type: none"> • Degree of control women have over resources to assure their own health. • Availability of nutrient-dense food crops.

(continued)

Table 2.1 Summary of Links Between the Agricultural Sector and the Millennium Development Goals, Principally at Household Level (Continued)

Goal	Direct	Indirect	Nature of Relationship	Complementary Requirements
6. Combat HIV/AIDS, malaria, and other diseases.	<ul style="list-style-type: none"> • Greater and more diverse food production • higher-quality diets • improved health. 	<ul style="list-style-type: none"> • More dynamic agricultural sector • increased income • more resources to devote to health services. 	<ul style="list-style-type: none"> • Two-way, principally indirect. • Reduced health burden enables more productive agriculture. • Possible negative ramifications if agricultural investments or labor migration patterns exacerbate or extend diseases. 	<ul style="list-style-type: none"> • Effective health system, both curative and public health services. • Effective interventions to limit HIV infection. • Particularly for HIV infection in subsistence farming households, availability of nutritious food crops that are not labor-intensive.
7. Ensure environmental sustainability.	<ul style="list-style-type: none"> • Agriculture practices can be both direct causes of and important immediate solutions to environmental degradation. 	<ul style="list-style-type: none"> • More productive agricultural technologies • withdrawal of agriculture from marginal, sensitive environments. • More profitable agricultural sector • reduced migration to urban slums. 	<ul style="list-style-type: none"> • Two-way. Both direct and indirect. • Agricultural sector is as likely to have negative ramifications on the environment as positive. Unprofitable agricultural systems tend to unsustainably mine environmental resources. • Declining environmental resource base is an erosion of the foundation for the agricultural economy. 	<ul style="list-style-type: none"> • To minimize negative environmental externalities of agricultural investments, participatory planning processes required. • Relatively equitable distribution of agricultural assets across the population. • Environmental costs of agricultural production incorporated into economic assessments of production systems.
8. Develop a global partnership for development.	<ul style="list-style-type: none"> • Expanding global agriculture trade increases need for formal trading partnerships and rules. • Capital requirements for comprehensive agricultural development • Significant increases in development assistance offered to the agriculture sector. 	<ul style="list-style-type: none"> • More profitable agricultural sector • expectation of better governance and provision of public goods by governments to sustain the benefits from agriculture in the long term. 	<ul style="list-style-type: none"> • Two-way, but principally toward agriculture. Primarily direct. • Globalization is as likely to have negative as positive ramifications on agricultural producers, particularly small-scale subsistence farmers, in the short term. 	<ul style="list-style-type: none"> • Sufficient knowledge, capital, and access to markets to enable agricultural producers to engage in regional and global trade.

Alternative Scenarios to 2015

Prospect and Policies for Meeting the MDGs on Poverty

If Sub-Saharan Africa follows current trends, it will be the only developing region where the number of poor people actually increases from the 1990 level.

COUNTRY-LEVEL ASSESSMENT OF SELECTED MDGS: ETHIOPIA AND ZAMBIA

Compared with other regions of the developing world, Sub-Saharan Africa faces a huge challenge in terms of meeting the two targets constituting the first MDG—halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day and halve, between 1990 and 2015, the proportion of people who suffer from hunger.

Indeed, as of 2001, approximately 46.5 percent of the inhabitants of Sub-Saharan Africa, or 314 million people, were living below the international poverty line (World Bank 2004b). If the region follows current trends, 39.3 percent of the population will remain below this line by 2015, and Sub-Saharan Africa will be the only developing region where the number of poor people actually increases from the 1990 level (AfDB/OECD 2002; UNDP/UNICEF 2002).

Poverty both contributes to and is reinforced by hunger and malnutrition. During the last decade, the percentage of undernourished people in Sub-Saharan Africa decreased only marginally, from 35 to 33 percent, while the number of undernourished people increased from 166 million to 198 million. At the same time, the average per-capita energy intake only increased by 100 calories and actually fell in some countries. Children are particularly vulnerable to the effects of hunger. During the 1990s, the proportion of children under five years of age who were underweight remained relatively stagnant, averaging about one-third, while the number of underweight children actually increased by 8 million (UNDP/UNICEF 2002). The extent of child stunting (proportion of children with height for age under 2 standard deviations from the reference population median) is even higher, affecting approximately 41 percent of preschool children in Sub-Saharan Africa (UNICEF 2004).

Agricultural growth is often identified as a means for ameliorating Sub-Saharan Africa's hunger and poverty. Indeed, agriculture is the primary livelihood of approximately 65 percent of people in the region, represents between 30 and 40 percent of the region's GDP, and accounts for almost 60 percent of its income from exports (IFAD 2003). Increased growth of the agricultural sector offers direct benefits to poor farmers, such as income and food, contributes to broader food security objectives, and helps establish forward linkages with higher value-added industries.

Nevertheless, the ability of the agricultural sector to contribute significantly to the MDGs in Sub-Saharan Africa will vary according to the constraints and opportunities prevailing within each country. This chapter focuses on the level and type of agricultural growth required in two countries of the region that are currently far from achieving the MDGs: Ethiopia and Zambia. As shown in table 3.1, the percentage of the population living below the international poverty line of \$1 a day is higher in both countries than for Sub-Saharan Africa as a whole.

Compared to Ghana and Uganda, progress at reducing poverty in Ethiopia and Zambia has been relatively slow over the last decade. In Zambia, the most recent household survey (1998) shows a 6 percent increase in the national poverty rate since 1991. In Ethiopia, the poverty rate declined from 51 percent in 1993 to 44 percent in 2000, but most

of the decline occurred in the early period and the poverty rate only changed 1 percent between 1996 and 2000. Table 3.2 shows the U.S. dollar conversion of the national poverty lines on which these poverty rates are based and highlights that Ethiopia's poor live on less than \$85 a year.

Economic and demographic indicators, along with broad growth trends averaged over the period from 1991 to 2001, further elucidate the similarities and differences between the two countries. In U.S. dollar terms, Zambia's per-capita income is almost triple that of Ethiopia and lies between the average for Ghana and Uganda. This is predominantly due to the higher urbanization rates in Zambia compared with Ethiopia and the higher incomes in these urban areas. However, once per-capita incomes are adjusted to purchasing power parity (PPP), both Zambia and Ethiopia are far below the average in the region (table 3.3). In Ethiopia, agricultural

Table 3.1 Comparison of Poverty Across Selected African Countries

	Trends in national poverty rates (survey year in parentheses)			Rural poverty rate	Urban poverty rate	Population under \$1 US/day
Ethiopia	51.1 ^a (1992/93)	45.5 (1995/96)	44.2 ^b (1999/00)	45.4 ^b (1999/00)	36.9 ^b (1999/00)	81.9 ^c (1999/00)
Zambia	68.9 ^d (1991)	79.4 ^d (1996)	75.4 ^d (1998)	85.6 ^d (1998)	58.3 ^d (1998)	63.7 ^c (1998)
Ghana	51.7 ^e (1991/92)		39.5 ^e (1998/99)	49.9 ^e (1998/99)	18.6 ^e (1998/99)	44.8 ^e (1999)
Uganda	56.0 ^f (1992)	44.0 ^f (1997)	35.0 ^f (1999/00)	39.0 ^f (1999/00)	10.0 ^f (1999/00)	n.a.
Africa						49.0 ^g (2000)

Sources: ^aMOPED (1994); ^bMOFED (2002); ^cWorld Bank, World Development Indicators (2003); ^dThurlow and Wobst (2004); ^ePRSP for Ghana (2003); ^fPRSP for Uganda (2003); and ^gUN Millennium Development Goals Database.
n.a. = Not applicable.

Table 3.2 Poverty Lines in the Country Case Studies

Country	Annual poverty line		Survey year	Type of poverty line
	Local currency	U.S. dollars ^a		
Ethiopia ^b	Br 696	84.65	1999–00	absolute
Zambia ^c	K 555,432	298.28	1998	basic needs

Sources: ^aConversions calculated from exchange rates given in the IMF's International Financial Statistics Database; ^bMOFED (2002); ^cThurlow and Wobst (2004).

Table 3.3 Economic and Demographic Indicators, 2001

	GDP per capita (US\$)	GDP PPP per capita (US\$)	Agricultural GDP per capita (US\$)	Total population (millions)	Rural population (millions)	Agricultural share of GDP (%)
Ethiopia	121	810	63.21	65.8	55.4	52
Zambia	405	780	94.71	10.3	6.2	22
Ghana	421	2250	253.41	19.7	12.5	35
Uganda	355	1490	167.79	22.8	19.5	37
Africa	567	1826	166.21	673.9	403.7	33 ^a

Source: World Bank (2003).

Notes: ^aExcludes South Africa.

growth is lower than the country's population growth, which is worrisome considering that agriculture constitutes 50 percent of Ethiopia's GDP and provides the livelihood for approximately 85 percent of its population. By contrast, agriculture provides only around 22 percent of GDP in Zambia, much lower than the African average. This is because the now faltering copper industry has traditionally dominated the economy. Although agricultural growth has, on average, outstripped Zambia's population growth, total economic growth has not (table 3.4).

The unique challenges facing Ethiopia and Zambia partially explain these trends. Since the early 1990s, both countries have been engaged in a process of economic liberalization. In Ethiopia, the government has been trying to transform the country from a centrally planned to a market economy and remains committed to maintaining macroeconomic stability. Nonetheless, the country's growth

has been hindered by a number of factors, including protracted conflict with neighboring Eritrea, declining world prices for its coffee exports, and the country's vulnerability to natural disasters, particularly droughts (AfDB/OECD 2002). Due to the prevalence of droughts, Ethiopia remains Africa's largest recipient of cereal food aid, which equaled approximately 1.2 million tons in 2002. The effects of food insecurity are particularly acute for children, as Ethiopia has Africa's highest rate of children who are underweight and the second highest rate of child stunting after Burundi.

In Zambia, a series of structural adjustment programs have been adopted that emphasize, among other things, privatization of the copper mines, trade liberalization, and agricultural reforms. However, because of the inadequate design and piecemeal implementation of many of these reforms, coupled with a sizable external debt burden, growth has not improved. In fact, the bias against

Table 3.4 Average Trends Across Countries, 1991–2001 Averages

	Average annual growth rate (%)		
	GDP	Agricultural GDP	Population
Ethiopia	5.28	2.31	2.47
Zambia	1.18	5.27	2.45
Ghana	4.27	3.36	2.18
Uganda	6.55	3.82	3.00
Africa	3.00	3.00	2.00

Source: World Bank (2003).

agriculture created by the mining sector is still prevalent, and insufficient input and output markets have circumscribed farmers' ability to improve production. Like Ethiopia, agricultural production in Zambia is also hampered by insufficient and unevenly distributed rainfall. Similar to many of its Southern African neighbors, the HIV/AIDS pandemic, which affects approximately 23 percent of the population, has severely diminished labor productivity and placed even greater pressure on food security. A combination of all of these factors has contributed to a deterioration in per-capita cereal production (table 3.5), culminating in 2002–03 in a major food crisis that caused an estimated 2.3 million people to require humanitarian assistance (Samatebele 2003).

Clearly, addressing the problems of hunger and poverty deserves priority in both countries. Results from the scenarios of economy-wide models, which are discussed in detail reveal that neither country will be able to meet the MDGs if they continue along their current growth trajectories. Improved performance in the agricultural sector will be crucial for substantial hunger and poverty reduction to occur, and fortunately each country's government is promoting development strategies targeted at enhancing the sector's growth. As the scenarios highlight, Ethiopia has the potential to meet the MDGs through combined growth in the staples, livestock, and nontraditional export sectors *if* there are concurrent improvements in the transport sector and further market development. Halving poverty in Zambia by 2015 will be more challenging to achieve. Nonetheless, agricultural growth is a necessary condition for poverty reduction in rural areas. As in Ethiopia, attention to market access issues in Zambia, particularly through

the construction of more roads, will be essential for growth in these areas to materialize.

Ethiopia: Agriculture-Led Growth and Poverty Reduction

With a per-capita income that is only one-fifth of the African average, Ethiopia classifies as one of the world's poorest countries. In addition to daunting poverty, persistent food crises have left a large portion of the population suffering from food insecurity. Despite significant amounts of food-aid assistance over recent years, there has been little progress at reducing this food insecurity.

Ethiopia's current circumstances reflect the cumulative challenges faced by the country over the past decades. In particular, the country is extremely vulnerable to drought and since the early 1980s, has experienced seven major droughts, five of which resulted in famines. The most recent drought, which occurred in 2002–03, affected approximately 30 million people (EM-DAT 2004).

In addition to climatic factors, the country has suffered under the misguided economic policies of the socialist Dergue regime, which ruled from 1974 to 1991. When the Ethiopia Peoples' Revolutionary Democratic Front (EPRDF) replaced the Dergue in 1991, a number of market-oriented reforms were implemented, including those aimed at stimulating agricultural and rural growth (World Bank 2004d). For example, the country liberalized its foreign exchange markets and dramatically decentralized the public administration to the *woreda* (district) level. In rural areas, grain markets were liberalized and fertilizer markets were opened up to participation from the private sector. In 1992, the EPRDF also established the Agricultural Development

Table 3.5 Cereal Production in Selected African Countries

	Production (kg per capita per year)				
	1991	1994	1997	2000	2001
Ethiopia	99.55	86.69	143.83	112.94	132.02
Zambia	138.48	123.30	109.24	94.38	65.72
Ghana	83.29	85.33	83.90	80.38	74.88
Uganda	84.61	94.26	72.19	86.27	91.92
Africa	130.65	135.17	127.11	120.94	118.50

Source: Calculated from FAOSTAT (FAO 1998) and *World Development Indicators* data (World Bank 2003).

Led Industrialization Strategy, which emphasizes the role of the agricultural sector as a catalyst for immediate improvements in food security and for long-term growth in the broader economy.

However, the outbreak of conflict with Eritrea between 1998 and 2000 created a humanitarian emergency in the northern part of the country and reduced the availability of resources to finance many of these reforms. Not only did donors and investors reduce their support to the country, but also increases in official defense expenditures decreased the availability of funds for other sectors as well as for antipoverty programs (World Bank 2004d).

With the return to peace, the government has reaffirmed its commitment to generating growth and reducing poverty, especially through a strong focus on the agricultural and rural sector. Since more than 85 percent of the country's population lives in rural areas where agriculture is the main economic activity and where the poverty ratio is significantly high, and since the nonagricultural sector is extremely small in Ethiopia, any strategy for slashing poverty and hunger has to focus on generating rapid growth in the agricultural sector. To this end, the Ethiopian government has not only continued to support the Agricultural Development Led Industrialization Strategy but has also launched a series of development and poverty reduction programs, such as the Sustainable Development and Poverty Reduction Program in 2001 and the Food Security Program in 2004. Agricultural growth, food security, and accelerated rural development are the cornerstones for all these programs.

To identify which investments can have the largest impact on agricultural growth and in turn drive broader growth and poverty reduction, a greater understanding is needed of the linkages between agriculture, growth, and poverty reduction. To this end, researchers at the International Food Policy Research Institute have developed a spatially disaggregated, economy-wide model for Ethiopia based on recent national household surveys, agricultural sample surveys, global information system data, and other national and regional data. The model analyzes the growth and poverty reduction linkages at both national and regional levels. The study shows that broad-based growth in agriculture is the key for Ethiopia's success in meeting the objective of halving poverty. Within the agricultural sector, growth in cereals and other staple crops should receive priority, given their

superior role in reducing poverty. The study shows that increasing national staple food availability by 50 percent by 2015 will significantly help poverty reduction. The feasibility of achieving this goal relies on reducing the productivity gap between traditional and modern technologies that have been adopted in the country. Achieving sustainable agricultural growth in Ethiopia also requires supporting investments in roads and other market conditions.

In addition, the study emphasizes the need for regionally differentiated strategies, given the country's size as well as heterogeneous conditions in both natural resource and economic environments. Indeed, more than 50 percent of the poor live in the food deficit area, where the availability of food staples per household is half the national average. The poverty and food security challenge is huge in such areas. On the other hand, more than 50 percent of food staples are currently provided from food surplus areas where food staples availability per household is already 70 percent higher than the national average. In these food surplus areas, there is a need for greater diversification in agricultural production. Consequently, market access and market development should be an integral part of a national agricultural development strategy.

The current growth path results in more poverty

In order to first demonstrate the necessity for increased agricultural growth, the International Food Policy Research Institute's model simulates the impact on poverty if Ethiopia continues along its current growth trajectory. Between 1995 and 2002, about 90 percent of increases in total crop production and 70 percent of increases in cereal production were due to area expansion. The annual growth rate of cereal production was about 2 percent, lower than the 2.5 percent population growth rate. The productivity growth rate (yield) for total crops and cereals was also low, about 0.2 and 0.6 percent per year, respectively. If the crop area expansion and growth in yields continue according to their current trends for the next 12 years, together with the growth trends in livestock production (4.2 percent per year) and non-agriculture (4.6 percent), a business-as-usual scenario shows that in the next 12 years the national economy (GDP) and the agricultural sector grow at 3.2 and 2.5 percent annually, respectively. Since agriculture, especially cereal production, will grow either close to or more

slowly than the population growth, the national poverty rate will keep at its high current level of 45.7 percent by 2015. With a 2.5 percent population growth rate, the number of the poor living under the current poverty line will increase to 40 million by 2015, equivalent to 10 million more than today's number. Increases among the poor will mainly come from the food deficit area, where the current poverty ratio is already very high. The majority of Ethiopians will still be struggling to meet their basic food needs, especially since average daily per-capita caloric intake will be even lower than its current level.

Growth in staples is the most important for poverty reduction

Cereals and other staple crops account for 65 percent of agricultural value-added, and the majority of small farmers are producers of staple crops. Thus, this sector should have the potential to substantially alleviate poverty. The model simulations show that if the average yield of staple crops grows by an additional 1.5 percent from its current rate of 0.6 percent to 2.1 percent annually, and is combined with the 1.3 percent expansion in crop area assumed in the business-as-usual scenario, cereal production can grow at 3.4 percent per year. By taking into account the demand-supply, agricultural-nonagricultural, and cross-sectoral linkages in agriculture, such a growth rate in staple crops (combined with the base-run growth trends in the other sectors) results in an annual GDP and agricultural GDP growth rate of 3.9 and 3.5 percent,

respectively, compared with 3.1 and 2.5 percent, respectively, in the baseline scenario.

More importantly, this staple-crops scenario contributes more toward poverty reduction than the other agricultural subsectors or the nonagricultural sector, even though these other sectors may have a similar impact on the growth of the overall economy (table 3.6). Growth in staple crops also benefits consumers, as staples are the most important sources of food energy for poor rural and urban consumers alike. The national household survey data indicates that the rural poor, whose income is already below the poverty line, spend about 70 percent of their total income on staple-crop food, which is 30 percent higher than the rural average. In the urban areas, households with incomes below the poverty line spend almost 50 percent of their incomes on staple-crop foods, which is 65 percent higher than the urban average. Thus, raising productivity in staple crops will increase the food supply, lower food prices, and help reduce the poverty rate in the urban and rural areas.

However, it needs to be highlighted that increased staple production often exceeds farmers' own consumption. Hence, expanding markets for these commodities is a necessary condition for farmers to benefit from growth. Moreover, to improve crop yield, farmers need to increase the use of modern inputs, which are purchased from markets. Development of input and output markets can strongly support the growth of agricultural production. If marketed staple crops increase too rapidly in the absence of market development, prices for these crops can be significantly depressed, nega-

Table 3.6 Growth and Poverty Reduction Under Agricultural Growth Options

Scenarios	Add. growth rate ^a	Agric. share (2002)	Annual growth rate			Poverty rate (2015)		
			GDP	Agric.	Nonagric.	All	Rural	Urban
Initial value						44.4	45.7	36.9
1. Current growth			3.1	2.5	3.7	45.7	48.0	33.0
Additional growth								
2. Staple crops	1.5	65.0	3.9	3.5	4.3	36.7	37.7	31.0
3. Livestock	3.6	26.0	3.9	3.5	4.2	40.0	42.0	26.8
4. Nontraditional	8.7	4.8	3.6	3.4	3.8	40.2	41.4	33.7
5. Three sectors	(2 to 4)		5.1	5.3	4.9	27.5	27.8	25.6
6. Market investment	(2 to 4)		5.8	5.4	6.1	24.4	25.0	21.2

Source: Results from Ethiopian multimarket model.

^aAdditional annual percentage yield or productivity growth rate in the relevant agricultural sectors.

tively affecting farmers if declines in prices are larger than increases in marketed products. It is important to realize such risks, and hence to gradually rather than abruptly increase production in order to avoid overwhelming the market.

After staple crops, the livestock sector is the country's second largest agricultural sector. The historical growth rate of 4.8 percent (1995–2002) in the livestock sector is higher than the growth rate in staple crops or in agriculture in total, implying that the sector has a strong growth potential. The “livestock growth” scenario simulates an additional 3.5 percent annual growth rate in the livestock sector, which raises the annual growth rate in the livestock sector to a total of 8.3 percent. Holding the growth rate in the other agricultural and nonagricultural sectors the same as in the baseline scenario, this simulation shows that growth in the livestock sector has the most significant effect on overall economic growth, causing GDP and agricultural GDP to grow at 3.9 and 3.5 percent per year, respectively. However, an 8.3 percent annual growth rate in the livestock sector has a relatively smaller poverty alleviation effect than a 3.4 percent annual growth rate in the staple crops. Although the urban poor benefit more, the rural poverty rate falls to 42 percent by 2015 in this scenario as opposed to the 36.7 percent achieved in the “staples growth” scenario.

While livestock is a relatively large agricultural sector in the economy, it accounts for a relatively small share of income for poor farmers. On the consumption side, poor consumers in both the rural and urban areas consume fewer livestock products. Calculated from the household survey data, the rural households living under the poverty line spend less than 4 percent of their incomes on livestock and dairy products, which is 40 percent lower than that for an average rural household. Thus, while increased livestock production depresses prices in domestic markets, farmers do not experience the same level of benefits that they do in the staples scenario.

The nontraditional-export sector, which includes exportable vegetables, fruits, other horticultural products, chat, cotton, sugar, and sesame seed, currently accounts for 5 percent of agricultural GDP. An additional 8.7 percent annual growth rate in the sector's productivity is equivalent to the 1.5 percent growth rate in staple crops or the 3.5 percent growth rate in livestock described in the two preceding scenarios. Nonetheless, growth in some

nontraditional exportable products has been very rapid in recent years, indicating that it is a booming sector in the economy. Therefore, a much more rapid growth rate of 13.3 percent is simulated for the sector in the “nontraditional growth” scenario. To support such production growth, nontraditional exports have to grow at 29 percent annually. This expansion of nontraditional exports can result in an overall economic growth rate of 3.6 percent and an agricultural growth rate of 3.4 percent, which is comparable to the projected annual growth rate under the “staple crops” scenario.

However, the nontraditional export sector's contribution to poverty reduction is relatively small. In fact, the rural poverty rate falls to 41.1 percent, only 4.6 percentage points below the current level. This is because nontraditional export growth is often concentrated around cities where there is greater access to transportation and other market facilities. Given the technical and financial constraints that they face, the majority of poor, rural farmers are unable to adopt the technology required for producing nontraditional crops.

On the demand side, increased production of nontraditional goods provides few benefits to poor consumers in both rural and urban areas, especially since such products are often intended for export markets. The greatest constraint to growth in such a sector is inadequate market access. Rapid growth in the nontraditional-export sector requires a timely expansion of markets for such commodities. Indeed, achieving the projected annual growth rate of 13.3 percent in the production of nontraditional exports is unlikely without huge investments in infrastructure and other market conditions. For this reason, this discussion regarding the sector's contribution to the overall economy and to poverty reduction may actually be too optimistic.

By focusing on individual agricultural subsectors, the preceding analysis emphasizes that growth options among different agricultural subsectors have different effects on poverty reduction. Obviously, growth in any single subsector alone cannot help the country meet the MDGs. Admittedly, growth in staple crops is critical for poverty reduction, but it needs to be supported by growth in other subsectors. Growth in staple crops and nontraditional exports can increase domestic demand for livestock products, which helps stabilize the livestock prices and raise livestock farmers' incomes. Similarly, growth in the livestock sector generates feed demand. Increased income from

growth in livestock and nontraditional exports can help stabilize the prices for food crops. Combining the growth rate in the three major agricultural sub-sectors results in a 5.3 percent annual growth rate for agriculture. Such a diversified agricultural growth strategy will significantly reduce poverty, causing the poverty rate to fall by 17 percentage points to 27.5 percent by 2015.

Assessing investment options

Achieving the requisite growth rates examined in these scenarios requires increased public investments. Various public investments, such as agricultural research and development, extension, irrigation, and other infrastructure, can directly improve agricultural productivity, raise farmer incomes, and reduce poverty. Although all of these investments are needed, each investment can have a differential impact on agricultural growth and poverty reduction. Given limited government budgets and international donor funds, as well as the extremely broad areas in which public investments are needed, priority matters in planning investment strategies. Accordingly, a broad analysis of investment strategies will be helpful in identifying which kinds of investments can bring pro-poor agricultural growth to the country.

Irrigation. We examine irrigation investments first because increased irrigation is important for reducing climate risk, which is one of the greatest constraints to agricultural growth in Ethiopia. Moreover, reducing climate risk helps induce the use of modern inputs, such as fertilizers and improved seeds, which can further increase agricultural productivity. Currently, there are about 200,000 hectares of irrigated area in the country, accounting for slightly more than 2 percent of total crop areas. Among the 200,000 hectares of irrigated land, 60 percent is dedicated to cereal production. According to the Agricultural Sample Survey data of 1997 and 2000, the yield gap between irrigation and rainfed crop production is 40 percent; that is, on average, irrigation can increase cereal yield up to 40 percent. Obviously, significantly increasing irrigation area can stimulate growth in cereal production. However, as irrigation currently accounts for less than 2 percent of total cereal production and slightly more than 2 percent of other crop production, it is unrealistic to expect that investment in irrigation alone can generate the growth rate

we analyzed above. Moreover, many researchers have shown strong diminishing returns in the large-scale irrigation investment, which implies that caution is needed in promoting large irrigation investment projects (Fan and Hazell 2001).

We simulate an increase in irrigation area according to the country's irrigation development program drawn from the country's Water Sector Development Plan (Ministry of Agriculture and Rural Development 2005). The model simulates an increase in irrigated land according to the plans and shows that even by doubling irrigated cereal areas by 2015, irrigation will only account for 3 percent of total cereal production. As a result, the average growth rate of cereal output will increase modestly, from 2.2 percent in the baseline scenario to 2.4 percent in the irrigation scenario, which is equivalent to about 0.2 percent of additional annual growth. Irrigated cash crop areas will triple by 2015, and will account for 5 percent of total cash crop areas, compared with the current 2 percent. This will benefit exports. For example, horticultural exports will increase by four-fold by 2015. A similar effect is also observed for coffee exports. Because the medium- and long-term projects are completed only toward the end of the period analyzed, the potential returns from the newly irrigated areas are not fully captured in the simulation.

Although irrigation has the potential to raise crop productivity, the ability of increased output, especially in the export sector, to reach international markets depends on simultaneously improving the underlying market conditions. The gains we analyzed here should not be understood as solely from investments in irrigation. Without investments in markets, national prices for increased output might decline, which may reduce the realized gains from the investment in irrigation.

With growth in both staple and cash crops due to doubled irrigation area, together with cross-sectoral linkage effects, the annual growth rate for GDP and agricultural GDP rises to 3.6 and 3.0 percent, respectively, from 3.1 and 2.5 percent in the baseline. The national poverty rate falls to 39.4 percent from its current 44.4 percent. While irrigation has a modest effect on national poverty reduction, its effect on the food staples deficit area is significant. Since projected increases in irrigated land are mainly located in the food staples deficit area, the rural poverty rate in the area falls to 51.5 percent by 2015 from its current 58.4 percent. There is a much smaller effect on poverty reduction in the food surplus areas due to a smaller increase in irrigated land in the area.

Adoption of improved seed and greater efficiency in fertilizer use. Compared with the international standard, the current yield level of crop production, especially for grains, is quite low in Ethiopia. Both the low utilization and low efficiency of modern inputs can partially explain such low yield levels. However, there are many factors restraining the dissemination of modern inputs. Survey data show that while fertilizer has been used on about 40 percent of the grain area nationwide, only a small portion of it is combined with the use of other inputs, especially with improved seed. As a result, the average yield gap in grain production due to fertilizer use is quite small. Yet, there are significant gains from combining fertilizer use with improved seeds in grain production, especially in maize production.

Thus, the model simulates a situation in which the technology combining improved seeds with fertilizer is expanded to all of the cereal area that is currently fertilized. At the same time, we increase the efficiency of fertilizer use by 50 percent over 12 years. This technology results in an additional annual growth rate of 0.9 percent for cereal production. As a result, the rural poverty rate falls to 40.3 percent by 2015, which is 4 percentage points lower than the current rate.

Increased irrigation combined with the adoption of modern seed and improved efficiency in fertilizer use. Since the returns to technology adoption are low if modern inputs are used in isolation and not supplemented by other technologies, modern technology needs to be disseminated in a package. Thus, we simulate a situation in which the adoption of modern seed varieties is combined with improvements in the efficiency of fertilizer use and combined with the expansion of irrigated area. By simultaneously investing in the three areas, the annual growth rate of cereal production rises to 3 percent, resulting in an annual growth rate of 3.8 and 3.4 percent for GDP and agricultural GDP, respectively. Growth in the cereal sector, combined with increased cash crop production from irrigation projects, helps the poverty rate fall to 37 percent, which is 7.4 percent lower than its current level and in line with the simulation result that analyzed the “staple crop growth” scenario.

The above analysis shows that through technology adoption and dissemination, combined with increases in irrigation area, it is possible to have a more than 3 percent annual growth rate in staple

crops. Although meeting the objective of halving poverty requires more than improving staple crops’ productivity, growth in the staple food sectors is obviously a necessary condition for any significant reduction in poverty. Exploiting the growth potential of staple crops from dissemination of modern technology requires not only investment but also changes in farm management and a transition from current farming traditions to more modern farming systems.

Combined with infrastructure investments that reduce marketing costs, the agriculture-led growth strategy has the potential to meet the MDG of halving poverty by 2015. An agriculture-led growth strategy does not imply that investments should only be in agriculture. Many studies have shown that poor infrastructure and dysfunctional markets prevent farmers from accessing markets and hence diminish agriculture’s profitability. It is important to remember that institutional barriers also constrain farmers from becoming actively involved in market activities and that market development does not solely imply infrastructure investment. Nonetheless, in this section we focus specifically on investments in roads and other infrastructure that could reduce the transportation costs of agricultural trade and improve market access for farmers.

The Ethiopian road density is 27 kilometers per 1,000 square kilometers, which is only half of the average for Africa. Seventy percent of farmers are reported to be more than half a day’s walk from an all-weather road (MOFED 2002). Such poor market access conditions and high transportation costs significantly increase the price gap received by farmers and paid by consumers. The average grain price gap is estimated to be about 30 to 70 percent across regions, and domestic marketing costs often account for more than 50 percent of fertilizer prices paid by farmers. These costs significantly reduce farmers’ profitability from increased production.

To address the constraints in the road sector, the Government of Ethiopia formulated a two-phase road sector development program (Ministry of Agriculture and Rural Development 2005). Under the first phase, which was completed in 2002, the focus was on the rehabilitation of the core networks. Substantial progress was achieved in reopening nearly all of the classified roads, accessibility was improved, and the percentage of roads in good condition also increased. The second phase of the program involves the rehabilitation of

1,168 kilometers, the upgrading of 2,045 kilometers, and the construction of 8,383 kilometers of roads.

Improving the road network also includes road maintenance. For example, the removal of rainwater from the surface of the road as well as from the adjacent ground is crucial in Ethiopia because most of the roads (about 90 percent) are gravel and earth. Rainwater can wash away the road surfacing construction, creating a significant inconvenience for vehicles and travelers. Because of poor maintenance, many existing roads have become impassable during the rainy season and even in the dry season.

Lack of market infrastructure also constrains the market accessibility of small farmers. For instance, lack of storage and marketing facilities and less developed formal trading systems significantly increase farmers' transaction costs and force many smallholders back to the subsistence mode of farming.

While it is known that the cost of building and maintaining roads is high in Ethiopia because of the rugged topography and torrential tropical rains, there is no approximate cost information for such investments. Consequently, we have to make two main assumptions before conducting the simulation. First, investment is modeled as a lowering of the marketing margins between food staples surplus and deficit areas. We assume that the market prices across zones will converge due to improved transportation and market conditions, and the price gap between surplus and deficit areas will be 70 percent lower by 2015 than its current level. We further assume that lowered marketing costs are due to the improvement in the service sector's productivity, and by 2015 the productivity in the service sector will be 20 percent higher than the level in the baseline's 2015, which is equivalent to an annual growth rate of 1.5 percent.

Once growth in the agricultural sectors is combined with improved marketing margins, the cross-sectoral linkage effects cause the growth rates of GDP and agricultural GDP to increase to 5.8 and 5.4 percent, respectively. Improving marketing conditions makes the terms of trade favorable to agriculture. Specifically, reducing marketing costs mainly benefits smallholders through increased prices they receive for their goods, which enables them to increase their income from producing the same amount of output. Due to such strong, cross-sectoral linkages and positive price effects, the

poverty rate is significantly lowered, and the country will be quite close to meeting the objective of halving the poverty rate by 2015. In fact, the national poverty rate falls to 24.4 percent by 2015.

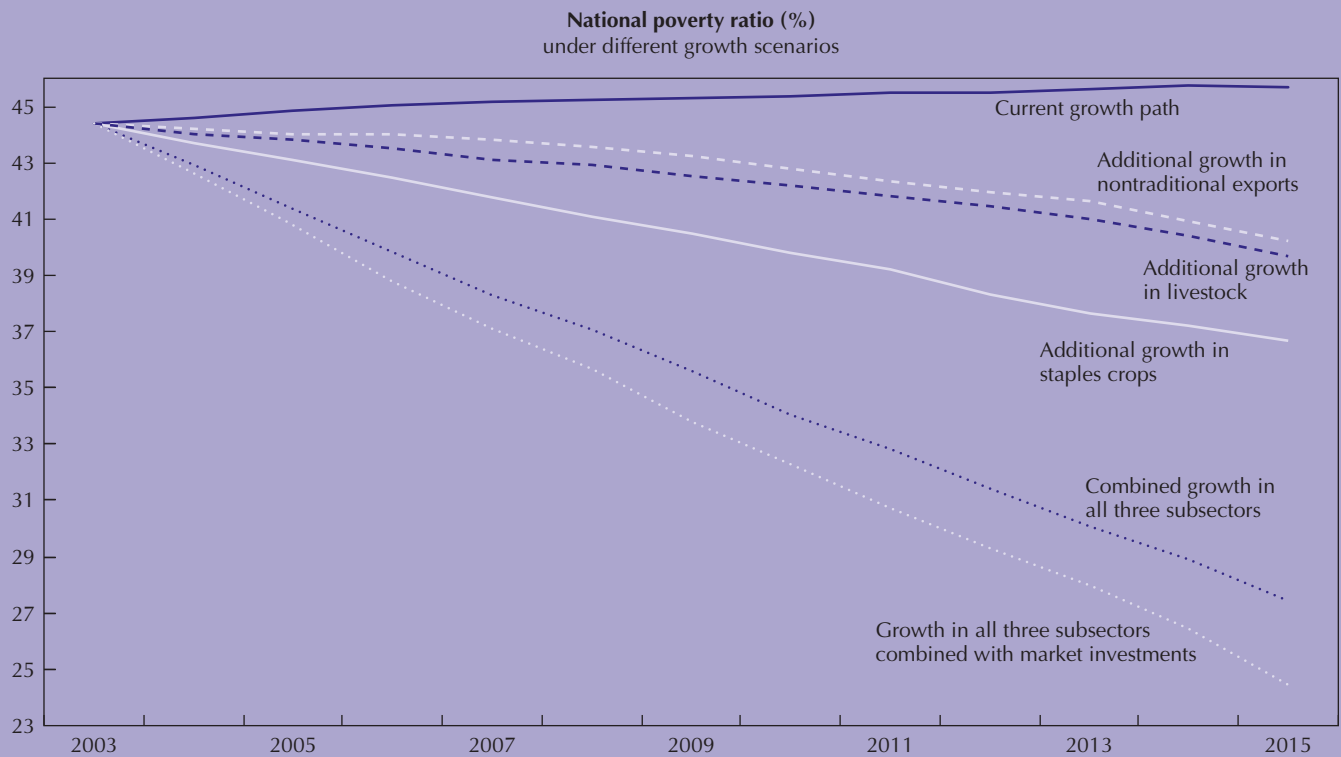
Summary for Ethiopia

Ethiopia faces serious challenges in attempting to meet the MDGs. Along a business-as-usual growth path, the country's food security will further deteriorate. Without additional growth in agriculture, the poverty rate will actually rise, resulting in 12 million more people living in poverty by 2015 (figure 3.1).

Growth in staple crops contributes the most to poverty reduction. With a 3.4 percent annual growth rate, (1.5 percent of additional growth rate in productivity), growth in staple food helps the economy and the agricultural sector grow at 3.9 and 3.5 percent, respectively. The country's poverty rate will reduce to 36.6 percent by 2015 from its current 44.4 percent. Combined growth in staple crops with growth in livestock and non-traditional exports leads to much more rapid growth in agriculture and poverty reduction. Such a growth strategy results in an annual growth rate of 5.3 percent for the agricultural sector, which will help the country reduce its poverty rate to 26.6 percent by 2015.

Increasing national food staple availability by 50 percent by 2015 will significantly advance poverty reduction. This goal is feasible by reducing the productivity gap between traditional and modern technologies that have been adopted in the country. By doubling the irrigation area by 2015, improving the efficiency of fertilizer use, and disseminating the technology to combine improved seed with fertilizer use, the model results show that growth in staple foods is feasible with the right investment strategies. However, as more than 50 percent of food staples are currently provided from the food surplus area, where per-household food availability is already 70 percent higher than the national average, market access and market development will be especially important and should be integrated into Ethiopia's agricultural development strategy.

As the model simulations reveal, broad-based agricultural growth is the key for decreasing poverty and increasing growth in Ethiopia. Within the agricultural sector, growth in cereals and other staple crops should receive priority. Due to strong, cross-sectoral linkage effects, an agriculture-led

Figure 3.1 Poverty Rate in Ethiopia Under Different Growth Scenarios

Source: Results from Ethiopian multimarket model.

growth strategy combined with investments in roads and other market conditions can significantly increase rural incomes. Only under such a scenario can Ethiopia potentially halve poverty by 2015.

Zambia: Facing the Challenge of the Millennium Development Goals—The Role of Agriculture

While Zambia shares with Ethiopia a high poverty rate, specifically in the rural sector, the circumstances contributing to Zambian poverty are quite different.⁴ In particular, Zambia's economic history has been shaped by the misuse of its abundant natural resources. It has failed to translate its considerable mineral wealth and agricultural potential into sustained growth and the improved well-being of its population. Even during periods of growth the poor population has had limited opportunities to participate in the growth process. As such, not only has poverty in Zambia remained high, but also trends in social indicators suggest that the economy has continued the declining trend that began three

decades ago. The marginalization of agriculture lies at the center of this development failure.

The marginalization of agriculture

Two policy-induced biases determined the condition of the Zambian economy at the start of the 1990s. The first of these was a general bias toward urban areas. During the 1970s the government adopted an inward-oriented development strategy based on nationalized and protected state enterprises. So comprehensive was this strategy that by 1991 over three-quarters of GDP was being generated by the public sector (Chanthunya and Murinde 1998). The subsequent dependence on copper earnings, as a source of both foreign exchange and public revenues, created an economy that was vulnerable to crisis. The first of these crises took place in the mid-1970s when world copper prices fell dramatically. Rather than undergo structural reform, the government chose instead to borrow from abroad to maintain current consumption. This marked the beginning of escalating foreign

debt, which would by the early 1990s make Zambia one of the most indebted countries in the world.⁵

Despite foreign borrowing, the continued deterioration in the terms of trade and falling revenues led to a reduction in social spending during the 1980s. The substantial gains in social outcomes that were achieved during the first decade after independence slowly began to deteriorate. During the global recession of the 1980s, the government again refused to embrace public-sector reform, this time opting to reduce public investment, first in rural infrastructure and later in its own industrial enterprises. This contraction of public investment and the small size of the private sector explain the country's poor growth performance into the 1990s.

Beyond supporting urban-based industrial and public-sector employment, the government's reliance on the mining sector directed social spending and political favor toward the urbanized Copperbelt and Lusaka provinces (Bigsten and Kayizzi-Mugerwa 2000). Perhaps the most important display of this urban bias is the food subsidies for urban areas. Ostensibly to ensure food security, these subsidies became entrenched and were eventually perceived as a right by the urban population. Attempts to reduce the scale of subsidies was met with considerable opposition and led to riots in the Copperbelt province.

More broadly speaking, the government's agricultural policies, of which food subsidies formed part, had a profound effect on poverty and vulnerability in rural areas. Largely driven by its desire to protect urban food prices, the government chose to support maize production throughout the country. This was done through publicly provided input subsidies and marketing support, and through pan-territorial price controls. The effect was to distort the pattern of agricultural production, such that over 80 percent of the land planted was devoted to maize (Saasa 2003). Pan-territorial pricing prompted many farmers to grow maize in areas that were not ideally suited to this crop. This was particularly true for the more drought-prone southern provinces, which are better suited to drought-resistant sorghum and millet, and whose inhabitants therefore became highly vulnerable to climatic changes (World Bank 2004e).

Apart from concentrating staple production in a single crop, the maize bias, together with the overvalued exchange rate caused by copper, effectively undermined incentives to produce exportable cash crops. At the beginning of the 1990s, Zambia

exported few agricultural commodities and was a net importer of food. This is a significant indicator of the failure of agricultural policies and of the country's severe food insecurity. Burgeoning public debt and the resulting fall in rural infrastructure investment exacerbated the situation. Many more remote areas of the country became isolated from input and output markets. Together the bias toward urban areas and maize production created an untenable situation, which forced the government to implement a series of far-reaching structural reforms.

Growth and poverty under structural adjustment

Due to the poor performance of the Zambian economy at the end of 1980s, the newly elected government in 1991 chose a political platform based on the implementation of a comprehensive structural adjustment program. This program, which was implemented during the 1990s, included macroeconomic stabilization, trade liberalization, privatization, and agricultural reforms. Each of these policies was to play an important role in determining the growth and poverty outcomes of the 1990s.

The government implemented a stabilization program aimed at curbing inflation and creating an environment conducive to private enterprise. Despite eventual success, the impact of deregulated financial markets, and the removal of food subsidies under agricultural reform, led to rapid increases in consumer prices. Inflation during the early 1990s undermined real incomes and raised the cost of living, especially in urban areas. Trade liberalization and privatization also led to widespread job losses and contributed to rising urban unemployment. Many semiskilled workers who had previously been employed in state enterprises were forced into the informal sector, where job security and wages are substantially lower. Many unskilled urban workers and their households moved to rural areas, thus reversing the long-standing migrant labor system that had urbanized 40 percent of the total population by 1991. Almost 10 percent of the urban population moved to rural areas, mostly into small-scale farming. This collapse of the formal economy explains much of the substantial increase in the incidence and depth of poverty in urban areas during the 1990s (table 3.7).

Agricultural reforms were also pronounced. The government abandoned its support of maize by removing subsidies and decontrolling prices.

Table 3.7 Poverty in Zambia During the 1990s

	Incidence of Poverty (P0)			Depth of Poverty (P1)		
	1991	1996	1998	1991	1996	1998
National	68.9	79.4	75.4	41.7	45.4	40.0
Rural	88.0	90.1	85.6	61.3	56.7	49.7
Urban	46.0	61.2	58.3	18.1	25.9	23.7
Central	69.8	84.1	78.9	38.2	47.8	43.9
Copperbelt	55.5	70.8	67.0	22.3	31.7	31.3
Eastern	84.3	89.0	82.7	58.8	58.2	45.3
Luapula	83.9	88.4	85.4	53.3	51.2	47.8
Lusaka	31.0	51.3	54.4	12.1	21.2	22.7
Northern	83.6	90.8	85.0	55.5	58.3	47.7
Northwestern	77.8	89.0	76.0	48.7	52.8	40.0
Southern	78.4	86.1	78.4	52.5	51.1	44.2
Western	84.5	89.2	90.3	59.1	59.7	54.3

Source: Thurlow and Wobst (2004).

The loss of protection revealed the artificial profitability of maize and led to its rapid decline in importance. Production halved during the 1990s, leading to rising poverty within rural areas. However, farmers shifted production toward more appropriate crops (Haggblade and Zulu 2003). While the rain-fed Northern and Luapula provinces reverted to cassava, the drier southern provinces planted millet. Production of these two crops doubled in response to agricultural reforms. Furthermore, the correction of the overvalued exchange rate—through privatization and falling copper prices—made export agriculture more internationally competitive. Cash crop production rose accordingly, with cotton, sugar, and horticulture showing rapid growth. Although initially hindered by adjustment costs and droughts, the incidence of poverty declined in rural areas in the late 1990s, driven mainly by improvements in cash crop production. Perhaps more importantly, the depth of poverty also declined, reflecting the lower vulnerability and improved livelihoods of the poorest among the rural population.

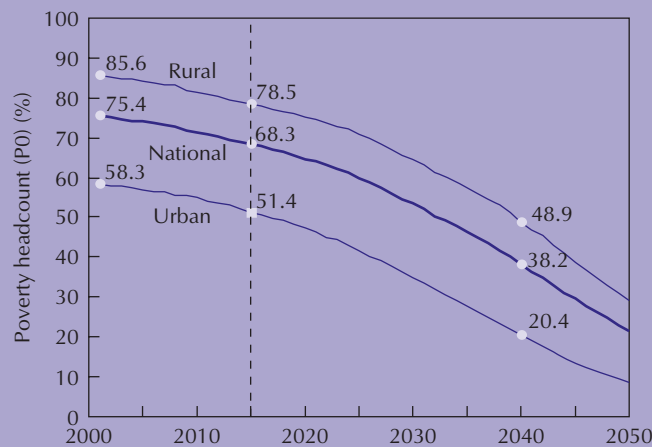
Prospects for halving poverty by 2015

Although poverty reduction was evident in the late 1990s, especially in rural areas, the observed overall changes in poverty during the 1990s suggest that Zambia is facing serious challenges to meet the MDG of halving poverty by 2015. Using a

spatial dynamic Computable General Equilibrium and microsimulation model for Zambia, by the International Food Policy Research Institute analysis shows that under its current average of 4 percent GDP growth, the country's poverty rate will be 68 percent by 2015, only 7 percentage points lower than the current poverty rate of 75 percent. Looking further into the future suggests that Zambia will not be able to halve poverty until after 2040 unless pro-poor growth is accelerated (figure 3.2). The model estimates that annual GDP growth of 8.8 percent is needed to achieve the target of halving poverty by 2015. These findings are consistent with estimates based on static growth-poverty elasticities, which suggest that the necessary GDP growth rate lies between 7 and 9 percent (Thurlow and Wobst 2004).

Rural areas are expected to perform better than urban areas, given the rising importance and export potential of the agricultural sector, and the gradual decline of copper production and earnings.⁶ The new diversification, achieved at the cost of structural adjustment, appears to have corrected some of the long-standing bias against agriculture and rural development. Small- and medium-scale households within rural areas benefit the most from diversification into agricultural export production. At the sub-sectoral level, it is small-scale-intensive cotton and medium-scale-intensive horticulture that grow fastest. Both sectors are expected to grow at around 10 percent per year, a rate that is consistent with

Figure 3.2 Poverty Reduction Under the Current Growth Path (2001–2050)



Source: Thurlow and Wobst (2004).

recent trends in these crops. However, export crop growth is largely limited to the Eastern, Central, and Lusaka regions where access to input and output markets is better. Accordingly, while the current growth path suggests that agriculture-led development is desirable, additional efforts targeting a majority of smallholders and broad agricultural sectors are necessary for achieving significant poverty reduction.

Agricultural growth is pro-poor growth

Although agriculture accounts for only 25 percent of GDP, it is still the main source of livelihood for most of the country's population, including the majority of Zambia's poor who live in rural areas where the incidence and severity of poverty is greatest. Apart from shifts toward more diverse staple production, the performance of cash crops has improved greatly. However, with the exception of cotton, which is grown in the Eastern province, most of the farmers engaged in cash crop production are located close to Lusaka or the country's main transport routes. Thus, the recent gains from agricultural growth have tended not to reach the more remote areas of the country. Given the need for faster economic growth, and in order to assess the constraints and opportunities for significant poverty reduction, we consider the impact of accelerating productivity growth in selected sectors such

that the overall GDP growth increases from its current 4 percent to 5 percent per year.⁷

Increased productivity stimulates economic growth and lowers poverty. However, there are considerable differences in the impact of targeting different sectors. The first two scenarios contrast the poverty effects of accelerating sector-wide growth either in all agricultural sectors or all nonagricultural sectors. More rapid productivity growth under the Agriculture-Led Growth Scenario leads to higher sectoral growth for both staples and export crops. Resulting declines in nonagricultural growth are partly offset by cheaper agricultural inputs into downstream textiles and food processing. Export agricultural growth stimulates urban investment by relaxing the foreign exchange constraint. Rural households benefit directly from higher incomes and falling poverty, although smaller-scale staple producers benefit less than medium-scale exporters due to the domestic market constraints they face for their food crops. Urban households also benefit from lower food prices, leading to rising real incomes and falling poverty.

Accelerating productivity growth under the Nonagriculture-Led Growth Scenario has very different implications for poverty reduction.⁸ Nonagricultural production is more dependent on imported intermediates, thus exacerbating the foreign exchange constraint and undermining import-intensive investment. High levels of exter-

nal debt and limited opportunities for further borrowing mean that the large increases in imports must be matched by more rapid export growth. Although urban poverty declines, the shift toward greater trade in capital goods offsets private consumption growth. Furthermore, nonagricultural growth reestablishes the bias against agricultural exports and generates few backward linkages into agriculture. Therefore, while rural households benefit from increased demand in urban areas, the overall effect of nonagricultural growth remains relatively small.

Despite the less optimistic results for broad nonagriculture-led growth, agricultural processing within the manufacturing sector does in fact represent a potential area for growth and poverty reduction. Agribusiness benefits smallholders through greater demand for their crops, and provides a source of income for the growing nonfarm population. For example, hand-milling in smaller and more remote urban areas has shown considerable growth in recent years. Furthermore, on-farm processing allows smallholders to raise the value added of their produce. Scenarios that focus on the agroprocessing sectors take into account these sectors' stronger backward linkages into agriculture. Although not shown here, model simulations suggest that increased productivity in the agroprocessing sectors is likely to benefit urban and nonfarm households more than other households, largely because they have better access to the required capital (Thurlow 2004). Relieving the credit constraint facing many farmers should extend the potential benefits of this sector.

Since agriculture-led growth appears to offer greater opportunities for broad-based poverty reduction, two additional scenarios contrast the effects of accelerating economic growth through either the staples or export crop sectors. The Staples-Led Growth Scenario concentrates agricultural growth within the staples-producing sectors at the expense of export agriculture. However, increased productivity of staple crops has little effect on poverty among small-scale farm households. This is due to current market constraints, which cause higher production to translate into falling prices. Lower prices in staple crops do not suggest that domestic demand for staples is insufficient, but rather that the current structure of the domestic market limits its ability to absorb substantially higher levels of supply. Poor market access therefore represents the dominant constraint to growth

and poverty reduction through the expansion of staple production.

Exportable commodities allow farmers to get access to foreign markets, and, hence, increased supply results in increased exports without depressing prices. This can be seen in the Export-Crop-Led Growth Scenario. The changes in poverty rate following export crop expansion indicate that rural medium-scale households would be better off if productivity of traded commodities could be raised. Again it should be stressed that only less-remote households that already have adequate market access are likely to benefit. This is evident in the strong declines in poverty within the Eastern and Central provinces.

The scenarios presented so far suggest that enhancing productivity within agriculture generates pro-poor outcomes. Given that a majority of the poor live in rural areas, it appears that agriculture has an important role to play in helping the country achieve faster growth and poverty reduction. However, the benefits from agricultural growth are unlikely to reach all rural households. Poor access to markets and credit has been a persistent problem in rural areas and continues to undermine rural development. Recently achieved macroeconomic stability and the increasing participation of the private sector in the rural economy suggest that market access might already be improving, at least in the less remote provinces. Private-sector to initiated outgrower schemes have proven highly successful in the cotton sector and, through credit provision, have allowed smallholders to become the largest suppliers of raw cotton in Zambia. However, the high cost of capital needed for horticultural exports and agribusiness production has effectively limited the participation of smallholders in these sectors. Furthermore, low productivity and labor shortages at harvesting limit production, indicating the need for new technologies and capital investment (Deininger and Olinto 1999). Inadequate financing sources, poor market access, and low levels of investment therefore represent the major constraints facing agricultural growth in Zambia.

Improving market access to encourage pro-poor growth

The agriculture-led growth scenarios have emphasized the importance of market access and its role in determining whether rural farmers can benefit

from economic growth. Transportation costs currently account for between 60 and 70 percent of the cost of production (Lofgren, Thurlow, and Robinson 2004). These costs, which are high even by regional standards, limit farmers' ability to market their produce and contribute to high prices and, hence, the prevailing poverty in the country. Although Zambia has an extensive road network, which supports the dominant modes of transportation, the system has deteriorated over the last three decades. The government has identified increased investment in transportation infrastructure as critical for growth and poverty reduction. Market access is especially limited in many rural areas. Only 18 percent of rural households are within 5 kilometers of input markets, and few of the more remote households have access to health and education facilities. These households' access is limited due to either a lack of roads or the poor quality of the existing network.

This section contrasts the impact of building new feeder roads in rural areas with new paved and gravel roads in less remote rural and urban areas. The scenarios consider a 10 percent increase in the provision of either feeder or paved roads. Improved infrastructure provision reduces transaction costs in specific sectors in the economy. In the case of feeder roads, lower transaction costs are likely to benefit only rural agricultural production. Paved roads, on the other hand, should benefit nonagricultural production and export agriculture. The latter is due to the existing concentration of export agriculture along the country's main road networks. Furthermore, based on the current geographic distribution of production, paved roads will reduce the transaction costs in both the domestic and export markets, whereas feeder roads will reduce the transaction costs in domestic markets only.

The construction of both feeder and paved roads increases growth and reduces poverty. However, improving market access for export crops has a much stronger growth effect due to the strong positive externalities that less-remote paved roads provide to other nonagricultural sectors. Despite slower growth and less impressive export performance, building feeder roads and improving market access for staple crops is better at reducing poverty since the benefits accrue to the larger and poorer small-scale farm population. Export crops, by contrast, benefit the smaller population of medium-scale farm households, and to a lesser extent, urban

households. Therefore, while infrastructure and market access consistently strengthen poverty reduction, especially in rural areas, there appears to be a tradeoff between poverty reduction and growth.

Summary for Zambia

Zambia has undergone substantial reforms, which the country's recent positive performance suggests might have been a prerequisite for renewed growth. Furthermore, the rising poverty and falling social outcomes of the pre-reform period suggest that structural adjustment might also have been a prerequisite for poverty reduction. However, short-run adjustment costs raised poverty during the 1990s, moving Zambia further away from achieving the goal of halving poverty by 2015 (table 3.8). A very high and unlikely growth rate would have to be achieved if the MDG poverty target is to be met.

Although meeting target 1 of MDG 1 appears to be beyond Zambia's grasp, the country's success at encouraging diversification is likely to increase its rate of pro-poor growth. However, several constraints remain. The most important of these constraints is slow agricultural growth, which has been largely undermined by low productivity and inadequate rural infrastructure.

Conclusions

As the two case studies illustrate, reaching the MDGs, and particularly MDG 1, will require much greater growth than both Ethiopia and Zambia have currently achieved. In Zambia, the GDP growth rate required to halve poverty is around 8.8 percent, much higher than the rate of 6 percent needed in Ethiopia. The unique characteristics of each country's economy and poverty profile account for this variation in growth rates. Specifically, Ethiopia is a predominantly subsistence economy with agriculture contributing 52 percent to GDP and with almost 85 percent of the population living in rural areas. By contrast, mining traditionally has dominated economic growth in Zambia and, in turn, has marginalized the country's agricultural sector. Indeed, 60 percent of Zambia's population live in rural areas while agriculture contributes only 22 percent to the country's GDP. Moreover, Ethiopia's national poverty rate is 44 percent with a concentration of poverty in the rural areas. In Zambia, however, the collapse of mining exacer-

Table 3.8 Growth and Poverty Reduction Under the Alternative Zambian Growth Scenarios (2001–2015)

	Current growth path	Agriculture-led growth	Nonagriculture-led growth	Staples-led growth	Staples market access	Export-Crop-led growth	Export-Crops market access
Average annual growth rate, 2001–2015 (%)							
Gross domestic product	4.0	5.0	5.0	5.0	5.1	5.0	5.6
Agriculture	4.6	7.7	4.2	7.8	8.1	7.1	8.6
Staple crops	4.1	7.3	4.0	8.0	8.4	4.0	3.4
Export crops	10.2	13.4	7.1	7.0	3.5	22.8	27.2
Mining	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Manufacturing	4.5	4.3	5.8	4.3	4.7	4.2	4.6
Services	3.9	4.1	5.6	4.0	4.0	4.7	4.7
Final year poverty headcount, 2015 (%)							
National poverty	68.3	59.4	63.9	59.5	54.5	62.0	55.8
Rural	78.4	68.1	76.4	68.1	61.2	72.3	64.2
Small-scale	79.0	68.1	77.2	68.0	60.4	73.0	64.4
Medium-scale	69.5	56.3	65.2	59.0	54.5	55.9	45.1
Urban	51.4	45.0	42.9	45.2	43.3	44.8	41.8
Central	73.8	66.4	70.1	66.5	64.2	67.7	61.9
Copperbelt	61.6	55.9	54.5	56.1	54.1	56.2	52.1
Eastern	67.1	56.0	68.3	62.5	58.1	51.0	36.7
Luapula	79.2	68.4	76.1	65.8	61.8	74.1	68.4
Lusaka	45.5	40.3	36.3	40.2	39.1	40.7	39.1
Northern	79.7	65.9	76.5	62.5	55.1	75.8	70.9
Northwestern	71.1	54.2	67.5	52.6	47.9	66.5	61.3
Southern	72.7	65.6	68.4	65.6	58.9	68.0	59.2
Western	87.3	77.9	83.9	76.6	56.7	83.3	78.0

Source: Zambia CGE-micro model results from Thurlow and Wobst (2004).

bated urban poverty and contributed to a national poverty rate of 75 percent. Not only is the incidence of poverty higher in Zambia than in Ethiopia, but the depth of poverty, which measures the distribution of the poor, is higher as well. In fact, the poverty gap in Ethiopia is 12 percent compared with 26 percent in Zambia. In other words, Zambia has both a higher proportion of its population living below the poverty line and a higher concentration of individuals at the low end of the income distribution. Consequently, Zambia requires faster GDP growth than Ethiopia to halve poverty by 2015.

Achieving these rates of growth specifically requires greater productivity in the agricultural sector. The unique structure of each country's economy determines the impact of this agricultural growth on poverty reduction as well as which agricultural subsectors are the most promising. In both countries, domestic demand for staples is high, and growth in the staples sector could increase the incomes of the rural poor and improve food secu-

rity in both rural and urban areas. Yet, in order for growth in staples to have its intended impact, significant market access constraints need to be overcome. Otherwise, increased staple production will cause a decline in local food prices and diminish farmers' incomes.

In Zambia, the expansion of export crops offers opportunities for increased growth because farmers do not encounter the same constraints in accessing foreign markets as they do domestic markets. Therefore, increased supply of export crops, even in the face of domestic market constraints, would typically not result in a decline in farmers' incomes, although the poverty impact is lower than for staples crops. Agro-processing also has the potential to complement growth in other agricultural sectors. By contrast, in Ethiopia, growth in nontraditional exports alone will not have a large impact on poverty reduction. However, a combination of nontraditional export growth with livestock and staple production growth can significantly reduce

poverty. For both countries, the level of technology and capital investment required to engage in nontraditional export production, as well as agro-processing, circumscribes the benefits to smallholders. Moreover, growth in nontraditional exports particularly benefits those farmers concentrated around cities and where market access and infrastructure are well developed.

Indeed, both case studies suggest that the lack of physical infrastructure represents a serious problem that needs to be addressed, not only for agricultural growth to occur but also for agricultural growth to reduce poverty, particularly in the most remote rural areas. By concurrently improving rural infrastructure and market development, agricultural growth might help Ethiopia to achieve MDG 1. In Zambia, on the other hand, reaching MDG 1 will be more difficult, particularly since the country is starting with a higher national poverty rate. Nonetheless, increased construction of roads, especially feeder roads, is no less crucial.

Notwithstanding Sub-Saharan Africa's vast diversity, the similarities shared by Zambia and Ethiopia have important implications for Sub-Saharan Africa as a whole. In particular, agricultural growth is absolutely essential for alleviating the most severe poverty, especially in rural areas. However, the nonagricultural sector has an important role in assuring that this growth reaches the intended beneficiaries. Consequently, efforts to increase yields and expand production areas must be appropriately sequenced with investments in roads, irrigation, and storage facilities as well as greater credit and fertilizer provision for smallholders and an enabling macroeconomic environment that encourages private sector involvement.

GLOBAL QUANTIFIED ASSESSMENT OF SELECTED MDG TARGETS: IMPACT-WATER

Malnutrition affects nearly one-third of all children under five years of age in developing countries, 174 million children in 1990. Malnourished children have lowered resistance to infection; they are more likely to die from common childhood ailments like diarrheal diseases and respiratory infections, and for those who survive, frequent illness affects their nutritional status, locking them into a vicious cycle of recurring sickness and faltering growth. Their plight is largely invisible: three-quarters of the chil-

dren who die from causes related to malnutrition were only mildly or moderately undernourished, showing no outward sign of their vulnerability. More than half of childhood deaths are associated with being underweight, and malnourished children who survive into adulthood are more likely to suffer from chronic illness and disability, and have a higher probability of reduced physical and intellectual productivity (de Onis and others 2004; Pelletier and others 1994; Smith and Haddad 2000; UNICEF 2004). Poverty, low levels of education, and poor access to health services are major contributors to childhood malnutrition, a complex issue that requires tackling on a wide number of fronts, including (UNICEF 2004):

- “Ensuring food security for poor households, both enough food and the right kinds of food;
- Educating families to understand the special nutritional needs of young children, notably the value of breastfeeding and the importance of introducing suitable complementary foods at the right age;
- Protecting children from infections, by such measures as immunization against common childhood diseases and provision of safe water and sanitation;
- Ensuring that children receive quality care when they fall ill;
- Shielding them from the micronutrient deficiencies that can bring death and disability, especially iodine, iron and vitamin A deficiencies;

Paying special attention to the nutritional needs of girls and women, since chronically undernourished women tend to bear low-birthweight babies and so perpetuate the vicious cycle of malnutrition into the next generation.” These devastating effects of malnutrition led world leaders to choose “to halve, between 1990 and 2015, the proportion of people who suffer from hunger” as one of the targets of MDG 1. One of the specific indicators chosen for this target and goal is the prevalence of underweight children under five years of age.

We use the IMPACT-WATER model to project the proportion of malnourished children under the baseline and one alternative scenario, titled the MDG scenario.⁹ Malnutrition is defined here as underweight (proportion of under-fives falling below minus 2 standard deviations from the median weight-for-age standard set by the U.S. National Center for Health Statistics and the World Health

Organization). This standard is adopted by many United Nations agencies in assessing the nutritional status of preschool children in developing countries. Other, less commonly used indicators for child malnutrition include stunting (proportion of children under five falling below minus 2 standard deviations from the median height-for-age of the reference population), and wasting (proportion of children under five with weight-for-height falling below minus 2 standard deviations from the median weight-for-height of the reference population).

IMPACT-WATER generates projections of the percentage and number of malnourished preschool children (zero to five years old) in developing countries. Projections for the proportion and number of malnourished children are derived from an estimate of the functional relationship between the percentage of malnourished children, the projected average per-capita kilocalorie availability of food, and nonfood determinants of child malnutrition, including the quality of maternal and child care (proxied by females' status relative to men as captured by the ratio of female-to-male life expectancy at birth), education (proxied by the share of females undertaking secondary schooling), and health and sanitation (proxied by the percentage of the population with access to safe drinking water). The equations used to project the percentage and numbers of malnourished children are as follows:

$$\%MAL_t = 25.24 * \ln(KCAL_t) - 71.76 LFEXPRAT_t - 0.22 SCH_t - 0.08 WATER_t$$

and

$$NMAL_t = \%MAL_t \times POP5_t$$

where $\%MAL$ is the percentage of malnourished children, $KCAL$ is per-capita kilocalorie availability estimated in IMPACT-WATER, $LFEXPRAT$ is the ratio of female to male life expectancy at birth, SCH is the percentage of females with secondary education, $WATER$ is the percentage of the population with access to safe water, $NMAL$ is the number of malnourished children, and $POP5$ is number of children zero to five years old.

The regression equation was derived based on a fixed-effects model of pooled, cross-section time-series data from 63 developing countries covering the 1970s, 1980s, and 1990s from a variety of sources for both dependent and independent variables. The majority of the data on prevalence of child malnu-

trition came from the World Health Organization's Global Database on Child Growth and Malnutrition (WHO 2004), with other sources including the United Nations Administrative Committee on Coordination-Subcommittee on Nutrition (ACC/SCN 1996) and *World Development Indicators* (World Bank 1997). Sources for explanatory factor data include calorie availability from the Food and Agriculture Organization FAOSTAT database (FAO 1998); female secondary enrollment data from the United Nations Educational, Scientific and Cultural Organization UNESCOSTAT database (UNESCO 1998) and *World Development Indicators* (World Bank 2004c); and female-to-male life expectancy ratios from *World Development Indicators* (World Bank 1997, 2004c). For greater detail on sources, data coverage, specific observations used, and model estimation procedures and tests, see Smith and Haddad (2000).

Table 3.9 presents 1990 and 1995 estimates for child malnutrition (low weight-for-age) for the reporting regions for this item in IMPACT-WATER, as well as the 2015 MDG target estimates (halving, between 1990 and 2015, the proportion of people [that is, under fives] who suffer from hunger) calculated based on 1990 values. Table 3.10 presents the same values for access to safe drinking water, related to Target 10 of MDG 7, to "halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation." As can be seen in Table 3.9, child malnutrition estimates between 1990 and 1995 declined, increased, or stagnated. This is one of several caveats that need to be taken into account when assessing the possibility of achieving the MDGs based on the indicators. For example, while the WHO global database on child growth and malnutrition for Myanmar reports a proportion of 32.4 percent preschool children malnourished in 1990, the value for 1995 was 42.9 percent, and the latter value is used for the IMPACT-WATER base year calculations. Furthermore, several countries do not have estimates for child malnutrition going back to 1990. In these cases, country assessment reports often suggest a halving of child malnutrition levels by 2015 with reference to the earliest year with reliable data. For example, in the case of Afghanistan, the country report suggests a reduction in child malnutrition (underweight) from 48 percent in 2000 to 24 percent by 2015 (UNDP 2004a) as an indicator for MDG 1.

Moreover, the data presented in table 3.9 do not capture rural-urban disparities, but as figure 2.4 shows, child malnutrition rates are typically higher

Table 3.9 Child Malnutrition Estimates (Underweight), 1990 and 1995, with 2015 MDG Indicator Target

	1990 estimates	1995 estimates	2015 target
	Percent		
Latin America	8.7	9.1	4.4
Sub-Saharan Africa	26.8		13.4
Nigeria	35.3	39.1	17.7
Northern Sub-Saharan Africa	40.3	40.0	20.2
Central and Western Sub-Saharan Africa	27.9	27.8	13.9
Southern Sub-Saharan Africa	28.5	26.9	14.3
Eastern Sub-Saharan Africa	26.7	27.6	13.4
West Asia and North Africa*	11.0	13.2	5.5
South Asia	54.2		27.1
India	54.7	53.4	27.3
Pakistan	40.2	38.2	20.1
Bangladesh	67.1	56.3	33.5
Other S Asia	49.0	41.2	24.5
South East Asia	35.2		17.6
Indonesia	36.8	34.0	18.4
Thailand	22.0	18.9	11.0
Malaysia	25.0	20.1	12.5
Philippines	33.5	29.6	16.8
Vietnam	43.6	44.9	21.8
Myanmar	32.4	42.9	16.2
Other SE Asia	47.0	40.0	23.5
China	19.0	17.4	9.5
Developing	30.2		15.1

Notes: *The value for West Asia and North Africa was estimated, as details for several countries in the region are not available. Latin America includes the Caribbean; N SSA stands for Northern Sub-Saharan Africa; C and W SSA stands for Central and Western Sub-Saharan Africa; S SSA stands for Southern Sub-Saharan Africa; E SSA stands for Eastern Sub-Saharan Africa; WANA stands for West Asia and North Africa; Other S Asia stands for Other South Asia; Other SE Asia stands for Other Southeast Asia. The regional disaggregation is presented in Annex 2. No estimates for child malnutrition are made for parts of East Asia (Democratic People's Republic of Korea, Macao, and Mongolia) and for the rest of the world, including Cape Verde, Fiji, French Polynesia, Kiribati, New Caledonia, Papua New Guinea, Seychelles, and Vanuatu. 1995 values are incorporated in IMPACT-WATER. The 2015 target is based on 1990 estimates.

Sources: 1990 estimates based on the WHO global database on child growth and malnutrition (WHO 2004); 1995 estimates also based on the WHO global database on child growth and malnutrition, but accessed in 1997, as well as additional sources (World Bank 1997 and ACC/SCN 1996).

for rural areas. As table 3.9 shows, on a regional basis, the incidence of low weight-for-age in 1990 was lowest in Latin America and the Caribbean among all developing regions, at just under 9 percent, followed by the West Asia and North Africa (WANA) region, at around 11 percent. On the other hand, the level was highest for South Asia, at 54.2 percent in 1990, followed by Southeast Asia. The incidence of low weight-for-age was somewhat lower in Sub-Saharan Africa, at 26.8 percent. Regional averages mask large differences within regions; for example, the average for West Asia and North Africa includes Lebanon, with a share of 3 percent malnourished children in 1996, but also Yemen, where the share was 38.1 percent in the

same year (WHO 2004). Even more important than point estimates are trends in malnutrition over time.

Over the last 30 years, South Asia, where the largest number of malnourished children reside, has made substantial progress, with the share of malnourished children declining from well over 70 percent in 1970 to under 50 percent by 1996–97. However, the absolute number of malnourished children declined by only 7 million children over this period due to continued rapid population growth. The most impressive developments took place in East Asia, where the number of malnourished children decreased by 50 percent, or 40 million children, between 1970 and 1997. Latin America also reduced the number of malnourished children

Table 3.10 Access to Safe Drinking Water, 1990 and 1995, with 2015 MDG Target Indicator and 2015 IMPACT-WATER Baseline Estimates

	1990 estimates	1995 estimates	2015 target	2015 IMPACT-WATER baseline estimates
	Percent			
Latin America	82.0	77.5	91.0	80.2
Sub-Saharan Africa	53.0		76.5	
Nigeria	53.0	50.0	76.5	64.9
Northern Sub Saharan Africa	41.6	37.9	70.8	51.3
Central and Western Sub-Saharan Africa	48.8	54.5	74.4	66.6
Southern Sub-Saharan Africa	47.8	51.2	73.9	66.7
Eastern Sub-Saharan Africa	48.3	47.2	74.2	61.9
West Asia and North Africa	84.0	81.9	92.0	88.2
South Asia	72.0		86.0	
India	68.0	81.0	84.0	89.6
Pakistan	54.2	60.0	77.1	72.5
Bangladesh	83.0	79.0	91.5	82.9
Other South Asia	54.0	60.3	77.0	71.0
South East Asia	70.1		85.1	
Indonesia	71.0	60.0	85.5	73.3
Thailand	80.0	89.0	90.0	94.3
Malaysia	80.9	77.0	90.5	87.2
Philippines	87.0	84.0	93.5	90.3
Vietnam	55.0	43.0	77.5	62.4
Myanmar	64.0	60.0	82.0	69.4
Other SE Asia	29.1	59.6	64.5	67.7
China	71.0	67.0	85.5	75.6
Developing	74.0		87.0	

Notes: Latin America includes the Caribbean; N SSA stands for Northern Sub-Saharan Africa; C and W SSA stands for Central and Western Sub-Saharan Africa; S SSA stands for Southern Sub-Saharan Africa; E SSA stands for Eastern Sub-Saharan Africa; WANA stands for West Asia and North Africa; Other S Asia stands for Other South Asia; Other SE Asia stands for Other Southeast Asia. The regional disaggregation is presented in Annex 2. No estimates are made for child malnutrition for parts of East Asia (Democratic People's Republic of Korea, Macao, and Mongolia), and for the rest of the world, including Cape Verde, Fiji, French Polynesia, Kiribati, New Caledonia, Papua New Guinea, Seychelles, and Vanuatu. 1995 values are incorporated in IMPACT-WATER. The 2015 target is based on 1990 estimates. 1995 and 2015 IMPACT baseline estimates were used for the baseline run.

Sources: 1990 estimates based on the World Development Indicators (World Bank 2002) and WHO/UNICEF (2001); 1995 estimates also based on World Development Indicators, but accessed in 1997.

by half, but the number of malnourished children in WANA today is virtually the same as it was in the 1970s. The most troubling region, however, is Sub-Saharan Africa, where the number of malnourished children increased by over 75 percent or 12.9 million over the last 30 years. In 1970, roughly 1 out of 10 malnourished children resided in Sub-Saharan Africa, today 1 in 5 do.

Despite Sub-Saharan Africa's discouraging developments, globally significant improvements in child malnourishment have been made, as shown by a sharp reduction in the proportion of malnourished children. However, because of population growth, the absolute number of malnourished chil-

dren has fallen much less sharply. In addition, despite the long-term improvement in most regions, progress has slowed in recent years, causing additional concern over future prospects for reducing child malnutrition (Rosegrant and Meijer 2002).

Regarding the proportion of people with access to safe drinking water, rural-urban disparities are important and are typically reported for developing-country regions (WHO/UNICEF 2001). An important issue regarding the access to safe drinking water data is that different surveys undertaken result in very different estimates even for the same year. For example, in Ghana, the Ghana Living Standards Survey of 1988 estimated that

36 percent of both the urban and rural population had access to an improved drinking water source (with different water sources for rural and urban areas), while the Ghana Demographic and Health Survey of 1988 reported that 84 percent of the urban population and 28 percent of the rural population had safe access to drinking water. Finally, the International Drinking Water Supply and Sanitation Decade Review of National Progress (as of December 1988) estimated that in 1988, 93 percent of the urban population and 39 percent of the rural population had access to safe drinking water in Ghana (WHO/UNICEF 2001 for Ghana).

On a regional basis, in 1990 access to an improved source of drinking water was estimated to be highest in West Asia and North Africa at 84 percent, followed by Latin America with 82 percent and Asia with around 70 percent. Coverage was lowest in Sub-Saharan Africa with 53 percent.

The data for the other two noncaloric parameters incorporated in the child malnutrition equation described above—the ratio of female-to-male life expectancy at birth, and the proportion of females attending secondary schooling—are presented in Appendix Table 1 for 1995 and 2015 (estimates for baseline and MDG scenarios). The indicator for the share of female secondary schooling is a reflection of Target 3—to “ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling”—of the second MDG, “achieving universal primary education,” and of Target 4—“eliminate gender disparity in primary and secondary education preferably by 2005 and to all levels of education no later than 2015”—of MDG 3, “promote gender equality and empower women.”

In 1995, the ratio of female-to-male life expectancy at birth for 195 countries with available data ranged from less than 1 (0.9876 for Nepal and 0.9982 for Uganda) to a high above 1.2 (Latvia, 1.2023, Estonia, 1.2042, and the Russian Federation, 1.2305). Among the developing-country reporting regions, Latin America and the Caribbean had the highest ratio of female-to-male life expectancy at 1.0989 in 1995, whereas Bangladesh had the lowest value (1.0072), followed by India with 1.0088 (Appendix Table 1). Regarding the proportion of female secondary schooling, in 1995, among the IMPACT-WATER reporting regions, the share was highest for the Philippines at 78 percent, followed by Malaysia at 63 percent, and China at 62 percent. The share was lowest in Northern and Eastern Sub-

Saharan Africa at 11 and 12 percent, respectively (Appendix Table 1).

For the analysis here, two scenarios were used. The first is a baseline scenario that reflects our best estimates of future trends in food supply, demand, and trade, as well as changes in the noncaloric parameters determining child malnutrition. The second scenario, titled MDG Scenario, attempts to reach the child malnutrition indicator of MDG 1 by 2015 through increases in economic and agricultural growth and complementary improvements in the service sectors, particularly for those countries and regions least likely to make sufficient improvements for this target if current trends prevail. Basic parameters for both scenarios are listed in tables 3.11 and 3.12.

Table 3.12 presents the increases in income growth required between 1995 and 2015 under the MDG scenario compared to the baseline scenario. Nonagricultural income growth rates for Latin America and Asia, with the exception of South Asia, are increased to 25 percent. Rates for West Asia and North Africa are increased to 6 percent per year, and rates for the two regions considered least likely to meet the MDG targets, South Asia and Sub-Saharan Africa, are increased to 8 percent per year.

Thus, the following items have been included in the MDG scenario:

- Nonagricultural income growth increases in developing regions by 25–150 percent, with particularly rapid increases projected for those regions least likely to reach the malnutrition indicator, Sub-Saharan Africa and South Asia.
- Annual irrigated yield growth per hectare increases by 50 percent and rainfed yield growth increases by 25 percent, for all developing countries and regions (cereals, roots and tubers, and soybeans). The increase of crop productivity is due to a large expansion of investments in agricultural research and irrigation infrastructure, enhanced property rights to land and water, improved coordination among agencies, and more transparent and accountable use of funds. Broad-based growth in production of meat and livestock products is assumed to be generated by more rapid expansion in animal numbers, with a 50 percent increase in annual numbers growth for all developing countries and regions. Both items, crop and livestock production growth,

Table 3.11 Parameters for Developing Countries, Baseline and MDG Scenarios

Parameter	Baseline scenario	MDG scenario
Nonagricultural income growth		See table 3.12
Population growth	UN medium variant	UN medium variant
Livestock numbers growth	Output numbers growth: 1.43%/yr, 2005–2015	Increase in numbers growth of animals slaughtered in developing countries by 50% beginning in 2005
Food crop yield growth	Output cereal yield growth: 1.39%/yr, 2005–2015	Increase irrigated yield growth by 50% for cereals, roots, and tubers and soybean in developing regions; increase rainfed yield growth by 25% for same crops and countries, all beginning in 2005
Irrigated area growth	Output irrigated harvested area growth: 0.16%/yr, 2005–2015	Increase irrigated area growth by a factor of 0.1
Access to water	Interpolated from IFPRI estimates for 2020 (see table 3.10)	Following MDG Target 10 (see table 3.10)
Female secondary education	Interpolated from IFPRI estimates for 2020 (see Appendix Table 1)	Increased from 1995 by between 20–150% to reach malnourishment indicator, but not higher than 95% (see Appendix Table 1)
Female-to-male life expectancy ratio at birth	Interpolated from IFPRI estimates for 2020 (see Appendix Table 1)	Adjusted to reach malnourishment indicator (see Appendix Table 1)
<i>Source:</i> IFPRI-IMPACT parameters.		

will increase food availability in developing regions and therefore reduce the share of malnourished children.

- Increased investment levels in health and access to improved drinking water sources will help achieve MDG 7 Target 10.
- Increased investment levels in education will help reach higher levels of secondary enrollment of girls.
- Increased investment in female and maternal well-being will help to reach improvements in the ratio of female to male life expectancy at birth.

Thus, the MDG scenario combines two broad courses for improving food security and reducing poverty in developing regions: the first way is through broad-based and rapid agricultural productivity and economic growth to increase effective incomes, effective food demand, and food availability; and the second is through investments in education, social services, and health (proxied in the model by female secondary enrollment rates, ratio of female-to-male life expectancy at birth, and access to clean water).

Results

The results of the 2015 baseline and MDG scenario simulations based on IMPACT-WATER show that the indicator for halving the prevalence of child malnutrition can be reached (or even overshoot) in some countries and regions, even in the baseline scenario, while it is unlikely to be met, even under the MDG scenario, for others.

The combined effect of the parameter changes is first, an increase in projected constant-price (rainfed and irrigated) cereal yield growth for all developing regions, 2005–2015, from 1.39 percent annually under the baseline to 1.88 percent per year under the MDG scenario; second, an increase of crop-irrigated harvested-area growth from 0.16 percent per year under the baseline to 0.21 percent annually under the MDG scenario; and third, an increase from baseline livestock numbers growth of 1.43 percent per year during 2005–2015 to 2.17 percent annually under the MDG scenario.

Under the MDG scenario, increased per-capita income and lower food prices resulting from food production increases lead to higher levels of per-capita food consumption. Increased per-capita food

Table 3.12 Income Growth Requirements for Baseline and MDG Scenarios, 1995–2015

Country/Region	Baseline scenario	MDG scenario
Percent per year		
Latin America		(25% increase)
Mexico/Brazil/Other Latin America and Caribbean	3.6	4.5
Colombia	3.8	4.8
Argentina	4.5	5.6
Sub-Saharan Africa		
Nigeria	3.8	
Northern Sub-Saharan Africa	3.3	
Central and Western Sub-Saharan Africa	3.8	8.0
Southern Sub-Saharan Africa	3.2	
Eastern Sub-Saharan Africa	3.5	
West Asia and North Africa		
Egypt	4.0	
Turkey	4.5	6.0
Other West Asia and North Africa	3.5	
East Asia		(25% increase)
China	6.0	7.5
South Korea	5.0	6.3
Other East Asia	3.5	4.4
South Asia		
India	5.8	
Bangladesh	4.8	8.0
Pakistan	4.5	
Other South Asia	4.5	
South East Asia		(25% increase)
Indonesia	4.5	5.6
Thailand/Malaysia	5.2	6.5
Philippines	5.0	6.3
Vietnam	5.8	7.3
Myanmar/Other South East Asia	4.0	5.0

Notes: Latin America includes the Caribbean; N SSA stands for Northern Sub-Saharan Africa; CW SSA stands for Central and Western Sub-Saharan Africa; S SSA stands for Southern Sub-Saharan Africa; E SSA stands for Eastern Sub-Saharan Africa; WANA stands for West Asia and North Africa; O S Asia stands for Other South Asia; O SE Asia stands for Other Southeast Asia; O E Asia stands for Other East Asia. The regional disaggregation is presented in Annex 2.

Source: IFPRI-IMPACT parameters.

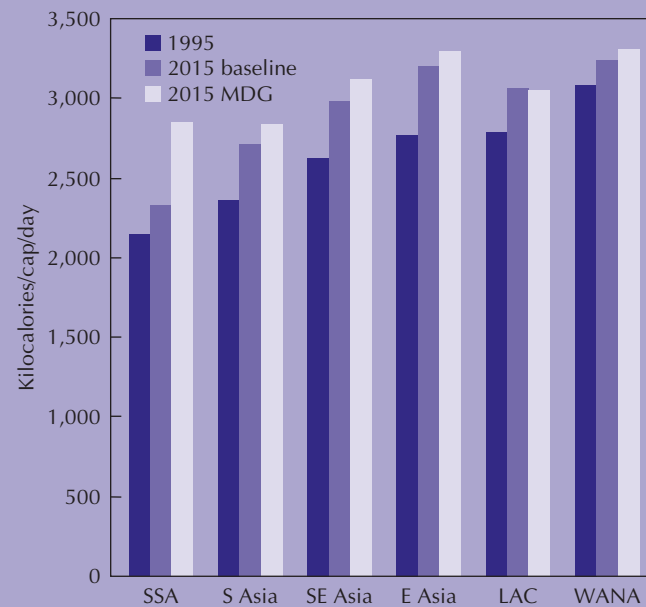
availability translates into higher per-capita caloric intake, which in turn reduces the share of malnourished preschool children. Strong growth in public investment in the social sectors, including total social expenditures, and particularly expenditures for education and water and sanitation, result in further reductions in the share of malnourished children.

The projected levels of calorie availability for the major IMPACT-WATER regions for the two scenarios are shown in figure 3.3. Compared to the baseline scenario, per-capita kilocalorie availability improves for all developing regions in 2015 under the MDG scenario, apart from a very small decline

in Latin America. The daily kilocalorie availability increase is largest by far for the Sub-Saharan Africa region at 515 kilocalories, driven by very rapid income growth (8 percent per year) and rapid agricultural growth. In South Asia, caloric availability increases by 128 kilocalories, driven by the same factors as in Sub-Saharan Africa. WANA, which already has high levels of kilocalorie availability in 1995 and the 2015 baseline scenario, is expected to further increase availability by a smaller amount, 65 kilocalories.

Figure 3.4 presents the results for child malnutrition for the group of developing countries for 1995 and 2015 (baseline, MDG scenario, and MDG indi-

Figure 3.3 Per-Capita Kilocalorie Availability in 1995 and Projections to 2015, Baseline and MDG Scenarios



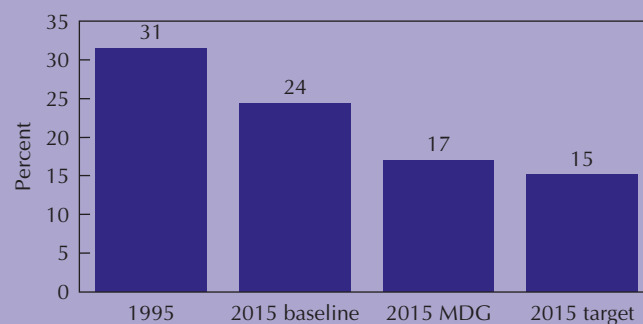
Source: IMPACT-WATER Simulations, IFPRI 2004.

cator target). On average, the MDG scenario misses the MDG 2015 indicator by only 1.9 percentage points. The changes in agricultural and complementary social indicators result in a reduction in total child malnutrition from 24.4 percent under the baseline to 17.0 percent under the MDG scenario. These declining shares reflect large reductions in

the absolute number of malnourished children: from 161 million children in 1995 to 131 million children under the baseline, and 91 million children under the MDG scenario.

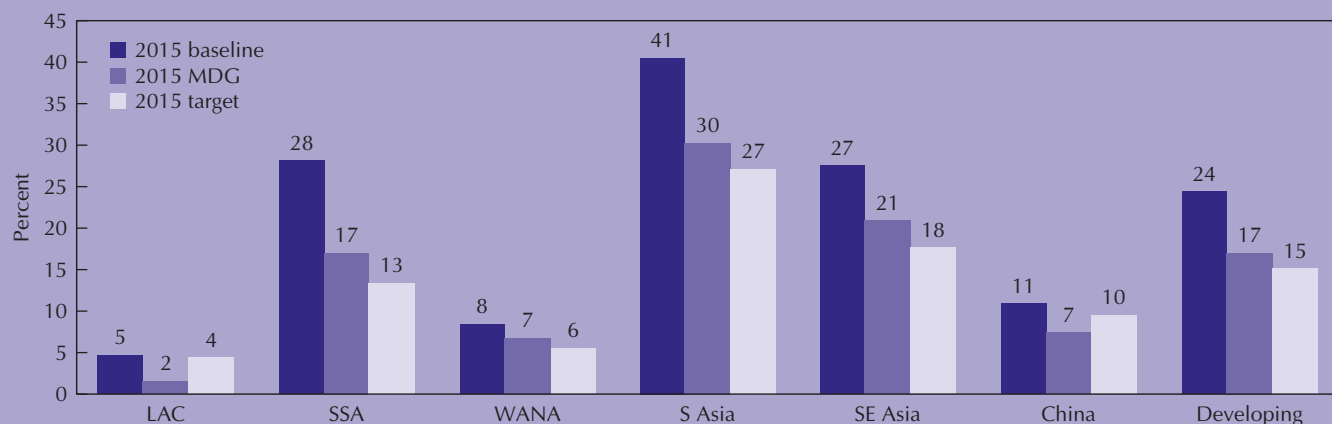
As can be seen in figure 3.5, the Latin America and Caribbean region basically achieves the target rate even under the baseline scenario (4.6 percent

Figure 3.4 Child Malnutrition, Developing Countries, 1995, 2015 Baseline, 2015 MDG Scenario, and 2015 Target



Source: IMPACT-WATER Simulations, IFPRI 2004.

Figure 3.5 Child Malnutrition, Developing Country Regions, 2015 Baseline, 2015 MDG Scenario, and 2015 Target



Source: IMPACT-WATER Simulations, IFPRI 2004.

proportion of malnourished children compared to a target rate of 4.4 percent). Noncaloric parameters of the child malnutrition equation were changed very little for the MDG scenario for this region.

Similarly, China, where declines in child malnutrition have been very rapid over the last 30 years, is projected to come close to the 2015 target indicator for child malnutrition even in the baseline scenario. Under the baseline, the share of malnourished preschool children is expected to reach 10.9 percent compared to a target rate of 9.5 percent. Under the MDG scenario projecting rapid increases in agricultural and economic growth, and moderate increases in income growth, the target is reached easily, even under very slow improvements in noncaloric parameters, an increase in the ratio of female-to-male life expectancy from 1.0467 to 1.0650, and an increase in female secondary school participation from 62 percent in 1995 to 74 percent by 2015. These increases result in an under-five malnutrition rate of 7.4 percent under the MDG scenario, or 7.0 million children malnourished by 2015.

WANA is the third region where reaching the target indicator for malnourished children appears feasible, on average. Under the baseline scenario, the incidence of child malnourishment declines to 8.4 percent compared to the target rate of 5.5 percent. Under the MDG scenario, income growth of 6 percent annually for all countries in the region, combined with rapid agricultural growth, limited improvements in female secondary schooling and the ratio of female-to-male life expectancy at birth,

and a high target rate for safe drinking water result in a rate of 6.8 percent preschool children malnourished.

However, other developing regions, including Sub-Saharan Africa, South Asia, and parts of Southeast Asia, are less likely to reduce the incidence of malnutrition in under fives by half from 1990 to 2015, although very rapid growth in both income and agriculture can help move these countries and regions almost within reach of the target indicator.

Under business-as-usual conditions, Sub-Saharan Africa is unlikely to meet the MDG target indicator of halving the prevalence of malnourished children by 2015 to 13.4 percent. In the baseline scenario, a reduction from 33 percent in 1995 to 28 percent in 2015 leaves the region still with more than double the target rate for child malnutrition levels. In absolute terms, this translates into an increase in the number of malnourished children from 32 million to 37 million children. Under the MDG scenario, in addition to very optimistic non-agricultural income growth rates and very rapid crop and livestock production increases, highly optimistic developments for the noncaloric parameters are simulated, including very rapid changes in the ratio of female-to-male life expectancy at birth and a doubling or more of the share of female secondary school enrollment. Even under these highly optimistic assumptions, the 2015 MDG scenario results in 17 percent of under fives malnourished, or 23 million children. Countries and regions

expected to struggle most with the MDG target indicator are Nigeria and Northern Sub-Saharan Africa, where child malnutrition rates in 1995 had been 39 and 40 percent, respectively.

In South Asia, the share of malnourished children is projected to decline from 51 percent in 1995 to 41 percent in 2015 under the baseline, a very substantial decline, translating into a reduction in the number of malnourished children by 20 million. This process is mostly driven by India, which is projected to reduce child malnutrition from 53 percent in 1995 to 43 percent in 2015, or an absolute reduction of 19 million children. The MDG scenario incorporates much faster economic and rapid agricultural growth, and very optimistic assumptions for the noncaloric parameters, such as a jump in the ratio of female-to-male life expectancy at birth from 1.0088 for India (the fifth lowest rank among 195 reported values in 1995) to 1.0850, and an increase in secondary female schooling from 38 percent in 1995 to 95 percent by 2015. These optimistic noncaloric parameters necessitate very large investments in the social sector. However, the outcome of the MDG scenario is still 30 percent preschool children malnourished in 2015, compared to the target rate of 27 percent.

In Southeast Asia, finally, some countries like Malaysia and Thailand almost reach their respective baseline target reductions of 12.5 percent and 11.0 percent, and therefore surpass the indicator target rates under the alternative scenario by 2.5

(Thailand) and 1.4 percentage points (Malaysia), despite low improvements in noncaloric malnutrition parameters. Other countries, including Indonesia, Myanmar, the Philippines, Vietnam, Cambodia, and Lao People's Democratic Republic are less likely to halve the proportion of malnourished children in the baseline scenario; Myanmar and Vietnam miss the target by 21 and 15 percentage points, respectively. Compared to the baseline, under the MDG scenario, rapid increases in agricultural and moderate additional economic growth, together with additional investments in social sectors—as proxied by improvements in the ratio of female-to-male life expectancy at birth, higher proportions of female secondary schooling, and enhanced access to water—lead to declines in the number of malnourished children by 2015. These declines are 6 percent in Indonesia, 3 percent in the Philippines (where many social indicators are already at high levels today), 11 percent in Vietnam, 13 percent in Myanmar, and 3 percent in other Southeast Asia, narrowing the Southeast Asia gap to just 3.3 percentage points from the target (table 3.13).

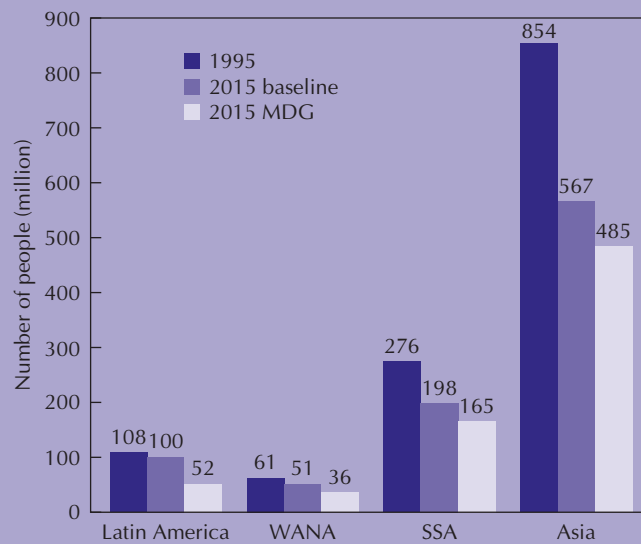
Figure 3.6 presents the number of people without access to safe drinking water in 1995, for the baseline and MDG scenarios, along the lines of MDG 7, Target 10, to “halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.” Rates of access to clean water underlying this figure are

Table 3.13 Southeast Asia, Share of Malnourished Preschool Children, 1995, and 2015 Baseline, MDG Scenario, and Indicator Target

Countries/ regions	1995	2015 Baseline	2015 MDG	Target
Percent				
Indonesia	34.0	27.8	21.4	18.4
Thailand	18.9	12.1	8.5	11.0
Malaysia	20.1	13.8	11.1	12.5
Philippines	29.6	23.1	20.0	16.8
Vietnam	44.9	37.2	26.1	21.8
Myanmar	42.9	37.4	24.5	16.2
Other SE Asia	40.0	29.9	27.1	23.5
South East Asia	34.1	27.5	20.9	17.6

Note: Other SE Asia includes Brunei, Cambodia, and Lao PDR. Myanmar's child malnutrition indicators worsened considerably between 1990 and 1995, but have since improved again.

Figure 3.6 Number of People Without Access to an Improved Water Source, 1995, and Projected 2015 Baseline and MDG Scenarios



Source: IFPRI calculations.

based on estimates of likely improvements in access for the baseline and required improvements to reach Target 2 for preschool children for the MDG scenario. In 1995, an estimated 1.3 billion people in developing countries lacked access to safe drinking water according to the IMPACT-WATER rates and population numbers. Under the baseline scenario, by 2015, 0.9 billion people still are estimated to be without access to safe drinking water. The decline in the number of people without access to safe water during 1995–2015 would be largest for Asia at 34 percent, followed by Sub-Saharan Africa at 28 percent, and slowest for Latin America at 7 percent. Under the much higher rates projected for the MDG scenario, the number of people without safe access would drop to 0.7 billion people, which also still falls short of the target. Under this scenario, only Latin America and parts of Asia would reach the target.

Implications for Investment

What are the implications for public investment for the 2015 baseline and MDG scenarios, based on IMPACT-WATER calculations? The most important public investment drivers in IMPACT-WATER are irrigation, rural roads, education, clean water pro-

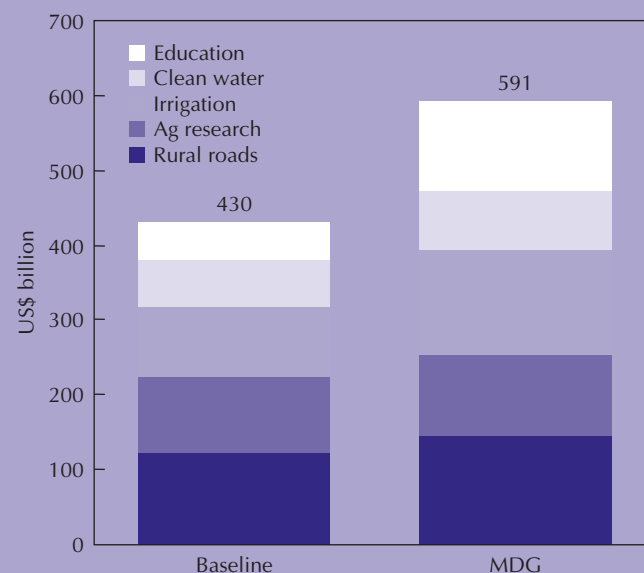
vision, and agricultural research. Total irrigation investments are calculated by multiplying the estimated increases in irrigated area, adjusted for cropping intensity, during 1995–2015 by the average cost of irrigation per hectare, expressed in 1995 real U.S. dollars. Rural road investments are calculated by multiplying the incremental road length required in 1995–2015 by road investment costs per kilometer. The incremental rural road length is calculated assuming first, that the density of roads is proportional to cropland area, and second, that crop yield growth also contributes to road expansion. Expenditures for public agricultural research are based on expenditure trends and projections and their relative contribution to crop yields. The estimated incremental investment in education is based on the cumulated annual costs of the additional number of female students required to increase the percentage of females with access to secondary education to the levels projected in the scenarios (Appendix Table 1). It is calculated by the cumulative annual required increase in enrollment multiplied by the annual cost of secondary school education per student. Incremental investment costs for clean water, finally, are based on the investment required to increase the share of people with access to clean water to the levels projected

under the alternative scenarios. Per-capita costs of providing clean water and estimates of the number of people gaining access to clean water are disaggregated by urban and rural areas. Additional details on calculation procedures are presented in Rosegrant and others (2001). The cost of improvements in the five sectors during 1995–2015 under the baseline and MDG scenarios are shown in figure 3.7.

As expected, the MDG scenario envisions large increases in investment in the key drivers. Total estimated expenditures during 1995–2015 for the group of developing countries are \$430 billion under the baseline scenario and \$591 billion under the MDG scenario. Investments in rural roads account for 28 percent of total investment under the baseline, followed by agricultural research and irrigation with 24 percent and 21 percent, respectively, and clean water and education with 15 percent and 12 percent, respectively. In the MDG scenario, the share of investments in education increases to 20 percent, with levels more than doubling from \$51 billion to \$118 billion due to the assumed rapid expansion in female secondary schooling, particularly in parts of Asia and Sub-Saharan Africa. There are increases in investments for rural roads, irrigation infrastructure, and agricultural research, corre-

sponding with the higher yield increases achieved under this scenario. The average irrigation cost per hectare increases from \$4,850 in the baseline to \$6,204 in the MDG scenario as more expansion occurs in areas where projects are more costly, such as Sub-Saharan Africa. The increase in irrigation investments is thus not only due to the expansion of irrigated area, but also to the increase in the cost of irrigation under the MDG scenario. Compared to the baseline 2015 net area, area under the MDG scenario is only 4 million hectares larger. As relatively high levels of access to clean drinking water are already achieved in the baseline scenario, only \$15 billion in investments are added for the MDG scenario. The increase in investment in agricultural research under the MDG scenario is relatively small, \$5 billion. Due to the long lags in generation of impact from agricultural research, increases in research expenditures, even beginning now, will have relatively small impacts on crop yields by 2015. Increased investments in agricultural research are likely to be essential to meet crop and animal production needs beyond 2015, but do not have large direct impacts on achieving the MDG scenario. Other investments, such as roads and irrigation, have significant lags in impact as

Figure 3.7 Cost Estimates for Implementing the Baseline and MDG Scenario, 2015, Developing Countries



Source: IFPRI calculations.

well, so implementing the investment portfolio required for the MDG scenario will require very rapid action.

The total increase in investments estimated based on IMPACT-WATER calculations is \$161 billion in agricultural and supporting sectors during 1995–2015 under the MDG scenario to bring developing countries and, in particular, two major regions unlikely to achieve the MDG target indicator for malnourished children—South Asia and Sub-Saharan Africa—within reach of the preschool malnutrition target indicator.

Conclusions

The alternative scenarios have shown that the combination of agricultural and economic growth, together with larger investments in social sectors including health and education, can almost completely eliminate the gap between the business-as-usual outcomes for 2015 (24 percent of developing-country preschool children malnour-

ished) and the target indicator (15 percent children malnourished) to reach 17 percent.

However, the outcome varies significantly by country and region. While Latin America, the West Asia and North Africa region, and China will likely come close to or possibly reach the target indicator by 2015, even under business-as-usual, chances that Sub-Saharan Africa and South Asia will reach their respective target rates are much smaller. In fact, on average, Sub-Saharan Africa and South Asia will not be able to reduce their shares of malnourished children by 2015 even under very favorable agricultural, economic, and social conditions, but improved conditions in these sectors can bring the countries in these regions much closer to the 2015 target and can facilitate further reductions in malnutrition later on. In Southeast Asia, finally, the picture is mixed, with some rapidly growing economies likely to reach the Millennium target indicator on child malnutrition, while others, including Myanmar and Vietnam, will need substantial additional investments in agriculture and social sectors to get closer to the target.

Global trends and Emerging Issues in Meeting the MDGs

A Trade, Macroeconomic, and Policy Perspective

Current trade barriers and subsidies are high for agriculture. Successful WTO agricultural trade negotiations that lower protection and subsidies could boost progress toward the MDGs.

POLICY ACTIONS AND THEIR IMPACTS ON THE MDGs

The prospects for meeting the MDGs of eradicating extreme hunger and poverty and achieving the health and education goals are essential to and directly affected by the agriculture sector. Farm-sector support policies and border protection worldwide are some of the policies at the sectoral level that influence both agricultural and MDG outcomes. Since most of the world's poor are rural and depend on agriculture for part or all of their livelihoods, agriculture is a critical sector in which the global trade system must work to their benefit.

Policies directed at achieving the targets specified under the MDGs should be particularly directed at smallholder agriculture. While small individually, in many cases smallholders account for a large share of agricultural production. In Sub-Saharan Africa, over 90 percent of agricultural output comes from smallholders, who account for nearly three-quarters of the poor. In India, farmers with less than 2 hectares account for 40 percent of total food grain production (Narayanan and Gulati 2002).

Macroeconomic policies of the developing countries also affect agriculture and rural poverty. A number of developing countries have implemented structural adjustment programs aimed at correcting fiscal imbalances, largely through reductions in public expenditures; redefining the role of the state in economic affairs; privatizing major sectors of the national economies; accelerating growth; and through trade liberalization (Goldin and Winters 1992). These structural adjustment programs affected agriculture and especially smallholders in a number of ways. Beneficial effects often arise from lower inflation, reduced government debt accumulation, and falling interest rates, as well as from depreciation of overvalued exchange rates. Yet, redressing fiscal imbalances also typically involves reductions in both agricultural and nonagricultural subsidies (Schiff and Valdez 1998) and significant reductions in public spending, with potentially adverse impacts on agriculture.

Relative impacts on agriculture depend in part on the targeting of the remaining allocation of public spending; if public investments are targeted to public goods and specifically to services that foster economic growth, then impact on agricultural output may well be positive. For example, Van Blarcom, Knudsen, and Nash (1993) analyzed a sample of 32 countries in which public spending on agriculture had been cut some time after 1970. As mentioned by Schiff and Valdez

(1998), the 1993 analysis concluded that much of the public spending on agriculture in these countries had been directed toward relatively unproductive purposes and, therefore, reductions were appropriate in those cases.

A review of a range of national poverty reduction strategy papers (PRSPs) showed evidence of a link between poverty and lack of infrastructure services. In particular, agricultural research, education, and rural infrastructure are the three most effective public spending items in promoting agriculture growth as shown for India and China (Fan, Hazell, and Hague 2000; Fan, Hazell, and Thorat 2000; Fan, L. Zhang, and X. Zhang 2002; Fan and Hazell 1999; Zhang and Fan 2000).

Fan and Rao (2004) compiled government expenditures by type across 43 developing countries from 1980 to 1998 and found that structural adjustment programs had different consequences for different sectors. In Africa, governments reduced expenditure shares for agriculture, education, and infrastructure, while Asian governments reduced shares for agriculture and health. In Latin America, education and infrastructure suffered from reduction in government expenditures.

Trade liberalization has been another major component of structural adjustment programs, and liberalization of nonagricultural trade has to some extent improved agricultural incentives through lower industrial prices and through the depreciation of the real exchange rate. However, the potential benefits of agricultural trade liberalization have not been generally realized because agriculture has long been treated as a special case left outside the multilateral trade-liberalization process in the General Agreement on Trade and Tariffs (GATT). As a result, extensive Organisation for Economic Co-operation and Development (OECD) subsidies and border protection continue to block opportunities for those poor people who depend on farming for their livelihoods.

The Uruguay Round of GATT negotiations (1986–94) created the World Trade Organization (WTO) and also produced the first comprehensive framework of multilateral disciplines on agricultural subsidies and trade policies. Yet, the Uruguay Round Agreement on Agriculture achieved only modest agricultural trade liberalization. A critical question is whether the current Doha Development Round of WTO trade negotiations (2001) can build on this framework to deliver further market opening and opportunities for trade. The overarching

policy issues, as mentioned in Orden, Torero, and Gulati (2004), are whether agriculture will be brought more fully under liberalized trade rules and how the outcomes will affect the rural poor.

Additional dimensions of the possible disciplines on agricultural support and protection policies are their effects on food aid and the impact of technical regulations and standards on agricultural trade opportunities. The latter are posing challenges to market participation by smallholders just as high-value demands are creating potential new income streams.

In this chapter we examine four aspects of the policies affecting achievement of the MDGs. These include trade and domestic support policies for agriculture in developed and developing countries, macroeconomic reform and public sector infrastructure and other investments, the role of the private sector and public-private partnerships, and the importance of good governance. We argue that supportive government investments and well functioning private and public market institutions, together with foresight in the design of agricultural policies, are required to take advantage of market opportunities to sustain increased agricultural output and raise rural incomes that will help achieve the targets formulated for the MDGs.

TRADE POLICIES

Policies of Developed Countries

Support policies and border protection of wealthy Organization for Economic Co-operation and Development (OECD) countries, valued at hundreds of billions of dollars each year, cause harm to agriculture in developing countries. Evaluating the overall effects of the subsidies and protection among developed countries, assessing the effects of these policies specifically on developing countries, or even more specifically assessing their effects on poverty in developing countries, are complex challenges. The evaluation must rest on counterfactual simulation of alternative policy scenarios. A diverse set of policies has to be represented, and models to accomplish these tasks differ in assumptions about crucial parameters, levels of aggregation, scope of commodity and country coverage, and many other dimensions.

A number of model results were reviewed recently by Beierle and Diaz-Bonilla (2003) with the objective of describing what is known and the

remaining knowledge gaps on whether trade liberalization (in the form of reduced protection and export subsidies and lowered import restrictions) would benefit smallholder farmers and others in poverty in developing countries. Several key findings from their review and other assessments follow:

- Most models demonstrate negative impacts of current developed country (OECD) trade protection policies and positive impacts from developed country liberalization on developing country welfare, agricultural production and incomes, and food security.
- Impacts vary by country, commodity, and sector, and for regions within countries.
- OECD market access restrictions harm developing countries, but effects of production and income-support subsidies are more ambiguous.
- Developing countries tend to gain more from liberalization of their own policies than from reforms by the OECD. Consumers in developing countries benefit widely from developing country liberalization reforms.
- Model results differ on the basis of assumptions such as the scope of commodity coverage, mobility of resources among alternative crops and between farm and nonfarm employment, availability of underutilized labor, and static versus dynamic analysis.
- Multilateral liberalization reduces the benefits derived from preferential trade agreements, but these losses are relatively small compared to the overall gains from the broader reforms.
- Most models have not had sufficient resolution to analyze the impacts of reforms on smallholders, subsistence farmers, and other poor households, but there is an emerging literature attempting to do so (Beierle and Diaz-Bonilla 2003; Hertel and Winters 2004; Narayanan and Gulati 2002; Tokarick 2002).

With the diversity in modeling approaches, no single model has all the desired features that would allow an examination of the impacts of trade protection and liberalization on smallholder and subsistence farmers and food security. Most of the studies disaggregate only to the regional level—Sub-Saharan Africa, for example. Many analyses with world general equilibrium models consider only an aggregate household per country and present the results mainly in terms of overall national

welfare. However, there are some studies that differentiate impacts by types of households (for example, agriculture, self-employed, nonagriculture; male or female head), focus on food security or poverty reduction, or, most recently, incorporate detailed household survey data to evaluate net and distributional effects of reforming trade policies.

A few representative results illustrate the points above. The primary mechanism by which OECD transmits agricultural protection and subsidies around the world is commodity prices in world markets. The analytic studies suggest that OECD agricultural subsidies and protection depress world prices of basic agricultural food crops in the rough range of 1–5 percent. OECD protection (mainly tariffs and tariff-rate quotas [TRQs]) depresses the prices of other nonstaple commodities by a larger amount, such as 8 percent for sugar, 22 percent for sheep meat, and 24 percent for milk. Averaged across all commodities, a common estimate of the extent to which OECD policies depress prices is 10 percent, with various studies estimating average price changes in the range of 5–20 percent.¹⁰

The models show that the increase in world prices from removal of OECD protection will lead to larger agricultural production in developing countries. Beghin, Roland-Holst, and van der Mensbrugghe (2002) estimate that removal of OECD protection could boost rural value added in low- and middle-income countries by \$60 billion per year. Tokarick (2002, 2003) arrives at lower numbers, estimating that OECD market access barriers and subsidy policies cost developing countries as a whole \$8 billion in (overall) welfare annually (0.13 percent of developing country GDP).

In a model that allows for unemployment in rural and urban sectors in developing countries and for slight positive effects of technical change correlated with higher levels of trade openness, Diao, Diaz-Bonilla, and Robinson (2003) estimate that OECD subsidies and border protection reduce agricultural exports from the developing world by \$37.2 billion (25.3 percent) annually. Agricultural value added among developing countries is reduced by \$23.0 billion annually, while national welfare of developing countries is repressed by \$9.4 billion. For specific countries and specific commodities, the effects can be critical, as in the case of cotton for the rural poor in a number of African countries. Minot and Daniels (2003), using household survey data, find that a drop of world cotton

prices by 20 percent, as might be due to developed-country subsidies, raises poverty in cotton export-dependent Benin by 4 percentage points (an increase of 10 percent of the population under the poverty line) through direct and indirect effects on rural incomes.

Beyond the effects of tariff and farm-support policies captured in models as described, the fastest growing world agricultural markets are for fruits and vegetables, livestock products, and other high-value commodities. For these products, regulations related to safety and quality play a large role in determining trade opportunities. The WTO embodies agreements to discipline agricultural and food safety and quality regulatory decisions that are primarily sovereign prerogatives. These WTO disciplines call broadly for countries to achieve legitimate regulatory goals in the least trade-distorting manner. Effectiveness of these disciplines is an important aspect of a rules-based agricultural trade system (Josling, Roberts, and Orden 2004).

Developing countries have a lot at stake in the area of food regulation. Production of high-value products is potentially a source of higher incomes among the rural poor. But stringent developed-country regulatory measures to address health, safety, and quality goals can close off market opportunities. There is a trend in quality regulation toward the required use of certain production methods or required labeling of production and processing attributes. These process-focused measures often demand complex conformity assessment with high compliance costs. Innovations are needed to ensure efficient implementation of such measures. There is a great need to build up the capacity of developing countries to produce up to the exacting standards of importing markets. And there is a challenge to the MDG: agricultural and food regulations that are well-intentioned in some dimension can have the undesirable effect of reducing income-earning opportunities or blocking technology adoption that would benefit the poor.

Policies of Developing Countries

There is growing agricultural trade among developing countries, but these countries also retain substantial trade barriers on agricultural products. Developing-country governments (and civil society organizations) that are largely united in seeking lower agricultural subsidies and protection in the developed countries have been divided concerning

what to do about the agricultural trade barriers in developing countries. Developing countries are not homogenous with regards to agriculture liberalization. They have different trade specializations (different export products facing varied degrees of protection or support in developed countries); some are net food importers, and others are faced with different trade barriers. Those countries with strong agricultural export potential have called for more open markets, but those fearful of negative effects on their poor farmers have been reluctant to endorse such moves. Many development advocates are adamant that developing countries be granted room to retain agricultural trade barriers.

What is at stake in the reduction of agricultural protection among developing countries is somewhat different than the stakes from developed-country reforms. When developing countries join in agricultural trade liberalization, reducing high levels of trade restrictions, relaxing quantitative restrictions on imports, and lowering import tariffs, they can achieve overall welfare gains of \$19.9 billion annually, according to Diao, Diaz-Bonilla, and Robinson (2003). This is twice the gains in national welfare compared to reforms in the developed countries only. The additional overall gain is primarily due to consumers facing lower internal prices as their countries' own trade barriers are reduced. Developing-country trade policy reforms add an additional \$14.9 billion annually to aggregated agricultural exports of developing countries, but do not increase their aggregated agricultural production value added in the Diao, Diaz-Bonilla, and Robinson model.

These results suggest that trade policy reforms among developing countries boosts their overall welfare but also creates distributional impacts among those developing countries that are best able to gain from trade openness versus those less able to do so. These reforms also create distributional effects between food consumers and producers within (poor) countries. There is a need to understand these distributional effects better. However, the overall welfare benefits are important as well; they extend to poor food consumers, including poor farmers and landless rural workers who use nonfarm income to buy food.

Three leading empirical studies that focus on Africa's growth performance—Easterly and Levine (1997), Rodrik (1998), and Sachs and Warner (1997)—conclude that the region performed poorly after the reforms of the 1980s, even though the

reasons provided for the poor performance vary. Easterly and Levine emphasize the role of ethnic fragmentation and poor quality of institutions, while Sachs and Warner stress poor trade policies and geography. Rodrik reports that, contrary to Sachs and Warner, the fundamentals for long-term growth are human resources, physical infrastructure, macroeconomic stability, and the rule of law.

In an overall context, a successful conclusion for agriculture in the WTO Doha Development Round trade negotiations can be understood to make an important contribution to achieving the MDGs by establishing sustainable positive incentives for agricultural production among developing countries. A July 30, 2004 WTO framework agreement to guide further negotiations came at the last possible hour to avoid a collapse of the Doha round. For agriculture, it narrowed the negotiating field somewhat, but still leaves wide latitude about how much trade will be opened under an agreement's final terms. Because of the way WTO disciplines on tariffs and subsidies are defined and administered, agreed reductions in protection and domestic farm support would have to be quite big to have much effect on trade (Anderson, Martin, and van der Mensbrugghe 2004).

In summary, an increase in the share of national income that is exported, or lower importing prices, does not in itself generate growth in per capita income and will not on its own set an economy on a sustained growth path unless it is accompanied by other structural reforms.¹¹ However, excessive levels of export taxation and import restrictions can contribute to the relative decline in growth of some countries. In addition, to achieve some of the positive gains, developing countries that will benefit from more open markets abroad need to participate in multilateral agricultural trade policy reforms. Benefits for poor farmers in countries less able to compete as trade barriers come down will come not from multilateral trade policy reform itself, but from complementary investments and policy improvements.

Policies in Development Assistance: The Case of Food Aid

Food aid is another component of international transactions that directly and indirectly affects rural poverty in a globalized agricultural economy and therefore could have a significant impact in achieving the MDG targets.

Modern food aid emerged after World War II, particularly with the United States P.L. 480, the Agricultural Trade Development and Assistance Act, of 1954. This law asserted multiple goals for food aid. Food aid would combat world hunger and malnutrition and promote agricultural development, but it would also expand trade and develop export markets for U.S. agricultural commodities. Food aid from the United States peaked in the 1960s, but the country has remained the largest single donor of food aid, accounting for about 55 percent of the total during the 1990s. Food aid now accounts for less than 5 percent of global trade in agricultural and food products. Yet many controversies surround the use of food aid, either for emergency crisis relief or as an instrument of humanitarian and development policy. Given relatively fixed or slowly changing budgets, there is a built-in cycle of food aid: the volume of food aid available will be lowest when commodity prices are highest (and need is, in that sense, greatest). Moreover, there is much evidence that the provision of food aid is subject to political pressures related to supporting world commodity prices and other objectives.

Food aid falls under emergency aid, project aid, or program aid. Emergency aid, which has been increasing its share in total food aid recently, is a response to natural disasters or conflicts that leave vulnerable populations at risk of starvation or severe malnutrition. Project aid is associated with the development of specific food security or development projects, such as school feeding programs. Program aid is the most general use of food as a form of foreign assistance, essentially providing the monetized value of the food as a resource for use by a developing-country government, although sometimes with conditionality requirements about how this aid is utilized.

Food aid can be procured in the donor country, local markets of the recipient country, or from third-country sources. It can be provided through bilateral or multilateral channels, and these channels can encompass governments, multilateral agencies such as the United Nations's World Food Programme (WFP), and nongovernmental organizations. The U.S. P.L. 480 requires the use of commodities produced in the United States; in 2002, for example, nearly 90 percent of the total 9.6 million tons of food aid delivered worldwide was procured in the donor countries. Contributions in financial terms by donors, rather than in the form of food commodities, allows greater flexibility in providing food

aid, which can be sourced in the donor country or elsewhere using the aid financing. Local or third-country (triangularization) purchases accounted for a higher percentage of the food aid delivered by the European Commission's multilateral food aid program (70 percent), when food aid is provided for emergency purchases (67 percent), and of food deliveries through the WFP (which accounted for nearly 40 percent of total food aid in 2002, nearly 60 percent of which was procured in recipient or third countries) (Hoddinott, Cohen, and Bos 2003).

Once food aid is provided to recipient agencies, it can either be delivered directly as food to targeted populations or "monetized" through sale in recipient country markets. When monetized, the cash value of the food aid becomes a resource that the agency can use to support various activities. Even in the case of food aid for emergency purposes, some of the food can be sold to cover nonfood costs of aid delivery. In the cases of project and program aid, a great deal of monetization occurs. There is therefore concern that food aid can depress incentives for local food production. But well directed food aid, or aid programs financed by monetization of food aid, can also provide essential emergency relief and reduce vulnerability of the poor to short-term shocks that undermine their long-term human and physical assets (Barrett and Maxwell 2004; Hoddinott, Cohen, and Bos 2003).

Several international institutions provide guidelines for food aid.¹² The current rules exempt "bona fide food aid" from restrictions on export subsidies, and the nonbinding 1994 WTO Marrakesh Ministerial Decision recommends increased food aid as a means to help developing countries. But as direct export subsidies allowed under the Agreement on Agriculture are subject to increasingly disciplined negotiation (and are even being phased out), indirect forms of subsidization, including some uses of food aid, are also under scrutiny. The July 2004 framework agreement calls for elimination "by a credible end date" of export subsidies and "parallel" elimination of "all export measures with equivalent effect." For food aid, the agreement calls for elimination of "provision of food aid that is not in conformity with operationally effective disciplines to be agreed. The objective of such disciplines will be to prevent commercial displacement."

Food aid remains the subject of ongoing controversies in the context of the issues described above. It is widely recognized that provision of aid in the form of food is not the optimal form for develop-

ment assistance, but likewise that donors would probably not provide equivalent cash development assistance in place of food if existing food-aid programs were terminated (Hoddinott, Cohen, and Bos 2003). Thus, attention has focused on how its effectiveness can be maximized and its potential harms mitigated (Barrett and Maxwell 2004; von Braun 2003).

Macroeconomic Reforms and National Government Infrastructure Investments

For the last two decades developing countries have experienced several changes in their macroeconomic policies. Macroeconomic policies changed from development strategies aimed at the domestic market, with strong public-sector intervention, to more outward-looking strategies with openness to trade, deregulation of markets, more fiscal control, and the private sector as the main agent for development.

Although it was expected that these new policies would lead to an increase in growth, the results are not clear and vary among regions. Results derived from cross-country comparisons may be indicative but are not very conclusive. Such comparisons involve differences in the experience of each of the individual countries, not only in terms of the effects of the policy reform but also of the initial conditions at the initiation of reforms and the timing and consistency of them. However, many experts agree that there is a need to maintain macroeconomic balances, to further trade and financial openness, to restrict activities of the state, and to deregulate markets (Devarajan and others 2000; Edwards 1995; Stiglitz 2000).

Similarly, agricultural policies changed significantly in the 1990s. An example is shown in table 4.1 for Latin America and the Caribbean. Serious concerns have been raised regarding the effects of policies on the agriculture sector and on the more vulnerable parts of the population. Demand contraction, the abolition or reduced role of parastatals, significant reductions in public expenditures, and the withdrawal of state interventions—combined with rigidities in resource mobility, slow response of the private sector, and lack of appropriate infrastructure and institutions—have resulted in an increase of unemployment and therefore an increase in inequality between and within rural and urban areas. Reductions in public investment outlays were not (fully) compensated by private investments,

Table 4.1 Latin America and the Caribbean: Main Features of Changes in Agricultural Policies

Policies in the 1950s to 1980s	Present Policies
Strong state centralism	Political, institutional, and financial decentralization aimed at serving local projects
State planning and financing of “public” goods and services	Demand-oriented approach, with cofinancing of investments in infrastructure and services
Concern for the food security of the country, with research therefore focused on increasing production and yields of staple foods (rice, wheat, maize, potatoes, beans, lentils, etc.).	Demand-oriented approach, with cofinancing of research both in public research institutes and universities
Free technical assistance, with programs prepared by state bodies with little or no user participation	Paid private technical assistance in response to demand from producers, subject to presentation of a project for competition when subsidies are involved
Subsidized credit through special lines of credit for the sector	Elimination of specific lines of credit for the agricultural sector, of development banks, and of the obligation of private banks to loan a certain proportions of their portfolio to the sector
Labor reforms leading to the monetization of the rural economy and the gradual disappearance of sharecropping-type systems, with their labor force being replaced by permanent or, most often, temporary wage laborers	Deregulation of the labor market, although in the case of agriculture the <i>rurales</i> had always been less strict and more difficult to enforce
Price controls for staple foodstuffs in order to check inflation and keep minimum wages low so as to encourage industrialization	Freedom of prices
Exchange rates favorable to imports	In principle, equilibrium in exchange rates
Tariff rates that were generally high but covered a wide range of rates	Reduction of tariff rates and application of a uniform rate, albeit with some exceptions, especially for agricultural products
Taxes on agricultural exports	Elimination of taxes and other hindrances to exports
Agrarian reform programs aimed at reducing the inefficiency of highly heterogeneous production systems (with abundant land and capital for a few agents and abundant labor in the case of the rest) and above all at reducing the possibility of social disorder in rural areas	Replacement of agrarian programs with purchase through the land markets, aided by loans or subsidies for small producers; promotion of formal proof of ownership through the issue of official property titles

Source: Dirven (1999).

and this of course affected expenditures in infrastructure, health and education services, and social programs.

Infrastructure is of particular concern as one of the key inputs entering into the “production function” of the MDGs and the achievements of many of the MDG targets, from poverty reduction to environmental sustainability targets.¹³ For instance, in Sub-Saharan Africa, where less than half of the population has access to safe drinking water (Fishbein 2001) (see also table 3.10), child mortality may depend on the availability of clean water (Galiani, Gertler, and Schargrotsky 2005), and attainment of universal primary education for girls may also crucially depend on access to piped water (Leipziger and others 2003).

Importance of Rural Infrastructure

There is an increasing consensus that providing adequate infrastructure is an important step in the process of poverty alleviation and in providing a more equitable set of opportunities for all citizens. Several authors have studied the aggregate-level links between poverty and rural capital-intensive infrastructure, including Jimenez (1995), Lipton and Ravallion (1995), and Van de Walle (1996). In particular, the literature on specific infrastructure components, such as the role of rural roads, telephones, or access to electricity on poverty alleviation is very broad, including Binswanger, Khandker, and Rosenzweig (1993), Howe and Richards (1984), Jacoby (1998), and Lebo and Schelling (2001).

Recently Renkow, Hallstrom, and Karanja (2002) estimated the fixed transaction costs (those not dependent on commercialized volume) that impede access to product markets for subsistence farmers in Kenya. The authors estimate that high transaction costs are equivalent to a value-added tax of approximately 15 percent, illustrating the opportunities to raise producer welfare with effective infrastructure investments. Smith and others (2001) show that, for the case of Uganda, the rehabilitation of roads increases labor opportunities in the service sector.

Moreover, based on an infrastructure index that includes road, rail, and telecommunications density, Limão and Venables (1999) found that infrastructure is a significant and quantitatively important determinant of bilateral trade flows. Improving destination infrastructure by 1 standard deviation reduces transport costs by an amount equivalent to a reduction of 6,500 kilometers at sea or 1,000 kilometers of overland travel. According to their findings, most of Africa's poor trade performance can be accounted for by poor infrastructure. Moreover, lack of adequate infrastructure in much of Sub-Saharan Africa impedes more productive agriculture. In Norman Borlaug's words, "an effective system to deliver modern inputs—seeds, fertilizers, crop-protection chemicals—and market output must be established. If this is done, subsistence farmers, who constitute more than 70 percent of the population in most countries there [Sub-Saharan Africa], can have a chance to feed their people." (Borlaug 1999)

In addition, and as argued by Leipziger and others (2003), achieving the health and education MDGs will require more than health and education interventions; in particular, infrastructure services have a crucial role to play. In health, there is clear evidence that better access to basic hard-infrastructure services has an import role to play in improving child health outcomes and therefore in complying with the three health-related MDGs. For example, Jalan and Ravallion (2001) showed the importance of piped water to reduce diarrhea in young Indian children; and Galiani, Gertler, and Schargrodsky (2005) found that child mortality fell 5–9 percent in areas that privatized their water services. Brennenman and Kerf (2002) showed that electricity allows for more hours of studying and road access promotes easier establishment of schools and higher attendance.

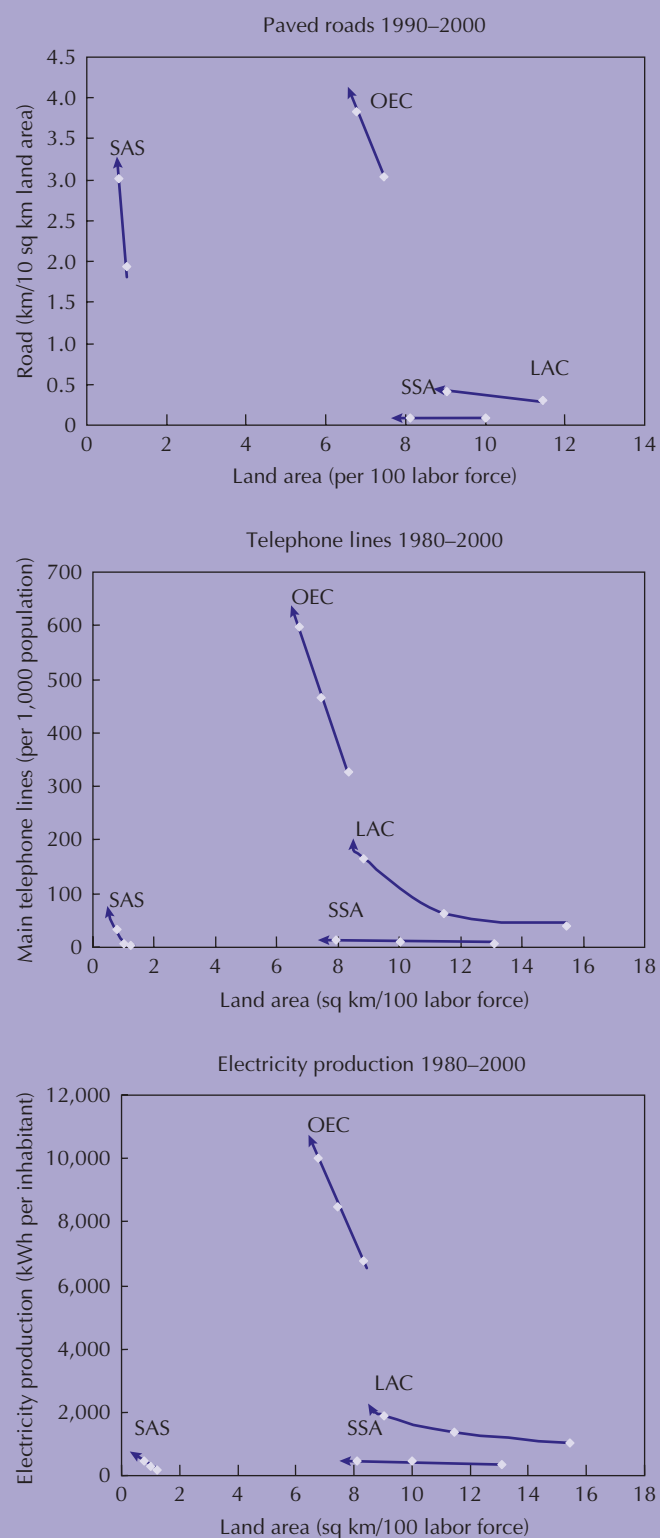
Sub-Saharan Africa seems to particularly lag behind in infrastructure investments, as is shown in figure 4.1 for paved roads, telephone lines,

and electricity production. Increases in population moved each group to the left by reducing its ratio of land to labor, and each group of countries also moved upwards because of the expansion to access in each of the infrastructures. It is obvious that the size of movement for Sub-Saharan Africa was significantly smaller than those for other country groups. The major reason for this significant lag has normally been attributed to geography (Diseases, internal distance, and low populated areas were a much bigger obstacle.) and to the poor initial condition of infrastructure in Africa.

Unlike Asia and Latin America, Sub-Saharan Africa inherited a highly dispersed and unevenly distributed infrastructure from its colonial past. There was little improvement of infrastructure, if any, during the colonial era, and "in some important respects, it can even be said that colonial policy reinforced the handicaps of SSA [Sub-Saharan Africa]" (Platteau 1996, p. 200). The limited infrastructure that was built during that era was driven by the objective of connecting natural resources to export markets. For instance, "two-thirds of the African railways built in the colonial period connected mines to a coastal harbor" (Platteau 1996, p. 200). The rest of the continent was virtually ignored and "only the Union of South Africa with mass immigration of Europeans had more than six meters of railways per square kilometer in 1970, and six countries had no railways at all" (Boserup 1981, p. 148). The skewed distribution of infrastructure was perpetuated even after independence.

If structural impediments predominate in agriculture as in the case of Africa, it will be difficult to achieve sustained growth in production by price incentives alone unless countries develop serious strategies to reduce these impediments. In a recent study, Fay and Yepes (2003) predicted the demand for roads, railroads, telecommunications, electricity, water, and sanitation. According to their estimates, in order to meet the predicted demand, the countries of Sub-Saharan Africa will need to invest around \$25.9 billion annually between 2005 and 2010. Of this sum, \$12.6 billion will be needed for maintenance of the existing infrastructure and the rest to build new infrastructure. This would require an annual investment of more than 5.5 percent of GDP. Wood (2002), taking into account the low population density of Africa, predicted that Africa will need to invest at least twice as much of its GDP in infrastructure as does low-income Asia, as well as meet higher recurrent charges for operation and

Figure 4.1 Changes in Paved Roads, Telephone Lines, and Electricity Production Over Time, Selected Regions



Note: LAC = Latin America & Caribbean; OECD; SA = South Asia; SSA = Sub-Saharan Africa.

Source: Torero and Chowdhury (2004).

maintenance. Therefore, strategies for infrastructure development are needed to be able to move toward the required trends to reach the MDGs.

On Public Investment and Infrastructure

Even among countries that have advanced the most in market-oriented reforms, as mentioned earlier in this chapter, there is still a significant infrastructure access gap, and reforms alone are not enough to provide complete access in remote poor rural areas. Some sort of public intervention is needed to close this gap and therefore to achieve the MDGs. Where the government believes that service should be provided beyond what a well-functioning market will offer, subsidies may be justified to promote additional investment to achieve these government goals. But the government should also seek to improve the functioning of the market so that subsidies can provide a maximum benefit when and where they are needed. In particular, a failure to address the impediments to efficient working of the market in rural areas through regulatory reforms will reduce the availability and effectiveness of resources to address the real access gap in these areas.

Moreover, the potential best practice to reduce the access gap largely depends on the institutional framework existing in each country. Countries with sound regulatory institutions and legal frameworks can adopt some solutions that will be out of reach for countries with weak institutions. However, there could be institutional solutions adequate to reduce the access gap while simultaneously developing the legal, institutional, and regulatory framework needed to advance different strategies.

There are two other issues that concern public investment on infrastructure. The first issue is the lack of coordination in public investments at the country, regional, and donor levels. Where the linkages and complementarities of infrastructure investment have not been realized, it is common to find fragmented approaches, lacking sufficient attention for substantive policies and development issues. In fact, in many cases, access to infrastructure has not been linked to poverty alleviation strategies or to the general development goals of countries. Therefore, it is necessary to take an integrated approach, even if the actual design may vary from country to country.

Second, investment in infrastructure in these areas is done from top to bottom rather than being

demand driven. At present, the estimation of rural infrastructure investment is generally based on the needs assessed for each sector at the national level, with little or no assessment of demand and coordination at the local level where the service ultimately will be provided. More often than not, such investment assessments do not reflect the preferences of users of services and the contingencies of services. For instance, demand for secondary schooling may be contingent on access roads, and failing to coordinate these two may result in a mismatch between availability of a service and its actual use. Furthermore, it is important for communities to be informed about the technology they want to use, the service level they require, and especially to have a clear understanding of long-term costs and maintenance implications, so that communities can choose what is most appropriate for them under their budget constraints. There is evidence that if provided with appropriate information and technical support, communities can make informed choices about service options as well as clearly identify their willingness to pay, thereby assuming ownership and responsibility for the infrastructure (Brenneman and Kerf 2002; Estache, Foster, and Wodon 2001, 2002; Torero, Chowdhury, and Galdo 2003).

Finally, public sector intervention alone is not enough; forging private-public partnerships seems to be the most efficient way of closing the access gap in all services covered as we discuss later in this chapter. Public intervention alone is usually not cost effective, and isolated private initiatives also fail to deliver all services. Despite the rise in private-sector involvement in infrastructure provision, the overall investment levels, particularly concerning small subsistence farmers, are far from adequate. The need for the public sector to play a facilitating role has not been addressed. Since there is little evidence that rural infrastructure is commercially viable on a stand-alone basis, the role of the public sector needs to be reinvented.

THE ROLE OF THE PRIVATE SECTOR IN SUPPORTING AGRICULTURE TO MEET THE MDGS

Public intervention alone is not sufficient to deliver the services and investments required to achieve the MDGs as outlined in the MDG scenario

described in chapter 3. Thus, the role of the private sector for providing investments and delivering services is receiving increased attention in the agriculture as well as the rural nonfarm sector. Ideally, the public and private sectors complement each other, with the government providing an appropriate enabling environment for private initiatives to develop. Good governance principles for both public- and private-service provision are crucial to achieve both effectiveness and efficiency in resource allocation. The following section describes how the private sector can support agriculture's role in achieving the MDGs.

To alleviate rural poverty in developing countries, the private sector can contribute to economic growth through creating jobs both on and off farm. The private sector can also empower the poor by providing a broad range of products and services at lower prices (UNDP 2004b). Large local companies and multinational corporations can channel private initiatives into development efforts. This could be done, for example, through the expansion of public-private partnerships in the fields of education, such as with vocational schools; in the retail sector, through contractual arrangements drawing in small-scale farmers; and, generally, through the diffusion of knowledge and information to small- and medium-scale enterprises working on forward and backward linkages of agriculture. The private sector is also important in the finance sector, where it can provide resources and relationships that can help establish these enterprises.

Rural development that helps achieve the MDGs creates the demand for timely and efficient credit availability to support private investments in agriculture and related services. As development proceeds, rural areas will generate large capital surpluses that need to be captured and managed efficiently by the financial sector. Appropriate development of the rural financial sector can also reduce household vulnerability through promotion of savings mobilization. Efficient rural financial markets that serve the full range of financial needs of farmers and nonfarm enterprises are usually more important than targeted or subsidized credit programs. Such programs should be demand driven, not donor or supply-side oriented. These financial programs should provide a broad range of financial services, not just savings mobilization; emphasize viable and sustainable financial intermediation based on market interest rates; and provide credit for all purposes. The private sector has a

particularly important role to play in the provision of rural financial services, while the public sector should provide an appropriate enabling environment for the private sector to operate efficiently. In particular, the public sector should facilitate access to broader financing options by continuing development of domestic financial markets coupled with skill building for regulators and private financial institutions.

The Bank Rakyat Indonesia (BRI) system has shown that microfinance services can be provided to low-income and poor households at fully commercial terms by a large national commercial bank, thus combining maximum outreach and sustainability. The BRI Unit Desa (Village Bank) system, which has developed into the largest internationally acknowledged successful microfinance operation in the developing world, reaches almost 3 million borrowers and nearly 28 million small savers. As BRI Unit Desa practice shows, savings and credit interest rates are not among the most important considerations for micro-clients. The massive amount of rural savings mobilized by the unit desas demonstrates the demand for attractive savings products and the capacity of rural people to save. The BRI experience further demonstrates that policies and institutions can be designed to achieve high levels of outreach, serve the very poor, and attain financial and institutional sustainability using an individual lending technology. The unit desas reach poor clients by using an individual loan technology requiring collateral, but group loans may be useful for reaching even poorer clients. Among the key factors for BRI Unit Desa success are user-friendly products and services priced for institutional viability; close and regular relationships with micro-customers; convenient bank locations, simple loan procedures, quick processes, flexible terms; offering savers a combination of security, convenience, liquidity, confidentiality, service, and return; simple management information systems and transparent accounting and reporting systems; and close loan monitoring and incentives for repayments (SEARCA/IFPRI/CRESCENT 2004; Meyer and Nagarajan 1999).

In Africa the private sector, together with public-sector support, is crucial for expediting the rate of market development; removing or reducing barriers to market access, both by providing special support for markets that are slow to develop and easing market participation by poorer producers; and establishing a more equitable set of market relations

between (small-scale) producers and market intermediaries (NEPAD 2002). The following activities are suggested to further market development.

- The government can develop the skills and organization for smallholders, for example, through the promotion of producer groups or associations.
- The government can help the private sector to develop and broaden its outreach. A greater private-sector presence will then provide more competitive and efficient services to smallholders, particularly for input supplies, produce, marketing, and agroprocessing. This approach is also vital to support the development of micro-enterprises.
- Both the government and the private sector can finance the provision of essential connecting infrastructure, such as market access roads, communications, and price and market information.
- Most important, the private sector can assist smallholders in promoting a dialogue between the main stakeholders to generate the policy, institutional, and legal context required for enhanced market linkages.

The Rural Nonfarm Private Sector

The rural nonfarm sector is an important engine in economic development. During successful rural economic growth, the emergence and rapid expansion of the (mainly private-sector) nonfarm economy in rural areas and the towns they serve is a major source of growth in incomes and employment. From a relatively minor sector, often largely part-time and subsistence-oriented in the early stages of development, the rural nonfarm economy can develop to become a major motor of economic growth in its own right, not only for the countryside but for the economy as a whole. Its growth also has important implications for the welfare of women and poor households, sometimes helping to offset inequities that can arise within the agricultural sector. In Asia, for example, the rural nonfarm economy accounts for 20–50 percent of total rural employment and 30–60 percent of total rural income. The rural nonfarm economy is especially important to the rural poor. Landless and near-landless households everywhere depend on nonfarm earnings; those with less than 0.5 hectare earn as much as 90 percent of their income from

nonfarm sources (Rosegrant and Hazell 2000). Nonfarm shares of income are strongly and negatively related to farm size. Low-investment manufacturing and services—including weaving, pottery, gathering, food preparation and processing, domestic and personal services, and unskilled nonfarm wage labor—typically account for a greater share of income for the rural poor than for wealthier rural residents (Hazell and Haggblade 1993). The reverse is true of transport, commerce, and such manufacturing activities as milling and metal fabrication, which require sizable investments.

As noted, effective financial institutions are required in order to promote trade, commerce, and manufacturing in the rural nonfarm economy. Microfinance programs to help women and poor people develop nonfarm enterprises may contribute to poverty alleviation. Microfinance also needs to be accompanied by appropriate training programs to give women and poor people the skills they need to compete in the market.

Rural people need adequate training if they are to obtain relevant technical, entrepreneurial, and management skills. The rural nonfarm economy provides much of its own training through apprenticeship schemes and on-the-job learning, but in an increasingly technical and communications-oriented world, specialized training schemes (in computing and accounting, for example) are needed, including programs for women, who dominate many service and trading activities.

In much of the developing world, apart from some manufacturing activities, the rural nonfarm sector was largely ignored by policymakers until recently. Furthermore, because it depended heavily on agriculture either directly or indirectly for much of its demand, the rural nonfarm sector also suffered as a result of macroeconomic policies that discriminated against the agricultural sector. Recent macroeconomic policy reforms that have benefited the agricultural sector should, therefore, have led to positive growth-multiplier benefits for the rural nonfarm economy. The policy reforms have also favored tradable-goods production in general, and this should have been directly beneficial to much rural industry. However, these benefits for the rural nonfarm sector are often limited by a continuing bias toward capital-intensive industry at the expense of trade and services. In many cases, small firms have effectively been placed at a competitive disadvantage to their larger rivals (for example, they do not receive the same subsidies and tax benefits),

and this has encouraged a more capital-intensive pattern of development than is optimal.

In spite of the constraints on the role of the private sector, development of this sector is essential to progress in meeting the MDGs. We now examine the role of the public sector in enhancing the performance of the private sector through provision of appropriate regulation and oversight, setting fair ground rules for the private sector, and through the provision of public goods.

Effective Legal, Regulatory, and Institutional Environments

Effective legal, regulatory, (for example, to secure property rights and enforce contracts) and institutional (for example, financial) environments are required to promote agricultural trade, commerce, and manufacturing. At the farm level, effective regulatory systems need to be provided, particularly in the areas of standards and quality control, to ensure future competitiveness of farmers both in the emerging supermarkets nationally and internationally in the global markets, which demand increasing labeling, standards, and quality control.

At the firm level, in order to ensure the long-term viability of the private sector in development, the creation of an enabling environment is required that includes strong accounting and disclosure standards, bankruptcy and foreclosure processes, and improved taxation and accounting laws. Garnaut (1998) summarizes the objectives of prudential regulation: accuracy, honesty, and transparency in financial reporting; the avoidance of related-party and other noncommercial transactions; and the maintenance of relatively high capital-to-asset ratios—higher than the norm for developed countries. Prudent regulation should focus on simple, enforceable targets, rather than attempting to regulate a wide range of indicators (Fane 1998). Corporate governance also needs long-term reform, including, for example, monitoring of enterprises by commercial banks. Enhanced disclosure and accounting practices and strengthened enforcement of corporate governance regulations, especially as they relate to capital markets, are also essential components of corporate governance reform. Institutions need to be strengthened so that analysis of corporate financing and monitoring of firm performance and behavior are comprehensively covered by a combination of private, semipublic, and public organizations (World Bank 1998).

Private-Public Partnerships and Investment Synergies: The Case of Water and Agricultural Research

How should investments in agriculture and related sectors be supported to achieve the MDGs? Public-private partnerships are an important way to increase financial, human, and social capital in rural areas. Partnerships include publicly provided training for small- and medium-scale enterprises, partnerships in education, agricultural research, the provision of information and communication technologies, the expansion of rural infrastructure including roads, and the development of rural industrial clusters. Because public funds are increasingly scarce, private-public partnerships are one important means to enhance investments in rural areas.

Private-public partnerships are considered particularly important to close the access gap in infrastructure and social services. Public intervention alone is usually not cost-effective, and isolated private initiatives also tend to fail to deliver all services. Despite the rise in private-sector involvement in infrastructure provision, overall investment levels are particularly far from adequate. According to the Commission on Private Sector and Development (UNDP 2004b), private-sector management of small-scale energy production and water supply projects can be particularly effective. These projects allow management by smaller domestic companies whose final product is delivered to the rural customer or informal sector. Decentralized power production through distributed energy of various kinds can also be contracted to the private sector through agreements with the public-sector grid. Examples are solar power and small hydro-power plants.

In particular, water resources have been recognized as under serious threat with growing national, regional, and seasonal scarcities (Rosegrant, Cai, and Cline 2002). Over 1 billion people lack access to improved water services. Worse, another 2.4 billion people still live without improved water sanitation. The need for investment, particularly from the private sector, is obvious. To facilitate investments, the World Bank, through the Multilateral Investment Guarantee Agency (MIGA), is engaged in public-private arrangements for the provision of water and wastewater. However, the lack of sufficient public funds and difficulties in attracting private money in the sector makes achieving the

Both public and private companies have been able to effectively provide water service when they are operated properly and certain guidelines are taken into consideration. Gleick and others (2002) spell out several principles that need to be considered for private water provision. Many of these are key elements of effective public water systems as well. These principles include ensuring that all basic human and ecosystem needs for water are met, with a basic amount of water provided at a subsidized rate for those too poor to afford to pay; provision of water at reasonable rates, with increases in price linked to improved service when possible; subsidies that are economically and socially sound; and new water projects that are permitted only when shown to be less costly than efficiency improvements. It is also crucial that there be significant government oversight, with government regulation of water quality, clear contracts that spell out the role of all parties, clear rules for dispute resolution, and clarity and stakeholder involvement during the negotiation process. Finally, the ownership of the water should remain in the

The private tubewell revolution in South Asia since the 1980s is an excellent example of effective private investment and private-public investment synergies. Public investments have been an important facilitator of private irrigation investment. Private tubewells in South Asia have grown most rapidly in areas with reasonably good roads, research and extension systems, access to electric or diesel energy, and access to credit; therefore, the wells have been concentrated in and around the command areas of large, publicly developed surface irrigation systems. Seckler (1990) notes three reasons for the complementarity between public and private irrigation investment in South Asia: deep percolation losses from the surface systems recharge the aquifers for tubewells; tubewells are often used together with surface irrigation water, which lowers pumping costs and concentrates these costs in periods of the highest marginal returns; and the tubewells ride piggyback on the infrastructure created for the surface systems.

The role and structure of agricultural research are changing over time. The relative importance of productivity-driven growth will increase, because growth in input use is declining as many regions in Asia are reaching high levels of input use. Private investment in agricultural research—which gener-

PUBLIC-PRIVATE ARRANGEMENTS FOR THE PROVISION OF WATER AND WASTEWATER SERVICES



Source: MIGA (2004).

ates significant public benefits—will increase in importance, if policy reforms continue to create and improve the incentives for private investments by eliminating price distortions and strengthening property rights. Market failures and social objectives will continue to call for an important role for public investment in agricultural research, however.

Through partnerships, public research institutions can gain access to advanced scientific knowledge and technologies held by the private sector, mechanisms for developing, processing, marketing, and distributing final products to farmers and consumers, and financial resources that are increasingly difficult to obtain. There are few examples, however, of successful public-private partnerships in agricultural research. Part of the problem stems from the sectors' inherently different research objectives: while public institutions conduct research according to their broad social mandates, firms pursue more narrow, profit-maximization goals. Furthermore, public institutions and private firms compete over the ownership and use of proprietary scientific knowledge and technologies, over scarce financial resources for research, and over markets, clients, and beneficiaries for their outputs. This competition incurs real and hidden costs and risks that make partnerships difficult to create or sustain—costs and risks that are exacerbated by deep-rooted misperceptions and information gaps between the sectors. To succeed, public-private partnerships require that both parties identify research areas where their objectives are compatible, and where both parties are willing to engage in detailed and often difficult negotiations for project planning and implementation (Spielman and von Grebmer 2004).

Agricultural research is often long term, large scale, and risky, and while the returns to new technologies are often high, the firm responsible for developing the technology may not be able to appropriate the benefits accruing to the innovation—as in the case of improved open-pollinated rice and wheat varieties. The benefits of agricultural research often accrue to consumers (through reduction in commodity prices due to increased supply), rather than to the adopters of the new technology, so social returns may be greater than private returns to research. Therefore, a sustained public role in funding agricultural research will be essential, particularly for crops and regions in less favorable environments, which are unlikely to be served by the private sector.

New agricultural technologies in Asia—such as technologies to improve pest management and the nutrient balance and the timing and placement of fertilizer applications—are increasingly complex, knowledge intensive, and location specific; they demand continued investment to create a better and more decentralized research and extension system. Because new technologies are more demanding for both the farmer and the extension agent, they require more information and skills for successful adoption compared to the initial adoption of modern varieties and fertilizers. Decentralization of existing extension services structures that encourage a bottom-up flow from farmers to extension and research could also help farmers cope with the additional complexity of efficiency-enhancing technology. Bottom-up information flows, combined with adaptive, location-specific research, are particularly important in the transfer of complex crop-management technologies. Other modern technologies, such as commercial poultry technology, will be transferred essentially intact from developed countries, without local adaptation, but will similarly require higher levels of education and management skills than traditional livestock operations. Finally, the increasing importance of new, knowledge-intensive technology requires a market-friendly environment for the adoption and adaptation of new technologies and the removal of restrictions on technology imports, which must be encouraged through continued progress in economic liberalization. Privatization of extension through contracting to private companies can introduce incentives for higher efficiency, and has been applied by seed companies, including for hybrid maize. Privatization of extension is likely to be successful when extension is linked to the delivery of a specific technology (such as hybrid maize or poultry) and to larger, more homogeneous groups of farmers. For commodities where private extension services cannot be self-supported, the government needs to continue providing assistance and training.

In contrast to other developing regions of the world, the private sector in Africa is not increasing its research efforts as government spending declines. Given a share of 2 percent in total spending, the private sector plays an exceptionally small role in funding agricultural research in the region. Increasing their contribution is highly unlikely because the potential profits from conducting research on important crops are not sufficiently

high to attract the interest of either domestic or international private firms in Africa (NEPAD 2002). This is a marked contrast to industrial countries, where private enterprises fund over 50 percent of agricultural research. African governments have reduced their support to agricultural research and extension because of the pressures to reduce spending in general. This may also be due to the shift in priorities when governments question the value of research and extension, given the lack of improvement in agricultural productivity in Africa. Donor assistance to agricultural research likewise declined as a result of priorities that shifted from agricultural production to environmental protection, health, education, water and sanitation, and so forth. Many question the need of continued public funding on agricultural research and extension, thinking that the world's food problems are solved, or constrained by research systems or extension services, or the private sector will do the job. In order to correct these perceptions, it is necessary to maintain and increase support to these services, which are fundamental to maintain the competitiveness of agricultural economies in Africa (NEPAD 2002).

Private financing of investment may be explored as a general way to ensure availability of basic services, particularly as the official development assistance (ODA) or aid for the water and other sectors has been declining in recent years (Winpenny 2003).

Nonetheless, the U.N. Conference on Financing for Development in Monterrey in 2002 declared that the decline in ODA should be reversed and assistance should increase by 25 percent or \$12.5 billion by 2006. To allow the agriculture sector to develop its full potential for achieving the MDGs, the share of ODA spent on agriculture needs to increase significantly.

For the case of Africa, NEPAD (2002) reported that estimates on the likely distribution of financing between the public and private sectors remains highly hypothetical and requires specific country conditions to be taken into account. Table 4.2 presents one set of assumptions on financing. The public sector is expected to take the lead in water and land development and rural infrastructure; it is also expected to increase food supplies at an approximated \$7.5 billion, albeit with considerable matching contributions from the farm sector. The total incremental investment requirement, including operations and maintenance, is about \$15.7 billion per year from 2002 to 2015. This figure was derived from both the national public and private resources in addition to international cooperation, in line with the Monterrey 2002 commitments on financing for development.

A report by Atkinson (2003, cited in Reisen 2003) focused on the role of rich countries and on the sphere of public finances, but urged not to limit

Table 4.2 Possible Scenario Regarding Financing Sources for Agriculture Under NEPAD

Source of investment	Share of total investment (US\$ billion)			
	Immediate future (2002–2005)	Short term (2006–2010)	Medium term (2011–2015)	Total (2002–2015)
Africa				
Public domestic sources	19.6	40.0	37.8	97.4
Private domestic	2.8	10.0	14.2	27.0
Subtotal	22.4	50.0	52.0	104.4
External				
Concessional assistance (such as ODA)	25.2	35.0	28.3	88.5
Nonconcessional loans	5.6	10.0	4.7	20.3
FDI (private)	2.8	5.0	9.5	17.3
Subtotal	33.6	50.0	42.5	126.1
Rounding adjustment	—	—	—	0.8
Total	56.0	100.0	94.5	251.3
Annual	14.0	20.1	18.9	17.9
—Not applicable.				
Source: NEPAD (2002).				

perspectives to a resource transfer from rich to poor countries. Rather, options should also consider income redistribution and tax efforts in China, India, and other poor countries to co-finance the MDGs. The additional \$50 billion considered necessary for achieving the MDGs could be financed through both traditional and innovative means, such as through the enactment by all major economies of a global tax on carbon use; an agreement by the U.S. and other major economies to create additional SDRs for development purposes; the enactment of a currency transaction tax (Tobin tax); the establishment of a Global Lottery in agreement with national lotteries; measures to increase flows of remittances by immigrant workers for development purposes; other global taxes, such as a brain drain tax, an international airport tax, taxation of ocean fishing, taxation of arms exports, a "bit" tax on computer use, or a luxury goods tax.

The Role of Foreign Direct Private Investment

International capital flows. Foreign direct investment (FDI) and other long-term, relatively stable investment have a significant impact on agricultural and overall economic growth. FDI in developing countries by companies based in industrial countries has increased substantially with globalization and now dwarfs foreign aid. Private investment was five times greater in 1998 than in 1968, in constant 1993 U.S. dollars. However, the impact of this investment on hunger and poverty may be limited. Little of this investment goes directly into agriculture or rural areas. Moreover, FDI is largely concentrated in just a few countries. Only five countries accounted for over half of all FDI in 1998 and just 12 for all but a small amount of FDI (Runge and others 2003).

In contrast to FDI, the benefits of short-term international capital are relatively small and uncertain because, unlike FDI, short-term capital does not bring along technology and management innovations (World Bank 1998). Moreover, when savings rates are already high and marginal investment is misallocated, short-term capital greatly increases the vulnerability of the economy. Management of international capital flows should therefore focus on the creation of an environment conducive to long-term investments and discouraging to short-term capital inflows. Tax incentives and other distortions that favor short-term inflows

over long-term investments should be eliminated. Moreover, both prudential regulations on currency positions of banks and strengthened supervision of these regulations and other risk-management procedures are required. Finally, short-term and unhedged borrowing by corporations should be disclosed to reduce the credit risk.

The Role of Governance Structures in Agriculture for Achieving the MDGs

According to the Transparency International Corruption Perceptions Index 2004 (CPI), corruption is considered rampant in many developing countries. Among the 14 worst offenders—expressed as a level of 2 or less with 10 indicating a clean score—are five countries in Sub-Saharan Africa, three in Asia, two in Latin America, and four in the former Soviet Union (Transparency International 2004).

Perceived levels of corruption are but one indicator of lack of adequate governance structures in these countries, and lack of governance is considered one of the major stumbling blocks to achieving the MDGs in general, and to realizing the MDGs through improvements in the agricultural sector in particular.

Indications abound that poor governance is related with bad outcomes for the population, and particularly the (rural) poor. Conflicts that are often associated with poor governance are linked with hunger, both as a cause and an effect of food insecurity (Messer and Cohen 2004). Good governance conveys stability and security, which again have important linkages to agricultural and economic development (Zhang 2004). Estache and Kouassi (2002) showed that high levels of inefficiency in the African water sector are linked with weak governance and institutions.

Good state governance is typically defined under the terms of accountability, transparency, predictability, and participation. Accountability translates into government institutions following clear lines of responsibility that ultimately end up with the electorate, from which authority flows. Transparency is a concept that makes it possible for governments (and other institutions) to be accountable. Predictability relates to the knowledge that the rules of the games are certain and predictable. Participation is both a principle and a means for achieving good governance. For example, enhanced participation of communities in local government can

increase accountability, transparency, and predictability. These principles are only meaningful given adequate institutional and social structures, where they can be implemented.

Countries with a good governance structure and adequate institutions tend to ensure political and economic stability, possess reasonable state capacity, enforce property rights and contracts, provide sufficient public goods, and limit government corruption and predation. On the other hand, countries with poor governance and poor institutions typically have poor public services, including for agricultural extension and research, and particularly for social services such as water provision and education (Wolfensohn and Bourguignon 2004). In such countries, the neediest—typically poor farmers and other rural dwellers—are left out of the supply chain, as resources are deviated to private pockets and to those who can bribe or otherwise coerce the government to supply their needs. Moreover, the voiceless rural people in these cases tend to have no access to recourse or complaints. At a higher level, the investment climate in countries lacking good governance and quality institutions is adversely impacted, resulting in fewer and more expensive private-sector investments in both rural and urban areas. Good public governance should include the attainment of development targets and delivery of crucial public services for the rural poor. On the other hand, good corporate governance essentially means responsible corporate citizenship, that is, responsible stewardship of the assets of the company by increasing the economic value added without damaging the environment or abusing consumers in the process.

How can governance structures in agriculture be amended for agriculture to play its due role in achieving the MDGs? Good governance can be built through the development of social capital. Social capital affects economic development mainly by facilitating transactions among individuals, households, and groups in society. This facilitating function can take the following forms:

- Participation by individuals in social networks increases the availability of information and lowers its cost. This is true in the rural villages, especially when the information can increase the returns from agriculture and trading. Examples include crop prices, location of new markets, sources of credit, or treatments for plant or livestock diseases. Often, social

capital is the only asset to which the rural poor have easy access.

- Participation in local networks and attitudes of mutual trust make it easier for any group to reach collective decisions and implement collective action. Since property rights are often imperfectly enforced in developing countries, collective decisions on how to manage common or communal resources (such as watershed land, irrigation, drinking water, and urban waste disposal) can help maximize their access, use, and benefits.
- Networks and attitudes reduce opportunistic behavior by community members. Social pressures and fear of exclusion can make individuals behave in certain community-beneficial ways. For example, farmers have been known to use such networks and attitudes to exert mutual pressures to prevent individual diversion of irrigation water, or to prevent loan defaults in group borrowing situations with joint liabilities (SEARCA/IFPRI/CRESCENT 2004).

In addition to the explicit implementation of good governance principles, the development and support of community-based organizations (CBOs) and general civic education can play an important role in good-governance reforms in agriculture. Effective CBOs, such as farmer associations or cooperatives, water user groups, farm and other micro-credit and lending groups, or other existing rural CBOs, can improve governance in several ways: by encouraging government ministries to adopt successful approaches developed within these groups; by educating and sensitizing the public about their rights and entitlements under public programs; by acting as a conduit to the government for public opinion and local experience; by collaborating with official bodies; by influencing local agricultural development policies of national and international institutions; and by helping government and donors fashion a more effective development strategy through strengthening institutions, staff training, and improving management capacity. Pitfalls for CBOs can be their own internal governance structures and processes, particularly their transparency and accountability. These organizations should strive for financial sustainability, for example, through developing stronger links with the private corporate sector. This is especially workable for nonadvocacy CBOs, such as those that deliver educational, healthcare, and humanitarian services.

As has been shown in Indonesia, decentralization can improve governance in rural areas, as local governments are usually more adept with and knowledgeable about rural agricultural needs in particular. However, administrative decentralization without preparatory capacity building and adequate fiscal support could force regional and district governments to enact new tax laws and other regulations that add to the costs of doing business without corresponding increase in public services, or improvement in the quality of governance (SEARCA/IFPRI/CRESCENT 2004).

Improved governance will help lessen conflict and encourage greater levels of government funding to be allocated to the agriculture sector. Although governance is important to sustainable agricultural development in all countries, the specific political situation in each country will determine the appropriate measures needed to ensure good governance.

With rapid development of agricultural exports and trade, as well as with the very rapid growth of the retail sector in many developing countries, it has become more important for the agriculture sector, including smallholders, to be in tune with corporate and retail sector development, increasingly the buyers of agricultural products. Because of these developments, improvements in corporate governance should be promoted to support agriculture as well, such as by consistently enforcing laws and providing some incentives for good governance practices. Good governance in the rural nonfarm sector is also essential, so that the rural private sector, particularly small- and medium-size enterprises, can exploit the emerging investment and business opportunities in the rural sector offered by agriculture and related activities.

At a higher level, donor countries and international aid agencies should focus their resources on these countries where good or improving governance structures will ensure that the rural poor are reached. The poverty reduction strategy papers (PRSPs) that the World Bank and others rely on increasingly include sections on addressing governance objectives. Whereas the MDGs provide a long-term perspective, PRSPs can provide medium-term targets to address these long-term goals. Both PRSPs and reaching the MDGs requires strong national planning and implementation capacity, a feature of good governance. Increased levels and direction of ODA toward agriculture are also important (Wolfensohn and Bourguignon 2004).

Finally, at the international level, enhanced governance and commitment could help improve the global trade agenda by making progress regarding the needs of the poorest countries, including enhanced access to agricultural and other markets. Enhanced international governance and commitment can also improve the global environmental agenda, as developing countries would gain from enhanced environmental standards, including protection of remaining biodiversity in these countries, or from participating in and gaining from climate mitigation policies.

CONCLUSION

To meet the MDGs, there are several concerns that all organizations, from the government to the private sector, in the developed and developing world need to face. To begin with, the complementary roles of government agencies, the private sector, and public-private partnerships cannot be ignored when addressing the lack of basic services in water, land, health, and other infrastructure development in most developing countries. Likewise, the assistance of international and regional organizations for financing investments, extending technological and intellectual support, and strengthening skills and capacity will move forward economic growth and progress in the developing world.

Government agencies in developing countries need urgently to revisit the legal, regulatory, political, and institutional framework in the agriculture, research, extension, and industrial sectors. A refocusing of priorities and policies to meet the specific needs of poor people, especially on property rights in land and water to augment their requirements of food and nutrition security, must be achieved to adequately address MDG 1. In addition, government agencies, through the assistance of international and regional organizations, must facilitate the development of alternative rural nonfarm livelihoods.

Both the private and public sectors must foster private-public sector partnerships with the objective of addressing the MDGs, and specifically MDG 8—to develop a global partnership for development. Several methods have been discussed here on how the private sector and government institutions can work together to create mutual opportunities and benefits. It is also anticipated that the private sector will increase its investment in agricultural research and extension in developing countries. Use of food

aid has to be considered judiciously to avoid negative impacts.

Good governance is also a cross-cutting issue. Governance plays a role in the decision making and implementation of policies both nationally and internationally, in public administration, and in service delivery, and therefore plays a role in achievement of the MDGs.

Finally, if the appropriate investments and governance are to help reduce global poverty, con-

ducive and sustainable international price incentives must be brought about through multilateral reform of agricultural trade and domestic subsidy policies. Current trade barriers and subsidies are high for agriculture. Benefits will accrue to poor farmers from reforms both in developed and developing countries. Successful WTO agricultural trade negotiations that lower protection and subsidies could thus boost progress toward the MDGs.



Agriculture paves the way for economic growth in poorer nations and underlies progress on the broad array of economic and social indicators that the MDGs emphasize.

Conclusions

The most effective strategy for making steady, sustainable progress on the Millennium Development Goals is to serve all the goals in an integrated way. However, each goal will need a well-defined package of technologies and services for success at the field level. Pursuing the goals separately without acknowledging their interlinkages will reduce the complex process of human and economic development to a series of fragmented, conflicting, and unsustainable interventions. A comprehensive and harmonious development approach is in order.

Given that the majority of poor people live in villages or rely on agriculture, and that agriculture paves the way for economic growth in the poorer nations, agricultural and rural development will underlie progress on the broad array of economic and social indicators that the MDGs emphasize.

In pursuing the MDGs, we should seek ultimately the elimination of hunger, poverty, and maternal and child malnutrition, with each MDG being an important step along the way to this ultimate target. An emphasis on healthy, productive individuals means that we must attend not simply to food security at the aggregate level, but to nutrition security (economic, physical, social, and environmental access to a balanced diet and clean drinking water) at the individual level of child, woman, and man. In the longer term, the goals should be modified to promote a reduction in the absolute number of people living in unsuitable conditions across all countries, rather than a reduction in global proportions, and ultimately the elimination of hunger and malnutrition.

Despite these limitations in framing the task at hand, the MDGs can be used to set a powerful agenda for developing countries and the international community, because they offer a guide for planning and implementing a broad range of development efforts. Of the eight Millennium Development Goals, the first goal is the one whose attainment most clearly involves the agricultural sector: The poor around the globe are disproportionately farmers and herders, and, perversely, the hungry also most commonly find their livelihoods through agriculture. The impact that a dynamic agricultural sector will have on the attainment of the other seven goals is less direct. Nonetheless, important gains in these can be made through explicit attention to agriculture.

1. *Eradicate extreme hunger and poverty.* Improving the productivity of and the economic returns of agriculture will have immediate effects in eradicating extreme poverty and reducing hunger. In

addition, subsistence farming households will enjoy immediate benefits from increased food production. But more importantly, increased food production will lead to real reductions in food prices, improving the purchasing power of the poor throughout the economy. Furthermore, economy-wide effects will occur when the focus on agriculture increases. Agricultural growth will, therefore, have ripple effects into other sectors—enhancing the productivity, increasing the returns, and improving the incomes of those working in sectors quite far removed from farmers, herders, and fishermen and women.

2. *Achieve universal primary education.* Investments in agriculture will advance progress toward this goal primarily in an indirect fashion. At the household level, the profitable use of labor-saving agricultural technologies will reduce the opportunity costs to farmers who allow their children to go to school. Broad economic growth likely will demand increasingly skilled labor, and will increase the returns of investing in schooling one's children, both in agriculture and in other sectors.
3. *Promote gender equality and empower women.* Throughout the developing world, but particularly in Sub-Saharan Africa, women are farmers. To a greater degree than for men, women's principal productive activities are in agriculture. Agriculture also provides key contributions to the economic empowerment of women. A dynamic agricultural sector that offers broad welfare benefits can only be expected to emerge when women are given the opportunity to participate profitably in the sector. However, if the benefits of a dynamic agriculture are to result in sustained improvements in the direct determinants of welfare—income, health, and education, among others—it is necessary that women have an important role in determining how the fruits of their agricultural activities are used.
4. *Reduce child mortality.* The linkages between agriculture and child mortality are indirect but important. Agriculture is a critical component in assuring food and nutrition security. It is estimated that 45 to 55 percent of all child deaths are due to malnutrition exacerbating the negative effects of disease (Pelletier and others 1994). In addition, increased agricultural productivity may come at the expense of women's ability to offer dedicated care to children in their care. Consequently, agricultural labor and time-

saving innovations are required to eliminate this potentially zero-sum tradeoff.

5. *Improve maternal health.* Agriculture can contribute to this goal in a similar manner to how it contributes to attaining all of the previous three goals. In addition, agriculture can contribute to improved maternal health in other ways. Agriculture has considerable potential to directly improve maternal health by improving the quality of the diets of women. Micronutrient deficiencies are particularly severe among young children and women. Among women, the health effects of such deficiencies are most pronounced during pregnancy, at birth, and in the months following birth. By increasing the micronutrient content of food crops the prevalence of micronutrient deficiencies among women should decline and maternal health would improve.
6. *Combat HIV/AIDS, malaria, and other diseases.* The analysis for several of the other goals also applies here. Although the indicators for this goal have no or very little agricultural content and the direct links between agriculture and these health issues are not immediate, they are important nonetheless. For agricultural households, as for all households, the productivity of their economic activities is an important determinant of whether or not such households live in an environment that allows them to enjoy a healthy and active life. Besides, a dynamic agricultural sector also has the potential to radically alter the disease environment in a region. New health challenges likely will emerge with an evolving agricultural sector. For example, wage-labor migration associated with agriculture may expose populations to new diseases, increasing the health burden they bear. The resources of the agriculture sector, particularly in the public sphere through the extension services, can be used in a coordinated fashion with those of the health sector to address such challenges.
7. *Ensure environmental sustainability.* This MDG covers a broad sweep, including biodiversity, critical natural habitats, energy use and global climate change, unsafe water and poor sanitation, and urban slums. A productive agricultural sector will reduce pressure in all of these areas, including the following:
 - A productive agriculture requires less land, leaving marginal agricultural lands to other uses, including forests and other critical habitats.

- Proper agricultural policies will allow the full costs of agricultural technologies to be considered as they are being used, reducing the scope for excessive nutrient runoff from agriculture, providing incentives for efficient energy use in the sector, and promoting the ecologically sustainable use of a range of technologies, including pesticides and GMO materials.
 - Agriculture has the potential to be an important component in any systems established to manage global carbon stocks.
 - A dynamic agricultural sector and the public revenues that accrue from the sector will enable greater levels of public provision of safe drinking water and improved sanitation. Increasingly productive and profitable farmers in many developing countries will be more able to privately provide these amenities for their own households. For agricultural development programs to be environmentally sustainable, their long-term environmental costs and benefits have to be taken into account. Plus, policies and regulations need to be in place to encourage efficient—instead of excessive—energy, water, fertilizer, and pesticide use. Sound water management in agriculture is critical for safe drinking water, as well as for prevention of water-borne diseases and wasting of water. At the same time, agriculture-led economic growth will provide public revenues that governments can use to provide safe drinking water and better sanitation, as well as higher incomes that will allow individual farming households to invest in these basic needs. The issue of better resource management arises in urban areas as well. Urban water subsidies, for example, go disproportionately to the better off in most developing countries because they are connected to the public system. The urban poor, who must rely on water vendors, pay many times more for water than better-off residents. Removing such subsidies and using the available money to finance wider distribution of piped water would benefit the poor.
 - Population pressures in urban slums will be alleviated to a significant degree if profitable agricultural systems are developed in the rural areas.
8. *Develop a global partnership for development.* There are several areas where agriculture can contribute to achieving the targets under this goal,

especially to achieve an open, rule-based, predictable, nondiscriminatory trading and financial system. A renewed focus on agriculture could support improvements toward achieving this goal. Global agricultural trade must be harmonized and rationalized. Moreover, the rationality used must include a judicious consideration of the special needs of poor agricultural producers and how they might derive benefits from global agricultural trade. The sectoral (re)allocation of reoriented ODA should be specified and, with the preponderance of poor people in rural areas, agriculture and rural development should receive significant priority in allocations.

In the remainder of this conclusion, the focus is on policies to meet MDG 1. Eradicating hunger and poverty requires an understanding of the ways in which these two injustices interconnect. Hunger, and the malnourishment that accompanies it, prevents poor people from escaping poverty because it diminishes their ability to learn, work, and care for themselves and for their family members. If left unaddressed, hunger sets in motion an array of outcomes that perpetuates malnutrition, reduces the ability of adults to work and to give birth to healthy children, and erodes children's ability to learn and lead productive, healthy, and happy lives. This truncation of human development undermines a country's potential for economic development—for generations to come.

There are strong, direct relationships between agricultural productivity, hunger, and poverty. Three-quarters of the world's poor live in rural areas and make their living from agriculture. Hunger and child malnutrition are greater in these areas than in urban areas. Moreover, the higher the proportion of the rural population that obtains its income solely from subsistence farming (without the benefit of pro-poor technologies and access to markets), the higher the incidence of malnutrition. Therefore, improvements in agricultural productivity aimed at small-scale farmers will benefit the rural poor first.

Increased agricultural productivity enables farmers to grow more food, which translates into better diets and, under market conditions that offer a level playing field, higher farm incomes. With more money, farmers are more likely to diversify production and grow higher-value crops, benefiting not only themselves but the economy as a whole. A larger supply of agricultural products also brings prices down, allowing both the rural and urban

poor to purchase essential foods for less money. Smaller food bills mean that landless poor people will have more money to invest in assets, which will help them increase income and survive future economic shocks. This income and asset security helps build a solid foundation for economic growth, by enabling people to work free from the debilitating effects of hunger and undernutrition. A flourishing agriculture sector also facilitates job creation in other areas, such as the food processing and marketing sectors, and creates secondary economic effects in the nonfarm economy.

By increasing food availability and incomes and contributing to asset diversity and economic growth, higher agricultural productivity and supportive pro-poor policies allow people to break out of the poverty-hunger-malnutrition trap. A closer examination of how the targets of MDG 1 can be achieved in Sub-Saharan Africa (Ethiopia and Zambia) illustrates that countries in the region will need to achieve significantly larger economic growth, and very soon. In Zambia, the GDP growth rate required to halve poverty is around 10.5 percent, and in Ethiopia, 5.8 percent. Achieving these rates of growth requires greater productivity in the agricultural sector. The unique structure of each country's economy determines the impact of this agricultural growth on poverty reduction as well as which agricultural subsectors are the most promising. In Ethiopia, investments in the staple food sector have the largest potential impact on both growth and poverty alleviation, while in Zambia, the expansion of traditional and nontraditional goods is more important. Both countries have in common significant constraints to market access that need to be overcome to attain projected rates of agricultural and economic growth and decreased poverty. Multisector strategies, such as a combination of nontraditional export growth with livestock and staple production growth, can significantly reduce poverty in Ethiopia. By concurrently improving rural infrastructure and market development, agricultural growth could help Ethiopia to achieve MDG 1. In Zambia, on the other hand, reaching the poverty target under MDG 1 will be more difficult.

A global assessment of Target 2 of MDG 1 (halving child malnutrition levels) shows that the combination of agricultural and economic growth together with larger investments in social sectors, including health and education, can substantially narrow the gap between the business-as-usual outcomes for 2015—24 percent of developing-country

preschool children malnourished—and the target indicator—15 percent children malnourished—to reach 17 percent.

However, the outcome varies significantly by country and region. While Latin America, West Asia and North Africa, and China will, on average, likely get close to the target indicator by 2015, even under business-as-usual, the likelihood that Sub-Saharan Africa and South Asia will come close to their respective target rates is much smaller. In fact, on average, Sub-Saharan Africa and South Asia will not be able to halve their shares of malnourished children by 2015 even under very favorable agricultural, economic, and social conditions; but improved conditions in these sectors can bring the countries in these regions very close to the 2015 target and can facilitate further reductions in malnutrition levels later on.

Under the MDG scenario, to bring developing countries, particularly South Asia and Sub-Saharan Africa, within reach of the preschool malnutrition target indicator, total investments in agricultural and supporting sectors during 1995–2015 will have to increase by \$161 billion based on IMPACT-WATER calculations. The three main areas of investment for the MDG scenario in percentage terms are rural roads, irrigation, and education. Together these three areas will require \$403 billion between 1995 and 2015 to achieve the rapid levels in childhood malnutrition simulated under the MDG scenario. The increase in irrigation investments is not only due to the expansion of irrigated area, but also to the increased irrigation costs under the MDG scenario as a result of expansion in more costly areas, such as Sub-Saharan Africa.

Agricultural research investments account for \$109 billion, and \$78 billion of investments toward increasing access to safe water is also required. Due to the long lags in the generation of impact from agricultural research, increases in research expenditures, even beginning now, will have relatively small impacts on crop yields by 2015. Increased investments in agricultural research are likely to be essential to meet crop and animal production needs beyond 2015, however. Other investments, such as roads and irrigation, have significant lags in impact as well, so implementing the investment portfolio required for the MDG scenario will require very rapid action. As relatively high levels of access to clean drinking water are already achieved in the baseline scenario, only \$15 billion in investments are added for the MDG scenario,

but these investments have basically no lag period in becoming effective.

In addition to these investments, significant policy and governance reform is required. How can the poor benefit most from greater investments and higher agricultural productivity? Experience has shown that a number of key conditions help maximize the benefits of a growing agriculture sector for poor people. To achieve faster agriculture-based growth rates, favorable macroeconomic and trade policies, good infrastructure, and access to credit, land, and markets must be in place. These conditions create level playing fields and give farmers incentives to adopt new and sustainable technologies and diversify production into higher-value crops, actions that raise incomes and lift households out of poverty.

At the macroeconomic level, trade liberalization, particularly in developing countries, will enhance the targets under MDG 1. To achieve these overall gains, developing countries that will benefit from more open markets abroad need to participate in multilateral agricultural trade policy reforms. Improved investments in infrastructure are another important avenue to enhance MDG 1. However, if there is a lack of coordination at the country, regional, and donor level, the linkages and complementarities of infrastructure investment will not be realized. As a result, fragmented approaches that lack sufficient attention for substantive policies and development issues do not help countries achieve their MDG targets. Moreover, local recipients need to be integrated fully in any investment plans.

Other important areas of reform in the trading area include the elimination of export subsidies; the move toward income-support instead of production-stimulating support measures in developed countries; the expedition of importing-country risk assessments and regulatory changes that can help open market access for poor countries; and the reform of the international and national governance of food aid programs. An improved domestic regulatory framework would intensify competition among suppliers of essential inputs, such as seeds and fertilizer. In addition, the elimination of trade barriers for agricultural products, especially the high-value-added products, would encourage a greater number of private entrepreneurs to explore opportunities in agribusiness. A healthy market and private sector would provide value-added, skilled work to the landless poor

and generate multiple livelihood opportunities in both the farm and nonfarm sectors.

In addition to pro-poor economic and agricultural policies, agriculture, like other sectors, needs good governance, absence of conflict, and well-functioning markets and private enterprise to flourish. As the financing requirements for realizing the MDGs are substantial, the private sector is increasingly called upon to fill investment gaps. Its complementary and supporting role in the provision of basic services in water, land, health, and other infrastructure development that are lacking in most developing countries cannot be ignored. The development and business communities must increasingly recognize that the MDGs cannot be achieved and private enterprise cannot flourish without greater and more equitable involvement of poor people in markets. The idea of enticing global private enterprise into developing-country markets is not new but the expectations are different this time around. In many respects they are driven by a greater understanding that not just any kind of economic growth will improve the lives of the poor. It will take a particular kind of private-sector involvement to generate the necessary economic transformations. Private entrepreneurs are now increasingly held to environmental, social, and corporate governance principles that stress sustainable business practices and adherence to labor standards. Without these standards and practices, the private sector and disadvantaged groups cannot mutually benefit from consumer, employment, and entrepreneurial activities.

Likewise, international and regional organizations' assistance in terms of financing investments, extending technological and intellectual support, promoting skills, and strengthening capacity will move forward economic growth and progress in the developing world. Government agencies in developing countries urgently need to revisit the legal, regulatory, political, and institutional framework in agriculture, research, extension, and industrial sectors to facilitate private-sector involvement. Moreover, both the private and public sectors must foster private-public-sector partnerships and cultivate this relationship with the end objective of addressing the MDGs. To allow the agriculture sector to develop its full potential for achieving the MDGs, the share of ODA spent on agriculture needs to increase significantly.

The role of good governance systems in achieving the MDGs and agricultural and economic devel-

opment in general has long been recognized. Good governance can be built and strengthened through the development of social capital. In addition to the explicit implementation of good governance principles, the development and support of CBOs and civic education, in general, can play an important role in good-governance reforms in agriculture. As has been shown in Indonesia, decentralization can improve governance in rural areas, as local governments are usually more adept with and knowledgeable about rural agricultural needs in particular. Improved governance will help lessen conflict and encourage greater levels of government funding to be allocated to the agriculture sector. Although governance is important to sustainable agricultural development in all countries, the specific political situation in each country will determine the appropriate measures to ensure good governance. At a higher level, donor countries and international aid agencies should focus their resources on those countries where good or improving governance structures will ensure that the rural poor are reached. Finally, at the international level, enhanced gov-

ernance and commitment could help bring about improvements in the global trade and environmental agenda.

When good governance, equitable markets, and the other key conditions noted above are absent, poor farmers are unlikely to earn decent incomes and secure adequate diets for themselves and their families. If agriculture underperforms or fails, nonfarmers will also feel the negative effects. We need to keep uppermost in our minds that significant gains in agricultural productivity have provided the critical first steps in economic development in many countries. It is a promising development that the review of progress—and lack thereof—in achieving the MDGs has reached global attention. Calls for accountability and action that have real impact on people are growing because of that attention. Policy action and increased investment in the critical arenas of sustainable agriculture productivity and food and nutrition security will be essential for responding effectively and responsibly to reach the Millennium Development Goals.

CHAPTER 2

1. This is particularly the case in Africa and Asia, but less so in Latin America where poverty in several countries is concentrated in the urban centers (Khan 2000).
2. Although here rural statistics are used as a rough proxy for the population that is dependent on agricultural livelihoods, it is important to highlight that agriculture is also a key livelihood strategy for the urban poor, particularly in Africa.
3. Johnston and Mellor (1961), who provided one of the first comprehensive descriptions of the role of agriculture in economic development, note that “insufficient movement out of agriculture will perpetuate, or lead to, excessively small farms and serious underemployment of labor as the proximate causes of sub-standard farm incomes (p. 590).”

CHAPTER 3

4. This section on Zambia draws on Lofgren et al. (2004), Thurlow (2004), and Thurlow and Wobst (2004).
5. Based on per-capita debt to GDP.
6. The simulations assume somewhat optimistic projections for the copper mining sector, including the stabilization of world copper prices and the availability of private investment (see Lofgren, Robinson, and Thurlow 2002 and Lofgren, Thurlow, and Robinson 2004).
7. Given that the purpose of this section is to identify differences in the poverty-reduction potential across agricultural sectors, no attempt is made to account for the fiscal costs of raising productivity under these scenarios.
8. The Nonagriculture-Led Growth Scenario excludes productivity gains in mining. For a discussion of the effects of renewed mining growth see Lofgren, Robinson, and Thurlow (2002) and Lofgren, Thurlow, and Robinson (2004) and Thurlow and Wobst (2004).

9. IMPACT-WATER is described in detail in Rosegrant, Cai, and Cline (2002).

CHAPTER 4

10. References and further details are provided in Beierle and Diaz-Bonilla (2003).
11. As mentioned by Rodrik (1998), extensive trade liberalization during the 1980s along with other reforms helped some of the region’s leading reformers, such as Uganda and Ghana, recover from long periods of economic decline. But neither Uganda nor Ghana has yet reached the level of income per capita it attained in 1970s.
12. The Food Aid Convention is a voluntary agreement among donors that has attempted to establish global food aid targets, eligible commodities, and other guidance criteria, but has no enforcement capacity. The FAO also has an advisory committee on food aid. In addition, food aid is subject to limited rules under the WTO, and those rules may be subject to additional clarification in the ongoing Doha Round negotiations.
13. Wharton was one of the first to emphasize the importance of infrastructure in the generation of positive externalities at the microeconomic level. The author recognized that agricultural development is not exclusively determined by the “economic behavior of the producers,” but also depends on the environment, which according to Wharton includes physical-climatic, socio-cultural, and institutional components in what he calls “the agricultural infrastructure.” We follow Wharton’s (1967) definition of infrastructure that identifies three categories: one that is capital intensive (like roads or bridges); one that is capital extensive (principally extension services or animal sanitation services); and institutional infrastructure (consisting of formal and informal institutions).

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Appendix 1

The Millennium Development Goals, Targets, and Indicators

Appendix 1 The Millennium Development Goals, Targets, and Indicators

Goal	Target	Indicators
1. Eradicate extreme poverty and hunger.	1. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day. 2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger.	1. Proportion of population below US\$1 (PPP) per day. 2. Poverty gap ratio [incidence \times depth of poverty]. 3. Share of poorest quintile in national consumption. 4. Prevalence of underweight children under five years of age. 5. Proportion of population below minimum level of dietary energy consumption.
2. Achieve universal primary education.	3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.	6. Net enrolment ratio in primary education. 7. Proportion of pupils starting grade 1 who reach grade 5. 8. Literacy rate of 15–24 year-olds.
3. Promote gender equality and empower women.	4. Eliminate gender disparity in primary and secondary education preferably by 2005 and to all levels of education no later than 2015.	9. Ratios of girls to boys in primary, secondary, and tertiary education. 10. Ratio of literate women to men 15–24 years old. 11. Share of women in wage employment in the nonagricultural sector. 12. Proportion of seats held by women in national parliament.
4. Reduce child mortality.	5. Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.	13. Under-five mortality rate. 14. Infant mortality rate. 15. Proportion of 1-year-old children immunized against measles.
5. Improve maternal health.	6. Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.	16. Maternal mortality ratio. 17. Proportion of births attended by skilled health personnel.
6. Combat HIV/AIDS, malaria, and other diseases.	7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS.	18. HIV prevalence among 15–24 year old pregnant women. 19. Condom use rate. 20. Ratio of school attendance of orphans to school attendance of non-orphans aged 10–14.

(continued)

Appendix 1 The Millennium Development Goals, Targets, and Indicators (Continued)

Goal	Target	Indicators
7. Ensure environmental sustainability.	8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.	21. Prevalence and death rates associated with malaria. 22. Proportion of population in malaria risk areas using effective malaria prevention and treatment measures. 23. Prevalence and death rates associated with tuberculosis. 24. Proportion of tuberculosis cases detected and cured under directly observed treatment short course (DOTS). 25. Proportion of land area covered by forest. 26. Ratio of area protected to maintain biological diversity to surface area. 27. Energy use (kg oil equivalent) per US\$1 GDP (PPP). 28. Carbon dioxide emissions (per capita) and consumption of ozone-depleting CFCs (ODP tons). 29. Proportion of population using solid fuels. 30. Proportion of population with sustainable access to an improved water source, urban and rural. 31. Proportion of population with access to improved sanitation, urban and rural. 32. Proportion of households with access to secure tenure (owned or rented).
	9. Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.	
	10. Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.	
	11. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers.	
8. Develop a global partnership for development.	12. Develop further an open, rule-based, predictable, nondiscriminatory trading and financial system. Includes a commitment to good governance, development, and poverty reduction—both nationally and internationally.	Official development assistance (ODA) 33. Net ODA, total and to LDCs, as percentage of OECD/Development Assistance Committee (DAC) donors' gross national income (GNI). 34. Proportion of total bilateral, sector-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation). 35. Proportion of bilateral ODA of OECD/DAC donors that is untied. 36. ODA received in landlocked developing countries as proportion of their GNIs. 37. ODA received in small island developing states as proportion of their GNIs.
	13. Address the special needs of the least developed countries (LDC). Includes: tariff- and quota-free access for least developed countries' exports; enhanced program of debt relief for Heavily Indebted Poor Countries (HIPC) Initiative and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction.	
	14. Address the special needs of landlocked developing countries and small island developing states.	

(continued)

Appendix 1 The Millennium Development Goals, Targets, and Indicators (Continued)

Goal	Target	Indicators
	15. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term. 16. In cooperation with developing countries, develop and implement strategies for decent and productive work for youth. 17. In cooperation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries. 18. In cooperation with the private sector, make available the benefits of new technologies, especially information and communications.	Market access 38. Proportion of total developed country imports (by value and excluding arms) from developing countries and LDCs, admitted free of duties. 39. Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries. 40. Agricultural support estimate for OECD countries as percentage of their GDP. 41. Proportion of ODA provided to help build trade capacity. Debt sustainability 42. Total number of countries that have reached their HIPC decision points and number that have reached their HIPC completion points (cumulative). 43. Debt relief committed under HIPC Initiative, US\$. 44. Debt service as a percentage of exports of goods and services. 45. Unemployment rate of 15–24 year-olds, each sex and total. 46. Proportion of population with access to affordable essential drugs on a sustainable basis. 47. Telephone lines and cellular subscribers per 100 population. 48. Personal computers in use per 100 population and Internet users per 100 population.

Appendix 2

Impact-Water Developing Countries and Regions

LAC—Latin and Central America

1. Argentina
2. Brazil
3. Colombia
4. Mexico
5. Other Latin America: Antigua and Barbuda, The Bahamas, Barbados, Belize, Bolivia, Chile, Costa Rica, Cuba, Dominica, The Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Suriname, Trinidad and Tobago, Uruguay, and Venezuela

Sub-Saharan African

1. Central and Western Sub-Saharan Africa: Benin, Cameroon, Central African Republic, Comoros, Democratic Republic of Congo, Republic of Congo, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Côte d'Ivoire, Liberia, São Tomé and Príncipe, Senegal, Sierra Leone, and Togo
2. Eastern Sub-Saharan Africa: Burundi, Kenya, Rwanda, Tanzania, and Uganda
3. Nigeria
4. Northern Sub-Saharan Africa: Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Somalia, and Sudan
5. Southern Sub-Saharan Africa: Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Reunion, Swaziland, Zambia, and Zimbabwe

West Asia and North Africa (WANA)

1. Arab Republic of Egypt
2. Turkey
3. Other West Asian and North African countries: Algeria, Cyprus, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates, and Republic of Yemen

South Asian

1. Bangladesh
2. India
3. Pakistan
4. Other South Asian countries: Afghanistan, Maldives, Nepal, and Sri Lanka

Southeast Asia

1. Indonesia
2. Malaysia
3. Myanmar
4. Philippines
5. Thailand
6. Vietnam
7. Other Southeast Asian countries: Brunei, Cambodia, and Lao People's Democratic Republic

China: Includes Taiwan and Hong Kong

Appendix Table 2.1 Noncaloric Parameters of the Child Malnutrition Estimation Used for the Baseline and MDG Scenarios

	Ratio of female-to-male life expectancy at birth			Share female secondary schooling		
	1995	2015 base	2015 MDG	1995	2015 base	2015 MDG
Latin America	1.0989	1.0989	1.0900	59.0	60.2	70.3
Sub-Saharan Africa						
Nigeria	1.0603	1.0690	1.0975	28.9	36.6	57.7
Northern Sub-Saharan Africa	1.0527	1.0670	1.0920	10.6	11.8	26.4
Central and Western Sub-Saharan Africa	1.0534	1.0600	1.0870	17.7	20.9	35.5
Southern Sub-Saharan African	1.0498	1.0450	1.0750	20.6	30.3	41.2
Eastern Sub-Saharan Africa	1.0335	1.0468	1.0650	11.6	15.6	28.9
West Africa North Africa	1.0489	1.0498	1.0510	54.7	66.9	68.3
South Asia						
India	1.0088	1.0580	1.0850	38.0	50.8	94.7
Pakistan	1.0327	1.0388	1.0770	18.5	28.2	46.3
Bangladesh	1.0072	1.0550	1.0870	13.4	21.1	33.5
Other South Asia	1.0241	1.0380	1.0570	38.7	57.6	46.4
South East Asia						
Indonesia	1.0580	1.0598	1.0770	47.6	56.9	71.4
Thailand	1.0659	1.0772	1.0800	53.6	63.3	75.1
Malaysia	1.0692	1.0699	1.0850	62.6	75.1	78.2
Philippines	1.0639	1.0690	1.0746	77.8	88.4	95.0
Vietnam	1.0687	1.0777	1.0793	46.0	52.8	92.0
Myanmar	1.0849	1.0734	1.0988	33.1	41.0	82.7
Other South East Asia	1.0536	1.0690	1.0650	21.4	43.1	53.6
China	1.0467	1.0498	1.0650	61.8	70.2	74.1

Notes: Latin America includes the Caribbean; N SSA stands for Northern Sub-Saharan Africa; C and W SSA stands for Central and Western Sub-Saharan Africa; S SSA stands for Southern Sub-Saharan Africa; and E SSA stands for Eastern Sub-Saharan Africa; WANA stands for West Asia and North Africa; Other S Asia stands for Other South Asia; Other SE Asia stands for Other Southeast Asia. The regional disaggregation is presented in Annex 2. 2015 baseline values are interpolated from IFPRI IMPACT 2020 estimates. 2015 MDG scenario values are changed to attempt to reach the child malnutrition indicator of MDG 1.

Sources: 1995 values for the ratio of female to male life expectancy and for female secondary schooling based on World Development Indicators (World Bank 2004c).

