



7. Markets and policies to make the poor income and food secure

Forces of change, such as globalization, market liberalization, privatization, urbanization, HIV/AIDS, population growth, climate change and the changing proprietary nature of agricultural research redefine many of the problems to be addressed and the kinds of solutions available. It is imperative to develop and adapt national agricultural science and technology (s&t) policies within this changing environment, and these policies must also be viewed in a broad social and economic context.

While the uptake of improved technology options constitutes an important pillar for national agricultural growth, poverty reduction, food security and environmental sustainability, there are other crucial pillars that demand attention. Trade and market policies, infrastructure, education and health, access issues by the poor and environmental policy must all be considered. And these pillars also condition the context in which agricultural technology options are introduced and determine which ones are attractive to farmers. Efficient, fair and competitive markets are crucial for technology options to be sustainably adopted.

The interaction among science, technology and policy is of critical importance. The New Partnership for Africa's Development (NEPAD) provides a comprehensive approach that takes these factors into account. Efforts to strengthen science, technology and policy linkages for African agriculture should be fully integrated with NEPAD. This chapter addresses these contextual issues and their implications for national policies.

The changing context for national S&T policies

The context in which agricultural science and technology is undertaken is changing rapidly, and s&t policies must adapt appropriately.

Change in agricultural science

The nature of agricultural science is changing in fundamental ways as genetic engineering developments and intellectual property rights (IPR) rede-



fine the proprietary nature of many new technology options. Private research and seed firms are competing with – and in some cases displacing – some lines of public research, and IPR threatens to constrain access to improved genetic materials and research techniques for public research and development (R&D) agencies working on crop improvement and other problems of poor farmers. As the private sector increases its role in the traditional lines of genetic improvement for mainstream crops for commercial farms (small and large), the public sector can focus more sharply on the R&D problems of poor farmers, poor regions and natural ecosystem conservation and management – all of which are less likely to attract the private sector. The public sector also has important roles to play in conservation of African genetic resources, both in farmers' fields and in gene banks (especially for orphan and lost crops critical to food security) and in provision of safety nets for the poor and food insecure.

There is also scope for more effective partnerships between public and private research organizations. Although some types of research are public goods that the private sector will not undertake, this does not always mean that the public sector is best placed to undertake that research. Even when the public sector must pay, it might still be better to contract out the research to private firms – or other specialized agencies – that have a stronger capacity for the particular kind of work.

The IPR regimes (including patents, licenses, and breeders' rights) can encourage useful private sector investment in agricultural research and extension. But unless designed with care they can also lead to high social costs by restricting public access to new technology options and knowledge and to concentration in national seed markets (sometimes by multinational firms). This may deny farmers compensation for indigenous genetic materials that they have nurtured and husbanded over generations. Intellectual property rights not only benefit the private sector, but if managed properly, can be of benefit to the public sector. Unfortunately, most public sector institutions in Africa are ill equipped to effectively manage intellectual property and there is a need to strengthen their abilities in this respect.

Although the World Trade Organization (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) provides broad guidelines for WTO member countries in writing IPR legislation, there is still much flexibility. The provisions of the World Intellectual Property Organization (WIPO) and the International Union for the Protection of New Varieties of Plants (UPOV) also require increased attention by African govern-



ments. Countries need to find the balance between private and public interests as well as national vs. regional research that is most appropriate for their needs. They also need to pursue access to technology through such institutions as the new African Agricultural Technology Foundation (AATF), which aims to provide private processes and materials protected by intellectual property rights, free of charge to public agricultural R&D institutions in Africa. The AATF is a good example of effective private-public partnerships.

New technology in food and agriculture is increasingly politicized, fuelled by publicity of perceived risks and little confidence in its benefits. In many cases, especially those involving genetic engineering, consumer organizations and the media are playing an increasingly more important role than farmers, science, business and industry in public acceptance or rejection. In this changing environment, African public research institutions need to redefine their roles vis-à-vis private research firms, and governments must adopt national IPR regimes that comply with WTO/TRIPS, the Convention of Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture. They must also develop and implement acceptable biosafety regulation systems that ensure food and environmental safety and build public confidence. With the large number of small countries in Africa it would seem that a regional approach to biosafety regimes should be encouraged. In this way the costs of establishing regulatory regimes for genetically modified organisms (GMOs) may be substantially reduced, even though of necessity it will be largely a national and local responsibility to set up and implement monitoring and evaluation processes.

Persley (2003:5), in her synthesis of 50 science-based reviews of modern genetics and its applications in food and agriculture and the environment, indicates that 'The cost, complexity, and uncertainty of regulation in new genetics in food and agriculture make regulatory requirements a barrier to entry for public research institutes, poor countries, and small companies.' Public-good agricultural research in Africa will miss the opportunities of the new genetics without concerted regional efforts to economize on the requirements of establishing the regulatory regime.

There is usually a trade-off between the cost and feasibility of a regulatory system and the level of biosafety achieved. Also, the lower the level of risk that is tolerated, the more likely there will be lengthy delays before release of new technology that could make important contributions to national economic growth, food security, poverty reduction and environmen-



tal sustainability. These trade-offs will vary with the capacity of a country to undertake effective biosafety regulation and with the type of technology to be evaluated.

Countries will also place different social values on the trade-offs depending on their levels of wealth, the importance of the agricultural sector, and the degree of urgency in solving food and nutrition problems. Large countries like South Africa or Nigeria can afford more costly systems, and they have the capacity and trained people needed for implementation. But many smaller countries in Africa cannot afford the same degree of investment, nor do they have enough capacity and trained people to implement ambitious biosafety regulatory systems. Regional biosafety systems offer the best solution to this problem. These should be based on agreed objective risk assessment founded on sound scientific bases. Harmonization of biosafety standards and cooperation among countries can facilitate such regional approaches, with economic benefits to all. Risk assessment could be conducted in a few countries that typify the major agro-ecologies and farming systems and the results accepted by cooperating countries. This would obviate the necessity to duplicate risk assessments in every country with similar ecologies or systems. Of course the decision to release GMOS would remain the sovereign right of each country. Current efforts by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) show a possible way to proceed in this respect.

Globalization

Globalization is increasing the competition that Africa's farmers face from cheap, often subsidized food imports. Trade-distorting policies by the Organization for Economic Co-operation and Development (OECD) countries are particularly harmful to African agriculture because of agricultural subsidies (mostly the European Union and the United States), limited market access (European Union, Japan and the United States) and export subsidies (mostly the European Union). Countervailing responses by African governments will not be in the best interests of the poor and food insecure. National, regional, continental and international markets should be competitive, free and fair for African farmers and consumers. Export markets for Africa's traditional export crops are also being challenged by new suppliers from Asia and Latin America, and rich importing countries are becoming choosier about product quality and standards. New export opportunities are emerging for nontraditional export crops, livestock production and processed foods, but mostly for producers who are well connected to



markets and who can meet quality standards. However there is potential for Africa to benefit from globalization and trade liberalization; this is outlined in Box 7.1. To capitalize on this potential requires regional, national and local markets to be linked more explicitly than they are currently.

In order to enhance competitiveness, new technology options are needed that reduce unit costs of production, improve product quality and add

Box 7.1 The benefits of globalization and trade liberalization to Africa

In the past two decades, Africa has lost ground in the global market place for its traditional export crops (coffee, tea, cocoa, tobacco, sugar and cotton). Its share of world exports fell from about 4 percent in the early 1980s to 2 percent in the late 1990s (IFPRI, undated). This illustrates that Africa's productivity growth and quality improvements have fallen behind those of its competitors.

The good news is, using economic simulation models, Runge and colleagues (2003) have estimated that Sub-Saharan Africa stands to benefit most from trade liberalization, in terms of the share that such economic benefits would represent of the value of agricultural production and of gross domestic product (GDP) (Table 7.1). West Asia and North Africa also stand to benefit, though not to the same extent as Sub-Saharan Africa. Together they would represent 21 percent of the total world gains, a disproportionately large share. These benefits arise from improvements in economic effi-

ciency from reduced producer and consumer subsidies, with attendant tax savings and trade liberalization through reducing tariff and other barriers. They illustrate the importance of competitive, free and fair markets at all levels to Africa. The Study Panel heard this plea consistently during its consultative processes around Africa.

Globalization could also lead to significant improvement in food security, especially for net exporters, due to higher prices that they would receive. African farmers would also face less competition after removal of subsidies on exports from European and other developed countries. Also the removal of taxes that most African governments impose on food production and consumption would stimulate farm investment and lower food prices. Sub-Saharan agricultural exports would increase by US\$10.7 billion, a 45 percent increase.

Table 7.1 Net gains in economic welfare from global trade liberalization towards 2025

Region/Country	US\$ billion	As % of value of agricultural production	As % of GDP
Developed countries	13.2	2.9	0.03
Developing countries	19.3	2.6	0.10
Sub-Saharan Africa	4.6	10.5	0.91
West Asia/North Africa	2.1	5.5	0.10

Source: Runge et al. (2003: 64). The analysis uses the IFPRI IMPACT- WATER model, which includes 16 agricultural commodities.



value. This would be essential to market-led productivity change as described in Chapters 4 and 5, and holds true for on-farm production, post-harvest storage and treatment, agro-processing, marketing and transport. Post-harvest losses in Africa are high, and there is good scope to reduce these through improved roads and markets, together with active encouragement of private sector investment in research and development at the lower end of the production-to-market chain. Creative partnerships between the public and private sectors, such as the African Agricultural Technology Foundation, can also open up new and innovative institutional and technological opportunities.

Enhancing the benefits from research and development

The impact of agricultural research and technology on national economic growth, poverty reduction, food security and environmental sustainability will depend on complementary interventions such as trade and market reforms, infrastructure investments, education and health policies, access issues by the poor, and environmental policy. In this milieu, African governments will need to strengthen the scientific basis of their policymaking.

Urbanization, expanding markets and trade opportunities

Africa is rapidly urbanizing, and by 2020 almost half the African population will live in urban areas (Rosegrant et al., 2001). This will be an engine for most national market developments. Although peri-urban agriculture can be an important source of food, urban people depend primarily on purchased rather than homegrown foods. They also usually consume less coarse grains, roots and tubers, and more livestock products, fats, fresh horticultural products, and processed and pre-cooked foods. This offers important new opportunities for agricultural diversification into higher value products for African farmers, agro-industry, and food wholesaling and retailing. Marketing chains are also becoming more integrated in urban areas with the rise of supermarkets and convenience shops. Agricultural research will need to address the problems of an increasingly diverse array of crop, tree and livestock activities, and give more attention to post-harvest storage and processing properties, as well as rural to urban markets. The private sector should have an important role to play in these kinds of research.

Modern technologies requiring external inputs only have a chance of adoption when smallholders produce for the market. However, with poorly



developed markets and infrastructure, trying to produce for them can be highly risky and economically unattractive. Stifel and colleagues (2003), for instance, found that the incidence of poverty in rural Madagascar increases with remoteness, the yields of major staple crops fall considerably and the use of agricultural inputs declines as one moves farther from markets.

Nevertheless, when markets eventually develop, transport and transaction costs usually decline substantially, which make production for the market more attractive. The difficult and risky start-up phase of market development impedes the transition from subsistence- to market-oriented agriculture. Along similar lines, Omamo and Lynam (2002) argue that subsistence farmers are further constrained by their own learning and production routines.

Market reforms in Africa are seen to have been necessary, but they have not gone far enough to generate greater supply response and competitiveness in export markets (Kherallah et al., 2002). Market liberalization may have removed price distortions, but it did little to benefit most small-scale farmers, especially those living away from roads and markets. Indeed, high transaction costs and the limited development of private trade are forcing many small-scale producers back towards subsistence modes of farming. Without opportunities for export, successes in expanding production frequently result in large price drops because of inelastic domestic demand.

Africa currently imports 25 percent of its food grains. This offers scope for better integration of domestic and intraregional food-grain markets within Africa and expanded intra-African trade, which can place a floor on grain prices. However, such integration is currently constrained by poor regional infrastructure, institutions, market coordination and competition from low-cost and often subsidized imports from OECD countries. Recent research suggests that reducing marketing margins and increasing the productivity of the grains and livestock sectors, in tandem, would have a greater impact on income and food consumption growth in Africa than increased export growth in the traditional and nontraditional export sectors alone (Diao et al., 2003).

Growing competition in export and domestic markets also makes it imperative that African farmers meet more stringent demands for grading and food quality/safety standards and strive to differentiate their products from competitors. Several things are needed: (a) increasing attention to market development (e.g., strengthening institutions responsible for standards and quality control, enforcement of contracts, market information and product promotion); (b) strengthening market-support services (e.g., credit and oth-



er financial services, transport, refrigeration and storage); (c) improving rural infrastructure (especially roads, information and communications technology and telecommunications) and (d) reinforcing policymaker commitment to market reforms. Nongovernment organizations (NGOs), producer organizations and the private sector could play a greater role in facilitating the development of effective marketing institutions, particularly in remote areas. Price information systems developed using the Kenya Agricultural Commodity Exchange are innovative examples of best practice in this regard.

With more liberalized markets, farmers and consumers are now exposed to more volatile prices than before, and this is impacting on the vulnerability of the poor and on farmers' willingness to invest in new technology options. Some forms of market mediation – such as efficient and targeted input subsidies, safety net programs, subsidies for provision of environmental services provided by farmers where market failure leads to inferior societal outcomes and market-based risk management interventions (e.g., weather insurance and futures price contracts) – may still be needed. There are new institutional possibilities for these kinds of instruments today.

Investing in rural infrastructure

Inadequate investments in rural development have taken a severe toll on the provision of infrastructure and services. The road system in Africa today is only a fraction of what India had decades ago (Spencer, 1994) and leaves about 70 percent of its farmers poorly connected to markets. Many farmers can neither procure fertilizers and other inputs at affordable prices nor market their own products effectively. Poor telecommunications infrastructure also keeps farmers in isolation. Similarly, poor access to health and education services diminishes agricultural productivity, contributes to the spread of infectious diseases and locks rural people into a poverty trap. Box 7.2 outlines the benefits of increased infrastructure investment.

Africa's low population densities make per capita infrastructure investment and maintenance costs high and difficult to finance. Capacity building in Africa should not be limited to science and technology but also involve technical and vocational training for staff of agro-service centres, engineers to maintain infrastructure and machines. New technologies present alternatives to expensive conventional large-scale infrastructure development, often difficult to maintain. The use of wireless communication technologies and the convergence of technologies give new affordable possibilities for telephony and Internet access. Wind and solar power can be viable alternatives to



conventional sources of energy. Encouraging greater use of locally available labour could contain the costs of feeder roads. Encouraging greater local ownership of investments through co-financing arrangements and by devolving responsibility for maintenance to local governments and communities addresses many previous problems associated with upkeep.

Achieving realistic levels of infrastructure and rural services will require substantial increase in public investment. Public investment in rural areas has fallen in many African countries in the past decade or so due to the fiscal pressures imposed on governments through structural adjustment programs and a precipitous decline in donor support for such fundamentals

Box 7.2 Increased investment in infrastructure lifts productivity and benefits the poor

A recent International Food Policy Research Institute (IFPRI) study evaluated the returns to public investments in rural Uganda. The results show that government investments in agricultural research have had the most favourable benefit-cost ratio for growth of all public investments and they raised more people above the poverty line for each 1 million Ugandan shillings (Ush) spent (Table 7.2).

Roads

Investments in roads also have a very attractive benefit-cost ratio and the second largest impact on poverty reduction. The impact of low-grade feeder roads on poverty is much larger than of

high-grade roads, such as murrum and tarmac roads, mainly because feeder roads impact significantly on poverty reduction and agricultural productivity improvement, while murrum and tarmac roads had no significant impact on agricultural productivity. The impacts of the murrum and tarmac roads on poverty reduction are mainly through improved non-farm employment opportunities.

Education

Education investments, which rank third in terms of growth and poverty reduction, benefit the poor by lifting agricultural productivity and non-farm employment and increasing rural wages.

Health

Government spending on health did not show a large impact on growth in agricultural productivity or on rural poverty. This is probably because much of the current expenditure is on prevention and treatment of HIV/AIDS-related diseases, for which the benefits are not captured in the relatively short data series available for this study.

Win-win investment

The implications for Uganda are that increasing current research intensity from the low level of about 0.5 percent of agricultural GDP would be a win-win investment. Increased investment priority should also be accorded to feeder roads and education.

Table 7.2 Returns to government investments in rural Uganda

Investment	Benefit/cost ratio	Reduction in numbers of poor per million Ush
Agricultural research and extension	22.7	107.2
Education	2.7	12.8
Feeder roads	20.9	83.9
Murrum roads	n.s.	40.0
Tarmac roads	n.s.	41.4
Health	0.6	2.6

Source: Fan et al. (2003).

Note: n.s. denotes effects were not statistically significant.



(Fan and Rao, 2003). The over-zealous downsizing of the public institutions that provide essential public goods and services like research and development, infrastructure, education and health will also need to be reversed. These institutions have key roles to play and need to be revamped and strengthened to fulfill their functions in cost-effective and demand-responsive ways.

Strengthening producer organizations

Structural adjustment and market liberalization that removed African governments from many market and service functions have created both a vacuum and an opportunity. The hasty retreat of government from service delivery to rural communities without a credible back-up plan or set of alternatives in place has left many communities and farmers fending for themselves. In many cases these shocks have worsened the conditions of the rural communities and created political backlashes, causing backsliding on market reforms. Amidst the acrimony, there is growing understanding that the future belongs to the organized.

While the private sector is emerging as a key player in linking larger-scale commercial farmers with markets, voluntary producer organizations of various types, such as co-operatives, will have important roles to play in providing the basic linkages between small-scale farmers and businesses (agro-service centres, food processors, manufacturers, traders, supermarkets and other food outlets) that do not have the ability or will to deal with small-scale farmers on an individual basis. Simply because farms are small in size does not imply they are not commercially viable per se or that they can become so. Indeed many large-scale commercial farms, especially state-owned ones, are not economically viable. A distinction must be made between small farms and resource-poor farmers. Small farms in Africa have scope for sustainable intensification that is productive, profitable and environmentally sound, provided they have equitable access to input and output markets, credit, innovations, knowledge and information.

Linking farmers and businesses creates opportunities, adds value to producer efforts and helps serve businesses by providing an efficient conduit to reach the mass of small-scale producers. Such producer organizations will play a central role in gaining value from market and trade systems development, investing in technology systems and improving access to micro-finance. Effective producer organizations can also add to the social capital of a community, enhancing the likelihood of effective cooperation in areas such as natural resource management. Farmer organizations in sev-



eral African countries have successfully strengthened farmers' market participation.

Investments in strengthening producer organizations should have the following benefits: lower marketing margins and higher prices for producers; improved product quality; increased access to extension, input and financial services; and greater participation by the rural majority in decision-making processes.

Unlike former state co-operatives that are widely discredited because of their poor performance and high cost, key design principles for future organizations will ensure they are voluntarily organized, economically viable, self-sustaining, self-governed, transparent, and responsive to community and producer-based groups. Supporting these kinds of organizations will require government and donor involvement, engaging with businesses, NGOs, and other civil society groups.

Investing in people and institutions

Development of human capital and institutions is critical for achieving agricultural growth. Over the past decade there has been significant policy reform, and limited institutional reform. Many of the institutions that were created during central government control of markets and services were ill equipped to work in a liberalized market environment. Good policies and investments can go sour, not because they are poorly conceived but because the institutions that implement them do not work well.

Reform of public institutions must overcome vested interests; otherwise new forms of rent-seeking and corruption simply replace the old. New actions may be needed; increased donor support of key public sector investments could come from new financing arrangements that empower the users of public services (e.g., vouchers, user fees, and other co-financing mechanisms) with appropriate institutional reforms to improve mandates and performance.

It is critical to form new partnerships between the public, private, and NGO sectors for the provision of public services such as credit, extension and research. Even where governments must pay all or most of a service, this does not mean they necessarily have to supply it themselves. Contracting out arrangements with other parties can be much more cost-effective, and may offer better possibilities for involving local people and communities. The types of partnerships desired will vary by sector and function. It may be more opportune to diversify supply arrangements for education and health services, for example, than to provide rural roads and market regulation.



Targeting vulnerable groups

Broad-based agricultural growth centred on small farms would make deep inroads into poverty and hunger in Africa. Each 10 percent growth in agricultural productivity in Africa has been shown to reduce poverty by 6 percent. Stated differently, with more than 110 million poor in Africa, a 10 percent increase in crop yields can help almost 7 million more people raise their incomes above the poverty line of us\$1 per day (Thirtle et al., 2001). At this rate, a smallholder-led growth strategy could lead to huge cuts in Africa's rural poverty and enhanced food security within a couple of decades. But even this will not be enough to alleviate poverty or to reach the poorest of the poor. There is also need for targeted investments in the poor and food insecure and the establishment of effective safety nets.

There have been real advances in recent years in targeting and delivering assistance more effectively, often by involving local communities in the design and implementation of targeted programs. But safety net programs are still costly, and there is need for better integration of relief with development efforts. The objectives of these efforts should include (a) helping the chronically poor and hungry in rural Africa find viable pathways out of poverty by helping them to accumulate assets such as land and credit; (b) reducing the vulnerability of poor and near-poor people to weather, markets and conflict-induced shocks; and (c) enhancing the capacity of countries to manage shocks that have regional and national impacts.

It is important to develop national capacities for food insecurity information systems to identify the chronically food insecure, their location, their livelihood systems and the nature and causes of their food insecurity and vulnerability. Such information is critical to efficiently design and target appropriate policies and interventions. Such information is also necessary to target food aid during crises.

Africa, unlike South Asia or Latin America, is fortunate that most countries have relatively equitable land distribution. East Asia also had relatively equal land distribution, which makes increasing crop yields a powerful anti-poverty instrument. What is unequal in Africa is farmers' access to new technology and access to both input and output markets. Although only a few countries in Africa (such as Zimbabwe and South Africa) have a land reform program, satisfactory resolution of this issue is crucial to future stability and food security. Land redistribution is a challenging political process. Market-mediated reforms have been tried, but the results are ambiguous at best.

There is a need for more secure tenure for smallholders to facilitate access to credit, so vital to technology adoption and productivity growth.



Customary or usufruct tenure, while effective in traditional agriculture, does not confer the necessary ‘ownership’ to establish the required collateral with institutional credit institutions in the event of loan defaults. There are examples in Uganda where introduction of land titling has succeeded in this way while also protecting women’s land rights. Hence land titling should be explored by countries to examine whether it could improve access of smallholders to credit. Land titling is distinct from land reform. With the increasing availability of information and communications technology such as satellite imagery, remote sensing, geographical information systems, and the global positioning system, there is now good scope to apply these to codify African land tenure.

Microfinance institutions have proved effective in providing services and increasing assets of the poor. They are valuable mainly for non-farm investment, however. Improving smallholders’ ability to save and invest requires the development of an entire rural financial infrastructure that enables farmers to deposit and withdraw cash, receiving a competitive interest rate on their deposits and paying a competitive rate on their withdrawals.

The central goal is to assist the chronically poor through broad-based agricultural growth. Many small-scale farmers will need to diversify into high-value products to exploit their comparative advantage and to increase value added per person and per hectare. They will need to organize to obtain better access to markets and better terms in the market. Small-scale farmers, both male and female, should receive greater priority in agricultural research and extension and in credit programs.

Poor people have complex livelihood strategies, and agricultural development is rarely sufficient on its own to eliminate poverty. Increased investments in rural health, education and training, in conjunction with agricultural programs, combine to form a key tool to reduce vulnerability, because healthier and more educated people are usually able to adjust more quickly to changing circumstances. Multi-sectoral approaches to reduction of poverty and malnutrition are essential, involving the promotion of health, education and clean water, as well as increases in food supplies and non-farm sources of income.

Investing in environmentally sound development pathways

Land degradation and the unsustainable use of natural resources are limiting the potential for agricultural development in Sub-Saharan Africa. Encroachment into fragile areas, reduced duration of fallows, continued low levels of input use and limited adoption of available resource-conserving



practices underlie the problem. Improvements in marketing and access to input services and credit will be important for promoting more widespread adoption of these technology options. In some cases, farmers also need more secure property rights or more effective local institutions for managing common property resources and encouraging investments in longer-run land-conserving technology options.

Governments need to develop more effective land-use planning strategies and the means to implement them within the framework of customary land tenure arrangements, which mostly work well in Africa. Growing population pressure can sometimes help induce the adoption of labour-intensive technology options to improve land and other resources and reduce degradation (Boserup, 1965; Tiffen et al., 1994), but in practice sustainable pathways to intensification typically require other key interventions such as improved access to roads and markets, non-farm income-earning opportunities and improved technology options (Pender et al., 2001).

A case can be made for selective subsidies on strategic inputs, such as fertilizers, until infrastructure can be improved to the extent that prices paid and received by African farmers are more in line with international competitors. During the 1990s inorganic fertilizer use in Sub-Saharan Africa decreased from 10 to 8 kilograms per hectare. Most of this was applied to commercial non-food crops and some to food crops such as maize that are widely traded. The current annual rates of nutrient depletion of nitrogen, phosphorus and potassium between 50 and 100 kilograms per hectare in Africa means overexploitation of already depleted natural resources is rapidly leading to a downward spiral of productivity. Intergenerational equity hence provides an additional rationale for fertilizer subsidies; Breman and Debrah (2003: 157) point out that 'The paradox of African agriculture is that agricultural development is inhibited at once by overexploitation of the land because of overpopulation, and by poor market development because of underpopulation.' They refer to an additional paradox whereby those African countries that subsidized fertilizer prices or had government price control had growth rates of fertilizer consumption in the 1990s of 1 percent per year, whereas those without controls or subsidies experienced a 6 percent annual growth rate. Clearly soil fertility conservation and management policy remains a complex issue in Africa.

Government, NGOs, community-based organizations, the private sector and individuals all have a potential role in the dissemination of inputs and information on technology options that will lead to improved land man-



agement. Here information and communications technology can be a catalyst, as described in Chapter 4. In general, strong community-based institutions offer the greatest potential for the exchange of information on new technology options. Strengthening farmer organizations and other community-based organizations will facilitate innovation and adoption of natural resource conservation technology options. NGOs also have significant potential to have a lasting impact on land management through the development and dissemination of land management technology options and by organizing communities for successful collective action. Despite the potential for increased involvement of NGOs, community-based organizations and the private sector, governments still have critical roles to play in providing adequate finance for technology development and dissemination efforts, ensuring that environmental and other externalities are taken into consideration and pursuing strategies suited to marginal areas and the poorest rural people.

Although many of the interventions already mentioned will improve incentives and local capacities for rural people to manage natural resources in more sustainable ways, this will typically not be sufficient to achieve the levels of environmental stewardship demanded today by national and international interests. There remains a fundamental problem – markets do not reward rural people for the environmental services they provide when they grow trees, protect watersheds, or conserve biodiversity. Without such compensation, rural people will provide less of these services than desired by society at large. This will result in further environmental degradation, with consequent adverse impacts on agricultural productivity growth and food security.

A common solution to this problem is for government to regulate some resource management practices. For example, tree cutting is often banned or regulated in hillside areas, and certain land uses may be prohibited at sites where they are particularly degrading. At the extreme, sites of especially high environmental value are often converted to parks or conservation areas. Such approaches tend to work against the interests of local people, worsen the plight of the poor, and create incentives to cheat, all of which adds to the difficulty and cost of a regulatory approach.

More promising approaches are based on emerging markets for environmental services. Such markets can change incentives and benefit the poor. For example, as a result of global agreements to cut greenhouse gas emissions, markets already exist that require large users of energy (e.g., oil and electricity companies) to pay for each tonne of carbon sequestered in



forest or farmland. High transaction costs and difficulties in monitoring and enforcing contracts limit the prospects for most African farmers to benefit from such markets unless they can be effectively organized for this purpose.

Fair trade arrangements are another way of trying to capture higher prices to pay poor indigenous producers for some of environmental benefits that they generate. There are several successful examples involving non-timber tree products, such as nuts, honey and medicines. As more countries formalize property rights over genetic resources, there may be new opportunities for communities to use farmers' rights to collect royalties on some of the indigenous biodiversity that they conserve.

Innovations along these lines are constrained by the lack of an expressed market demand for most environmental services. Although environmental services are increasingly appreciated by society, there is little tradition or expectation of having to pay for them. International environmental agreements (e.g., the Kyoto Agreement to reduce carbon emissions) can be effective in bringing the needed pressure to bear, and perhaps similar agreements can be developed for some other environmental services.

New and emerging technology options such as genetic engineering, information and communications technology, and geographic information systems (GIS) also offer opportunities for better management of natural resources. Remote sensing and GIS tools allow for empirical analyses of land-use change over time and in a spatial context. Genetic engineering to raise productivity allows farmers to produce more output with less exploitation of natural resources. For many regions of Sub-Saharan Africa that depend upon one or two staple crops that are prone to pests and diseases, new crops that offer resistance have enormous implications for food security and rural livelihoods in general. As food security and incomes improve, farmers will be more likely to invest in natural resource management options offered by new technology.

Good governance

Success of the above-mentioned policies will require good governance, such as the democratic decentralization processes under way in Uganda. An effective public sector is essential for private-sector-based economic growth and eradication of poverty and food insecurity in Africa. Governments must develop a vision for agriculture that will be backed up with sound strategies and allocation of the necessary financial and technical resources. It is the Study Panel's view that the low priority given to agricul-



ture and rural areas by governments of most African countries is the main reason for the poor performance, not only of the agricultural sector, but also of African economies in general.

As NEPAD recognizes, good governance also implies the enforcement of law and order and the absence of corruption. Widespread conflict in many African countries, as well as failure on the part of the government to maintain law and order, are important reasons for the existing food insecurity and poverty. Where conflict has been replaced with law and order – such as in Mozambique and Uganda – transient and endemic hunger and poverty have been reduced significantly. However, the continual absence of conflict does not ensure that hunger and food insecurity will disappear. It remains a necessary but not a sufficient condition.

Investment requirements to improve food security in Sub-Saharan Africa

Improved agricultural productivity from greatly enhanced public investments in agricultural research and extension will play a key role in achieving and sustaining measurable improvements in African food security. The Study Panel recognizes that such improvements must be accompanied by ancillary public investments. These include investments in education, especially of women, access to clean water, rural roads and irrigation. These must be complemented by private investments in inputs such as fertilizers, farm and post-harvest machinery, and vehicles.

The Study Panel urges governments and international agencies to respond to the need for a renewed commitment to African agricultural research and development and help to make food insecurity a thing of the past. To illustrate the magnitude of the task, yet its feasibility, estimates have been made of the public investments required on the items above to reduce the number of malnourished children in Sub-Saharan Africa by 33 percent – from the 1997 level of 33 million to 22 million in 2020 (Rosegrant et al., 2001). Projected investments between 1997 and 2020 would need to increase by 71 percent, achieving an aggregate total investment of US\$183 billion compared to a baseline or most likely scenario level of US\$107 billion over the same period. This amounts to an increased investment of only US\$4.27 per person in Sub-Saharan Africa per year.

To achieve these reductions in child malnutrition would require realized crop yield annual growth rates of between 2.7 and 3.6 percent from 1997 to 2020. These rates are double those in the baseline scenarios examined, but achievable, as we have seen in Chapter 4. They may imply a 10 percent annual growth in fertilizer use, a level commensurate with the 9 percent



annual growth in Asia from 1960-95. Rates of female schooling are projected to rise by 20 percent in this scenario, with access to clean water and female life expectancy both increasing 10 percent.

Conclusions

If a market-driven agricultural productivity recovery is to be initiated, improved governance, market access, information, transport and communications are vital complements to science and technology. Increased domestic market opportunities for both food and non-food commodities depend crucially on improved access by Africa to international markets and seamless intra- and inter-regional trade within Africa. The former is constrained by OECD agricultural subsidies and increased use of non-tariff barriers as tariff rates are reduced under the WTO regimes. If trade is to become an instrument of hunger and poverty alleviation, it must be free, competitive and fair. Many otherwise viable technology options for Africa produced by past research remain under-exploited because of high input prices and low output prices that result from under-investments in markets and infrastructure, structural adjustment programs and distortions in international markets. The scale of the increased investments needed to make a real difference in agricultural productivity growth and improved food security are well within the reach of African governments and the international community.

Creating an effective policy environment, capable of exploiting the potential that science and technology offers, will require innovative ways to engage smallholders to become better informed and more active participants in markets, policy processes and priority setting in agricultural research and development. African countries need increased capacity to address product quality, comply with biosafety standards and phytosanitary requirements, and work with regulatory regimes related to GMOS. They also need the skills to negotiate effectively with OECD-importing countries. Only then will the private sector express its unrealized potential to contribute to the agricultural productivity recovery.



Recommendations

- ▶ Increase investments in rural infrastructure
- ▶ Strengthen capacity to expand market opportunities
- ▶ Institute effective intellectual property rights regimes to encourage the private sector and facilitate public-private partnerships
- ▶ Reduce barriers to increased African trade with OECD countries
- ▶ Improve data generation and analysis related to agriculture, food and nutrition security, and vulnerability



References

- Boserup, E. 1965. The conditions of agricultural growth: The economics of agrarian change under population pressure. New York: Aldine Publishing Company.
- Breman, H. and S. K. Debrah. 2003. Improving african food security. *SAIS Review* Vol. XXIII, No. 1 Winter-Spring 2003, 153-170.
- Diao, X., P. Dorosh, and S. M. Rahman. 2003. Market opportunities for African agricultural products: An examination of demand-side constraints on agricultural growth. Discussion paper no. 2. Development Strategy and Governance Division. International Food Policy Research Institute. Washington, DC
- Fan, S. and N. Rao. 2003. Public spending in developing countries: Trends, determinants and impact. EPTD discussion paper. International Food Policy Research Institute. Washington, DC
- Fan, S., X. Zhang, and N. Rao. 2003. Public expenditure, growth and poverty reduction in rural Uganda. Discussion paper. Development Strategy and Governance Division. International Food Policy Research Institute. Washington, DC
- IFPRI (International Food Policy Research Institute). Undated. Exploring market opportunities for African smallholders. Washington, DC
- Kherallah, M., C. Delgado, E. Gabre-Madhin, N. Minot, and M. Johnson. 2002. Reforming agricultural markets in Africa. Baltimore, Maryland: Johns Hopkins University Press,.
- Omamo, S.W. and J. Lynam. 2003. Agricultural science and technology policy in Africa. *Research Policy*, 32: 1681-1694.
- Pender, J., P. Jagger, E. Nkonya, and D. Sserunkuuma. 2001. Development pathways and land management in Uganda: Causes and implications. EPTD discussion paper No. 85. International Food Policy Research Institute, Washington, DC
- Persley, G.J. 2003. New genetics, good and agriculture: Scientific discoveries – Societal dilemmas. Executive Summary of ICSU synthesis report.
- Rosegrant, M.W., M. S. Paisner, S. Meijer, and J. Witcover. 2001. Global food projections to 2020: Emerging trends and alternative futures. International Food Policy Research Institute. Washington, DC
- Runge, C. F., B. Senauer, P. G. Pardey, and M. W. Rosegrant. 2003. Ending hunger in our lifetime: Food security and globalization. International Food Policy Research Institute. Baltimore, Maryland, and London, U.K.: Johns Hopkins University Press.
- Spencer, D. 1994. Infrastructure and technology constraints to agricultural development in the humid and subhumid tropics of Africa. EPTD discussion paper no. 3. International Food Policy Research Institute. Washington, DC
- Stifel, D., B. Minten, and P. Dorosh. 2003. Transactions costs and agricultural productivity: Implications of isolation for rural poverty in Madagascar. Market and structural studies division discussion paper no. 56. International Food Policy Research Institute. Washington DC
- Thirtle, C., L. Lin, and J. Piesse. 2001. The impact of research-led agricultural productivity Growth on Poverty in Africa, Asia and Latin America. Working paper, Department of Environmental Science and Technology, Imperial College of Science, Technology and Medicine. London, U.K.
- Tiffen, M., M. Mortimore, and F. Gichuki. 1994. More people, less erosion: Environmental recovery in Kenya. Chichester, U.K.: Wiley.