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Continuing Opportunities



Scientific breakthroughs and technological innovations in the 20th century fueled substantial gains in agricultural productivity in many developed and developing countries. The development of new technologies and practices resulted from both public and private investments in research. Countries that enjoyed high agricultural productivity growth were able to increase incomes, participate in global markets, reduce hunger and poverty, and improve the quality of life of their citizens.

For the countries that were not able to benefit from the advances in science and technology, agricultural productivity did not grow quickly, which resulted in unmet needs for income growth and food security.

Many technologies and practices developed in the 20th century could be adapted to meet the unique needs of each developing country. Scientific understanding about the interactions between agricultural production and ecosystem health can also contribute to the development of a sustainable agricultural system. The choice of an appropriate set of technologies and practices should incorporate indigenous knowledge of the local economic, social, and natural resource environment.

Agricultural production technologies and practices have been developed to improve soil, water, nutrient, and pest management. Crop improvements contributed to the successes of the Green Revolution. Tools of modern biotechnology have been used to achieve higher levels of stability and sustainability in crop production. These

innovations have increased yields and reduced environmental impacts. Advances in animal breeding and health have increased both the quantity and quality of animal protein available to consumers.

Improvements in marketing, processing, and transportation technologies have expanded the choices of food that are readily available to consumers in developed economies. These innovations can be adapted to preserve and deliver vitamin-rich foods to help combat nutrient deficiencies in developing countries. In addition, technologies to reduce food safety hazards can be used to increase the health of both rural and urban populations.

Scientific and technological advances in the 21st century will result from research investments in both traditional agricultural fields and other emerging disciplines. Agricultural production research will be targeted to develop crops and animals that can tolerate a wider range of environmental conditions and offer consumers desired characteristics. Molecular methods will be used to diagnose diseases, locate pollutants in the environment, and detect harmful micro-organisms in food. Modern biotechnology holds promise for the production of pharmaceutical compounds such as vaccines within locally grown plants. Innovations in biological and information sciences have resulted in several emerging fields that hold promise for the development of future agricultural technologies. The new fields of bioremediation, nanotechnology, genomics, proteomics, and bioinformatics will increase

knowledge that can be shared and used to improve sustainable agricultural production and protect ecosystem functions in developed and developing countries alike.

Scientific and technological advances hold great promise, but the full benefits of scientific breakthroughs will not be realized without the dissemination and adoption of new technologies. In each country, the successful local development of technologies or the transfer and adaptation of innovations from other countries will depend on incentives and barriers faced by investors and producers. Countries with strong research, health, and education capacity will offer a supportive environment for technology investment. Financial resources are needed to train scientists, enhance and maintain research facilities, develop agricultural markets, and provide adequate health and education systems to the population. External funds could be used to fund these efforts, but the priorities for development must come from within developing countries to ensure that their unique economic, social, and environmental needs are met. Inadequate public utilities, transportation systems, and other infrastructure will impede the development of agricultural markets by limiting the availability of affordable inputs and inhibiting the timely delivery of high-quality agricultural products.

Financial, legal, and political institutions have profound effects on technology development and transfer and on the evolution of agricultural markets. Incentives for domestic and foreign investment are

tied to the stability and perceived fairness of the institutional infrastructure within a country. Domestic agricultural policies within developing countries may affect prices and costs, thus distorting incentives for research investment and technology adoption. The sharing of knowledge between countries currently is hindered in some cases by intellectual property rights systems that differ between countries. Innovative public/private partnerships are being designed to help developing countries gain access to new technologies.

It may be difficult to achieve development goals for a sustainable agricultural system in countries that have a poor natural resource base or an environment that is vulnerable to degradation. These conditions limit the choices of technologies and practices that are appropriate to use. In addition to domestic circumstances, international treaties and trade policies have impacts on the success of science and technology policy in developing countries. The liberalization of global trade will affect prices and incentives to invest. The TRIPS Agreement has the potential to enhance the science and technologies that will be available to increase agricultural productivity, and the Biosafety Protocol contains provisions for a clearinghouse to help developing countries make science-based decisions about trade in bio-engineered products. International deliberations can have an effect on decisions regarding investment in technology, even if the country does not actively participate in global markets.



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Increasingly, research investments and technology transfer will depend on cooperative endeavors between developed and developing countries and between public and private institutions. Developing countries have many crucial decisions to make in meeting their goals for sustainable agricultural systems. These decisions need to be made and implemented based on the knowledge of each country's unique environmental, social, and economic characteristics. Local expertise is needed to take advantage of indigenous knowledge, and to establish environmental and food safety safeguards to ensure that both the positive and negative potential impacts of a new technology are adequately assessed.

There are many ways that developed countries, international institutions, and businesses can increase the possibilities for developing countries to benefit from scientific and technological advances. They can continue to train scientists and offer the expertise needed to help develop workable plans to achieve productive and sustainable agricultural systems. Investment incentives can be increased directly, and by helping developing countries establish and maintain the legal, financial, transportation, and communications infrastructure necessary to encourage investment.

Public and private investment in research to increase agricultural productivity of the poorest nations can have many benefits. With supportive policy, regulatory, and institutional frameworks in place, science

and technology can drive agricultural productivity increases, alleviate hunger, and foster economic growth in developing countries. Incentives for private investment will increase as regions gain the economic resources to participate more actively in the global marketplace. Higher incomes and better nutrition will improve food security and allow more developing countries to share in the growth that many countries have enjoyed for the past half century. Thus, science and technology can play a critical role in helping to prevent famine, improve nutrition, and move countries closer toward a goal of ending world hunger.

