

**USAID Development
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Sustainable agriculture: a review of donor literature
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Sustainable agriculture: a review of donor literature

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WORLD BANK

1. Agriculture Knowledge and Information Systems - AKIS

An Agricultural Knowledge and Information System (AKIS) is a system of people and institutions that generates, transfers, and utilizes agricultural knowledge and information. The system is characterized by its key subsystems: agricultural research, agricultural extension, and agricultural education. Farmers, their needs and opportunities, drive education, extension, and research, and for each they provide direct input into design, funding, priority setting, execution, and evaluation. Investments in agricultural knowledge and information systems are of increasing importance to address needs of rural people and assure future food security and environmental sustainability. The World Bank increasingly supports client country investment in agricultural research, education, and extension in the context of holistic agricultural knowledge and information systems.

Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD): Strategic Vision and Guiding Principles

Food and Agriculture Organization of the United Nations
The World Bank
Rome, 2000

Purpose

This document has been prepared by the staff of the Food and Agriculture Organization of the United Nations (FAO) and the World Bank concerned with agricultural education, research and extension – and their integration into Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) – where rural people, especially farmers, are partners, not simply recipients. It is intended as a vehicle for sharing ideas and principles with the various stakeholders addressing the causes, and seeking solutions, for rural poverty. It has four main purposes:

1. To set forth a shared vision for an integrated approach to agricultural education, research and extension which would respond to the technology, knowledge and information needs of millions of rural people, helping them reach informed decisions on the better management of their farms, households and communities.
2. To facilitate dialogue with decision-makers, both in governments and in development organizations, ensuring that proposals for investment in Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) are well founded and receive due consideration.
3. To provide the staff of FAO and the World Bank, and their counterparts in client countries, with a common set of principles to guide their work in agricultural education, research and extension.
4. To ensure synergies from complementary investments in education, research and extension, resulting in more effective and efficient systems.

To view the entire document, click on the following:

[http://lnweb18.worldbank.org/ESSD/essdext.nsf/26DocByUnid/1C7585743258748385256B9E00144D32/\\$FILE/vision.pdf](http://lnweb18.worldbank.org/ESSD/essdext.nsf/26DocByUnid/1C7585743258748385256B9E00144D32/$FILE/vision.pdf)

2. Livestock and Animal Resources

Over the next two decades, a significantly changed livestock subsector will likely become the most important agricultural subsector in terms of value added and land use. The accelerated growth of livestock production and processing will require far-reaching changes in the roles of the public and private sectors in livestock development. With a strong and growing demand, rapid institutional and macroeconomic policy changes, and a fundamental shift in the functions of livestock, there is a significant danger that the poor are being crowded out, the environment eroded, and global food security and safety compromised. The World Bank recently released a strategy for the Livestock sector. Livestock Development: Implications for Rural Poverty, the Environment, and Global Food Security was prepared by a group of livestock specialists from the World Bank with input from its partners. In the strategy, the World Bank's Animal Resources Team (ART) argues that livestock can play an important role in poverty reduction, that the effects of livestock on the environment can be adequately managed, and that livestock can make an important contribution to global food security. This will only happen, however, if an appropriate policy framework is put in place. Public policy must facilitate producer access to knowledge and production inputs; promote environmentally sustainable production systems and ensure public health and food safety standards; and encourage development of efficient markets and processing facilities. The promotion of these enabling environments—particularly in areas where there are considerable market failures, such as equity, environment, and food safety—is seen as a core function of the public sector, including international financial institutions such as the World Bank.

Livestock production and sustainable resource use: putting livestock on the sustainability agenda

One of the world's greatest challenges is to feed a growing population while sustaining the global natural resource base. How the relationship between human needs and natural resource requirements will balance depends largely on livestock management and production practices. Livestock production has massive requirements for natural resources – livestock use one-third of the world's land, including one-fifth of its cropping area.

To view the entire document, click on the following:

www-
wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2000/11/10/000094946_00103105320484/Rendered/PDF/multi_page.pdf

3. Crops

Crop production is the basis for many agricultural systems, especially for those of small farmers. Technological improvements in crop production have been the basis for many of the past successes in agricultural development. Continued progress in increasing productivity of crop agriculture is central to efforts to ensure global food security and conserve environment resources. Future innovations must increase productivity and contribute to sustainability of the natural resource base for production. This will require improvements in management of production systems, the inputs for production, and the produce from these systems. Materials for World Bank and partner organizations relating to sustainable crop production are organized under the following major topics:

Integrated Pest Management (IPM) & Pest Control

Integrated Pest Management (IPM) is an approach to pest management developed to reduce reliance on chemical pesticides. The approach is driven by: high cost of pesticides; increased pest resistance to pesticides; awareness of negative impacts of pesticides on human health, biodiversity, food and water quality, and trade and other regulations. IPM practices generally reduce chemical use and enhance long-term sustainability of yields by increasing farmer management skills and exploiting location-specific knowledge of agro-ecosystems. IPM approaches based on pest-resistant varieties, biological control agents, and cultural practices are knowledge-intensive, requiring extensive training and strong links between research, extension services and farmers. Social benefits of pesticide use reduction and sustainability of agricultural systems make public IPM investment a priority, though challenges are less in technology generation and more in developing a conducive institutional and policy environment that favors IPM adoption by farmers. The Bank is committed to supporting IPM in client countries through lending and non-lending activities and expects to update its IPM strategy in FY 02/03.

Organic Farming

Organic agriculture promotes environmentally, socially and economically sound production of food and fiber. Organic agriculture adheres to globally accepted principles respect the natural productive capacity of plants, animals and the landscape and strives to maintain quality in all aspects of agriculture and the environment. Organic agriculture reduces use of external inputs and does not use synthetic chemical fertilizers, pesticides and pharmaceuticals. It takes local soil fertility as a key to successful production and seeks to use legumes for symbiotic nitrogen fixation, organic fertilizers, and some native minerals. Natural pesticides are used under certain conditions and emphasis is on management systems that use sustainable cultural practices. Livestock production systems seek to satisfy the animals' needs, use organic feed, and limit livestock numbers to the grazing and manure absorption capacity of the farm. Organically produced food and fiber can carry substantial price premiums, which along with reduced input costs provide opportunities for farmers to substantially increase their profitability. Technology generation and market system development are important to the expansion of organic agriculture.

Post-Harvest Storage, Marketing, & Handling

Increasing production is one approach to improving farm incomes and food availability, but an additional strategy with considerable promise is that of making better use of what is already produced. Improving post-harvest handling, marketing, and storage and has not received the attention warranted. Some losses are inevitable, but reducing loss can increase farmer incomes and total food availability without using additional natural resources. Cereal grains, livestock products, and especially fruits and vegetables can benefit from improved post-harvest handling. Improved post-harvest and marketing technologies also improve food quality and safety and meet needs of increasingly demanding consumers. Improving post harvest management can also improve food nutritional quality and safety. Improvement to post-harvest handling of crop production requires attention to handling and storage systems, market systems, and processing facilities and systems and involves the farmer, the market traders, processors and exporters, and government regulatory agencies.

Seed Production & Marketing

Seed is an essential input for increasing crop productivity, as it embodies the genetic potential of plants, determining the upper limits of plant yields. A reliable source of quality seed of locally-adapted improved varieties can greatly increase agricultural productivity and profitability. Currently, many of the world's farmers have limited access to quality seed, as in Sub-Saharan Africa where less than 10 percent of smallholder land is planted with modern varieties. Part of the problem has been that in many countries governments have controlled seed industry, even though parastatal seed production and distribution has proven ineffective. Institutionally pluralistic seed systems that exploit the comparative advantages of the different participants are needed to develop, multiply, process, store, market, and ensure quality of seed. In these processes, farmers are important in farmer-to-farmer seed exchange; local institutions (NGOs,

extension services, producer associations) to promote use of quality seed; small commercial seed companies to develop local markets; larger formal seed companies to introduce new varieties and innovation; seed associations to represent industry interests; and government institutions to provide an enabling legal and policy framework for the seed industry. The challenges to establishing sustainable and efficient seed systems include: reform of governmental seed sector support, improvement of local seed systems, and development of regionally competitive seed industries.

4. Markets & Agroenterprises

Private agribusiness must drive rural development and increased agricultural productivity to meet social goals of poverty reduction, economic growth, and environmental conservation. Private agribusinesses provide inputs and services needed for on-farm production and markets for farm products. Agribusinesses also provide important employment opportunities in rural areas and contribute to the growth of the larger private sector. In many developing countries, private agribusiness is called upon to expand into areas opened up with the retreat of inefficient parastatal operations in input supply and marketing and to respond to opportunities growing out of the liberalization of economies and globalization of trade. While private agribusiness growth depends principally on private initiatives, the public sector maintains an important role in creating a facilitating policy environment and promoting development of free and fair markets. The World Bank seeks to help client countries promote growth of efficient agribusinesses and markets. This section provides a guide to agricultural markets and agroenterprises. It reflects cooperation between individuals who hope to alleviate poverty in developing countries by sharing their knowledge with others in the field.

Agricultural Market and Agribusiness Assessments

Data on the policy conditions and constraints facing agro-enterprises are often scarce in developing countries – and inadequate understanding of the situation may lead to inappropriate programmatic and policy decisions. Various types of agricultural market and agribusiness assessments are useful to fill this information gap. Enterprise-level surveys, subsector assessments, and policy inventories provide insights into problems facing private sector agribusinesses. This helps analysts and decision-makers better understand the dynamics of the subsector, identify constraints and opportunities for growth, and formulate policies and projects to improve the climate for agribusiness investment and growth.

Policies and Regulations

A wide range of government policies and regulations condition the environment for agribusiness investment and growth. Policy reform can foster growth of agribusiness and a good understanding of policies that promote or hinder agribusiness investment and growth is important before undertaking an agribusiness project or policy reform. Agribusiness policy inventories are versatile tools for organizing and understanding complex economic and agricultural policies and their impact on agribusiness development. Such inventories bring attention to key policy issues affecting agribusinesses and provide insights into policy alternatives.

Competitiveness

Industry competitiveness is reflected in sustained growth in productivity of producers, firms and industry clusters in the agribusiness sector. This competitiveness is a result of sound business strategies and supportive micro-economic and macro-economic conditions. An agribusiness competitiveness initiative assists private sector agribusiness clusters to respond to reformed policy and institutional environments to increase investment, growth, productivity, profitability, employment and exports. A competitiveness initiative contributes to continued policy and institutional reform in the public sector and stimulates productive and effective dialogue between the private and public sector. This site provides access to World Bank and partner documents and resources relating to agribusiness competitiveness issues.

Market Information, Food Safety, and Standards

Knowledge of market information tends to reduce risks and lower transaction costs of participating in the market. These efficiency gains can lead to increased participation in markets and greater stability of prices and supply/demand. Improved market supply in turn tends to reduce costs and therefore increase demand. More efficient agricultural markets benefit all participants: growers, traders, processors and consumers and can favorably impact food security especially in poorer countries. Market information systems are improved by better understanding of grades and standards, more effective food safety interventions, market information services, and trade matching services.

Post-Harvest, Processing, and Other Technologies

Agribusinesses can increase value addition and profitability by adopting improved post-harvest handling technologies. Some of these technologies might be used on-farm immediately after harvest, while others are used further on in the market chain in transport, processing, storage, and marketing. Technologies might improve the quality of the final product to help meet consumer's growing demand for quality or might reduce costs and increase efficiency of processing/handling operations. Technologies also offer opportunities to make use of byproducts that might have significant value.

Supporting Individual Agro-Enterprises

Public support for individual agro-enterprises can be important to introduce innovation in the agriculture sector and to help establish new enterprise sectors. Agro-enterprises can contribute to the over-all output, profitability, productivity and sustainability of the agricultural sector. Enterprises involved with seed supply, fertilizer and agrochemicals distribution, packing and packaging materials, equipment and machinery, processing and product assembly, and other functions provide a basis for a competitive agricultural sector and are important for rural employment and innovation. This can justify support to individual enterprises, but such public support must be carefully targeted to public goods issues, must be transparent, and must avoid unsustainable or unwarranted subsidies.

Supporting Associations & Cooperatives

Associations represent an increasingly important form of participatory development and can make a major contribution to agribusiness growth. Agribusiness trade associations can serve as a vehicle for defining and promoting interests of the industry; taking collective action; delivering centralized services; and networking among members and other stakeholders. The importance of a particular association to agribusiness development depends on: (1) how critical the economic activity is to the welfare of the subsector; (2) how representative the association is in terms of membership; (3) how broadly the association defines its mandate and scope of services; (4) the resources the association has at its disposal; (5) the quality of the board of directors and senior management; and (6) how much support members give to the association. Trade associations represent an important element of civil society that can play a key role in policy debate and industry promotion.

Finance, Investment, & Risk Management

A significant portion of the agribusiness output in developing countries is produced by small and medium enterprises that lack dependable sources of credit. This tends to constrict their individual growth and hamper the growth of the agriculture sector with which they are interdependent. Lack of access to credit is one of the most significant constraints to business formation and expansion for all but the largest firms and this constraint is exacerbated in rural areas where financial services are limited by rural physical and economic conditions. Rural enterprises often have limited access to formal financial services and appropriate financial products and services, because of high transaction costs associated with small transactions, highly segmented markets, and dispersed rural populations involved in risky economic activities. Political interference in rural financial markets can also reduce the credibility of formal financial contracts and legacies of mismanagement of rural financial programs impede development of sustainable services.

Trade and the International Dimension

The past 30 years has seen a tenfold increase in the global export of agricultural products. Increased reliance of consumers on agricultural products grown in other countries and of producers on markets in other countries presents a host of new challenges and opportunities for the supply chains that link producers, exporters, wholesalers, retailers, regulators and consumers. Improved global communications and transport facilities make these supply chains possible and enable more and more agribusinesses to participate. The improved global communications also lead to greater expression of social and environmental concerns over product quality and production processes, concerns that raise important new issues of business responsibility and consumer safety. NGOs, buyers, consumers, governments of importing countries, and the media all scrutinize agribusinesses for their adherence to standards for environmental and food safety in processing facilities and on farms where unsanitary practices and uncontrolled chemical usage were perceived as common-place. More recently, concerns over human rights, worker welfare, and biodiversity loss have become determinants of success or failure for products, companies, and countries in the global marketplace.

5. Producer Organizations

Seventy-five percent of the world's poor live in rural areas and agriculture or agriculture-related activities are their primary income source. Rural producer organizations contribute to food security, making marketable goods available. They also contribute to natural resource management and biodiversity conservation. They both preserve local cultural heritage and contribute to economic development by building profitable businesses on traditional know-how. They are therefore identified in the World Bank Group's [Strategic Framework](#) as key economic stakeholders in the fight to reduce rural poverty.

6. Irrigation and Drainage

Irrigated agriculture accounts for nearly 20 percent of farmed land and contributes to 40 percent of the world's food production. It has been a main driver of increased world food security, agricultural growth and rural development over the last 40 years. Now, irrigation is by far the largest user of water, accounting for more than 75 percent of all water use in developing countries. Increasing water scarcity, competing demands of other sectors, pressing environmental concerns, and high cost of investment pose challenges to the new generation of irrigation and drainage projects. The irrigation and drainage sector has to go through a modernization process including major policy and institutional changes to insure higher crop per drop, equity in distribution, and sustainability of resources and investments. The Bank has played a central role in the irrigation sector in developing countries and will continue as a major actor to help transforming the sector into efficiently managed and highly productive sector. The main objectives are agricultural growth, sustainability and poverty reduction.

Planning and Development

Effective development of irrigation and drainage depends largely on careful planning which addresses the economic, social and environmental needs of the society and the capacity to build, manage, operate and maintain the projects. Sharing lessons, best practices and innovations would help and improve the planning and development of new projects.

Economics and Finance

Water Pricing is one of many policy interventions to mitigate water sector crisis. It is one of the most important policy instruments for integrating supply augmentation with demand management so that an efficient allocation and use of the already developed resources provide the economic and financial justification for the development of additional supplies from both conventional and unconventional sources. It has two key roles, (1) a financial role of being the main mechanism for cost recovery and (2)

an economic role of signaling the scarcity value and opportunity cost of water to guide allocation decisions both within and across water sub-sectors. Water pricing policies in most countries fail to perform due to faulty approach and inappropriate institutions that have their roots in immature political economy environment. The economic and political consequences of declining investment, deteriorating physical health of water infrastructure, increasing physical and economic inefficiency, and growing water conflicts have prompted a vigorous debate not just on the need for a realistic water pricing policy but more so on the indispensability of supportive institutional reforms.

Institutions

Institutional factors limit the performance of a large number of Irrigation and Drainage systems. Obtaining "more crop per drop" from existing systems requires a policy reform that increases user participation, implements a set of appropriate incentives and improve irrigation and drainage services by increasing flexibility of service delivery, sustainability and equity. Reform of the institutional framework needs to address governance issues and the allocation of functions and responsibilities within the context of each country. The Irrigation and drainage sector in the Bank works on institutional reform on four dimensions: user participation, agency reform, private public partnerships and water resource management.

Irrigation for Smallholders

The Irrigation for Smallholders is a focal agenda of the Irrigation and Drainage Group of the Rural Development Department. The activities aim to bring smallholders an access to modern and efficient agricultural production technologies. Irrigation has been accused of disproportionately benefiting a limited number of relatively favored farmers. The decreased allocation of funds towards irrigation further confines the benefit to the same limited groups via rehabilitation projects. On the other hand, development practitioners in several parts of the world start discovering low cost irrigation equipment as an effective tool for the reduction of rural poverty. They also realize that the low cost irrigation technology can be spread via commercial channels if the needed intervention is successfully designed and implemented. To direct more benefits of irrigation to the broader group of less favored smallholders, the Irrigation and Drainage group thus promotes low cost, stand-alone irrigation options and market-based approaches for their dissemination. The group also extends the synergy with non-conventional partners such as the irrigation industry and NGOs in heading towards this frontier. A technology contest that targets poor small holders, demonstration projects of promising equipment, and knowledge management are under way in partnership with NGOs, industries, and research institutes. A relevant video and reports are available on affordable on-farm irrigation methods and their growing potential among poor smallholders. Please contact any of the group members if you need more information or copies of those materials.

Policies and Strategies

Irrigation and drainage as instruments for agricultural growth and rural development are at cross roads towards a new vision which maximizes the benefits and insures sustainability. The World Bank is working with its partners and clients to help devising new policies and strategies which address cross cutting issues as well as country specific needs.

Technology

Modern technologies open new horizons and present opportunities for efficient water management and water saving in irrigation. They could help in mitigating and control problems due to using marginal water for irrigation, waterlogging, salinity, and disposal of drainage water. Cost effective technologies would substantially reduce the cost of investigation and monitoring the performance of large scale irrigation and drainage projects.

Water Quality and Environment

Many environmental factors play a role in the quality, success or failure of the crops in both irrigated and rainfed agriculture. Excess water can cause serious problems when natural drainage is not sufficient. It can result in waterlogging and/or salinization. Pollutants that are attached to soil particles (salts, nutrients and pesticides) can be transported with drainage effluent and endanger the health of downstream users and ecosystems. Meanwhile, reuse of treated and untreated waste water in irrigation brings many environmental and health concerns.

7. Fisheries and Aquaculture

The rationale for The World Bank's involvement in fisheries (including coastal small-scale fishing) and aquaculture is the sector's substantial contribution to local employment, rural income generation, poverty alleviation and food production. The World Bank assists countries develop sustainable methods of exploiting aquatic resources and protecting aquatic biodiversity (including coral reefs, freshwater, mangroves, and wetlands ecosystems). World Bank activities in the fisheries and aquaculture sector have closely mirrored world developments in this sector over time. In the 1970s and 1980s port infrastructure, public market and processing facilities, and lines of credit dominated, and lending was restricted to situations in which fish resources were under-exploited. Since then the fishing sector has experienced two major paradigm shifts: a rapid increase in overexploited fish stocks worldwide and a rapid growth of fish culture, followed, for some species, by massive outbreaks of disease.

Aquaculture

With increasing global population and decline in production from capture fisheries, aquaculture has become a means of making up the shortfall. Over the past two decades aquaculture production has expanded rapidly, growing at ten percent a year in the 1990s and providing rural income and employment and diversification in production systems. Future growth will have to address second-generation problems of environmental quality and disease control and seek to establish more sustainable production systems.

Capture Fisheries

Fisheries are important in many developing countries as sources of employment, food, and export earnings. Increased pressures on stocks of natural fisheries have resulted in stagnant or declining production from capture fisheries and many fish stocks have reached the limit of sustainable production. It is unlikely that production levels will increase, but the fisheries industry will remain important and must adapt to changing conditions. The emphasis of investments and government policies must be on improved management systems to increase efficiencies in the capture fisheries industry and to manage fish stocks on a sustainable basis. This may require difficult economic adjustments and introduction of strict regulation regimes.

Sustainable Fisheries Workshop

January 22-23, 2002

Proceedings

Representatives from various countries and organizations around the world involved in the promotion of sustainable fisheries management were invited to participate in a workshop to launch the Global Trust Fund Program for Sustainable Fisheries at the World Bank, financed by the Government of Japan. The objectives of the workshop were to introduce the 3-year Trust Fund program to Bank staff, and to work with the participants to refine its work program and more clearly define a role for the World Bank in the fisheries sector.

The workshop included presentations on current issues and challenges to sustainable fisheries management in several developing countries around the world, as well as a comparison with current issues in the United States. The United Nations Food & Agriculture Organization (FAO) provided an

update on the state of world fisheries production and demand, and the World Fish Center (ICLARM) highlighted some of the current key research questions.

Representatives from international donors such as Japan and Iceland presented some of the complexities involved in trying to promote sustainable fisheries management, and several World Bank staff related some of the Bank's past experiences in the sector. All of the participants asked that the World Bank assume a more prominent role in the fisheries sector, particularly through collaboration with the organizations present.

FAO

Sustainability: the Challenges in Agriculture, Forestry and Fisheries

SD dimensions

Posted March 1996

extracted from "*Strategies for sustainable agriculture and rural development (SARD) - new directions for agriculture, forestry and fisheries*" (FAO 1994)

Introduction

In the 1980s, average income declined in 46 of the 82 developing countries for which figures were available. In the period 1970 to 1985, the numbers of the very poor increased from 944 million to 1156 million. In both Africa and Latin America, the percentage of poor people increased during the 1980s, from 41 to 47 percent.

As many as 70 million people, mostly from developing countries, are working (legally or illegally) in other countries. Each year more than a million people migrate permanently, with almost the same number seeking asylum. The number of refugees rose from 2.8 million in 1976 to 17.3 million in 1990. Migration has created tensions in many parts of the world, and immigrants have been attacked in several countries. The effects of these trends can be seen in:

- rapidly increasing poverty, malnutrition and human suffering;
- increasing social unrest, leading to breakdown of social structures, aggression and war;
- periodic famine in the least-favoured areas and in mega-cities, as administrative and distribution networks deteriorate.

The challenge of sustainable agriculture and rural development (SARD) is essentially to provide solutions that counteract these trends. The key is to increase incomes and improve lifestyles for the rural poor who constitute a large percentage of the populations of most developing countries.

One way of doing this is to create synergies between on-farm and off-farm economic activities. Agriculture, forestry and fisheries are characterized by myriad production units operating in diverse natural and socio-economic environments. Initiatives must be strategically coupled with growth in related economic activity and employment, as farm, forest and fishery products pass through the processing and manufacturing sectors, gaining value as they move towards the consumer. This task is urgent and complex, especially in the developing countries where agriculture faces under-development, fragile environments and resource degradation, as well as some of the environmental and socio-economic problems associated with the over-intensification of agriculture and fisheries in industrialized countries.

Translating the concept of SARD into strategies and action requires governments to confront the challenges posed by population growth, food security and poverty, the limited availability of agricultural land, and issues related to national policies and international trade.

Major challenges to agriculture

Population growth

Despite recent evidence of slowing growth rates in some regions of the world, the global population is projected to increase by almost 2 billion between 1989-90 and 2010, all but 6 percent of which will be in the developing countries, where some 20 percent of the population is already suffering from chronic undernutrition. Given future levels of population growth, world food output will have to more than triple over the next 50 years if all of the projected 9 587 million people are by then to receive an adequate diet.

Food security and poverty alleviation

Failure to alleviate poverty is the main cause of undernutrition in a world which has had little difficulty in increasing overall food production to meet growth in effective demand. In most developing countries, however, increasing food production is one of the principal tools used to combat poverty because most of the poor depend on agriculture for employment and income. One of the major problems is thus not that the world cannot produce more food but that the population that depends on agriculture for a living continues to grow.

Achieving sustainable food security is an important and difficult goal for SARD. It means much more than increasing farm productivity and profitability while minimizing environmental impacts. It requires a spectrum of action from the level of the household to the level of the global economy.

At the household level, improving food security will mean improving access to credit, rural incomes, women's status, dietary intakes and systems of food distribution. It will mean reducing agricultural waste. At the policy level, it will mean a more equitable distribution of land and other resources, and especially effective action about population growth in relation to carrying capacity. At the macro-economic level, it will mean focusing domestic policy more accurately on the needs of the poor and the hungry, and improving the terms of international trade.

Land and water scarcity

FAO's study "*Agriculture: Toward 2010*" projects that, between 1988-90 and 2010, the expansion in arable land in the developing countries, excluding China, will be about 93 million ha, an increase of 12 percent over the 760 million ha in use in the base period. About three-quarters of this increase will be in sub-Saharan Africa, and Latin America and the Caribbean, because many countries in Asia and the Near East are already using nearly all their potential arable land. Cropping intensity is projected to increase from 79 to 85 percent, and increases in average crop yields will account for two-thirds of the projected growth in crop production. The increase in arable land devoted to crop production excludes additional land needed for human settlements, industry and infrastructure, and for shifting agriculture and grazing which escape official statistics.

These global increments in land used for crop production appear relatively modest compared to that already used (760 million ha) and to rainfed land with some crop production potential (2.5 billion ha, excluding China). However, most land with some crop production potential faces production constraints - of slope, soil type or climate. It may be under forest cover or be providing another environmental service. Its use will therefore involve a trade-off.

Water scarcity is a constant constraint for countries with arid and semi-arid climates. Of major concern is the lack of storage facilities and a continuing decrease in the rate of expansion of irrigated land in

developing countries while population growth rates are about 1.8 percent per year. Cross-sectoral national water strategies and policies are urgently needed in water-scarce countries. These will require consideration of the opportunity costs of water in different uses and pricing systems that take account of the economic costs of water supply, rather than the numerous forms of water subsidy that currently exist and which encourage profligate use, even in dry countries.

National policies and international trade

Developing countries generally lack the financial and technical resources needed to invest efficiently in SARD. Part of the problem lies in the measures adopted by industrialized countries to subsidize and protect agriculture. At the same time, the policies of some developing countries do not encourage saving, investment, employment and income generation in support of sustainable rural development.

The agricultural policies of industrialized nations tend to stimulate surplus production. Governments then often shield domestic producers by moving surpluses onto the world market at subsidized prices. For this and other reasons, the products exported by developing countries have been declining in price for some time. During the period 1986 to 1990, adverse terms of trade are estimated to have cost Africa \$50 billion in reduced revenue from the export of commodities. These trends make it harder for rural people in developing countries to run their farms profitably and earn reasonable incomes. They also make it more difficult for developing countries to pay for their imports.

In addition, developing countries frequently pursue domestic policies unfavourable to the agricultural and rural sectors, on the premise that rural areas are best utilized as a source of cheap labour, of revenues for use in other sectors (through high taxation of farm produce or exploitation of natural resources, such as trees or minerals) or of foreign exchange (through cash crop production or export of raw materials). These policies under-value natural resources and fail to internalize the costs of environmental degradation. The reaction of farmers to these policies usually leads to further degradation of natural resources.

Major challenges to forestry

Forests are an important part of the environment and are the home of more than 200 million people in the tropics. Forests conserve mountain watersheds, soil and water; protect land from wind and water erosion; help prevent desertification; modulate climate; and sequester carbon thereby buffering the global warming attributed to increasing levels of atmospheric CO₂. In coastal areas, mangroves protect the land against erosion by the sea as well as providing breeding grounds for fish and shrimps.

Forests have been seen by most planners and decision-makers as a source of one product: wood. Yet forests and trees provide many other products such as foods, medicines, materials for handicrafts, spices, resins, gums, latexes, fibres, dyes and animal fodder. Non-wood forest products multiply opportunities for entrepreneurship. The wildlife in forests contributes to food supplies and supports a substantial tourist industry.

The main threats to forests include rapid deforestation and degradation in tropical and other developing countries (the estimated rate of forest depletion in the tropical zone in the decade 1981-1990 was 15.4 million hectares) and quality decline in temperate and boreal forests. The main immediate cause of tropical deforestation is agricultural expansion in all its forms, from shifting cultivation to cattle ranching; the need for this stems, in turn, from high population densities and growth rates.

The issue of forest depletion in the developing world is fundamentally about poverty, under-development and population growth. The success with which these challenges are met will ultimately determine the

fate of the tropical half of the world's forests. The problem cannot be solved from within the forestry sector alone.

In most tropical countries, forest clearing is virtually unstoppable at current levels of economic development. What can be done, however, is to manage deforestation and degradation by keeping it in line with land-use plans and by maintaining sufficient trees and woodland within farming systems. Residual forests must be brought under sustainable management to produce large enough incomes to provide real alternatives to agriculture.

Controversy surrounds these issues. According to some environmentalists, the focus of management should be on preservation of forest resources. However, these people fail to realize that the conservation of an area of forest land will only be successful if the local people who normally use the forest (for hunting, fodder, agriculture or gathering medicinal herbs), are compensated for their foregone benefits. Thus, activities such as eco-tourism, which aim to conserve the environment and at the same time provide local populations with an alternative income, should be promoted.

Major challenges in fisheries

In the field of fisheries, the principal challenge lies in organizing and stimulating production in order that per caput supply of fish as food does not decline.

In the capture fisheries sector problems arise due to overfishing and costs of catch for some species. In developing countries these issues are complicated by the low-income of artisanal fishermen who are not in a position to maintain sustainable fishing practices to protect future generations, and a lack of enforcement of any regulations in such small outlying communities. Although there is growing pressure to ban certain types of fishing which threaten biodiversity, such bans cannot function alone but must be reinforced by policies which concentrate on selective but economically viable fishing and which include research into unexploited oceanic stocks e.g. mesopelagics and squids. Likewise in the field of coastal fisheries, policies need to be developed which ensure both a sustainable and optimal supply of fish.

A special effort should be made in the aquaculture section to provide high-volume/low-value species which will give an assured supply of affordable fish, bearing in mind that the inputs needed in commercial aquaculture are also used for agriculture or livestock production. However, such aquaculture practices which provide affordable fish have to be closely monitored for possible pollution problems.

In the field of international fish trade, the danger lies in the increase of trade in the low cost fish which would provide greater exports for fish meal at the cost of depriving the poor of a basic food. It is important that fishery managements systems which take account of both the needs of fishermen and environmental security are developed. In this respect, it is essential that greater resources are made available to study this problem scientifically.

A Learning Approach to Sustainable Agriculture and Rural Development: Reflections from Hawkesbury

SD dimensions
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from *"Training for Agricultural and Rural Development, 1995-96"* (FAO, 1996)

Worldwide, institutions of agricultural higher education are facing a serious crisis quite unlike anything they have had to face before. The periodic challenges of falling student enrolments, diminishing graduate employment prospects and declining community and political support with its resource implications have been around for as long as the institutions themselves. These are called "tactical" crises. The current "strategic" crisis is much deeper: it relates to the self identity of professional agriculturists and to the prevailing model of agricultural science in which they are trained. This in turn raises questions about the relevance of the institutions themselves and their future sustainability.

Unlike their counterparts in medicine, law or even teaching, agriculture graduates do not have an easily identifiable profession to enter when they leave the institution. There are, therefore, very few guidelines to help in the design of curricula appropriate to the practising professional agriculturist. If it is not clearly known what graduates will actually do as practitioners in the field once they enter the workforce, then it is difficult to help them learn how to do it while they are at university; if it is not known who the clients of the profession are, and the nature of the problems they face, then it is equally difficult to decide what scientific and technical knowledge the graduates need.

Standard responses

Universities frequently respond to this uncertain situation by offering non integrated specialized "bodies of scientific and technological knowledge" on the premise that any scientific knowledge acquired by students could be useful in improving levels of farm production and productivity when applied to a practical situation. Moreover, academics are generally unsatisfactory role models for their students since most university teachers of agriculture are discipline or subject specialists who have had little if any training as educators; typically they teach as they were taught. Where they are also active as research scientists, they reinforce the importance of specialist, fragmentary knowledge and of the specialized research methods gained through their own postgraduate studies. As a result, their students are seldom exposed to the professional knowledge and skills relevant to participatory work with rural communities in collaborative projects designed to make sustainable improvements to the quality of life, production systems, supporting infrastructure and the total environment.

There is growing public concern about the negative environmental impacts of many of the intensive agricultural technologies that focus solely on improving farm productivity. Increasingly, society and farmers alike are demanding that agricultural professionals redesign farming systems so as to address these destructive impacts on the quality of life of many rural people as well as on the environments in which they live. The challenge for rural people is to learn new ways of thinking and evaluating as a basis for developing new ways of acting appropriate to the complexity of the circumstances in which they live and work. Those in the service sectors, such as agricultural extension, will have to play a major role in facilitating this transformation.

Only through holistic thinking will holistic practices be developed that lead to systemic improvements, as environmentally responsible and ethically defensible as they are economically desirable, culturally feasible and socially and politically acceptable. The development of new systems that ensure rural well being is, therefore, dependent on individuals and groups of people developing the skills to think in terms of sustainable systems and to value that capability. The challenge for agricultural educators is to design learning environments and educational strategies where these new ways of integrating "thinking with acting" can be developed.

It is not as if there is a "grand science" of agriculture to help this learning process – an all encompassing set of theories and philosophies that provides holistic explanations of agriculture as a

sustainable human activity. Agricultural science is, in effect, the sum of many sciences, both basic and applied, focused essentially on aspects of crop and animal production. As for philosophy, it is usually ignored altogether, at least in undergraduate curricula. The irony is that, at the very time society is looking to agricultural universities and colleges to help in the holistic (systemic) development of sustainable agricultural and rural systems, the institutions are facing the prospect of becoming non sustainable systems themselves.

This is not a simple tactical crisis that can be addressed merely by amending the curriculum to include new "subjects" such as environmental science, social science and philosophy. This is a complex strategic crisis that will only be met through serious re evaluation of the entire purpose, function and organization of institutions of agricultural higher education, including profound review of the very nature of the prevailing models of agricultural science.

This is not a novel suggestion. In recent years a number of studies have pointed to similar conclusions. Among the most significant of these are the extensive evaluations of agricultural education assistance conducted by major international organizations such as the United States Agency for International Development (USAID) (Hansen, 1989), the Food and Agriculture Organization of the United Nations (FAO) (1991) and the World Bank (1992).

Views from the international organizations

The main issues of most concern to the evaluations were:

- the sustainability of the institutions, particularly in light of declining financial support following the termination of assistance programmes;
- the linkages between the universities and external constituencies, including national and international research centres, extension agencies and policy arenas, particularly with respect to the tensions between budgetary dependence and institutional autonomy;
- the mission of the institutions, with particular emphasis on broadening the focus on agricultural production technologies to include policy and institutional concerns that contribute to more comprehensive and innovative rural and agricultural development;
- the management and leadership of the institutions, especially with respect to their own strategic and human resource development;
- the focus of the educational programmes, the nature of the curricula and the pedagogical methods, particularly with regard to the ever-increasing complexity (and multidisciplinary) of issues involving sustainable resource use and improvement of the quality of life and the environment of rural people.

In a creative response to the situation, Hansen (1990) proposed that the time had come for a "new order" of agricultural universities in the developing world -- "post-neoclassical" institutions, as he called them -- which would be characterized by the following four attributes:

- the purpose of the university (or at least its agricultural college) would be truly reflected in its mission, with the recognition that enhancing rural well-being includes much more than increasing farm production and productivity;
- the role of the university would be one of learning and innovation with respect to devising and testing strategies for achieving the comprehensive mission of rural development, with particular emphasis on cooperative efforts of faculty, students and rural folk working together to improve conditions in the rural areas;
- the structure of the university would become a matrix of interconnected task groups clustered around major programmatic themes, with disciplinary departments, if they exist at all, subordinate to the multidisciplinary themes;

- the educational experience, particularly at the undergraduate level, would be dramatically different from the prevailing pedagogy of "passive knowledge transfer" and would embrace the practice of cooperative learning -- involving students, faculty and rural "clients" working together on strategic problems of agricultural and rural development -- as the context for students "learning how to learn" about concepts and their practical application through practice.

Without the benefit of such lessons and insights from these international reviews, a number of institutions of agricultural higher education have long been engaged in programmes of fundamental reform. In Australia, for example, Hawkesbury Agricultural College committed itself in 1978 to self-transformation (Bawden, 1992) and has become an organization that bears remarkable similarities to the "post-neoclassical" university envisaged by Hansen (1990).

Systemic learning for sustainable rural development

Three concepts are central to the way Hawkesbury responds to the challenges of more responsible agriculture for sustainable rural development. The first relates to professional competencies for agriculturists, for which the word "praxis" -- defined as the art and craft of being a practitioner who is consciously informed by theories, values and beliefs -- has been adopted. The praxis that both students and faculty are attempting to develop, and around which the curricula are designed, relates to the notion of learning how to become a "facilitator of sustainable rural development".

The second key concept concerns the use of systems theories and philosophies by development facilitators as essential aspects of their praxis for dealing with the complex and uncertain issues that characterize everyday rural and agricultural development. Thus, the word systemic relates to holistic or integrated ways in which people deal with problematic situations, or systems thinking in action: systemic development practitioners use systems theories and philosophies to inform their praxis.

And, finally, there is the aspect of critical learning as it relates both to the characteristics of systemic development facilitators as practitioners and to the outcomes of their praxis -- individuals and groups of rural people learning critically how to improve the situations in which they exist. Thus, systemic development facilitators are critical learners, being consciously critical of their own practices and contexts and of the theories, values and beliefs that inform them, while attempting to encourage others (especially their "clients") to do the same.

This emphasis on the three notions of praxis, systemic and critical learning, and on the concept of agriculture as a vehicle for the sustainable and integrated development of rural people, their resources and the environments in which they operate, represents a reinterpretation of the agricultural practitioner. This has led to an institution of agricultural higher education that is very unconventional in its organization purposes, functions and curricula, and in the major activities of its faculty and students.

Hawkesbury in a "post-neoclassical" era

The essence of the reforms at Hawkesbury can perhaps be best conveyed by offering the following points of comparison as statements of transformation from what used to happen there in the mid-1970s to what happens currently. To illustrate the strong similarities between these developments and the lessons learned from the international studies mentioned above, the points are presented under Hansen's (1990) four post-neoclassical attributes.

Vision, mission and strategic management

- From the view of agricultural improvements centred on increasing agricultural productivity through technology to the view of agriculture as a vehicle for improving the quality of the lives and environments of rural people through "development through collaborative learning".

- From a mission to provide trained technical labour essentially to fill public-service positions to direct involvement as an agency of development through the learning/research activities of its faculty and students working together with rural people to deal with their everyday problems.
- From management strategies designed to maintain the stability of the organization to strategies deliberately focused on the management of complex change and conflict for sustainability in the future.

Role and linkages within society

- From a teaching institution providing graduates for unspecified jobs in agriculture to a learning organization committed to developing and sharing innovative ways of dealing with complex, problematic situations in rural Australia and beyond, and to the development of rural communities through systemic community learning.
- From an organization depending solely on government funds to educate students to meet national labour needs to an international, development-focused institution, attracting funds from a number of different sources to support an increasing number of development projects, at home and abroad.
- From a public-service institution linked in linear fashion with only a few other organizations in its environment to an autonomous institution linked through a large number of extensive networks to rural individuals, families and communities and to many other organizations concerned with agricultural and rural development, at home and abroad, including rural schools, colleges, agribusinesses and government agencies.

Organizational structure

- From an essentially bureaucratic institution hierarchically structured around inflexible discipline-based departments (and confined essentially to the natural sciences) to a collegial, self-organizing, self-managing learning organization, in which the predominant management structures are flexible task forces composed of people with backgrounds in the social as well as the natural sciences, working and learning together on defined projects.
- From an elite institution accessible only to relatively high-performing school-leavers to an institution that is accessible to a wide range of people through the provision of a "multi-entry level" spectrum of curricula (two-year diplomas, three- and four-year undergraduate degrees, course-work and research postgraduate degrees), as well as non-formal learning opportunities and participatory development projects that involve students, faculty and "clients" co-learning in collaborative ways.

Curriculum

- From a curriculum focused on the acquisition of technical and scientific knowledge that the students expect to apply only when they graduate and enter the workforce to one that focuses on the students' enhancement of their own praxis as critical systemic development facilitators
- From systematic (building-block) curricula, where students are taught the knowledge that the teachers believe they need to know, to systemic (integrated) curricula, where students learn how to deal with "real world" agricultural and rural situations through their experiential involvement with them and through their integration of theories, values and beliefs into appropriate practices.
- From presentation by the teacher to the student of discipline-based subjects, designed to progress from basic scientific knowledge to more advanced scientific theory and applied technology, to the co-involvement of student and teacher in theme-based experiential projects that progress from relatively simple "problems to be solved" to much more complex situations to be improved systemically".
- From instructive education strategies involving lectures and demonstrations in which the students play a passive and dependent role to interactive strategies that facilitate the active and interdependent involvement of students in a "self-development for development" process.
- From the role of teachers as purveyors of "expert" knowledge gained through their own discipline and reinforced by their ongoing discipline-based research to teachers as co-learning facilitators of the development of students as active, critical, creative, systemic and enterprising learners, problem solvers and "situation improvers".

- From a single, predominant world-view of production improvement through science and technology to an appreciation and application of multiple world-views for systemic and sustainable improvements to the lives of rural people, established through close collaboration of people with diverse ways of thinking and acting.
- From a highly structured educational environment in which each student is assessed by his or her capacity to pass prescribed subject matter examinations to one that is characterized by uncertainty and complexity, and in which assessment is based on the capability of each student to present evidence of the development of his or her own praxis as an increasingly critical and systemic learner to a level appropriate to the demands of the next phase of the programme, or graduation from it.

Hawkesbury day-to-day

The changes in Hawkesbury's School of Agriculture and Rural Development have never been static nor perfect. Like the cooperating rural families and communities with whom they work, faculty members are continually attempting to develop, improve and transform themselves through their critical and systemic praxis. And like their rural counterparts, they too must spend time critically reflecting on their day-to-day activities of dealing with the complex, uncertain, chaotic and often stressful environments in which they operate. Thus, the faculty must learn not just about better agriculture and rural development, but also about better community and organizational development by learning about their own community and organization.

Furthermore, they must learn how to do this in critical, systemic and developmental ways that help them to integrate what they learn from their own experiences (experiential learning) and the theories and philosophies of others (propositional learning) and from observing the practices of others (practical learning).

Above all, they must learn how to share and promote such learning with others -- especially their students and clients. Curriculum design under these circumstances is based on the notion of teachers and students co-learning in relevant problematic situations with the aim of developing improvements, and thus developing a relevant systemic and critical praxis as they go. Day by day, students and faculty alike are learning about a multitude of different situations, some organized as formal learning or research projects and others as more informal, ad hoc situations. Sometimes they learn as individuals, but more often than not they learn cooperatively, in teams or groups. In this manner, they attempt to replicate the circumstances confronting those who live and work in rural situations, developing a praxis appropriate to facilitating sustainable development.

Like any other healthy critical learning organization, the Hawkesbury faculty community has, over the past decade and a half, been characterized by its energy and collective enthusiasm, as well as by its readiness to debate important differences in interpretation and in opinions of experiences, theories, values and beliefs. Indeed, critical debate on all these dimensions has been actively encouraged for the development of the faculty community and its environment.

Bibliography

Bawden, R.J. 1992. "Systems approaches to agricultural development: the Hawkesbury experience". In: P. Teng & F. de Vries, eds. *"Systems approaches for agricultural development."* Barking, UK, Elsevier Applied Science.

FAO, 1991. *"Higher education in agriculture: status, issues and ideas for future development"*. Expert Consultation on Strategy Options for Higher Agricultural Education. Rome, FAO.

Hansen, G.E. 1989. *"Universities for development: lessons for enhancing the role of agricultural universities in developing countries"*. Evaluation Occasional Paper No. 31. Washington, DC, USA, United States Agency for International Development (USAID).

Hansen, G.E. 1990. *"Beyond the neoclassical university: agricultural higher education in the developing world. An interpretative essay"*. Program Evaluation Report No. 20. Washington, DC, USA, United States Agency for International Development (USAID).

World Bank. 1992. *"World Bank assistance to agricultural higher education 1964-1990"*. Report No. 10751. Washington, DC, USA, World Bank.

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Rome, 1997

<http://www.fao.org/docrep/W7541E/W7541E00.htm>

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What is Sustainable Agriculture?

Sustainable agriculture refers to an agricultural production and distribution system that:

Achieves the integration of natural biological cycles and controls,

Protects and renews soil fertility and the natural resource base,

Optimizes the management and use of on-farm resources,

Reduces the use of nonrenewable resources and purchased production inputs,

Provides an adequate and dependable farm income,

Promotes opportunity in family farming and farm communities, and

Minimizes adverse impacts on health, safety, wildlife, water quality and the environment.

The Sustainable Agriculture Network

SAN is the communications and outreach arm of the Sustainable Agriculture Research and Education (SARE) program. SARE is a U.S. Department of Agriculture-funded initiative that sponsors competitive grants for sustainable agriculture research and education in a regional process nationwide. SAN is dedicated to the exchange of scientific and practical information on sustainable agriculture systems using a variety of printed and electronic communications tools.

Sustainable Agriculture Research and Education (SARE) program

SARE works to increase knowledge about -- and help farmers and ranchers adopt -- practices that are economically viable, environmentally sound and socially responsible. To advance such knowledge nationwide, SARE administers a competitive grants program first funded by Congress in 1988.