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Agricultural Education for Sustainable Rural Development in Developing Countries: Challenges and Policy Options

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Abstract

Governments all over the world have focused upon sustainable rural development in an organized way. Rural locations, in particular, need more economic development in order to match urban centric development. Poverty in rural areas has remained by and large, the main focal point of governments and development agencies. Sustainable rural development is the most effective way to eliminate this curse. Environment friendly growth stimulators have been provided to rural populations. This paper aims to: (a) *give an insight into the linkages between the agricultural education and sustainable rural development*, and (b) *present strategies for sustainable rural development*. Challenges in sustainable rural development for developing countries in the 21st century have also been looked into. The paper concludes that agricultural education institutions in developing countries will need to address not only immediate production needs, but also long-term food security, sustainable agriculture and rural development needs.

Keywords: Education, *agriculture, developing countries, and sustainable development.*

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Introduction

Sustainable development is the management and conservation of the natural resources base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development in the agriculture, forestry and fisheries sectors conserves land, water, plant and animal genetic resources, is:

- *environmentally* non-degrading,
- *technically* appropriate,
- *economically* viable, and
- *socially* acceptable.

Food security and its relationship to sustainable agricultural and rural development have increasingly become matters of concern for developing countries and for the international community. While there are many complex factors that influence sustainable development and food security, it is clear that education in agriculture plays an important role in preparing farmers, researchers, educators, extension staff, and members of agri-businesses and others to make “*productive contributions*”. A critical issue in the 21st century will be the changes and adaptations required in agricultural education in order for it to more effectively contribute to:

- *improved food security,*
- *sustainable agricultural production, and*
- *rural development.*

Poor training of agricultural extension staff has been identified as part of the problem of the relative ineffectiveness of much of extension in the field. This applies not only to extension staff, but to agricultural professionals in general. Unfortunately, the training of human resources in agriculture is often not a high priority in the development plans of countries. As a result, curricula and teaching programmes are not particularly relevant to the production needs and employment demands of the agricultural sector.

The situation has become more serious in recent years due to the economic crises in the public sector in many developing countries. In the past, the public sector absorbed nearly all agriculture graduates. This is no longer the case, and agriculture graduates are finding it increasingly difficult to find employment. Governments can no longer afford to hire every graduate. Over and above, education in agriculture has not kept up with the increasingly sophisticated labor demands of the private sector. These and other factors, such as environmental degradation, rapid changes in technical knowledge and the increasing marginalisation of rural areas, all call for changes in the current systems of education in agriculture in many developing countries.

This paper aims to: (a) *give an insight into the linkages between the agricultural education and sustainable rural development,* and (b) *present strategies for sustainable rural development.* Challenges in sustainable rural development for developing countries in the 21st century have also been looked into.

Sustainability and Rural Development

The term ‘*sustainable development*’ has largely been promulgated by the industrialized nations in the context of global environmental processes and concerns, and it has catalyzed attention on the relationship between economic growth and the natural resource base on which this depends. Although the term has been used in a variety of ways since its early conceptualizations in the 1980s, broadly speaking, the notion of sustainable development highlights the existence of the social and ecological conditions necessary to support human life at a certain level of well being through future generations. Like sustainable development, sustainable rural development tends to be seen as socially and politically constructed and, at the same time, as an ongoing and evolving process that requires constant reappraisal.

In short, although sustainable rural development may assume a variety of forms, there are three key expressions of this emerging paradigm:

- *It* is a response to the price/cost-squeeze on agriculture. It adds income and employment opportunities to the agricultural sector by enlarging value added;
- *It* expresses new relationships between the agricultural sector and society at large. It contributes to the construction of a new agricultural sector that corresponds to the needs and expectations of society at large;
- *It* implies a redefinition, recombination and/or reconfiguration of rural resources.

Sustainable rural development processes are likely to result in drastic, far-reaching and multi-level transformations in rural economies and societies. These may include:

- The re-integration of tasks and activities externalized in the past.
- The creation of multi-product, multi-functional farms.
- Changing roles and patterns within the farm, especially gender relations.
- The emergence of new networks, new dialogues and new institutional arrangements.
- A shift from economies of scale to economies of scope.
- The elaboration of responses to the cost-price squeeze.
- The re-localisation of production-consumption patterns.

Relevance of Sustainability for Rural Areas

The emerging paradigm is especially relevant to the future of rural areas for three main reasons:

- *First*, rural development is a response to the ‘squeeze’ on European agriculture. It is through sustainable rural development that new sources of income are currently being mobilised to augment the otherwise stagnating agrarian income. Rural development practices have also facilitated the elaboration and implementation of new, innovative methods to combat increasing costs. In short, sustainable rural development reconstitutes the eroded economic base of both the rural economy and the farm enterprise.
- *Second*, among the key manifestations of sustainable rural development is the emergence of new inter-linkages between agriculture and society. Sustainable rural development entails the creation of new products/services; new markets and new forms of cost reduction that often coincide with the needs and expectations of society at large. Sustainable rural development implies “*a reconstruction of agriculture and countryside and their realignment with European society and culture*”.
- *Third*, sustainable rural development also concerns the redefinition and reconfiguration of rural resources. Through sustainable rural development, rural resources – land, labour, nature, eco-systems, animals, plants, craftsmanship, networks, market partners, town-countryside relations – are reshaped and recombined, as it has happened, for example, with the emergence of alternative food supply chains. In other words, through sustainable rural development “*new resources are mobilised and combined with existing ones along new lines that secure ecological sustainability and new, robust economic constellations; the new resource combinations allow also for new multifunctional enterprises and new networks interlinking the rural and the urban*”.

Contextual Constraints

Changing Employment Opportunities in Agriculture

Reduced government spending as a result of structural adjustment has put pressure on agricultural education institutions to better relate curricula to employment opportunities. The dramatic reduction in employment by Ministries of Agriculture in recent years, in some cases over 50 percent staff reductions, means that students increasingly need to learn knowledge and skills for private-sector employment. It is also likely that employment opportunities outside the agricultural sector will grow at a faster rate than in agriculture. This requires a continuous analysis of job markets and employers' requirements in order to plan and develop appropriate curricula.

The message of sizable reductions in the public-sector workforce is not lost on students who are demanding curricular changes that will prepare them for employment opportunities in the private sector. University and college administrators and teaching staff, however, have been slower to accept the need for changes. What is required is that they engage frequently in consultations with prospective private-sector employers to obtain estimates of the numbers and types of jobs that are likely to be available for graduates and to plan curricula accordingly.

To adjust training to private-sector employment requires that agricultural education institutions develop ways of keeping in touch with the labor market. Ideally, institutions should set up permanent mechanisms for observations of the job-market and continuous adaptation of courses. However, a lack of financial and human resources often makes this difficult to accomplish. Some institutions are taking action, however, to establish better contact with potential employers of graduates. For example, the Institut Agricole de Bouaké in the Ivory Coast has set up a committee to study the agricultural employment market and identify related training needs. The Institut also makes use of visiting instructors from agri-business firms and has arrangements for attaching students to agricultural enterprises so that they gain practical experience and possible entry to jobs.

A similar approach is being used by a secondary agricultural school in Zaragoza, Colombia. With FAO assistance, the school established an educational advisory committee consisting of school

staff, local government organizations, representatives of farmers' cooperatives and students and their families. The committee helps the school formulate educational policy and programmes and also serves as a resource for internships and job placement for graduates.

Recent changes in employment opportunities mean that the curricula and training programmes in agriculture need to be reoriented to meet the learning requirements of diverse groups - unemployed and under-employed people, dismissed public-sector workers, agricultural professionals seeking career changes and advancement and young graduates seeking employment for the first time. Only by involving potential employers in the curriculum development process will it be possible to ensure that agricultural education will result in gainful employment for graduates.

Improving the employment opportunities for graduates requires that curricula focus less on specific technical knowledge that will quickly become obsolete and more on processes and abilities of students to think and solve problems that are relevant to societal needs. Students should learn skills and abilities that are transferable to a wide range of occupations. For example, excellent communication skills are as needed by agricultural graduates who plan to work in extension as business school graduates who hope for a career in the banking industry. Likewise, teaching methods should be changed to reflect the needs of society, and thus better respond to demands for trained human resources. Teaching with practical, reality-based cases is a good example of how teachers can change methods to meet student needs and those of the larger society.

Budgetary and Financial Crisis

In most developing countries, the major source of funding and financial support for agricultural education is the national government, or the provincial/municipal government level where decentralization has been implemented. Generally, agricultural education institutions operate on the basis of an annual budget which depends on the number of students enrolled, previous funding levels and government capacity to support the institutions. Tuition, fees and other possible sources of income (such as donations and institutional revenue from farms or the provision of various kinds of services) are often of limited significance.

The economic crises of recent years and recurrent structural adjustment measures have imposed severe budgetary restrictions in many countries which have negatively affected support to agricultural education. For example, the analysis of 20 case studies carried out for the 1991 Food and Agriculture Organization (FAO) expert consultation showed that institutions use up to 85 percent of the total budget for salaries. If the educational infrastructure were in place (teaching labs, instructional equipment, and materials) spending 80-85 percent for salaries is within an acceptable range. *However*, in most developing countries this is not the case.

Agricultural education is expensive. It requires teaching aids and materials, scientific and technical equipment as well as adequately equipped training and experimental farms. The initial funds for buildings, teaching equipment, text books, and agricultural machinery have usually been provided in the past by governments and donor assistance. The maintenance and replacement of these facilities is generally beyond the existing financial resources of many institutions. The result is that agricultural education institutions face great difficulties in ensuring properly equipped, maintained and functioning laboratories and practice farms. Not surprisingly, the objectives of experimentation, teaching, outreach or agricultural production are inadequately achieved.

Budget cutbacks have also made it difficult to maintain teaching standards due to reductions in recruitment and in staff development programmes, especially those involving training abroad. Limited budgetary resources often do not allow teachers to obtain the scientific and technical publications necessary to keep their knowledge current, or to conduct up-to-date research. This has resulted in a decline in the standards of teaching, research and extension in many countries.

New innovative ways of funding institutions need to be explored. A small percentage of money received from the sale of cash crops could be used as "*check-off money*" for research and extension efforts. Agribusiness support of funding schemes for research could also contribute revenue. An example of funding diversification that addresses the '*capitalization*' needs of both the institution and individual faculty members is the Faculty of Agriculture, Cairo University, Egypt. The university has established specialized centres (e.g., Reclamation and Development Centre for Desert Soils) which provide fee-based services to commercial agricultural enterprises. The income that is generated is shared by both the faculty members and the teaching and research programmes of the centres.

Marginalisation of Agriculture and Rural Life

As they develop, almost all countries of the world have decreasing proportions of their economically active populations dependent on agriculture. Despite increased demand for food production, the percentage of the population which makes a living directly from agriculture continues to

fall in developing countries. Intensification of production through improved technology and increased inputs is responsible in most cases for increased production, rather than from increased numbers of producers.

High rural population growth rates and increased efficiency in agricultural production have led to increased levels of unemployment and underemployment, and a consequent migratory drift (some would say flood) to cities in search of work and better standards of living. National budgets tend to be directed to satisfying the needs of urban centres at the cost of funding and services for rural areas. This urban bias and rural neglect has led to decreasing levels of real income in the rural areas.

Funds and resources for agricultural education are reduced as national budgetary restrictions are applied to rural areas. Reduced funding for primary and secondary education in rural areas means poorer educational standards. In many developing countries, rural youth find difficulty in obtaining a basic education of the same quality as urban youth, and hence have difficulty in gaining entrance to higher education institutions. This in turn means fewer agricultural students with an in-depth understanding of rural life.

This situation is unlikely to change as long as admission to these institutions is based solely on academic qualifications which place rural young people in direct competition with better schooled urban youth. The result is a significant waste of human resources, since rural youth possess unique aptitudes and qualities for understanding and working in the rural sector and are well suited for technical work in agriculture.

In some cases, the urban origin of agricultural students is now so dominant that it is becoming difficult to teach them about agriculture without special, often expensive, educational efforts. The result is that urban-based graduates, with little practical knowledge of rural development and agricultural production, are working as extension agents and agricultural advisers.

The increasing number of students with urban backgrounds has led some institutions to look for ways to ensure that these students gain a practical understanding of the realities of rural and farm life. One way is early integration of students in rural life through practical training before final admission and a series of practical training periods throughout the programme of study. Agricultural universities and colleges need to take into consideration during admission the willingness of students to follow an agricultural career and their ability to adapt to work in rural areas.

Policies and strategies need to be developed that ensure representation of rural youth in higher agricultural education. Bright but economically disadvantaged students need access to education. Quotas or community representation schemes are one means to ensure opportunities for rural youth. Another option is community or regional scholarships for capable youth interested in studying agriculture. Intellectually capable rural youth lacking academic skills may require an adjustment period and a make-up year to meet standards. Similarly, urban youth may need to obtain agricultural competencies through mandatory internships and systematic exposure to rural life.

Relationship between Agricultural Education and Research and Extension

With few exceptions, the institutional relationships between agricultural teaching and research and extension services are inadequate. In many countries, this is the result of the deliberate separation of education, research and extension into different ministries and agencies and a lack of functional mechanisms to link them together to solve common problems.

Agricultural research is usually conducted at government research stations and laboratories, the majority of which are not linked with universities. Research activities are often carried out as part of postgraduate programmes of higher agricultural education, but they are seldom directly related to national research priorities and programmes.

There are some significant exceptions to this separation of education and research. In India, for example, agricultural universities carry out an important part of research activities and are integrated within the programmes of the Indian Council for Agricultural Research (ICAR). Some specialised centres of ICAR (called University Centres), in turn, offer postgraduate M.Sc. or Ph.D. training programmes. Another example is the Colegio de Postgraduados in Mexico, which was created specifically to balance research, postgraduate teaching and extension activities.

The participation of higher education institutions in research activities needs to be planned as part of the regular activities of the teaching staff and their students. The credibility of these activities, and the possibility of obtaining the necessary research resources, depends on the activities being relevant to farmers and to national research priorities. For agricultural education institutions to participate more fully in research, the role of research should be clearly defined in the institutional policies and in the responsibilities of faculty members.

As with research, close working relationships between agricultural education institutions and extension systems are indispensable in order to ensure the relevance and contribution of agricultural

education. As with research, however, the involvement of agricultural education institutions in extension and community outreach is often limited. Even in those countries where extension and agricultural education are not separated into different ministries, the lack of resources and linking mechanisms greatly limits joint activities.

Notable exceptions are those institutions which have been organized with outreach or extension responsibilities and are provided with the necessary means to carry them out. Looking again at the example of India, the responsibility for extension falls to a large extent on universities. They provide training and technical support to extension subject-matter specialists and have direct contacts with significant numbers of farmers. The universities often maintain their own units of extension and communication for this purpose. In the case of Mexico, the Colegio de Postgraduados has established a Centre for Development Studies with four regional units, one in each ecological zone of the country. These units provide a link between academic programmes, extension activities, and rural producers.

One way for universities and technical institutes to implement development outreach activities is by follow-up technical support to graduates working in agri-businesses or managing their own production enterprises. Also, short courses of continuing education can be designed to update extension officers' knowledge and to qualify extension staff for career advancement. Continuing education should, wherever possible, make use of farmers' associations, graduate associations, NGOs, commercial enterprises and research and extension centres.

Agricultural education institutions, working with appropriate government agencies and non – governmental organizations (NGOs), need to develop research and demonstration plots that directly address farmers' needs. This requires that farmers be valued for their contribution to production through their innovations and sharing of local knowledge. For their part, farmers' organizations need to do a better job of communicating the needs of their members to agricultural education institutions. Farmer advisory boards are one way to improve communication between agricultural education institutions and local producers.

Changes to Curricular Content and Emphasis

Rapid Scientific Progress and Technical Change

Although agriculture generally kept up with scientific progress in the past, the pace of change is much faster today, requiring continual updating of curricula. Scientific knowledge is changing very quickly as modern communication technologies facilitate the global sharing of information among scientists and educators. Since "new" knowledge becomes "old" knowledge so quickly, it is essential that students develop the skills and attitudes that will allow them to continue to learn and develop their competencies throughout their professional lives.

Rapid advances in information technologies (e.g., electronic mail and the Internet) now make possible new modes of collaboration and cooperation between institutions of agricultural education. Reduced funding for education makes inter-institutional collaboration both increasingly necessary and difficult to achieve. Access or lack of access to the Internet will determine if the information gap is reduced, or if it will widen even further. If institutions are to keep pace with rapid changes in science and technology, continuing education for faculty members is necessary through scientific meetings and inter-institutional exchanges, including those that apply innovative uses of electronic information systems (e.g., electronic networks for collaborative curriculum development and distance education). A commitment must be made by institutions to improve the information infrastructure to ensure that students and faculty have access to the new information technologies.

New global developments in science and technology have profound implications for agricultural education institutions. New advances in science and technology influence the subject matter and types of courses students need to understand today's agriculture. Food processing and post-harvest technologies, biotechnology, agri-business management and farming systems development are some of the subject areas which need to be incorporated into curricula. These subjects will attract increasing numbers of students as new employment opportunities are created which demand expertise in these fields. Advances in biological sciences increase the complexity of agriculture and complicate access to technology by poor nations. Regional cooperation and centers are a possible solution. Partnerships with private companies should also be explored as a means to improve access to new technologies.

In addition to new scientific knowledge, the most important source of knowledge for agricultural development is rural people themselves and the time-tested systems of production that embody their knowledge. An understanding of rural people and their production systems should be an integral part of agricultural education. This requires that agricultural education institutions play not only an academic role, but also a community development or outreach role that allows them to understand

local knowledge and combine it with modern agricultural science. Understanding the contributions that local people can make to solve their own problems is the key to sustainable rural development.

Environmental Issues in Agricultural Education:

In many parts of the world, the increasing needs of growing populations for food, fuel and fibers have led to deforestation, severe soil erosion, loss of water resources, and eventually declining crop production. It is clear that the loss of natural resources and environmental degradation affects food security. It is also clear that institutions of education in agriculture need to incorporate environmental and sustainable agricultural development issues into their curricula.

Environmental and sustainable agricultural development problems require an inter-disciplinary approach to curricula since sustainable development relates not only to technological concerns, but also to economic, social, cultural, ecological, and public policy matters. Furthermore, curricula need to provide students with opportunities to observe first-hand the physical, technological and social aspects of natural resource uses for agriculture through learning activities that are experiential and problem-focused.

Experience shows that institutions of agricultural education can play a vital role in bringing about changes in peoples' attitudes and practices so that they are more environmentally responsible. Developed countries have for some time included environmental concerns in their teaching curricula, research activities and outreach programmes. Current practice in agricultural education in many developing countries, however, does not demonstrate widespread integration of environmental and sustainable agriculture topics into academic programmes. Rather, these topics are added piecemeal to existing curricula, if at all.

Three main issues can be identified which affect the challenge of integrating environmental and sustainable development themes or issues into agricultural education programmes. Brief description of these issues is presented below:

- *First*, such issues are complex and diverse. They involve social, cultural, political and economic aspects as well as technical and scientific information. Thus, an interdisciplinary approach is essential.
- *Second*, agricultural education institutions are not always structured to deal with the complexity of these issues. Substantial institutional reorientation and attitude change among faculty members may be necessary. In order to achieve such changes, the training and redeployment of teachers may be needed along with greater involvement of students, younger, environmentally-aware staff and rural communities in the design of new curricula.
- *Third*, new approaches to learning and knowing which incorporate the environmental knowledge of local people are needed. These new approaches should involve people (students, teachers, producers) learning together in collaborative, knowledge-sharing situations on campus and in the field. The ultimate aim should be to make environmental issues inseparable from the professionalism of graduates, the production practices of farmers, the commercial objectives of agri-businesses and the interests of society for a safe and secure environment.

Integrating Population Issues into Agricultural Education

Today, there is a greater need in the developing countries to teach agricultural students population issues in relation to development problems. Institutions of agricultural education need to incorporate population education concepts and principles into curricula since many agricultural graduates will become managers, planners, and policy-makers who need to understand the dynamic inter-relationships between food, population, the environment and socio-economic development. Furthermore, students trained to work as extension agents need to be able to engage farm families in dialogue about sensitive population issues and to effectively communicate population messages to rural people.

Population education should develop awareness and understanding of the nature, causes and implications of population growth and distribution as they relate to agricultural productivity and rural development, and how these issues affect, and are affected by, farmers, their families and society as a whole. Population education can be integrated into training institutes by creating a separate population education course required of all students; by introducing population education as modules into existing courses; and by integrating population education issues and content into relevant topics in courses of study within existing curricula.

An FAO project in Malawi has taken the route of integrating population issues into existing courses of study at the Natural Resources College and the National Forestry College. The country has one of the highest annual population growth rates in Africa and its population density is one of the highest on the continent. The project was a response to escalating concerns about the relationships

between rapid population growth, food security, land use, environmental stress and poverty in Malawi. The basic strategy of the project was to enable extension agents to include population education, as it relates to agriculture and forestry, in their work with farm families. To implement this strategy, the project had two training components:

- a) *pre-service training for students, and*
- b) *in-service training for agents in the field.*

Population issues are a good example of how to integrate the teaching of values and attitudes into an agricultural subject area. Educators need to develop teaching strategies that emphasize and help students develop their affective reasoning skills. Since the attitudes and values that people possess are difficult to change, educators need to place greater emphasis on the psychology of the change process, thus improving the likelihood that change in practice will come as a result of educational efforts.

Gender Issues in Agricultural Education

Women play a major role in the world's agricultural production systems. In the less developed countries, an estimated one-third of all rural households are managed by women. In Sub-Saharan Africa and the Caribbean, women produce 60-80 percent of basic foodstuffs, while in Asia they perform over 50 percent of the labor involved in intensive rice cultivation.

In recent years, there has been widespread recognition of the vital roles played by women in all areas of agriculture and the need for women to have access, through formal and non-formal training, to the knowledge and skills needed for improved agricultural production, processing and marketing. Extension agents, researchers, teachers and students all need to be educated and informed about rural women's problems, potentials and aspirations.

The 1991 FAO expert consultation urged that special efforts be made to recruit and support female students from rural areas who could become extension agents, agricultural researchers, teachers and policy-makers. One of the reasons why there are few women extension workers, researchers and other agricultural professionals is the small number of female graduates from intermediate and higher-level agricultural education institutions. Yet, there are various countries where the enrollments of women are proportionately high. On average in Africa, FAO data show that there has been a 10 percent increase from 1983 to 1993 from about 15 to 25 percent female enrollment in agricultural education institutions.

The question of how to attract more female students to agricultural disciplines is linked to the issue of encouraging students from rural areas to enter higher education. As noted above, the number of female students has increased over the past ten years and this trend should be supported and encouraged. Also, more role models for young women to emulate are needed, including teachers in agricultural education institutions. Raising the number of women in agricultural education, both as educators, administrators and students is important as a means of reinforcing a commitment to understanding and changing the status of women in agriculture.

Educators need to become more responsive to gender related issues by taking into account women's roles and contributions in the total agricultural industry. While there is a trend for increased enrollment of women students in agricultural sciences at the technical or higher levels, this has not resulted in the dissemination of improved technology to women farmers because few female graduates are employed in extension work. Agricultural education institutions may increasingly have gender-sensitive admittance policies, but due to traditional barriers female graduates continue to have problems finding employment in agriculture. Strategies, curricula, and policy shifts need to emphasize and include women as role models and leaders in agriculture.

Gender-sensitive policies have, at best, resulted in training programmes in which women are treated equally with men. However, it is not only the equal treatment of women that is important; it is equal employment benefits that are important. Equal treatment does not necessarily lead to equal benefits for women; indeed, the treatment may have to be different in order to take into consideration the different needs, time constraints and productive activities of women.

Gender-sensitive educational policies should be developed with a wide-range of stakeholders, including community leaders, politicians, potential employers and especially women themselves. Measures should be put in place to encourage young women and better prepare them to take up agricultural studies. For example, special attention should be paid to revising admissions policies that discriminate against women and to the creation of special scholarships for women to study agriculture. There is also a need to provide gender sensitisation courses for teaching staff and to eliminate stereotyping of females in agricultural studies. In some cases, professional organizations of women agriculturalists can act as pressure groups for these changes.

Changes to Educational Processes

Extension Education:

Extension, as a non-formal educational input, can make important contributions to sustainable agricultural production and rural development. There is a critical need for well-trained extension workers in many developing countries. However, the extension methodology portion of the curricula and programmes of study of many agricultural education institutions is inadequate and in need of review and revision.

There is a tendency among many institutions to place emphasis primarily on providing students with scientific and technical knowledge in the various agricultural disciplines. Often, too little attention is paid to providing the types of courses that are important for preparing students as agricultural extension workers who can effectively communicate with diverse rural groups as well as support these groups in a process of collaborative problem-solving. In revising curricula for extension training, it is important to recognize that there has been a shift in thinking and in practice from expert-driven, technology-transfer extension approaches to collaborative learning approaches with participant groups.

Students studying extension need to see and work with applied technology on farms. Curricula should place less emphasis on theoretical models and more on practical application of research. There is a need to provide an interdisciplinary perspective into which a wide range of different disciplinary components can be integrated and to provide experiential, field-based learning activities. Learning should emphasize inductive reasoning skills so that students can interpret problems and devise solutions. Furthermore, curricular revisions for training extension workers should take into account a number of the issues:

- a) *the decline in public sector employment,*
- b) *the deterioration of the natural environment,*
- c) *population education, and*
- d) *the changes in the roles and responsibilities of women farmers.*

In many cases, the lack of relevance of extension education to the rural world is a problem for students graduating from agricultural institutions. The gap between the methods and content taught and the rural socio-cultural context causes difficulties for graduates in establishing good communication with rural people. As noted above, this is especially serious for those with an urban background who go into extension work.

In many developing countries, small-scale family farms constitute the majority of the total number of agricultural holdings. A major challenge for extension is helping them advance in sustainable ways from subsistence agriculture to commercial agriculture. Agricultural education institutions, especially those at the intermediate technical level, have a key role in training extension workers so that they are oriented towards addressing the improvement of small-farmer agriculture, and in particular improving their food crop production and marketing capabilities.

This situation calls for more interaction among academic staff and students with members of the farming community, including the NGOs and agri-business firms that provide production services to farmers. The development of mechanisms and channels of communication which facilitate the understanding and utilization of local agricultural knowledge is of vital importance for the training of extension workers. Periodic curriculum review and revision, with a focus on local development problems and solutions, are needed in order to keep the knowledge-base relevant and to ensure that there is not a "cultural gap" between extension workers and the ultimate beneficiaries -- farmers and rural dwellers.

The implications for extension education are clear: an improved effort needs to be made to better relate local knowledge systems to scientific farming methods. Teachers and students need to use applied, field-based practices when learning how to improve agricultural production. Participatory teaching and learning strategies need to be incorporated into all aspects of educational delivery.

An Inter-Disciplinary Systems Approach to Agricultural Education

At a relatively early stage of their education, students need an overview of the agricultural and rural systems of their countries. Throughout their training, they need not only specialized courses which deal in-depth with specific technical subject-matter, but courses that help them think holistically, or in terms of integrated agricultural systems, so that they can understand the multi-dimensional nature of sustainable agricultural production. This requires an inter-disciplinary systems approach to agricultural education.

Training in the systems approach is essential for agricultural education because of the increasing complexity of agriculture, food and rural systems, the problems of environmental protection and management, women farmers and household issues and the needs of small-scale farmers. Even

conventional subject-matter teaching should take place within an inter-disciplinary framework of agricultural systems rather than as isolated subjects.

Increasingly, education in agriculture needs to take the form of courses in agro-forestry, agro-ecology, and the socio-economics of integrated production systems. Local food production systems need to be studied in terms of the complexities of the larger economic and social context. A systems approach to agricultural education makes it possible to understand, evaluate and integrate the many disparate elements of production systems into a unified study of how those systems work and how they affect the biological, economic and social environments.

Teaching an inter-disciplinary, systems approach to agricultural and rural development applies to training students at every level of agricultural education (secondary, intermediate and higher levels). A systems approach to agricultural education requires a team-teaching methodology using case studies, problem-solving approaches and practical, field-based exercises. The goals of education in agricultural systems can be achieved through approaches that:

- Focus on whole-farm systems rather than single disciplines;
- Incorporate methods (e.g., participatory rural appraisal) to assess socio-economic impacts on agricultural productivity;
- Use agro-ecological systems as the unit of study and analysis;
- Encourage multi-disciplinary teams in teaching and encourage students to work in problem-solving groups; and
- Emphasize the linkages between basic and applied science, between research, education and extension, and between people, the environment, sustainable agricultural production and rural development.

Students need to be provided with more active learning roles within a farming systems perspective. Curricula need to integrate course work so that students can apply a range of skills to solving agricultural problems. To be effective agricultural change agents, students need to learn how to effectively communicate with farmers. Finally, more of their education needs to be experientially based.

Sustainable Rural Development - Emerging Challenges

Rural development increasingly needs to be understood as a “*process that takes into account the mobile as well as fixed assets in and across rural and urban spaces*”. Whilst it has been recognised for some time that rural areas owe much of their development and trajectory to their particular regional contexts, and that these have not only economic but also social and political dimensions, it is now also clear that this regional context holds important ecological and eco-economic flows and fixities that interact with the economic, social and political arenas. *At the same time*, rural development must cope with the variable and growing public expectations about the function and purpose of rural areas – for example, consumer demands for quality foods, amenity, tourist spaces and areas of environmental management. In this sense, rural areas are variably coming under increasing pressure from urban populations to deepen, broaden and reground the rural eco-economy. Hence, these processes are not just endogenous to rural areas; rather, they are increasingly interactive between different and more fine-grained producer-consumer networks (both of rural goods and services). These are not always regionally specific or necessarily very stable. In some cases, the demands for rural goods and services are based upon consumption cultures and constructions that may be influenced by wider media, such as corporate retailers, tourist advertising, scientists and experts, ethical concerns. Hence, the *quality as well as the quantity of knowledge flows between rural and urban networks* is likely to become more important in sustaining eco-economic relationships in the context of rural sustainability.

Changing urban demands can also affect the sustainability domain. For example, fostering urban-based forms of public and private food procurement could have a major impact on rural areas located around large urban centres – as it can easily be understood when considering that a city like Rome provides some 27 million school meals/year. Innovations in bio- and renewable energy can also have an impact here. Under conditions where towns and cities begin to adjust to the increasing costs and protracted demise of the carbon-based economy, this is likely to change flows of foods, energy, transport, as well as a range of household goods and services. So, the sustainability of the rural resource base will have to be linked with the rise of ‘*green cities*’ and the new ‘*webs of interaction*’ that these begin to create. In other words, the re-calibration of urban demands with the reconstitution of the rural resource base is an important area for development – one that the rural development policy community needs to take into serious consideration not only in terms of the protection or preservation of environmental resources, *but also in their redefined social and ecological utility*. Indeed, there is need for new definitions of utility maximisation of multi-functional rural resource use that stem the urban-rural divisions of the past. Clearly, these emerging, but potentially volatile, forms of mobility and

vulnerability are posing threats as well as opportunities to the process or *condition of sustainable rural development*.

In addition, it is important to recognise that the capacity of rural sustainability to take hold in any one place will be directly affected by the dominance (or lack of) of the conventional and ‘*race to the bottom*’ tendencies inherent in the agro-industrial model and its associated hygienic-bureaucratic state apparatus. This involves, for instance, the continuing operation of a regulatory system that perpetuates the traditional cost-price squeeze of production and ties producers in to a lock-in situation or a combination of a technological and regulatory treadmill.

Suggested Strategies for Sustainable Rural Development

Agriculture will remain for many years a major contributor to the economies of most developing countries. In some countries, however, its share of gross domestic product (GDP) will progressively decline. The agricultural sector in developing countries is undergoing rapid changes as a consequence of both technological progress and economic forces which call for an increased market focus, competitiveness and higher productivity. Employment opportunities in the off-farm sector are expected to increase at a faster rate than in agriculture. This will further emphasize the present employment shift of agricultural graduates to related sectors, requiring a revision of existing curricula to better address educational needs.

Agricultural education curricula need to be redirected to address the labor demands of the private sector. Curricular reorientation will need to incorporate both the new role of market-oriented agriculture as well as issues of direct relevance to food security and rural poverty. Curricula also will need to better reflect the importance of social and environmental issues for sustainable agricultural development. Meaningful curricular revisions will require a better understanding and incorporation of the underlying psychological processes that influence learning, with special attention to experiential learning and participatory learning strategies that focus on inductive reasoning skills.

Agricultural colleges and universities need to determine their unique functions and the special attributes that they can offer students and the agricultural community. They will need to do a better job of communicating these attributes if they expect to remain financially sustainable, given current economic constraints. Moreover, agricultural institutions need to do a better job of carrying through with their unique ability to solve the agricultural problems of the communities they serve. A holistic approach to teaching agricultural production through a multi-disciplinary systems perspective will increase the utility of both scientific and local knowledge.

Inter-university alliances offer a means to capitalize on individual university strengths and to reduce costs reflected in the duplication of efforts. Regional collaborative strategies should be explored as a means to keep pace with accelerated scientific advancement. A commitment to developing communication infrastructure, especially with regard to the new computer-based communication technologies, should be a priority because of the potential to reduce the information gap.

The curricula of agricultural colleges and universities in developing countries need to adjust to the current and future employment needs of graduates. The emphasis in curricular revisions should be on process skills of problem solving and on skill sets that are transferable to a diverse employment sector. New options for programs of study should be based on enabling students to meet the expectations of agricultural employers, and increasingly the employment needs of the private sector.

Given the severe restrictions on financial resources, governments in developing countries need to determine levels of continued support to higher education in agriculture based on the ability of colleges and universities to carry out curricular modifications that reflect employment markets. In some countries, there has been excessive growth in the number of diploma and degree granting agricultural education institutions. The challenge is to achieve a "better fit" between the supply and the demand for trained human resources in agriculture.

Conclusions

Governments all over the world have focused upon sustainable rural development in an organized way. Rural locations, in particular, need more economic development in order to match urban centric development. Poverty in rural areas has remained by and large, the main focal point of governments and development agencies. Sustainable rural development is the most effective way to eliminate this curse. To improve the standard of living, governments have allocated more financial muscle for the rural areas. Constant efforts are being taken to ensure development of infrastructure in such areas. Also, environment friendly growth stimulators have been provided to rural populations.

To maintain sustainable rural development, several regional development agencies, national governments, international development organizations and NGOs are putting in their best efforts. The things which have been focused upon include:

- *advisory services to farmers and forest holders,*
- *creating awareness about economic values of forests,*
- *modernization of agricultural tools and equipments,*
- *introduction of new process, products and technologies, and*
- *emphasis upon infrastructure development.*

New methods have also been encouraged for farming in barren lands. Most of the farming land remains unused during no-crop season in underdeveloped countries. To improve that, cyclical production of different crops is encouraged so that land does not remain unused. Farmers are also being supported by launching numerous agro-environment schemes. Income generation and equal growth are likely resultants of such initiatives. These initiatives are being taken in not only developing countries but in developed countries as well.

In the next century, agricultural education institutions in developing countries will need to address not only immediate production needs, but also long-term food security, sustainable agriculture and rural development needs. This will require moving from a single-disciplinary approach to an inter-disciplinary, systems approach which incorporates a wide range of new topics, including gender, environmental and population issues. A major challenge will be the transformation of agricultural education institutions into dynamic promoters of change within their environments. This will require that they abandon long-established traditions of academic isolation and become active contributors to sustainable agricultural and rural development through innovative teaching, research and extension.

To sum up, agricultural universities, colleges and schools face major challenges in the 21st century. Meeting these challenges will require new educational strategies, innovative leadership and institutional reforms that take into account the current trends and factors that influence agricultural and rural development.

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