

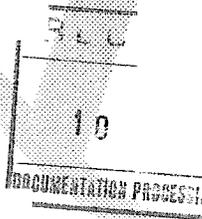


REPORT

Rome,
Italy,
16-20 December
1991

Strategy options for higher education in agriculture

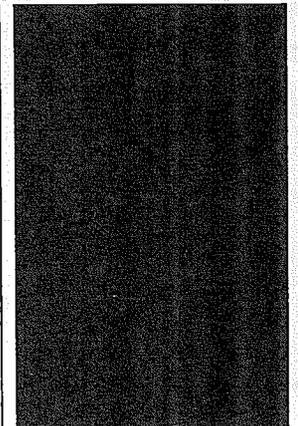
Expert consultation



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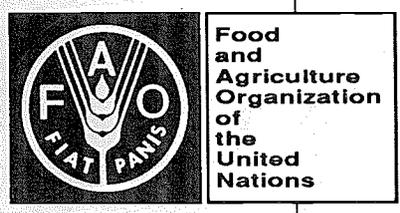
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**REPORT
OF THE EXPERT CONSULTATION
ON
STRATEGY OPTIONS FOR HIGHER
EDUCATION IN AGRICULTURE**

Rome, Italy, 16-20 December 1991

**Food and Agriculture Organization of the United Nations
Rome, 1993**

FOREWORD

World agriculture development faces its greatest challenge ever in the history of mankind. In spite of the great progress achieved in science and technology, over 50 million people are threatened by famine and some 800 million people suffer from chronic under-nutrition. The situation in the medium-term future will become even more difficult when an additional three billion people will have to be fed by the year 2025.

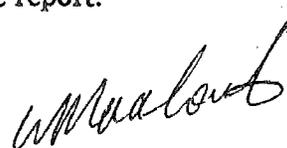
Increased food production can be achieved by raising productivity levels through the application of improved agricultural education and production technologies. Research and education (formal and non-formal) need to be intensified in order to develop and convey appropriate agricultural technologies to farm producers.

This situation creates a very difficult challenge for agricultural scientists and educators. An evolutionary process on a scale that is much more ambitious than the green revolution of the 1950s and 1960s is called for. There is a need for a technological and educational revolution that can lead to the sustainable production of enormous amounts of food through the appropriate use of limited land and water resources including an adjustment to climatic conditions and economic constraints faced by the majority of farmers. This implies a drastic change in our approach to agricultural production, education and the distribution of agricultural products. While increases cannot be expected in land and water resources, mankind's history is replete with scientific and educational breakthroughs that have changed the course of history. Agricultural colleges and universities should be on the front line of the battle to feed the world's population in an equitable manner.

Aware of this situation and looking forward toward the 21st century, FAO convened an international Consultation on Strategy Options for Higher Education in Agriculture in Rome from 16 to 20 December 1991. The consultation brought together participants from 16 countries and four international bodies. FAO is indebted to all of them for their active participation and their extensive contribution to a successful meeting.

At a time when policy changes and new approaches to programme design and institutional management are being debated in many countries, the Consultation took stock of previous achievements and current problems affecting higher education in agriculture in developing and developed countries. The meeting's main task was to look towards the future, suggesting strategy options for action to improve impact and efficiency of agricultural universities, colleges and faculties. Particular attention was given to five areas: (i) development of policies for higher education in agriculture; (ii) design of programmes for teaching, research and extension/public service; (iii) specific issues confronting institutions of higher education in agriculture; (iv) institutional management (including the management of programmes and resources) and (v) the role of FAO, other international organizations and donor agencies in support of higher education in agriculture.

FAO believes that the Consultation Report will be of value to policy makers, planners, rural development administrators, managers of educational programmes for agriculture and to administrators, professors and students of agricultural universities, colleges and faculties. International organizations and donor agencies operating at country, regional and/or global level, will also be able to draw benefit from the report.



W. D. Maalouf
Officer-in-Charge
Human Resources, Institutions
and Agrarian Reform Division

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EXECUTIVE SUMMARY

Policies and Programmes
Specific Issues
Institutional Management
International Organizations and Donor Agencies

The Expert Consultation on Strategy Options for Higher Education in Agriculture was held at FAO Headquarters in Rome, Italy, from 16 to 20 December 1991. Twenty high-level participants, including university presidents and deans, senior ministry staff and representatives of several international bodies, were called together to consider the current status of higher education in agriculture and to suggest ways and means to improve impact and efficiency of policies, programmes and institutional management.

The Consultation opened with a keynote address, emphasizing higher education's role in sustainable agricultural production and rural development. Participants were asked to give special attention to the need for qualitative improvement in institutional programmes and management practices. Discussions were aided by a comprehensive discussion paper, *Higher Education in Agriculture: Status, Issues and Ideas for Future Development*, which provided factual information and data on government and institutional policies, programmes of teaching, research and extension/public service, resource mobilization and use and on problems, constraints, potentials and achievements of agricultural universities, colleges and faculties in developing and developed countries. The paper offered a number of tentative suggestions on policy formulation, programme design, institutional management and international support to higher education in agriculture, for consideration by the Consultation participants.

Following the presentation of the discussion paper and a general debate, participants considered six specific, pre-selected issues which confront institutions offering higher education in agriculture at present and in the foreseeable future. Thereafter, attention was given to the design of new programmes, to management questions and to the future role of the international community in support of higher education in agriculture. Finally the draft report on the Consultation's deliberations was discussed and endorsed.

Policies and Programmes

The Consultation considered a stable policy framework which clearly expresses governments' expectations regarding institutional mandates and objectives and which encourages institutional initiative in promoting close communication with government ministries/departments as essential for the successful operation of agricultural universities, colleges and faculties. Both government and university officials should be involved in setting policy on programmes. Institutions' social responsibility to improve the quality of life of the rural population through human resource development, research and extension/public service was stressed, as well as the need, for example in Eastern Europe, for new policies and programmes focusing on the individual family farm. In order to assist institution building and the provision of high-level training of agricultural specialists, Consultation experts advocated twinning arrangements between institutions and strongly endorsed the concept of

networks of centres for postgraduate education and research (centres of excellence) at national and/or regional level.

In the interest of institutional impact and efficiency, the Consultation clearly favoured the tripartite design of teaching research and extension/public service, rather than a more narrow approach to the responsibilities of agricultural universities, colleges and faculties. In the design of agricultural undergraduate curricula, a systems approach should receive increasing importance as well as subjects emphasizing management skills and teaching/extension/information techniques. Particular attention should also be given to systematic curriculum reviews in consultation with rural development planners, private sector employers, institutional staff and student representatives. Consultation participants were convinced that postgraduate programmes and research would need to focus on the complex subject area of sustainable agriculture and rural development and natural resource management and that many institutions of higher education in agriculture should, in the future, place more emphasis on postgraduate education, research and extension/public service.

Specific Issues

Major new developments such as changes in world agriculture, advances in science and technology and changes in population and society, require the integration of academic learning and development tasks and institutional approaches to decision-making which combine leadership and a more participatory approach to the planning processes. In order to adequately accommodate new production technologies in agricultural teaching programmes, the science base of such curricula would need to be strengthened as well as the study of the socio-economic context of agricultural development. Participants suggested, however, that of equal importance was the role of agricultural universities, colleges and faculties in promoting the utilization of new technologies through outreach activities in collaboration with extension services operating in the rural areas.

While all institutions of higher education in agriculture, wherever they are located, must strive for academic excellence, a distinct focus of institutions in the developing countries needs to be on development orientation and responsibility towards rural development. Consultation participants urged, however, that agricultural universities, colleges and faculties in developing countries apply the same scientific methodology to problem identification and analysis which their sister institutions in developed countries use. With respect to the key institutional goals of strengthening groups of institutions, the Consultation highlighted the following: strengthening institutional capacity - particularly important in least developed countries; maximum utilization of existing capacity for teaching, research and extension/public service - in developed and some advanced developing countries; support of other institutions - well established agricultural universities, colleges and faculties.

The Consultation proposed the integration of the farming systems approach into the institution's teaching, research, and extension programmes. There was broad agreement on the farming system approach, recognizing that behind the farming system development concept must be a deeply-rooted institutional commitment to realistic problem solving and identification. This requires the teaching and learning of farming systems' principles and practices in field situations, as well as joint course planning, teaching and student evaluation by staff teams belonging to different scientific disciplines - most difficult but promising undertakings. It also requires the institutionalization of on-farm research and the training of scientists who are able to conduct on-station and on-farm research and to work closely with farmers and extension workers. Attention to farming systems methodology should be at the centre of postgraduate education and research.

The Consultation recognized **sustainable agricultural production and rural development** as a concept of paramount importance for agricultural universities, colleges and faculties. Institutional administrators were encouraged to develop teaching and research strategies which reflect the concept's multi-dimensional scope

and its holistic approach to policies and pragmatic problem-solving actions. Likewise, public information programmes and clear communication channels with policy/decision makers need to be established and maintained in order to facilitate dialogue, understanding and joint action. Increasing population pressure, one of the most problematic elements within the complex sustainability issue, should be addressed through the inclusion of population education concepts and principles in the curricula of intermediate and higher level institutions.

Agricultural universities, colleges and faculties have three principal roles in addressing the issues related to **women in agriculture**: (i) to educate qualified male and female staff for teaching, research, decision making and field activities, who understand the functions, specific problems and potentials of women farmers and female heads of households; (ii) to create appropriate conceptual and analytical linkages between agricultural production, sociology, extension, economics and population issues within agricultural curricula, and (iii) to develop and apply methodological tools for data collection and analysis that help to clarify the roles of women farmers and their specific problems. Institutions of higher learning should encourage female students to enrol in agricultural teaching programmes in order to prepare for a professional career in the agricultural sector. The Consultation urged that special efforts should be made to recruit and support female students from rural areas who could become extension agents, agricultural researchers and teachers.

Consultation experts suggested that institutions' effective performance in teaching, research and extension/public service contributes decisively to the impact and efficiency of **agricultural knowledge systems**. However, optimum results are possible only if there is close interaction between different programmes and staff at institutional level and if the agricultural universities, colleges and faculties communicate closely with other education, research and extension institutions as "providers" and as "beneficiaries" of mutual support. Of equal importance is the interaction between academic staff and the agricultural community which needs to be strengthened in many countries. Feedback from the field level and from former students helps to ensure programme relevancy and quality of teaching/learning, research and extension/public service.

Institutional Management

The Consultation paid particular attention to the importance of strategic planning for institutions as a whole and of institutional reviews at periodic intervals to diagnose impact and efficiency of programme delivery and resource use. In order to improve staff dedication and work quality, institutional recruitment and promotion systems should be oriented towards quality performance, with appropriate weight given to teaching, research and extension/public service. Low teaching quality, in particular, was cited as a problem in many institutions. Administrators should encourage and reward first-class teaching, which could also be helped by an educational methods and technology centre within the institution.

In order to broaden the financial base of institutions of higher learning in agriculture, extra resources should be mobilized through contract research, contract training and consultancy services, as well as, to the extent feasible, through tuition fees. Consultation participants expected structural changes in increasing numbers of institutions (e.g. by integrating base units/departments into larger units with broader disciplinary orientation). Although such changes might favour more centralized decision-making with less staff participation, the highest possible degree of decentralization should be ensured regarding staff responsibilities for programme planning and resource allocation.

International Organizations and Donor Agencies

The Consultation welcomed the important catalytic role which FAO performs in supporting higher education in agriculture. Special mention was made of the Organization's function as a forum for policy and programme discussions, as a

collector and world-wide distributor of vital information and statistics, as a supporter of institution building programmes and as a promoter of experiments with new curricula and with alternative approaches to research, extension and institutional management.

Consultation experts called upon FAO, other technical assistance organizations and donor agencies to continue and intensify their support to higher education in agriculture. Specifically, their assistance in improving programme relevance and towards increased management efficiency was suggested, e.g. through cooperation in institutional reviews, strategic planning exercises, curriculum review and revision, and institution building and strengthening projects. Further, in order to help strengthen institutional cooperation across borders, FAO, other international organizations and donor agencies were requested to support the establishment of centres for postgraduate education and research in key subjects, inter-institutional twinning arrangements and regional bodies promoting greater impact and efficiency of higher education in agriculture.

ORGANIZATION AND OVERVIEW OF THE EXPERT CONSULTATION ON STRATEGY OPTIONS FOR HIGHER EDUCATION IN AGRICULTURE

Background and Perspective

Higher education in agriculture¹ forms part of national systems of general education (primary-secondary-tertiary) and of agricultural education at vocational, technical and academic levels. At the same time, higher agricultural education is a key element in agricultural and rural development, contributing mainly through the preparation and training of high level personnel and, to varying degrees, through research, policy advice and extension/outreach type activities.

While training for improved farming practices has a tradition of more than a thousand years, in some countries, higher education in agriculture dates back little more than one hundred years. Before World War II, institutions were few and concentrated in the more developed countries. However, in the 1960s and 1970s, a number of additional institutions and programmes were created, especially in newly independent countries. By 1980, most nations had developed an institutional base for higher education in agriculture. Yet, due to severe economic constraints, other internal problems, and political influences, institutional advancement and the implementation of first class programmes of teaching, research and extension/public service were restrained or impeded in many countries. Thus, the quality of first degree programmes declined or did not reach full maturity. The development of postgraduate programmes lagged behind and, in many cases, institutional research and extension/public service activities remained, or became rudimentary. In addition, the build-up of qualified staff and adequate physical facilities was curtailed in many agricultural universities, colleges and faculties.

In order to be able to deliver optimum programme results, countries and institutions will have to tackle these problems which have already caused delayed programme development and low quality outputs. Newly emerging challenges need to be faced. A large proportion of these challenges will be related to country-specific and institution-specific factors of a political, economic, social and cultural nature. Other problems may be addressed in light of new developments in the world at large.

New scenarios which need to be addressed by higher education in agriculture in the next decade and beyond are exemplified by the focus on sustainable agricultural production and natural resource management, food security and development of

¹ The term *higher education in agriculture* is used interchangeably with *higher agricultural education* and concerns institutions which offer teaching programmes in agriculture leading to the award of a university degree.

renewable energy sources. Dramatic new challenges are expected to arise due to drastically increased population pressure, new political scenarios in several parts of the world, and the necessity to push technological advancement still further ahead. Particular emphasis will need to be placed on the socio-economic implications of such developments (e.g. for farmers, rural women and youth).

Governments and institutions of higher education in agriculture will need to prepare themselves for effectively dealing with current and future problems and challenges. This will require reconsideration of educational policy, institutional objectives, programmes, curricula, and management practices. It will also require changes in attitude, e.g. in favour of disadvantaged rural groups and environmentally friendly programmes on the part of decision makers, professors and students.

FAO's Commitment to Higher Education in Agriculture

FAO's mandate and concern for agricultural education are spelled out in its Constitution (Article I - Functions of the Organization):

The Organization shall promote and, where appropriate, shall recommend national and international action with respect to the improvement of education and administration relating to nutrition, food and agriculture and the spread of public knowledge of nutritional and agricultural science and practice.²

At least of equal importance as this legal basis for FAO's involvement in agricultural education is the conviction that has grown throughout many years of experience: that agricultural education at vocational, technical and academic levels must be an essential and integral component of agricultural and rural development. FAO sees its role primarily as being that of a catalyst and providing technical assistance.

One of FAO's tasks is the collection and dissemination of information on new approaches to higher agricultural education and on interesting experiences, e.g. with new types of curricula and educational programmes or with different institutional structures. Another task is to act as a forum for policy and programme discussions such as this Expert Consultation on Strategy Options for Higher Education in Agriculture. A third area is the production and dissemination of training manuals and instructional materials.

FAO's involvement in higher agricultural education is perhaps best known for its technical assistance activities. Over the last 15 to 20 years, numerous universities and colleges have been supported through the assignment of temporary personnel, fellowships for training abroad, equipment, and literature. In recent years, FAO has been called upon with increasing frequency to advise on governmental and institutional policy, programme development, and resource use of agricultural universities, colleges, and faculties in many developing and developed countries. Because of the Organization's long-standing experience, its expertise drawn from many different countries and institutions, and in view of its technical nature without linkage to any political system or ideology, FAO is in a position to offer appropriate advice and services in higher agricultural education.

Recognizing that higher education in agriculture has reached a critical stage in many countries and convinced of its enormous potential for increased contributions to national development, FAO felt that the time had come for taking a fresh look at higher agricultural education. To do this, a two-stage approach was adopted:

- obtain and sift information and data on the current status of higher agricultural education, prepare a preliminary analysis of the collected material and put

² Basic Texts of the Food and Agriculture Organization of the United Nations
FAO, Rome, 1970.

forward ideas for institutional and programme development in the short and medium terms; and

- call a group of high-level specialists together in order to refine and validate the preliminary analysis and elaborate strategy options of value to many countries and institutions, in the developing world as well as in industrialized nations.

Objectives of the Consultation

The following objectives were set for the Expert Consultation on Strategy Options for Higher Education in agriculture:

- Examine the present and future roles of governments and institutions regarding policies for and objectives of higher education in agriculture in their respective countries and suggest priority areas for future action.
- Identify recent trends in teaching programmes, fields of study, curricula and research, and outreach and extension programmes, in the light of recent technological changes and increased emphasis on new subject matter as they affect agricultural and rural development, now and in the future.
- Examine closely the resources available to institutions and how best to use them as a means of overcoming the difficulties and problem issues which institutions experience.
- Consider alternative internal, institutional organization and management structures, styles and procedures, and the emerging forms of interaction between governments/institutions and other institutions both in-country and abroad.
- Propose possible new strategies for higher education in agriculture for the next 10-15 years and indicate the strengths and weaknesses of the main alternatives suggested.
- Propose ways and means whereby the implementation of the most promising strategies can be promoted, indicating the types of action envisaged and the range and magnitude of the resources needed.

The output of the Consultation was intended to be useful to policy makers, planners, and programme managers in government ministries and departments (e.g. of agriculture, rural development, education and culture, higher education and research, economic affairs and finance). Administrators, professors and student leaders of agricultural universities, colleges, and faculties were also identified as potential beneficiaries. It was further expected that the Consultation's situation analysis, its assessment of different strategy options, and its suggestions and recommendations would be of value to FAO, other international organizations, donor agencies, voluntary groups, and individuals engaged in fostering education and training as a means of improving the quality of life for all.

Consultation Methodology

This Expert Consultation was a part of the Regular Programme of Work and Budget for 1990/91 of FAO's Human Resources, Institutions and Agrarian Reform Division. The Agricultural Education and Extension Service (ESHE) was responsible for organizing and servicing the Consultation.

Preparatory work prior to the Consultation started in 1987, with the design and subsequent implementation of a case study programme involving 20 institutions of higher agricultural education situated in as many countries. The list of these institutions (13 in developing and 7 in developed countries) is included in Appendix 1 of the discussion paper (Annex 2 of this report). The case studies were designed to provide information and data on the institutions' objectives, programmes, resources, and

management practices as well as on their major problems, potentials and plans for the future. The results from the case study programme, together with relevant information from other sources, were distilled into a document entitled: *Higher Education in Agriculture: Status, Issues and Options for Future Development*. The document, prepared by consultants in agricultural education and training, served as the main discussion paper for the Consultation.

Twenty experts participated in the Consultation in their personal capacities. They represented a mix of university presidents/rectors/vice-chancellors, deans of agriculture, eminent professors, high-level officials from national ministries and coordinating bodies, as well as from regional professional associations and international organizations. In addition, FAO staff from various technical divisions participated as observers. The list of participants and observers is included in Annex 4 of this report.

The Consultation worked in plenary sessions throughout the duration of the meeting. Following the presentation of the main discussion paper and a general discussion session, the Consultation focused on a series of six pre-selected issues which were thought to be of concern to a wide range of countries and higher education institutions. These issues were the following:

- Issue 1: *Major new developments in the world: How should institutions of higher education in agriculture react?*
- Issue 2: *Institutional goals and functions of higher agricultural education in developing and developed countries.*
- Issue 3: *From production orientation to farming systems: What are the consequences for higher education in agriculture?*
- Issue 4: *Sustainable development and natural resource management: What is the role of higher education in agriculture?*
- Issue 5: *Women in agricultural and rural development: the implications for higher education in agriculture.*
- Issue 6: *Relevance, quality, and effectiveness of higher agricultural education as part of agricultural knowledge systems.*

These six issues were considered during the second and third day of the consultation. In each instance, the respective issue was introduced by one of the participants, commented upon by two discussants, and thereafter debated in plenary.

- The Consultation's fourth day was devoted to the consideration of three themes:
- The design of new programmes (and/or the strengthening of existing ones) of teaching, research and extension/public service.
 - Practical measures to improve institutional management, e.g. in the areas of programme management, personnel management, and financial management.
 - New roles of international organizations and donor agencies in support of higher education in agriculture wherever their assistance may be needed.

The draft report on the consultation's deliberations was discussed and endorsed by the group on the final day. The Consultation concluded with a statement of thanks to the participants and the Secretariat by Dr. W. D. Maalouf, Officer-in-Charge, Human Resources, Institutions and Agrarian Reform Division. The Consultation timetable is included as Annex 3 of this report.

Opening Session: Challenges and Potential of Higher Education in Agriculture

The Expert Consultation on Strategy Options for Higher Education in Agriculture was officially opened by Dr. A. N. Cortas, Assistant to the Assistant Director-General, Economic and Social Policy Department. On behalf of the Director-General of FAO, Dr. Cortas welcomed the participants to FAO and to the Consultation. In his keynote address, he drew attention to the important role which education plays in promoting national advancement. Similarly, he stressed the importance of higher education in agriculture and related disciplines, in support of agricultural and rural development. Dr. Cortas noted that consideration should be given to measures facilitating access to education of rural young men and women, including their increased enrolment in higher education programmes in agriculture. With respect to the work of agricultural universities, colleges and faculties, Dr. Cortas called for improvement in the quality of the teaching/learning process, the development of viable research programmes which address the needs of the rural people, the strengthening of institutional outreach programmes for increased collaboration among institutions of higher learning, research institutions and extension services, and for better management and efficiency of the educational institutions. Lastly, Dr. Cortas invited the participants to assist FAO in thinking ahead, focusing on the development of strategy options which enhance the impact of institutions of higher education in agriculture throughout the world. The full text of the keynote address is included in Annex 1 of this report.

Following the presentation of the keynote address, the Consultation concurred with the draft agenda and with the appointment of session chairmen and rapporteurs as suggested by the secretariat. The aims and objectives of the Consultation were briefly explained by Dr. T. E. Contado, Senior Officer (Agricultural Training and Extension), and the working arrangements for the week were outlined by Dr. W. I. Lindley, Senior Officer (Agricultural Education).

The main discussion paper for the Consultation entitled *Higher Education in Agriculture: Status, Issues and Options for Future Development* was presented by Dr. H. K. F. Hoffmann, Consultant in Agricultural Education and Training. In presenting this comprehensive paper, Dr. Hoffmann stressed the need for forward looking policies, more appropriate programme design and monitoring, better institutional management, and more effective cooperation between institutions in almost all countries, wherever they are located. He raised specific questions in relation to the six issues to be discussed on days two and three and offered various options for possible solutions to identified problems, for consideration by the Consultation. Lastly, he pointed to new areas of support for higher education in agriculture by FAO, other international organizations, and donor agencies. The full text of the discussion paper is attached as Annex 2 of this report.

RESULTS OF THE CONSULTATION'S DELIBERATIONS

Policies for Higher Education in Agriculture

Improved Programmes of Teaching, Research,
and Extension/Public Service

Challenging Specific Issues

Improving Institutional Management

The Role of International Organizations and Donor Agencies in
Support of Higher Education in Agriculture

The Consultation participants welcomed the main discussion paper as presented by Dr. Hoffmann. The paper which offered factual information, analytical considerations, and a number of suggestions for change in relation to all agenda items was recognized as an excellent basis for discussion.

Policies for Higher Education in Agriculture

Participants recognized the importance of government policy for higher agricultural education. Policy framework, set at the national level, determines the goals of higher agricultural education, institutional structures, and type of governance, as well as criteria for programme design, and mobilization and use of institutional resources. Another key element within the policy framework is the relationship of institutions such as agricultural universities or faculties to government ministries or departments and to other educational and research institutions, both in-country and abroad.

The Consultation considered it essential for the smooth functioning of higher agricultural education institutions that governments define their expectations regarding the mandate and objectives of the institutions. Likewise, explicit procedures for constructive discussion of strategy for higher agricultural education between governments and institutions should be established. The improvement of relationships and dialogue with government ministries/departments should be the declared aim of agricultural universities/colleges/faculties in many countries.

Human resource development, research, and public service to society (including extension and information) were seen as the key functions of institutions of higher

agricultural education. Functions and expected achievements of their work should be clearly expressed in the mission statements of these educational institutions.

An overall objective of institutions of higher education in agriculture is to help improve the quality of life in the rural areas. This social responsibility of the agricultural universities, colleges, and faculties needs to be pursued with vigour. Policy makers and legislators must be convinced of the institutions' leadership role and obligation to the rural population. Institutions of higher agricultural education have an increasing responsibility to include this focus in their teaching, research, and extension/public service programmes.

Consistent with their mandates for excellence and limited by their resources, institutions should organize faculty and consumer task forces on teaching, research, and extension programmes, in order to set priorities and direction which are responsive to the demands of rural development. Institutions that only concentrate on instructional programmes in agricultural technology are proving to be too narrow to respond to national requirements and the broad-based needs of students and prospective employers.

The Consultation identified sustainable agricultural production and rural development as a key development issue. Institutions of higher agricultural education need to adopt more pro-active rather than reactive roles. Agricultural universities, colleges, and faculties have to act in a dynamic manner, taking more and more initiative in striving for programme relevancy, high quality staffing, adequate physical facilities, multiple sources of financing, and enrolment of motivated students in appropriate numbers. In some institutions, the original service goals (e.g. service to farmers) need to be revitalized and emerging *second generation problems* (e.g. fading programme focus, staff lethargy, and decaying physical facilities due to lack of maintenance) need to be addressed promptly through a strengthened tripartite approach involving teaching, extension, and research.

Without a doubt, agricultural universities, colleges, and faculties are important components of the agricultural knowledge system. Institutions should continuously update their scientific resource and information base and contribute to the utilization of knowledge and technology for the benefit of farmers, other rural people, and society-at-large.

The relationships between universities and the parastatal and private sector (e.g. production and processing firms) were considered important and should be further developed so that universities may become more involved in industrial and commercial applications of teaching and research. This could increasingly lead to joint activities, with universities playing an important role in manpower planning, training, research, and advisory work, with private sector support strengthening institutional resources.

The Consultation recognized that in most Eastern European countries, the policy framework for higher agricultural education was currently in a state of flux. Prior to World War II, good educational systems existed in many Eastern European countries. After the war, a centralized approach that separated agricultural faculties from comprehensive universities was adopted. As a result, many small and narrowly-focused institutions were created with very rigid requirements, limitations (e.g. regarding student numbers) and controls. Following the recent political changes in Eastern Europe, there is an urgent need for new policies and restructured institutions guided by a new philosophy, leading to less central management and more autonomy at the level of individual institutions and programmes. Further, with the change in agricultural policy orientation from large-scale production based on state farms to small or medium scale production by individual farm families, there is great need to emphasize not only production techniques and skills, but also farm management, agri-business and marketing as well as effective methods of providing extension services to farmers.

Institution-building is a long-term process which needs development inputs in terms of staff, physical facilities, and finance over substantial periods. In order to

assist in this process, twinning arrangements with one or more partner institutions from within the country or abroad would be helpful. The roles played by the institutions involved, the resources to be made available, etc., should be laid down in a formal agreement and the mechanism of cooperation between the partners should be institutionalized.

In the interest of ensuring high-level specialist training at reasonable cost, the participants endorsed the concept of networking among institutions of higher agricultural education. Centres of postgraduate education and research (sometimes referred to as *centres of excellence*), in specific subject areas, could be developed within countries as well as on a regional basis. While such centres could, with advantage, be established at existing national institutions, they should enjoy a high degree of autonomy from their host institutions.

Improved Programmes of Teaching, Research, and Extension/Public Service

The Consultation recognized that governmental and institutional policy set the tone and direction of programmes undertaken by institutions of higher learning. The needs of the country to be served should be the guiding principle for programme design and implementation.

The Consultation endorsed the ideas for the design of improved programmes of teaching, research, and extension/public service, which had been proposed in the discussion paper. The expectations as to what an agricultural graduate or a postgraduate degree holder is expected to master should be realistic. The undergraduate student needs more practical and field-oriented training, especially, but not exclusively, in developing countries. In contrast, postgraduate study should include more research orientation.

With regard to agricultural undergraduate programmes, two diverging programme development trends were noted: (i) towards more pronounced subject specialization and, (ii) towards a systems approach. Participants felt, however, that the increased emphasis on broad interdisciplinary subject areas such as natural resource management and farming systems development would favour the systems approach to agricultural undergraduate curricula. Likewise, increased emphasis on management skills and on teaching/extension/information techniques was called for in order to strengthen graduates' versatility and problem solving abilities.

In order to ensure that incoming agricultural students are genuinely interested in an agricultural career, admission policy should be considered that would examine the prospective students' science capability and their interest to apply this capability to agriculture. Practical experience with farming before and during enrolment could also give an indication of the students' aptitude for agricultural occupations.

Instances were cited where agricultural graduates were not familiar with production practices and other situations where extension workers were not familiar with research techniques. Participants called for specific attention to the difficult task of preparing graduates who not only had the appropriate methodological capacity in their work with new technologies, but also the ability to work at the farm level with producers who need assistance.

A mix of students, mainly drawn from secondary school leavers and in part from first rate agricultural vocational diploma holders, could favour respective teaching and learning results. Structural linkages of vocational diploma to degree programmes and access of high quality diplomates with successful field experience should be promoted by agricultural universities, colleges and faculties.

The consultation participants were seriously concerned about the low numbers and the lack of opportunities for young women to enter agricultural training and employment. Participants expressed the view that it was also necessary to broaden this

concern to include the educational needs of all audiences and groups of society who might be disadvantaged. Educating professionals drawn from the most promising pool of talent, whatever the source, was identified as the goal of an equal opportunity programme in which there should be no barriers related to sex, economic status or ethnic background.

Participants recognized a series of problems that face educational administrators, particularly in sub-Saharan Africa. While the number of years of training may be used as a measure of programme duration, a four or five year programme is, in itself, not a sufficient indicator for the quality type and focus of teaching and learning. Consequently, when assessing undergraduate curricula, close attention should be paid to the time spent (in terms of contact hours) in laboratories, classrooms, and field situations.

Consultation participants insisted that systematic curriculum review and revision at regular intervals was essential in order to ensure continued programme relevance, quality, and impact. Such exercises should take into consideration national concerns, student, needs and employment opportunities. They should, therefore, be undertaken by institutional staff committees in consultation with rural development administrators, national planners, main employers, and student representatives. Particularly difficult tasks are the restructuring of programmes and the introduction of new subject matter. Since most agricultural undergraduate curricula are already overloaded, priorities need to be set and decisions made on, (i) what material should be deleted, (ii) what new subject matter should be introduced in existing curricula, (iii) whether the introduction of new specialized curricula is warranted and, (iv) what should be learned through postgraduate work and in-service training.

Focusing on sustainable agricultural production, rural development, and natural resource management, the participants favoured the infusion of sustainable development concepts into existing agricultural teaching programmes rather than the design of new separate undergraduate curricula. To facilitate the slow and difficult process of orienting existing curricula towards sustainable agricultural development goals, special training or support groups would be helpful. These groups, which may include specialists in various fields from within and from outside the institution, could assist especially by developing relevant and practical subject-matter contents for inclusion in various agricultural teaching modules and by designing appropriate instructional materials and teaching aids. It is suggested that faculty coordinating committees be organized to discuss the integration of environmental studies into the curriculum.

In addition to developing relevant teaching materials and appropriate instructional methods for effective delivery of sustainable agricultural development related education, *experiential learning* including *learning by doing* should be encouraged.

Students and, also, teaching staff should observe first hand and actually work within the physical and social environment of rural areas whose ecological balance needs to be maintained. This could include environment appreciation, field training, living with rural families, assisting community organizations, and experiencing development internships as an integral part of the students' academic requirements. The active involvement and participation of teaching/research staff in such practical field activities should be a part of their educational and public services responsibilities.

As another new development, it may be necessary for agricultural faculties to organize courses for non-agricultural students that will bring them to an acceptable level of *agricultural literacy* that includes an appreciation of sustainable agricultural production and rural development and an understanding of problems related to the preservation of the natural environment.

The Consultation agreed that institutions of higher agricultural education should focus their postgraduate and research programmes more than in the past on the complex subject area of sustainable development and on its biological, technical and socio-economic components. Other scientific branches requiring more specialists

trained at postgraduate level and more research inputs could include biotechnology (plant and animal), environmental accounting, and survival strategies focusing on the rural poor. Postgraduate work, research, and also extension/public service activities should receive more emphasis in the future in many institutions of higher agricultural education.

The Challenging Issues

Major New Developments in the World: How Should Institutions of Higher Education in Agriculture React?

It was recognized that current and anticipated development trends in the world, of special interest to institutions of higher agricultural education, concern in particular three spheres: changes in world agriculture, new developments in science and technology, and changes in population and society. Such changing scenarios at global level directly affect higher education in agriculture; they demand the integration of *academic learning* tasks with *development* tasks.

The educational approach, especially at the undergraduate level, should be broad, practical, disciplinary-based, and offered in a modular teaching system to provide students with some flexibility in the selection of content. The specialized nature of postgraduate education, which is research-oriented and science-based should be made more inter-disciplinary but supervised or led by subject-matter specialists or experts. To cope with the changing needs and priorities affected by factors, such as those mentioned in the previous paragraph, institutions need to employ a decision-making approach which combines the *top-down* and *bottom-up* planning processes. In this way, the changes generated by new scientific discoveries, socio-economic and political events, as well as the local/field conditions and actual felt needs of the target beneficiaries of agricultural development programmes, can be taken into account.

Participants noted the need for appropriate government policies, as well as for assistance to help institutions achieve desirable educational goals. Research grants for solving practical extension-research-teaching problems, systematic evaluation of the relevance and quality of teaching programmes, incentives for teaching staff who are carrying out public-service, and/or outreach/extension service activities could be initiated. Community-based resources, including those in the private sector, also need to be mobilized in order to assist in the efforts to make higher agricultural education more responsive to changing needs and priorities.

New developments in science and technology, as well as the results of national development programmes, including industrialization, have opened up important teaching and research areas, such as food processing and technology, post-harvest technologies, agri-business management, and farming systems development. These areas may attract increasing numbers of students as new and/or more employment opportunities are created. It was suggested that, as student enrolment is very much related to employment opportunities, a continuous analysis of the market needs and employers' requirements related to the agricultural sector be made for the purpose of planning and developing university level agricultural curricula.

In response to the recent trend of decreasing world market prices for many agricultural commodities, coupled with reduced subsidies for farmers in many countries, the emphasis on agricultural development should focus on high quality, sustainable production at lower cost. Attempts to increase the efficiency of the agricultural production process require better use of traditional technologies and the development of new production techniques which do not need high energy inputs. This, in turn, points to the necessity that agricultural curricula receive a stronger science base through the inclusion of subjects such as micro-biology, biochemistry, plant physiology, and molecular biology. In addition, the socio-economic and socio-political context of the agricultural development process will need to be studied by students of

agriculture, in order for them to become familiar with the issues of equitable development and its distribution of benefits.

Although substantial new developments in science and technology have taken place, participants noted that the most important task was the utilization of new technologies to increase individual or national wealth. If authorized and funded, institutions of higher agricultural education can play a critical role in the knowledge/technology utilization process by providing or supporting outreach/extension activities, often in collaboration with the extension service of the Ministry of Agriculture (or other Ministries/Departments concerned).

Another key factor that was considered essential to respond in an effective and timely manner to new developments was the quality and content of the communication process. Communication among the staff, institutions, and other relevant development agencies, the private sector, and the community at large, including alumni and parents of present students, is important. Such communication processes may also be facilitated by applying appropriate information and/or communication technologies, such as computer-assisted data-bases, electronic mail, and other information networking facilities, so that relevant knowledge sharing and timely information exchange can be made more efficient and cost-effective.

While changes in the world-at-large seriously affect institutions and programmes of higher agricultural education, participants thought that, perhaps, more important than changes induced from outside were internal changes within most developing and in some developed countries. Urbanization of rural areas, rural-urban migration, declining size of agricultural land areas, high rates of inflation, low salaries, and heavy loads of external debt were mentioned as examples of internal factors affecting higher agricultural education. Such changes also necessitate adjustments in terms of teaching curricula as well as institutional management operations. Institutions have basically three choices: (1) *follow* society's needs and changes (2) *warn* society regarding the implications of these changes, or (3) *lead* society in coping with the changes. Ideally, agricultural universities, colleges, and faculties should contribute to providing leadership in coping with such changes, and to this end, effective mechanisms to help track and monitor the changes will be needed. Furthermore, institutions will have to inform and keep, up-to-date, their own administrators, staff, and students and adopt and prioritize practical but cost-effective actions for solving problems created by such changes.

Different Institutional Goals in Developing and Developed Countries

Institutions of higher learning in agriculture, regardless of their location, all strive for academic excellence. In most developed countries agriculture is characterized by a high degree of technological sophistication and institutions of higher agricultural education must respond to the challenges posed by high-technology agriculture. In contrast, the priority for institutions of higher agricultural education in most developing countries is to address the needs of masses of resource-poor farmers.

In many developing countries, teaching programmes must focus on familiarizing agricultural students with rural life, current farming practices, and development potentials of small farmers. Research programmes have to concentrate on searching for effective and appropriate technology and knowledge applicable to small farmers' problems. Extension programmes must ensure effective and timely dissemination of the findings of such research to farmers. Extension activities are also important means for acquiring first-hand knowledge and feedback from the farmers for use in teaching and research.

The Consultation insisted that developing country institutions should use, to the extent feasible, the same scientific methods for problem identification and analysis as their sister institutions in developed countries would apply. If this were to take place, a possible widening of the technology gap in agriculture between developing and developed countries was not considered a serious danger. The Consultation concluded

that institutions and programmes of higher agricultural education in developing countries need to be distinctly *development oriented* and fully responsive to the needs of the respective countries served.

With regard to the functions and goals of higher agricultural education in the world, the differentiation between developed and developing countries was thought to be useful. A more precise framework of analysis would perhaps be the classification of countries into three categories: developed, advanced developing, and least developed. A fourth category to be added could be the countries in political and economic transition from centrally planned to market-oriented economies (e.g. Central and Eastern Europe).

Given the above frame of analysis it would seem that the functions and goals of higher agricultural education would necessarily differ among the different country groupings. Not only will the functions and goals differ, the programmes and their substantive content would also differ.

Three implicit institutional goals would include:

- Institution building goal - strengthening and, where necessary, expanding institutional capacity. This is a common goal in many developing countries, particularly in least developed countries.
- Maximum utilization of existing institutional capacity for teaching, research, and extension/public service. This is a goal of well-established institutions of higher learning in agriculture, especially in developed countries and in some advanced developed countries.
- Support of other institutions at national, regional, or international level. This goal is of increasing importance among well-established institutions of higher agricultural education.

From Production Orientation to Farming Systems: What are the Consequences for Institutions of Higher Education in Agriculture?

The farming systems approach is an important component of sustainable agricultural production and rural development. The participants unanimously endorsed the concept of integrating the farming systems approach into teaching, research, and outreach programmes of institutions of higher education in agriculture. Academic staff members and all future graduates who will work in the agricultural sector should have a clear understanding of the principles of farming systems, their development potential and processes, and farming systems research. This was thought to be a prerequisite for effective research and extension work with farmers.

The main focus of farming systems development is the farmstead and the interdependent roles that members of the household play as they live in harmony with the environment and their agricultural production system. The consultation participants emphasized that sustainable agricultural production and rural development programmes must be based on an understanding of this system.

A key element in farming systems development is the goal of increased production through the use of comprehensive programmes of inputs and improved cultural practices. There was a call to redefine *production agronomy*. The current focus is on the principles of crop production, with improved technologies, such as genetically reconstructed high yielding varieties and the use of industrial inputs such as chemical fertilizers, pesticides, farm machinery and irrigation.

This type of technology was thought to be not fully relevant for the bulk of the subsistence farming community living on marginal and low fertility lands. Appropriate and sustainable agricultural production for these farmers basically means the use of improved cultivation techniques, the conservation of soil fertility and moisture, the use of renewable sources of energy, such as biologically-fixed nitrogen, integrated pest management, along with new kinds of high yielding varieties, characterized by disease and pest resistance, made possible through advances in biotechnology. This blend of the new and the old may constitute the best approach to offering the farmer ways to improve his production without endangering his or her

farming system. It will certainly require a thorough understanding of the potential and limitations of that system and how it functions.

University/Community Relationships

Participants recognized that, if the above concept is to be made functional, institutions of higher learning in agriculture will have to institutionalize on-farm research and their relationships with members of the farming community will have to undergo substantial change. In the future, universities should be producing a new breed of scientists, capable of conducting both on-station research and on-farm research and of working closely with farmers and extension workers.

Participants drew attention to the need for country-specific solutions and to the dangers associated with broad answers designed to fit many situations. Stress was laid on the need for an inter-disciplinary approach to client-oriented applied research which promotes feedback from the farmer. The lack of interaction between crop farmers and livestock producers, in some cases, is similar to the independent paths taken by some researchers in their own disciplines. Until there is an appreciation of the needs of the entire farming community, agricultural production and rural development will be less effective and sustainable.

Participants felt that an understanding of systems theory and the various components of the farming system are as basic as the scientific approach itself. It is on the understanding of the farming system that scientists and extension workers can make useful interventions. The consequences for institutions of higher learning are that these principles will have to be learned through practical experience and teaching/learning situations that involve experienced faculty members who have the knowledge, experience, and depth required to teach these concepts. This calls for an improvement in the dynamics of institutional management and the design of agricultural curricula that take into consideration all dimensions of the farming system.

A curriculum built around the farming systems approach as a core element requires joint course planning, teaching, and student evaluation by teams of teaching staff belonging to different scientific disciplines and academic base units (departments, etc.). Such close cooperation and intensive teaching efforts throughout the entire undergraduate programme may be difficult to achieve in practice. However, in several interdisciplinary production-oriented courses, such as watershed management, post-harvest technology, and integrated plant protection management, the farming systems approach could be introduced. A course explaining *agriculture* as an integrated system could, perhaps, be given at the beginning of the undergraduate programme, preferably by experienced staff, to achieve the right impact.

Practical training exercises to accompany classroom work should be given a clear farming systems perspective throughout the curriculum. The student evaluation system used in the institution should facilitate and encourage future agricultural graduates to view *agriculture* as a system which requires study of inter-related and mutually-reinforced scientific disciplines (i.e. through serious evaluation of practical training, work assignments, and theses requiring multi-disciplinary inputs).

At the postgraduate level, teaching and research could focus on farming systems methodologies and the application of systems theory to the solution of farmers' problems as they exist in the respective country or region concerned.

Sustainable Development: What is the Role of Institutions of Higher Education in Agricultural?

The Consultation noted FAO's definition of sustainable development. The term denotes natural resource management which *conserves land, water, and plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable*. Participants endorsed the concept of

sustainable development as a dynamic process with the objective of increasing agricultural productivity for improved human welfare and quality of life, without sacrificing much of the important socio-economic and socio-cultural values, as well as the availability and quality of unrenovable natural and other environmental resources. Maintaining such a dynamic process needs, on one hand, the development of a higher level of agricultural productivity to satisfy the requirements of the often rapidly growing population in many developing countries. On the other hand, to ensure appropriate social, economic, political, cultural, and environmental balances and stability is a challenging task which calls for contributions from institutions of higher agricultural education.

Consultation participants recognized that increased agricultural productivity has often been accomplished by resorting to expensive inputs, including the heavy use of nonrenewable fossil fuel, accompanied by subsidies. Such high-cost production technologies have led, in some countries, to serious over-production and decreasing levels of prices for agricultural produce and commodities. In many developing countries, rapid population growth has added to the problem of diminishing land carrying capacity and has led to the deterioration and erosion of soils and contamination of water. As a consequence, the general public will need to pay for the social, economic, and environmental costs of such production technologies, if no conscious efforts are made to minimize or avoid such undesirable effects. Institutions of higher learning in agriculture can play a leading role by clarifying issues and by helping set objectives for more appropriate production technologies, based both on indigenous knowledge and science-based agricultural technology.

Participants called upon the leaders in agricultural research and education programmes to develop strategies which reflect sustainable development and operational aspects in priority programmes of institutions of higher agricultural education. A holistic approach needs to be applied when integrating the concept of sustainable development into the curricula and research agenda, as it has a multi-dimensional scope related, not only to technological concerns, but also to economic, social, cultural, ecological, and public policy matters.

Institutions of higher learning, with professional and scientific credibility, can and should play leadership roles in sensitizing the public, including policy and decision-makers, agricultural practitioners, and future agricultural graduates, regarding the complex, multi-dimensional nature of sustainable agricultural development, including the social, economic, and environmental costs and implications. Policy advocacy and pragmatic problem-solving actions for developing research, teaching, and public information/education programmes that can contribute to cost-effective sustainable agricultural development programmes should be encouraged. Multi-directional communication channels between leaders of institutions of higher agricultural education and policy/decision makers, with the general public, as well as between members of academic and research communities, will need to be established to facilitate dialogue and joint action. Not only should an *early warning system* be installed, but also an *early listening system* for the benefit of policy and decision-makers.

The effects of rapid population growth were a concern to consultation participants. The consequences of large numbers of people using natural resources and social services negatively affect the prospect of achieving and maintaining agricultural sustainability in many developing countries. Unless the efforts to reduce the alarming rate of population growth are successful, additional pressure will be put on increasing production of food at all cost, in order to guarantee food security as a matter of public policy. It is, therefore, prudent to encourage institutions of higher agricultural education to incorporate population education concepts and principles into teaching curricula. Such an approach can be considered a long-term strategy, but an appropriate one. Many of the agricultural graduates, in 10-15 years, will become managers, planners, and/or policy/decision-makers who need to understand the dynamic inter-relationships between food, population, and environmental and national socio-economic development.

Too Few Women in Agricultural and Rural Development: The Implications for Higher Education in Agriculture

The Consultation concurred that farm women should be considered as farmers in their own right - in addition to their role as mothers, childbearers, and workers in the family household. Women farmers, therefore, need access to the know-how related to production goals and processes. They require training and information on respective farm practices, as well as on farming systems development, including the inherent economic and social management implications. Likewise, decision makers on gender policies and educational and rural development programmes need to be educated and informed about rural women's problems, potentials, and aspirations.

Three principal mechanisms for higher agricultural education to address issues of women in agriculture were identified:

- Training qualified staff for administrative, teaching, research, and field level activities. In this respect, the functions, specific problems and potentials of women farmers as producers and partners in agricultural and rural development need to be considered.
- When formulating agricultural curricula, it is necessary to create conceptual and analytical linkages between sociology and extension, economics, agricultural production, and population issues. These linkages would place women producers not only within the family and the farm unit, but also as economic operators in their own right within the production system.
- Development and application of methodological tools for data collection and analysis would help to address the roles and potential of women farmers as active members of the labour force. The familiarity of future extension workers, future researchers, administrators, economists, etc. with these tools would enable them to give proper attention to women-related issues.

The question of how to attract more female students for enrolment in agricultural disciplines should be linked to the issue of encouraging students from rural areas (male and female) to enter higher education. (It seems that the number of female students has increased over the past ten years and this trend should be supported and encouraged). Participants recognized that there are too few role models for young women to emulate.

An agricultural degree earned by women students should lead to the same opportunities and income-earning possibilities as men. Three principal options are offered: as teachers, researchers, extension workers, etc; in government service, workers in the private sector, and agricultural producers.

Agricultural institutions of higher learning should encourage female students from rural areas to enrol in agricultural undergraduate programmes with specific goals to become active professionals in research, teaching, and policy-making. The latter is of particular importance to ensure that women's issues, relevant to women farmers' constraints and potentials, are integrated into decision-making levels.

In some developing countries, too few young women follow the science stream through secondary school and continue with the study of agriculture in colleges or universities. There is a need for institutions to project virtues of agriculture as a profession, not only for men, but also for women students. Institutions with higher education in agriculture can help through appropriate publicity and liaison with schools, parent associations, and student groups.

Rural youth, who have grown up in an agricultural setting, make good extension workers and agricultural researchers. However, inferior educational programmes in the rural areas discriminate against them in favour of their young, urban counterparts for places in the agricultural universities and colleges. Thus, extra tutoring should be arranged for rural young men and women in preparation for entry into higher level education, including agriculture. To the extent feasible, institutions of higher agricultural education could cooperate with rural secondary schools in this effort. Consideration could be given to setting aside reserved places for sons and daughters of farmers.

Consultation participants urged that goals need to be set and more young women need to be educated so they can influence policy makers' thinking and acting in the future. To increase the interest of female candidates, new fields for training and employment opportunities need to be identified (e.g. agribusiness including marketing, food processing, environmental control). Further, the curriculum offered for the enrolment of female agricultural students could be tailored to their specific needs (e.g. in the form of a joint agriculture/home economics programme as practised at Egerton University in Kenya).

Relevance, Quality and Effectiveness of Higher Education as Part of Agricultural Knowledge Systems

Agricultural knowledge systems are based on interactive relationships which stretch from researchers to farmers who are not just passive recipients of information. Farmers should be partners in the development and utilization of agricultural information and data. Effective teaching, research and extension linkages contribute to the relevance, quality and cost effectiveness of the agricultural knowledge system.

Teaching, research, and extension/public service programmes were identified as essential components of higher agricultural education. The participants endorsed the concept that basic elements of a comprehensive institutional programme were important. The extent of implementation of the extension/public service goals and the particular activities in this area (e.g. responsibility for field extension work, pre-service, and in-service training of extension staff, production, and dissemination of extension materials) need to be adapted to specific country situations. Teaching, research, and extension complement and reinforce each other and add to the quality, relevance, and efficiency of agricultural knowledge systems. It was suggested that research be undertaken to document instances where successful implementation of these principles had taken place.

Institutions of higher learning in agriculture form part of national agricultural knowledge systems together with other educational institutions (e.g. vocational and technical agricultural schools), extension services, information agencies, and research institutes. While each of these institutes and agencies has a particular focus, some of their functions are similar and may overlap in certain areas. It is the three-fold mission of teaching, research, and extension that enables higher agricultural education to become a unique and effective two-way channel of communication between the producer, the research station, and the classroom. Knowledge development, knowledge transfer, and knowledge utilization form three components of the system.

The issue of knowledge transfer is particularly important when viewed from the perspective that two-way communication is an integral part of the process. Advisory services provided by the institutions to farmers should be designed to: take into consideration the system in which the farmer functions and, provide an opportunity for the farmer to question the advice given and discuss problem areas which have implications for additional information and/or further research.

Non-formal in-service training is another important contribution that institutions of higher education can make, not only in the local community, but at the regional and international level as well. The transfer of agricultural knowledge through special training programmes that address the learning needs of extension workers, researchers, and teachers is an effective role that institutions of higher learning can play.

The generation of knowledge and technology and the utilization of relevant information is the ultimate goal of research and extension programmes that are university-based and oriented toward increased agricultural production and rural development. The utilization of agricultural information may be measured best by the level of adoption by potential users (e.g. by farmers or processors). It is the use of knowledge that makes it valuable and a contributing factor to the development process.

Generation and transfer of information must be supported by sound policy and long-term funding commitments aimed at building lasting institutions.

Institutions of higher education in agriculture do not function effectively in isolation. There must be an interaction among academic staff and members of the agricultural community. The development of mechanisms and channels of communication which institutionalize the process of developing, transferring, and utilizing knowledge is of vital importance. The relevance, quality, and utilization of educational programmes are indicators of how effectively agricultural universities contribute to rural development. Periodic curriculum review and revision keep the knowledge-base relevant and ensure its utilization by the recipient. Feedback from the users and involving past students in curriculum review and revision offers an effective way of keeping research and teaching relevant and interesting. The link between the institutions of higher agricultural education and the farming community is weak in many countries and needs to be strengthened, with the institutions taking the initiative.

The contribution of institutions of higher learning to the relevance, quality, and cost-effectiveness of agricultural knowledge systems is mainly in the services rendered to members of the local, national, and international community. At the same time, agricultural universities, colleges, and faculties must understand their role as partners with other institutions in the system, who not only give to others but who also need to learn from others. Once this two-way relationship is ensured, institutions of higher agricultural education will be able to contribute more effectively to the functioning of agricultural knowledge systems. However, instances were cited where in-country separation and isolation of institutions prevented optimum educational, research, or extension performance. These institutions did not achieve synergy through effective linkages and cooperation (e.g. universities, technical/vocational schools, research institutes, extension centres) within the nation. FAO and other international organizations were called upon to be influential in breaking down existing barriers and helping to increase institutional cooperation.

Improving Institutional Management

The Consultation endorsed the identification of institutional *management problems*, as referred to in the discussion paper. Areas of concern, at least in some institutions, are: too little strategic planning; inadequate research coordination, monitoring and leadership; insufficient communication between institutions and respective national and/or provincial governments; inadequate procedures and monitoring of educational efficiency; lack of recognition of dedication and ability in teaching and extension; and insufficient efforts to broaden the institutions' financial base.

When discussing possible solutions to identified management shortcomings, particular attention was drawn to the following points:

Strategic planning, including the planning of institutional programmes and of resource mobilization and use) for the institution as a whole is of crucial importance. Such a planning exercise should start with a situation analysis, in which academic staff actively participate, and result in a master plan for institutional development over a four to eight year period. The agreed-upon plan should be periodically reviewed and updated.

Programme efficiency was recognized as an important management goal. Students enrolled in all institutions need to be encouraged to complete their programmes without undue delay or interruption. Identified procedural constraints (e.g. excessive time taken by external examiners to grade postgraduate students' theses) must be removed and more appropriate procedures introduced (e.g. postgraduate work could be guided and evaluated by internal staff committees). Further, specific units within the institution, for example the graduate school, the research director and/or the centre for continuing education, could be requested to monitor programme efficiency in teaching, research, and extension/public service.

Improvement in the *quality of teaching* is another urgent concern of institutional managers. While primary and secondary school teachers undergo pedagogical training before they are permitted to teach, in many countries, university staff are expected to master the techniques of teaching without formal training in relevant methodology. Furthermore, during their professional career, lecturers and professors usually receive little opportunity and incentive to attend teaching methodology courses. In order to bring about drastic improvements in teaching quality throughout the institution, academic staff must be encouraged and assisted to do a better teaching job; and those who succeed should be rewarded. An educational methods and technology centre within the institution could become the focal point for initiatives in this direction.

In order to achieve and maintain a high level of *staff dedication and work quality*, staff morale needs to be nurtured and closely monitored. Periodic reviews, at national and/or regional levels, of the factors influencing staff morale, should be undertaken and rewards given which need not only consist of monetary elements.

Many faculty members feel that there is more *prestige* attached to research work than to teaching in the classroom. The *publish or perish* philosophy is very much a reality; and faculty members are judged more favourably upon their published research results than on good teaching or extension activities.

Consultation participants considered the institutional *staff recruitment and promotion* system as an important factor influencing staff dedication and work quality. They urged that this system should be quality performance-oriented, with appropriate weight given to ability in teaching, research, and extension. To this end, monitoring and evaluation methods and procedures should be applied which ensure, in particular, the fair performance evaluation of teaching and extension activities. The experience of a few institutions, e.g. with the monitoring and award of teaching quality, could be helpful for the design and subsequent application of appropriate recruitment and promotion criteria and procedures.

Attention was drawn to the fact that there are *various levels of management* within the institution. The head of the institution is, of course, the top manager, but unless he/she can rely on the management ability at college/faculty, department, support services centre, and other levels, the system will not function effectively. Although this is often not realized by those who are in need of management training, many managers could benefit from short courses in institutional administration, programme planning and evaluation, and resource management, etc.

There is also the need for encouragement and support to individuals who are *entrepreneurs and innovators* in their chosen fields. These individuals influence institutional development; and there is a need for the provision of an institutional environment that promotes academic excellence and individual initiative. Likewise, students require support and guidance so that they may be able to live and learn in a challenging academic and *student friendly* environment.

Participants noted the difficulties which governments of many countries have experienced in recent years in providing adequate *financial resources* for agricultural universities, colleges, and faculties. The present trend seems to indicate that increasing numbers of governments are encouraging institutions to seek non-governmental resources, through contract research, contract training, and consultancy services and private giving. Tuition fees should also be considered in this context. However, tuition fees should be non-discriminatory against specific student groups such as talented students from resource-poor rural families and against foreign students from developing countries. The introduction of financial support schemes for these groups should be favourably considered.

Consultation Participants noted the *structural changes* which had recently been implemented in several institutions, as well as the on-going discussion of possible adjustments in others. They expressed the view that increased emphasis on interdisciplinary work, especially but not exclusively in research, would call for more intensive staff collaboration and programme coordination and that this development

would necessitate a higher degree of centralized decision-making. However, when planning structural changes, the following principles should be considered: as much decentralization of decision-making as possible, delegation of responsibility for resource allocation and use to the lowest administrative level feasible, and staff incentives encouraging good teaching and effective participation in inter-disciplinary research and extension activities.

As is customary with some national and international research centres, periodic *institutional reviews* at five year intervals would be most beneficial for institutions of higher agricultural education. These reviews of a diagnostic nature should be undertaken internally, followed by groups of competent consultants external to the institution. Close attention should be paid to how recommendations will be put into practice. The reviews should cover impact and efficiency of programme delivery, resource use, and related management questions, as well as short and long-term planning of the institution based on available and/or realistically expected resources. A key factor in the success of review and subsequent change is the level to which students, faculty members, and administrators are involved and committed to the process.

The Role of International Organizations and Donor Agencies in Support of Higher Education in Agriculture

Consultation participants endorsed the proposals made in the discussion paper regarding the role which FAO, other international organizations, and donor agencies should play in the long-term process of strengthening higher education in agriculture. The participants supported, in particular, FAO's important catalytic role, e.g. as a forum for policy discussion, as an advocate of specific programme concepts, as a collector and distributor of useful information, and as a supporter of experiments with agricultural curriculum structures, research, and extension approaches.

The Consultation suggested that international organizations and donor agencies continue to provide assistance in building capacities of institutions of higher education in agriculture, where such capacities are still limited, especially in some of the least developed countries. While attention to institution building assistance is being given, it should be linked to the development of related policy and institutional relationships to government departments, private sector organizations, and other educational, research, and extension institutions.

The Consultation made specific suggestions to FAO, other international organizations, and donor agencies, to assist in maximizing the utility, relevance, and cost effectiveness of existing capacities of institutions of higher education in agriculture. Among these were:

- improving institutional management through support and/or conduct of periodic reviews of faculty/university environment, mission, programme directions, and resource situations as a basis for strategic planning;
- increasing management efficiency through support of periodic, strategic planning exercises for the institution as a whole, with a view to effectively utilizing available resources not solely for raising additional funds;
- bringing about structural improvements and encouraging inter-disciplinary linkages within institutions and among related agricultural development agencies within the country of the region; and
- improving the relevance and quality of the institutions' programmes in teaching/learning, research/enquiry, and extension/public service through consultancy advice, information sharing, and workshop and project assistance.

The Consultation further requested FAO, other international organizations, and donor agencies to support the joint efforts of governments and institutions from

different countries towards bringing about improved efficiency and impact of higher agricultural education through the establishment or strengthening of:

- centres of advanced study and research (centres of excellence) in key agricultural subject areas at national and/or regional level for the purpose of training high-level specialist staff;
- twinning arrangements, with mutual benefits, for staff and student exchange and for research cooperation between well developed and developing agricultural education institutions;
- technical cooperation among developing countries (TCDC) arrangements, so that institutions of higher agricultural education of different developing countries can support and learn from each other; and
- sub-regional or regional inter-institutional bodies which spearhead policy formulation, programme planning and/or implementation for higher agricultural education, such as consortia of institutions for postgraduate education or the regional associations of higher agricultural education in Africa, Asia, and Latin America.

It was recognized that developing academic excellence is a long-term process requiring continuity of institutional effort and commitment from technical assistance agencies and donors over an extended period of time. Five years may be considered as a minimum life for institutional strengthening projects.

Higher Education in Agriculture

KEYNOTE ADDRESS

Presented by Mr. A. Cortas, Officer-in-Charge
Economic and Social Policy Department
16 December 1991, FAO, Rome

ANNEX 1

Distinguished guests, Participants, FAO Staff, Ladies and Gentlemen

It is a great pleasure for me, on behalf of the Director-General of FAO, Dr. Edouard Saouma, to welcome you to this Expert Consultation of Higher Education in Agriculture. It is a topic which is interwoven into the very fabric of the principles and goals of FAO. Confucius wrote, *If you are thinking a year ahead, sow seed. If you are thinking ten years ahead, plant a tree. If you are thinking one hundred years ahead, educate the people.* Perhaps this quotation captures the very essence of why we are here today. Without education, there can be no real advancement, no measurable improvement in the food security situation in the world. The single factor most highly associated with stable government, successful economic growth, sufficient agricultural production, industrial strength, and population growth which is under control is a country's level of education. You are gathered here this week to think ahead: to discuss policy and strategy which will help guide FAO's efforts to improve education in agriculture in the years ahead.

Human resource development includes building a technical capacity. But it also means an investment in raising educational levels, improving health and nutrition, slowing the rate of population growth, reducing poverty, and improving the quality of life. Increasingly, governments and educational institutions are going to have to justify large investments in education by demonstrating a measurable return on investment. Over the past decade, educational programmes have come under severe financial pressure during economic adjustment programmes. The long-term investments in sound educational programmes should be protected from misguided short-term economic policy which may be implemented in an attempt to deal with fiscal difficulties.

In a recent¹ issue of the *Economist*, reference was made to the four economic *tigers* of East Asia: South Korea, Taiwan, Singapore and Hong Kong. Close behind them are another four countries which are getting close to industrial take-off: Thailand, Malaysia, Indonesia and, most interestingly, China. The question is, *If countries have access to more or less the same technology and the same resources, and they all operate in essentially free-market systems (or as in the case of China, special economic zones) competing on a level playing field, what makes some more successful than others?* The *Economist* article goes on to say that the single biggest source of comparative advantage in these countries is their well educated workers. The average Taiwanese is twice as likely to go to university as his or her British peer. Today, a Korean teenager is more likely to go to a university than his Japanese counter-part. One in every four candidates for doctorates in electrical engineering at American universities is from Taiwan. This is not to say that education is the only important factor in development; but it is well documented that investment in appropriate education pays big dividends.

The problems and challenges of agriculture and rural development in the future will be varied and complex. If the institutions which deal with higher education in agriculture are to live up to expectations, forward-looking policies must be developed. This is not a time for lavish budgets. It is a time for fiscal efficiencies and strategies that will help educational institutions get the most out of a shrinking resource base.

As a technical organization, FAO also has limited financial and human resources. We often depend upon consultations such as this one to provide advice based on situations and concerns as they exist in many parts of the world. You have been invited here in your personal capacity as experts in the field of education as it is related to the many facets of the agricultural sector. It is in this capacity that we ask you to explore the issues, discuss the options, identify priorities, and help with the

¹ 16 November 1991

development of strategies which will make the most efficient use of the resources available for education in agriculture.

Agricultural universities, colleges or faculties of agriculture in many developing countries face a number of problems which include, among others, poorly qualified staff, inadequate teaching and research facilities, inappropriate curricula and teaching materials and limited capacity to carry out long-term strategic research. There are limited opportunities for student and faculty exchange programmes. Due to a variety of reasons which range from mismanagement to austerity programmes which are in effect in many developing countries, several educational institutions have physical facilities which are in a state of disrepair and equipment that is antiquated and/or non-functional. In short, the highest government priorities do not always include education. Until planners are presented with irrefutable evidence which demonstrates the value of higher education in agriculture, we cannot expect increased support for already tight budgets. Credibility is called for at all levels. The institutions' teaching programmes will have to demonstrate their worth. In 1984, the FAO assessment of trained agricultural manpower and agricultural education institutions in Africa concluded that there must be a progressive shift of emphasis away from increased numbers of trained personnel toward a substantial improvement in the quality of training. Until the credibility of educational and research programmes is firmly established, financial support will continue to be eroded and educational programmes will stagnate.

Later this morning, Mr. Hoffmann will be presenting the main discussion paper. The paper has been prepared based on input from several sources including 20 case studies from institutions of higher learning where agriculture is a main discipline area and three regional round-table discussions on education in agriculture which have been held over the last year or so. No paper can be exhaustive in the exploration of the factors related to university level education in agriculture. The characteristics, quality and impact of first degree and post-graduate programmes vary and more often than not are generally based on country needs which vary in scope and depth. What is clear is that there are no institutions without problems. Financial constraints appear to be universal and they have an effect on all six issues which have been identified for in-depth discussion.

Other global trends cannot be ignored. Rapid population growth continues to be problematic. Land use and sustainable agricultural production are at the forefront of international concern. The recent Den Bosch declaration² states that by the year 2025, the world will have to feed an additional 3.2 billion people from a resource base which is already seriously threatened by unsustainable farming practices and other environmental pressures. There is increasing recognition that farmers must have access to good information and a fair return on their labour and investment if there is to be any chance of eliminating cultural practices that contribute to the degradation of crop land and the increased use of marginal soils. The role of institutions of higher learning in promoting sustainable agriculture and rural development needs to be explored and defined.

There has been a proliferation of university level education in some countries to the point where graduates are unable to find employment. In some cases, governments are no longer in a position to absorb the continuing over supply of new graduates. These graduates are often not appropriately prepared to be competitive in the private sector job market. In other cases, it's a matter of over supply of students in specific disciplines. There may be valid arguments that there is no need for a balance between educational programmes and employment opportunities; that higher education is good for all. As food for thought, I would submit that in a technical area such as agriculture, careful consideration must be given to maintaining a balance of employment opportunities and educational programmes which are periodically reviewed and revised according to need.

² From the FAO/Netherlands Conference on Agriculture and the Environment ('s-Hertogenbosch, The Netherlands, 15-19 April 1991)

Post-graduate education is needed, but in relatively small numbers with an emphasis placed on quality and limited numbers based on demand. Post-graduate programmes should be located in places where comparative advantages exist. The concept of post-graduate centres of excellence is one which deserves our full attention and debate. It is difficult to justify the high cost of post-graduate education in all specialized subjects in every institution of higher education in agriculture when funding is in short supply and employment opportunities are limited. The consolidation of resources would seem to be more prudent than to spread what little wealth we have over too many locations. Regional and sub-regional post-graduate centres could serve several countries where only a few carefully selected students are needed in specific discipline areas. At the same time creditable research could be carried out with sufficient support to provide incentives for both staff and students.

In the less developed countries of the world, rural young women between the ages of 15 and 25 find themselves in the unenviable position of having the least opportunity for a meaningful education and the greatest possibility that they will assume the responsibilities of parenthood and perhaps earning a living before they are physically and psychologically prepared for the tasks which lie ahead. Limited family income sometimes forces parents to make difficult choices concerning the education of their children. In many instances where culture and tradition demand that priority be given to the education of male children, girls are forced to dropout of school at an early age.

The argument here is not one aimed at diminishing the importance of the traditional role of women as mothers and key members within the family structure. It is simply to address some of the issues related to inadequate and unequal opportunities for rural young women. Rural young women may be described as a group whose turn is always last in places where they are left with the least. It should be no surprise to see that there are only a few women from the developing countries engaged in agricultural research or extension work. There are too few role models for young women to follow and even fewer opportunities for educational pursuits that require long years of study and expense. Addressing these issues will not be easy, but there is affirmative action which can be taken. Talented young women can be identified and institutional admission policies can be modified to encourage the enrolment of more female students. FAO will continue to see that gender analysis is applied in project formulation and design and that institutions are encouraged to find ways to enrol more young women in programmes of higher education.

Rural youth, male and female, are at a disadvantage when compared to their better educated urban counterparts. Post-secondary places in agricultural institutions could be set aside for the sons and daughters of farmers. It is in these young people that the future of agriculture lies. These rural young people are no less clever than their urban counterparts, but they are victims of educational systems that favour the cities and discriminate against the rural areas. When places in programmes of higher education are awarded based solely on examination scores, the rural schools with fewer qualified teachers and poorer facilities produce fewer students who are deemed ready for advanced study. Affirmative action programmes designed to provide places for rural students would help in recruiting agriculture students who aren't afraid to get their hands dirty in the soil that feeds all of us. These young men and women from farm backgrounds deserve a chance to be our extension workers, our researchers and our teachers who understand farming and are willing to work to help producers in their struggle to feed an expanding population of consumers. There is a continuing need for education that is based on practical experience with farm work and an understanding of rural life.

The future concerns all of us and the task at hand is to ensure that programmes of higher education in agriculture focus on critical issues related to sustainable agricultural production and rural development. Some of the priorities include:

1. Improving the quality of the teaching/learning process and producing students who understand the broad spectrum of problems which face rural people in the agriculturally based economies of most developing countries;

The implications are challenging. Universities and intermediate level institutions will have to forge well-defined working relationships with their local communities. Students must become more involved in problem solving approaches and the rural development process. It means curriculum revision and the creation of competency based educational programmes where students develop the skills, knowledge and attitudes needed in work related to agricultural production, research, and extension. It means equal opportunities for the young men and women who come from the fields of the rural areas and the streets of the urban centres.

2. Developing viable research programmes which address the needs of the rural people;

Institutions of higher learning in agriculture should consider research as an essential part of their overall programmes. Faculty members and students should become more involved in applied research that is community based and need specific. Consideration should be given to research priorities which include the application of new technology to education and agricultural production. More research is needed in determining ways to improve levels of food security and to reduce the high incidence of post harvest food losses. The effectiveness of non-formal education through extension programmes, problem solving techniques and more practical approaches to education in agriculture need to be systematically evaluated. Ways to increase the enrolment of young women who are studying agriculture need to be explored. These activities have long-term implications and will require sustained commitment on the part of governments and institutional administrators.

3. Strengthening outreach programmes;

Extension activities and community services will need to be expanded in order to maintain local support for programmes of higher education in agriculture. Field days and on-farm activities which involve local farmers need to be regular events and they need to be jointly planned by members of the community and institutional staff members.

4. Increased collaboration and cooperation among institutions of higher learning, research institutions and extension services;

Twinning and sister relationships between institutions would stimulate academic excellence and provide opportunities for student and staff exchange and joint research programmes. The opportunities to develop such programmes are limited only by our imagination and enthusiasm.

5. Better management and increased efficiencies in the operational aspects of educational institutions.

I am sure that there will be considerable discussion on the various aspects of institutional management and the financial implications of trying to bring better services to your clientele along with improved working conditions for faculty and staff members. The challenge is to broaden, to the extent possible, the institutional resource base, especially the financial one, and to put to use the available resources most efficiently. Your challenge this week is to use this short period of time to develop suggestions aimed at improving education in agriculture and to enhance the impact of institutions of higher education in agriculture throughout the world.

FAO looks to you as experts in the field of higher education in agriculture to discuss and analyse the situation, to focus on the development of viable strategy options for higher education and to suggest courses of action that will benefit sustainable programmes in agricultural production and rural development.

Higher Education in Agriculture: Status, Issues, and Options for Future Development

An FAO Paper presented by Dr. H.K.F. Hoffmann
formerly FAO's Senior Officer
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ANNEX 2

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EXECUTIVE SUMMARY

Introduction Current Status of Higher Education in Agriculture Issues and Options for the Future

Higher agricultural education contributes significantly to agricultural and rural development in all countries. While in the eighties most industrialized countries had a sufficiently large institutional base for offering higher education programmes, many of the developing countries encountered grave economic problems, which in turn hampered or even paralyzed teaching, research, and outreach programmes. At the same time the need arose to focus on sustainable agriculture, environmental protection, food security, renewable energy sources, the population explosion, and necessary technological advancement.

FAO has taken a fresh look at higher agricultural education: issues under discussion by governments and institutions, options for programme design and institutional management, and the role of international organizations and donor agencies in its future development.

The results of case studies of 20 agricultural universities, faculties/colleges, and other institutions throughout the world have been compiled. Data on the status of institutional programmes, resources, management, constraints, and plans for programme changes are reviewed and summarized in this document.

Current Status of Higher Education in Agriculture

Government Policy and Institutional Development Functions

Manpower development in developing countries is frequently assigned to institutions of higher agricultural education. Government collaboration with institutions is frequently inadequate. Programme goals, structures and contents may not be jointly agreed upon and government supervision and/or financing may not be adequate.

All institutions included in FAO's case study programme identified research as being an essential function within their domain. However, institutional input in formulating national research policy and the execution of priority research activities is seldomly ensured.

In most countries, agricultural extension is the responsibility of sectoral ministries (e.g. agriculture, livestock, etc.). With the exception of the U.S.A., university extension programmes are limited.

Institutional Programmes

In smaller, resource-poor countries, teaching programmes offered by institutions of higher agricultural education commonly last four years and are of a general nature. Practical training is a shortcoming. More advanced institutions may offer specialized undergraduate and/or postgraduate degree programmes designed to last two years. These programmes frequently have high drop-out rates and students may take excessive time to complete their studies.

Research programmes not linked to postgraduate study are often limited by inadequate funding, support staff and physical facilities. Extension and public service activities suffer from lack of commitment on the part of institutional administrators and professors.

All but one of the FAO case study institutions accept foreign students. Cooperation across borders includes information exchange, project support for institution-building purposes, and, to a lesser extent, staff exchange and research collaboration. Lack and uncertainty of sufficient financial support over medium-term time spans have been main obstacles to the implementation of inter-institutional linkages.

Most case institutions offer health service, housing and catering, financial assistance and recreational facilities. In developing countries, the most significant short-coming is financial support due to government austerity measures; in developed countries, it is student housing due to a shortage of facilities and high cost.

Institutional Resources

Most of FAO's case institutions have benefited from vigorous staff development programmes. Institutional goals and objectives which often emphasize education-research-extension as equal level functions may not be practiced, however. Many institutions complain about the shortage of qualified support staff (technical as well as clerical) and suggest career development schemes in order to ensure work quality and staff stability.

Size and quality of physical facilities are in many instances inadequate, mainly due to insufficient funds and poor management. Most institutions, depending almost exclusively on government resources, may have to adjust to government budgetary and accounting procedures which do not fit their research and agricultural production activities.

The need to ensure adequate practical training must be addressed to balance increased urbanization of the student population which brings little practical experience to their agricultural studies. In accordance with women's roles in agriculture, increased female enrolment must be encouraged.

Institutional Organization and Management

Most case institutions belong to one of three groups: agricultural universities with a large range of agricultural and related programmes, including basic sciences and socio/economics; institutions based on the French educational system, narrowly focused on agriculture; and faculties/colleges of agriculture, narrowly focused on agriculture but with access to other faculties within the same institution. Due to their integration in comprehensive universities, agricultural faculties/colleges are usually further removed from sectoral ministries' support and cooperation.

Effective student participation in institutional decision-making is reported lacking in most institutions. A very few institutions reported excessive student participation.

The department is the base unit in most institutions; and the internal decision-making process starts there and passes through the faculty/college level to the Senate and University Council. Several of the case institutions have recently reorganized their internal structure by combining related departments in *clusters* or *divisions*, streamlining administrative procedures and obtaining greater staff efficiency and cooperation.

Research coordination, monitoring and leadership is an area of preoccupation in many institutions. Since interdisciplinary research is increasing, adequate machinery for research and extension coordination is necessary. Personal commitment of institutional administrators, professors and students to relevant research and extension/public service is even more important.

In many institutions, urgent management action is required in strategic and financial planning along with monitoring of educational practices.

Issues and Options for the Future

Issues Confronting Institutions of Higher Agricultural Education

Six specific issues of broad interest to institutions of higher agricultural education are suggested for consideration:

1. How should institutions react to new developments in world agriculture: changing production and processing patterns, growing international trade, marketing competition, etc.; in science and technology: molecular biology, information technology, computerization, etc.; in population and society: population explosion, different life styles, value systems, etc.?
2. Should there be different institutional goals in developing and developed countries, considering the need for local relevance of teaching, research and extension/public service programmes, and the danger of widening technological gaps between developing and developed countries?
3. From narrow production orientations to farming systems development (FSD), what does the emphasis on FSD require in terms of curriculum change, subject coordination, research orientation and practical training?
4. To what extent and how should institutions of higher agricultural education deal with sustainable development, considering its extreme importance and the need for promoting the concept through teaching, research and extension/public service?
5. What can be done in order to increase the number of female agricultural students and reflect the specific concerns of women farmers in the institutions' teaching, research and extension/public service programmes?
6. How can the institutions' contribution to the relevance, quality and cost-effectiveness of agricultural knowledge systems be maximized through sharing of responsibility for certain educational, research and extension activities and/or through effective collaboration with other development services operating in rural areas?

Ideas for the Design of Improved Institutional Programmes

Two trends compete with each other in the design of agricultural teaching programmes at undergraduate level: subject specialization and a system approach. With regard to the latter, more experimentation is suggested. The same applies to the handling of sustainable development topics within general agriculture curricula

and/or in separate teaching programmes. Management skills, including the use of suitable technology, and appropriate teaching/extension/information techniques are bound to receive more emphasis in future agricultural undergraduate curricula. Postgraduate programmes will likely receive a further boost in terms of student numbers and subject specializations focusing on natural resource management, biotechnology and other subjects.

These same subjects will be emphasized in the institutions' research programmes. However, effective participation of educational institutions in decision-making on research priorities and in the actual execution of the national agricultural research programme is of more fundamental importance. With respect to extension/public service, institutional commitment and initiative towards cooperation with farmers' groups and extension personnel are indispensable. In order to have enthusiastic staff participation, full recognition of extension activities alongside research and teaching for staff promotion and a small working fund to cover transport and other essential expenses are prerequisites.

More Efficient Institutional Management

The basic requirement for good institutional management is a five to fifteen year strategic master plan for the institution as a whole, including programme changes, infrastructure requirements and resource needs, etc. In view of the continuous and steady increase in multi-disciplinary work, especially in research, larger units than the traditional academic base unit (departments) have to assume increasing, essential integrative functions. This would entail more upper-level decision-making, possibly with less effective staff and student participation. Such approaches could run counter to more decentralization. To promote management with effective staff and student participation, several options for structural change are suggested which assign the responsibility for resource allocation to the lowest feasible administrative level.

Effective institutional management requires functional in-country linkages with policy makers, government departments, main employers, other educational and research institutions, extension services and rural communities. Such linkages must result, for example, in feedback on training requirements, in joint action at field level, or in joint use of scarce resources. Linkages across borders, e.g. through information exchange between institutions or through staff and student exchange, should also be promoted.

Regarding financial management, two goals need to be pursued: reduced institutional dependency on government financing, and increased financial self-management. Marketing of services in the form of contract training and contract research through laboratory and library services, farming operations, and consultancy work should take place. Consideration should also be given to obtaining extra resources from tuition fees and donations. Increased financial self-management could be fostered by loosening of rigid budgeting and accounting procedures imposed by government rules, allocating lump-sum government subventions and authorizing institutions to draw up and follow budgets by programme, without government interference. Institutions should develop respective models of autonomy and accountability for eventual government approval and implementation on a trial basis.

The Role Of International Organizations and Donor Agencies in Support of Higher Agricultural Education

International organizations spearheaded by FAO and donor agencies will be called upon to step up their support to higher agricultural education. As a leading agency for rural development within the UN system with technical responsibility for food and agriculture, FAO considers higher agricultural education of paramount importance. A main task will be to continue to provide a forum for the discussion of agricultural education policies and programmes. Advocacy and promotion of specific programme concepts will be another.

FAO will continue to place an emphasis on the collection and distribution of useful information, the development of new curricula and different institutional structures, and alternative approaches to institutional management.

FAO will encourage and support experiments with agricultural curriculum structures (e.g. testing of the systems approach to agricultural undergraduate curricula). International support for viable approaches to institutional research planning and the implementation and design of appropriate extension activities may increase. FAO project assistance will increasingly concentrate on short-term policy and programme advice.

International organizations like UNESCO, World Bank, and others will be invited to participate in the discussion of development trends, issues and options and join forces with FAO in the support of higher agricultural education. Donor agencies, such as bilateral aid organizations, foundations, and voluntary organizations, will also be called upon to assist through fellowship training and infrastructure provisions.

A common goal of all external assistance should be the establishment of lasting institutional partnerships to promote staff exchanges, student exchanges and research cooperation. Developing country institutions, in particular, can benefit immensely from linkages with outstanding educational and research institutions in neighbouring countries and other regions. International organizations and donor agencies alike should help to facilitate these linkages through the provision of technical advice and/or finances and to support higher agricultural education in general throughout the world.

2

INTRODUCTION

1. Human resource development is one of the key factors for the success of sustainable agricultural production and rural development. With enlightened policy makers, knowledgeable farmers, trained extension workers, outstanding researchers, and first-class agricultural administrators, programme managers and support staff, much can be achieved, especially if land, water, production inputs, and finances are available. Agricultural education and training must, therefore, be an integral part of all agricultural and rural development efforts, spearheaded by institutions and staff of higher agricultural education.
2. Institutions with higher education in agriculture prepare the decision-makers who will influence future planning and policy. A broad range of institutional responsibilities, including their formal education functions, are addressed in this paper.
3. Higher education in agriculture is a vital part of national systems of education offering university degrees encompassing three to five years of study after successful completion of ten to thirteen years of primary and secondary education.
4. In the context of this paper, *agriculture* includes all subject areas which constitute or are related to agricultural production/processing/consumption. Of equal concern are the interactions and impacts of agriculturally-oriented endeavours and rural life, and their broad economic, social and environmental consequences. Subjects such as plant production, agricultural engineering, veterinary science, forestry, fisheries, food technology, farming systems development, environmental protection, rural home economics, rural sociology, extension, and related organizational and management questions all fall within this broad definition.
5. Training for improved farming practices has a tradition of more than 2000 years. Higher agricultural education dates back more than 100 years in some European and North American countries. Before World War II, these few institutions were concentrated in the more developed countries. Following the independence of most Third World countries in the sixties and seventies, many national universities or institutions of similar standing were created, including agricultural universities, colleges and faculties.
6. In the eighties, most countries had sufficiently large institutional bases for higher agricultural education. In many developing countries, however, economic stringencies, the shortage of trained national staff, and inadequate physical facilities and finances, posed severe problems. These hampered the rapid development of appropriate teaching programmes at both undergraduate and postgraduate levels; they curtailed or even paralyzed many research activities and made sizable and effective outreach programmes almost impossible.
7. At the same time, the need arose to address scenarios to accommodate higher agricultural education in the future: sustainable agriculture and food security,

environmental protection and the development of renewable energy sources, overpopulation, and technological advancement and its application.

8. Immediate concerns and future directions confronting institutions motivated FAO to examine the *status quo*, issues, and options confronting further advancement of higher agricultural education.

9. FAO commissioned a series of case studies from 20 top level institutions having higher agricultural education. While not representative of the average higher agricultural education institutions in the world, their policies, programmes and management decisions indicate trends and alternative choices which newer or less advanced institutions may wish to consider. The case institutions were located in Africa (4), Asia (4), Europe (5), Latin America (3), North America (2), and the Near East (2). They include seven agricultural universities, one college of agriculture which forms part of an agricultural university, eight faculties of agriculture belonging to comprehensive universities, two institutes of higher agricultural education (French-based systems), one post-graduate training institution, and one combined teaching and research institution (Agropolis, France). The list of case institutions is given in Appendix 1.

10. The case studies, conducted between 1988 and 1990 by individuals or review teams contracted by FAO, reported on the status and future plans of institutional and programme development. Most case reports, as prescribed by FAO, included the following information:

- government and institutional policies on teaching, research and outreach programmes;
- staff, student, physical facilities, and financial resources;
- institutional structures, management and linkages in-country and across borders;
- current strengths, weaknesses, and contemplated future strategies; and
- supporting statistical material.

11. In addition to the case studies mentioned, FAO was able to draw on its own experience with policy formulation and institution-building for higher agricultural education from numerous technical assistance projects in more than 80 countries and conferences and consultations at global, regional and national levels. Materials and literature from other international agencies, national governments and institutions were also consulted.

12. This document was prepared to serve as the main discussion paper for the FAO Expert Consultation on Strategy Options for Higher Education in Agriculture, held in December 1991. It is structured in two parts: factual information and a preliminary analysis of the reported status of higher agricultural education, and proposed issues and ideas for consideration by the Expert Consultation. Where feasible, reference to case institutions and/or other information sources has been made.

CURRENT STATUS OF HIGHER EDUCATION IN AGRICULTURE

Government Policy and Institutional Development Functions

Institutional Programmes of Teaching, Research, Extension/Public
Service, International Development, and Student Services

Physical Facilities and Finances

Institutional Organization and Management

Government Policy and Institutional Development Functions

13. The framework in which higher agricultural education operates is set by national policy makers. Layed down in laws or charters, policies for higher agricultural education determine goals, scope, structure and financing of agricultural universities, faculties and colleges. Such policies also define the type of institutional governance, broad criteria for design of teaching, research and extension/public service programmes as appropriate, and the institutions' relationship to government ministries, departments, and other educational and research institutions in-country and abroad.

14. Policies for higher agricultural education have essentially a national focus. The number, type and distribution of institutions and programmes vary from country to country, depending on the status of socio-economic development, the importance of agriculture within the national economy, the advancement of human resource development, and policies on resource allocations for educational institutions. Policies regarding public employment of agricultural graduates also plays an important role.

15. In most countries, higher agricultural education operates within a fairly stable policy framework. In Eastern Europe, however, the policy framework for higher agricultural education is currently undergoing dramatic changes. Although the situation in late 1991 is still in a state of flux, it appears that some Eastern European countries intend to formulate and implement policies which are oriented towards western models and the integration of higher agricultural education within a new European region comprising all countries on the continent.

16. In many countries, particularly in the Third World, governments assign specific tasks to institutions of higher agricultural education. The main task is the training of upper-level professional agricultural personnel to serve national agricultural and rural

development. Other responsibilities may include research roles, extension/public service functions, policy advance and related development activities.

Agricultural Manpower Development

17. In Malaysia and Thailand, the governments provide projections for required agricultural manpower which may serve as yardsticks for training institutions. In Morocco, such estimations are made by a government-instituted committee on which public and private employers and the most important training institutions are represented. Such projections remain valid and useful, provided they reflect effective manpower demand and economic changes at national or international levels.

18. In Peru, the government is less specific in terms of numbers to be trained, requiring institutions of higher agricultural education *to contribute towards human resources development* without indicating exact purposes, subject specializations or numbers. Yet they count on the training institutions to help identify manpower requirements and corresponding training needs. In Nigeria and Brazil, there is an absence of planning and feedback mechanisms involving government authorities and/or main employers regarding manpower demand projections and the monitoring of training quality. Lack of communication between governments, main employers, and training institutions is, unfortunately, a widespread phenomenon even where suitable mechanisms exist. In a few instances, government recommendations concerning student numbers are largely ignored.

19. Mission statements supplied by institutions of higher agricultural education from developing countries refer invariably to the specific tasks to be performed in order to contribute to economic and social development within the home country. The training of high-level agricultural manpower, in many instances seen as the dominant objective, results in graduates with a first degree or postgraduate qualifications in specialized agriculture or a related field. The case institution in Malaysia advocates *graduates who are not only technically competent, but also intellectually and culturally developed and capable of assuming roles of leadership in an increasingly complex society*. The goal of leadership training is echoed by several other institutions of higher agricultural education. The surveyed Mexican institution, produces Masters and Ph.D. holders who can staff national and regional research and training institutions.

20. Younger institutions in Cameroon and Malawi concentrate on viable undergraduate programmes. The longer established institutions in Egypt, Kenya, Nigeria, and Philippines place at least equal emphasis on postgraduate work. Some regard themselves as being the prime national institutions responsible for supplying their nations with top-class agriculturalists, although other institutions of higher agricultural education in the country could claim to do the same.

21. Some case institutions offer lower-level teaching programmes which are not usually the responsibility of university-level institutions. Cameroon, Malawi, Malaysia, and Sweden offer formal teaching programmes up to four different academic levels.

22. Although not specifically mentioned in all cases, institutions of higher agricultural education contribute to the conservation, improvement and spread of scientific, technological, humanistic and artistic knowledge and culture related to human resource development. Service to society, especially the rural population, is an ethical and social obligation. The Peruvian case report is particularly dedicated to broad educational/humanistic/social institutional objectives, as are many others.

23. In most developed countries, manpower projections do not play an important role. Government directions with respect to the training activities of institutions of higher agricultural education are often rather general. The Canadian case institute integrates teaching, research and specific services within to educate society towards change and critical, analytical and moral thinking. The institution in Germany prepares students for occupations which require the application of scientific methods,

including various agricultural fields. In the Netherlands, efforts to obtain more detailed information on training needs and job opportunities for agricultural graduates have been undertaken. Nationwide surveys of agricultural graduates in service and on anticipated demand have been conducted by the central government. Surveys of Wageningen Agricultural University's graduates about popularity of study programmes, training requirements of specific jobs, employment status, etc. are conducted jointly by the University and the Society of Agricultural Alumni. The results of these enquiries provide an excellent basis for the planning or adjustment of teaching programmes on short- and long-term bases.

Governments' Influence on Individual Institutions

24. The extent and type of influence which governments exert on institutions of higher agricultural education depends on the institutions' relationship with particular ministries or departments. Affiliated with or guided by Ministries of Agriculture or other sectoral ministries (China, India), institutions may be encouraged to train suitable staff for agricultural and rural development more readily than in instances where direct linkages do not exist. This may be of a greater concern to agricultural universities, many of which are affiliated with Ministries of Agriculture or Rural Development (exceptions are the case institutions in Germany, Malaysia and the Netherlands) and most university-level agricultural training institutions of French origin, such as the case institution in Morocco.

25. With regard to government influence on faculties or colleges of agriculture which are affiliated with comprehensive universities, the situation is usually totally different. There is no direct link of the Faculty or College of Agriculture with any government ministry or department. Government ministries or departments of education and culture, or higher education/university affairs give policy directives of a general educational nature to the respective universities. Some of these universities decide the orientation of their agricultural teaching programmes by themselves. Others remain sensitive to the wishes of government regarding undergraduate or postgraduate training even in the absence of a formal link to the respective line ministry.

26. FAO's case studies indicate regional differences: the loosest links between governments and institutions of higher agricultural education are found in some countries of Europe and Latin America. In many countries, institutional autonomy is guarded and the participation of government representatives in programme design or evaluation is the exception rather than the rule.

Responsibilities for Agricultural Research

27. In many countries, governments assign important research roles to mature institutions of higher education. In Sweden, the national University of Agricultural Sciences conducts 75-80 percent of all research in the fields of agriculture, forestry and veterinary medicine. The College of Agriculture of the University of the Philippines at Los Banos is responsible for a sizeable portion of agricultural research. The case institution in Mexico, because of its special responsibility for postgraduate-level education in agriculture and its large corps of highly qualified staff, has a larger research role than most of the other institutions included in FAO's case studies. Young institutions especially (Cameroon and Malawi) need to demonstrate that they are capable of assuming important research roles. A very special case is Agropolis in southern France, which draws upon four universities, six specialized institutions of higher education (*Grandes Ecoles*), six regional French research institutes and one international centre. A few years ago Agropolis was specifically created by the French Government to combine and strengthen the capacity for research and education in agriculture and related fields with a focus on Mediterranean and tropical agriculture.

28. In most countries, the primary responsibility for the planning and execution of agricultural research is assigned to national or provincial/state agricultural research institutions. With the exception of a few private research institutes, these agricultural

research institutions operate under the direct control of government, often under ministries of agriculture, natural resources, rural development, or provincial/state bodies. The participation of institutions of higher agricultural education in the national research effort has to be decided, in most instances, in consultation with the national or provincial/state bodies primarily responsible for agricultural research. Unfortunately, in many countries where FAO's case institutions are located, a feasible *modus operandi* for the effective involvement of agricultural universities, faculties and colleges is non-existent. This has created problems which are detrimental to the educational institutions' effective research participation.

29. All institutions included in FAO's case study programme subscribe to their responsibilities to push forward agricultural knowledge and technology and see to it that new discoveries and methodologies are applied in the interest of national development. In some instances, institutions seek to emphasize selected research priorities (Kenya: dryland agriculture; Morocco: livestock development; France: agriculture in the Mediterranean and Sahel regions). In others the entire range of subjects covered by the teaching activities is addressed.

Responsibilities for Extension/Public Service ¹

30. In the USA, the major responsibility for agricultural extension lies mainly in the hands of colleges of agriculture in the state universities. In most other countries the responsibility for field extension work is assigned to ministries of agriculture/rural development (i.e. to line agencies with representation at state/provincial, district and village levels). In these countries, most of the institutions of higher agricultural education have a relatively minor role to play and some have no mandate for conducting agricultural extension work (Netherlands, Germany).

31. However, institutions of higher agricultural education are not restricted to undertaking only teaching and research. Because of their responsibilities towards rural communities and society at large, most participate in outreach programmes solicited or welcomed by governments. Some institutions aim to help in the dissemination of modern, scientifically-proven agricultural practices to farming communities, thereby strengthening the economic status of the agricultural sector and improving the quality of life of rural people. Such extension-type activities are seen as a means to bring the farmers' problems to the attention of the institution (Kenya, Malaysia). Some institutions cooperate by offering special non-degree programmes (Cameroon, Malawi, Morocco, Philippines), training sessions for serving extension field staff (Kenya), farmer training centres (India) or extension-type projects, rural newspapers or broadcasting services (Philippines).

32. An area of particular concern for some institutions in developing countries is the policy formulation process for agricultural and rural development (Mexico, Philippines). Through special scientific studies and through the participation of senior staff in national policy-making bodies, some institutions succeed in contributing in a decisive manner.

33. Service to society is an important goal for educational institutions in developed countries. The case institution in the USA aims to *provide public service activities and programmes which extend to the citizens of this State the most timely and relevant information concerning agriculture, forestry, family resources and rural development*. While, in many developed countries, farmed areas and agricultural populations are steadily declining, the case institution in Canada has identified a new target group for public service: *the recreational, hobby farmer, rural resident individual*.

¹ Extension/Public Service concerns agriculturally-related activities of higher education institutions, which are not linked to formal teaching programmes: in-service training of extension staff, responsibility for field extension work, preparation of training materials, and policy advice to public agencies and/or to private entities. Laboratory and library service functions may be included in the institutions' extension/public service responsibilities.

34. FAO's case studies and other sources indicate that most institutions of higher agricultural education perform some development activities in addition to teaching and doing research. Decisive steps for institutions to become true "development institutions" in favour of the rural poor must still be undertaken.

Institutional Focus and Linkages

35. Many of the case institutions have a national focus, as they are the only agricultural university or college in the country (Cameroon, Malawi, Malaysia, Morocco, Netherlands, Sweden). Others have distinct provincial/state responsibilities which are reflected in their programmes of teaching, research and public service as well as their governance and financing (Brazil, Canada, India, Thailand, USA). The institution in Agropolis, France, has no specific administrative boundaries and any country in the Mediterranean or Sahel region may benefit.

36. For utmost impact and efficiency, some governments encourage linkages and cooperation between national institutions and institutions of higher education in agriculture. For example, formal agreements on research and/or extension education with national or state governments have been concluded for that purpose in India, coordination machinery established in Malawi, and joint or cross-appointments made in several other countries. Participation of senior staff of institutions of higher agricultural education in policy bodies is common practice in most countries. In larger countries (Brazil, India, Mexico, Philippines), national associations of higher agricultural education institutions provide important fora for policy discussions. In Canada, the provincial Ministry of Agriculture and Food shares a government-owned research station with the case institution, while the provincial headquarters building is under construction next to the university campus. In order to draw maximum benefit from the physical proximity of agricultural research and educational institutions, the Government of the Netherlands recently reversed its previous decentralization policy in favour of concentrating such institutions around Wageningen Agricultural University.

37. In the same spirit, governments and institutions are encouraging regional cooperation (AFAA, AAACU or ALEAS, NATURA;² and between Wageningen Agricultural University, Netherlands, and University of Guelph, Canada). Collaboration among institutions in developing and developed countries in government-supported programmes to encourage institution-building in the respective Third World country is common. All institutions included in FAO's case study programme have participated in such activities, as receivers, providers, or both.

Institutional Programmes of Teaching, Research, Extension/Public Service, International Development, and Student Services

38. The most important area for institutions of higher agricultural education is a viable teaching programme at the undergraduate and postgraduate levels.

Undergraduate Programmes: Objectives

39. With rare exceptions (Mexico), the core programme is the undergraduate teaching programme. In most countries, undergraduate programmes in agriculture prepare young men and women for service in agricultural and rural development to benefit society at large. They are not a preparation for individual entrepreneurial farming.

² AFAA, the Association of Faculties of Agriculture in Africa; AAACU is the Asian Association of Agricultural Colleges and Universities; ALEAS, the Asociacion Latinoamericana de Educacion Agricola Superior; and NATURA, the European Network for University Cooperation in Tropical Agriculture.

40. In most developing countries, the majority of agricultural first degree holders have in the past been employed by governmental departments and other public or parastatal bodies. The most important single employer has often been the national or state agricultural extension service, assigning agricultural graduates as extension leaders in charge of provinces, districts or village groups and, to a lesser extent, subject matter specialists. Employment in fields like research and experimentation, marketing and credit supervision, development of cooperatives and other farmers' organizations has also been common. In view of severe economic stringencies confronting many governments, first degree graduates have found it increasingly difficult to secure public service jobs for which they were trained, within a year following graduation (Egypt, India, Malaysia, Peru).

41. So far, job opportunities for agricultural graduates in the private sector (processing of agricultural products, input supplies, agribusiness management, etc.) have not been widespread in developing countries. Some institutions of higher agricultural education have begun to pay greater attention to likely manpower needs, but so far, results of these efforts have been sporadic and limited.

42. In contrast, public employment in agricultural extension, research, teaching and administration in many developed countries has not exceeded 50-60% of the agricultural graduates. The Dutch case institution reports the following statistics for 1988: public employment (50% of agricultural graduates), private sector (43%) and work abroad (9%).

Programme Structures

43. In the majority of countries and institutions, first degree undergraduate programmes in agriculture are of four years duration. In the United Kingdom, such programmes are only three years, in many Latin American countries, Italy, and Sweden programmes are five years. Recent adjustments to the four-year formula were made in Kenya and Nigeria (from three to four years), and in Cameroon and Mexico (from five to four years). Increases came about as welcome changes in the national system of education or were justified by drastically improved opportunities for field practicals and subject specialization; decreases by the rationalization of programmes.

44. Most undergraduate programmes in agriculture require the completion of 12 years of general education (or a combination of general and vocational education) as an entry level requirement. In most countries, primary education starts at age six. Students may, thus, come out of their *alma mater* by age 22.

45. In a few countries, students may complete their undergraduate studies at an earlier age. In the Philippines, enrolment in universities requires only ten years of schooling beforehand making a total of 14 years of education which may be completed by the age of 20. In Italy, Germany, and Malaysia, 13 years of general education are required before university entrance. Upon completion of a four-year programme in agriculture, followed by the preparation of a dissertation requiring up to one year (Germany) or a five year programme (Italy), first degree graduates are at least 24 years old once they leave institutions of higher agricultural education. Personal maturity is enhanced, but entry into the job market or postgraduate programmes is delayed.

46. Except for a few countries (India, Malawi, Morocco, U.K.), the most common programme structure of undergraduate curricula is the semester system. A typical four-year programme is divided into eight semesters of some 15-22 weeks each. Most of FAO's case institutions have operated on semester basis for many years, others (Kenya) have introduced it very recently. One case institution reported that it pioneered the semester system in its home country (Malaysia).

Programme Contents

48. In many developing countries, the bulk of agricultural undergraduate students enrol in general agriculture programmes (Brazil, Kenya, Malawi). This is logical where

job opportunities are primarily in agricultural extension and related occupations, where institutional development is in the initial stage, and in smaller countries where greater numbers of general agriculturists are required, instead of specialists.

49. Such programmes usually start with foundation courses in basic sciences, mathematics, humanities and social sciences, followed by courses in general agricultural subject areas: plant and animal science, farm management, agricultural economics, agricultural engineering, and so on. Towards the end of the programme, a limited number of optional courses may be taken. Specialization in a particular major subject may be possible the last two years. At the Egyptian case institution, students may choose one of 19 specializations (pomology, soil science, rural sociology, etc.), in the Nigerian institution, one of 14, and in the Thai institution, one of 7 specializations.

49. In some developing countries, more advanced institutions offer an array of separate B.Sc. or similar programmes, instead of first degree programmes in agriculture with concentration/specialization. Examples of such programmes include technical subject areas within agriculture: plant protection, agricultural economics, agricultural engineering, fisheries, forestry, and veterinary science. Some institutions additionally offer undergraduate programmes focusing on particular aspects of the socio-economic sciences related to agricultural and rural development. The case institution in Malaysia offers, specialized programmes in resource economics, agribusiness, home economics, human development, agricultural education, science education and computer science. Other institutions offer cooperatives (Brazil), economics and planning (Peru), and development communications (Philippines).

50. As compared to specialization options within general agriculture programmes, separate specialization programmes usually provide more in-depth study. They often lack, however, the broad-based treatment of related subject areas and of agriculture as a system with various technical, economic, social and cultural components. Preparation for work requiring specific knowledge and methodology studied is ensured, but systems thinking and job versatility may be limited. The disadvantage of narrow specialization is recognized by developed country institutions (USA).

Relevance, Impact and Efficiency

51. All institutions of higher agricultural education included in FAO's case studies are concerned about the relevance, impact and efficiency of their undergraduate programmes. There is widespread conviction that programmes have to respond to national, state or provincial needs and to the aspirations of potential students. Careful programme planning and continuous monitoring of curricula and teaching methods is thought to be essential, but is not always followed systematically. Functioning feedback mechanisms involving government authorities, employers (both public and private) and graduates are in use in some countries (Malaysia). In others, the involvement of people from outside the agricultural university, college or faculty is not sought or is left to chance.

52. In chiefly agricultural developing countries, where government policies focus on increased agricultural production and quality of rural life, adequate field experience of rural development staff and a positive attitude towards rural people is of paramount importance. Many agricultural students lack practical experience in agriculture and need to be attuned to the problems, means, and aspirations of rural people. Yet, large student numbers (Egypt, Kenya), lack of staff, transport and finance (cited by many case institutions), lack of motivation on the part of both staff and students, and other factors hamper the development and maintenance of first-class practical training exercises for undergraduate students.

53. Perhaps one of the best programmes of practical training is at the Moroccan case institution. That programme includes the study of nature, rural life, practical farm work on the institution's and nearby farms, and the application of modern survey and planning techniques for village and regional development, in conjunction with the respective scientific subjects in the curriculum.

54. A common problem is the excessive time taken by some students to complete their undergraduate programme and high dropout rates. The Peruvian institution reports that its 1986 graduates required an average seven to nine years instead of five to complete programme requirements, with a drop-out rate as high as 82%. Those studying to obtain the title of Ingeniero Agronomo required an average ten years. Delayed graduation is common in Germany and the Netherlands.

55. Whereas the reasons for this delay may be attributed, in some countries, to students' inadequate preparation (e.g. in mathematics, basic sciences) before entering university, rather lax examination regulations, students' part-time occupations while enrolled, etc., extraordinary demands on students' work (including dissertation, where required), ineffective student/teacher ratios, and poor administrative procedures can also be cited. Similar reasons are given for excessive dropout rates.

Recent Development Trends

56. While the old battle about balance within the agricultural undergraduate curriculum is still undecided (basic vs. applied sciences, biological vs. social sciences, theoretical vs. practical classes, general orientation versus specialization), the case studies and other information clearly indicates three emerging curriculum development trends:

- new separate programmes, specializations or integrated courses in subject areas such as biotechnology, environmental protection (Malaysia), genetic engineering (Egypt);
- more weight given to the social sciences, (agribusiness, in particular), problem-solving methodologies, and students' personality development (Thailand and other countries where opportunities for employment in the private sector and self-employment are expected to increase substantially);
- skill-development within agricultural extension (Thailand), development communications (Philippines), computer science (Malaysia) writing, speaking and analytical thinking.

57. While these curriculum development initiatives sound hopeful, many institutions lag behind, maintaining old curricula without serious adjustments or review.

Combined Diploma/Degree Programmes

58. Several of FAO's case institutions offer, in addition to the *regular* undergraduate programme, abbreviated programmes designed for students with an agricultural vocational diploma. In fact, in the Malawi case institution, the first degree in agriculture is obtainable exclusively through the successful completion of a three-year diploma programme, followed by two years of degree training. In other countries (Netherlands, Thailand), the combination of vocational education plus agricultural degree training (usually two years at the respective institution of higher agricultural education) is available as a parallel road to the first degree. Such programmes are not only attractive to bright diploma holders, who otherwise would be barred from higher agricultural education, but are likely to produce graduates who may become excellent field practitioners and extension personnel.

Postgraduate Programmes

59. High-level specialist staff for agricultural research, teaching, extension, management and related functions are primarily trained through postgraduate programmes. The aim is to produce qualified people with in-depth knowledge of selected specialized fields to diagnose problems and seek solutions, applying modern scientific methods and presenting study and research results in a convincing manner. Postgraduate programmes are normally offered by the same institution of higher agricultural education which offers undergraduate programmes in agriculture and related subjects.

60. The most common system of postgraduate study is a two-year specialization programme requiring course work and research (time allocation, roughly 50:50). Entrance into the programme is open to upper-echelon first degree graduates in agricultural or related sciences with initiative and ability. The degree earned is called: Master (Anglophone countries), Mestre (Brazil), Licentiate degree (Sweden), Diplôme de spécialisation agronomique (Morocco), etc. Even in countries and institutions where this type of programme has no tradition (Latin American countries and in those following the French educational system), similar programmes are spreading.

61. More mature institutions which have well-qualified staff³, viable research programmes and adequate physical facilities, usually offer two-year specialization programmes in numerous subject areas. Younger institutions start off with one or two specializations, such as the case institutions in Cameroon and Malawi, which recently began with specialization programmes in plant protection and animal science, respectively.

62. The vast majority of postgraduate specialization programmes contain narrow technical subject areas: seed technology, forest entomology, plant virology, etc. Others have broader social science-related programmes: youth programme development, public relations and extension education (Malaysia). New additions reflecting recent development in global resource economics and international relations are energy management (India), environmental engineering (Egypt), economics and management of agro-industries (France), and international agriculture (USA).

63. Offering a postgraduate specialization programme is usually put forward by the academic staff of the respective department or institute, external donor agencies, or national planning authorities. The emphasis on postgraduate work vis-à-vis undergraduate programmes is often propelled by a feeling of staff strength (Nigeria, Philippines) or reduced numbers of undergraduate students in agriculture. Evidence from most of FAO's case institutions suggests that employment prospects for agricultural graduates with postgraduate qualifications is markedly better than for those without. Not surprisingly, enrolment in postgraduate specialization programmes has steadily increased in recent years. Problems cited by case authors include: shortage of well-motivated and able incoming students (Malaysia), dwindling staff enthusiasm to supervise students (Nigeria, Philippines), and reduced support for physical facilities and finances. Considering current resource availability, some institutions have reached the upper limit of postgraduate student enrolment.

61. The efficiency of programmes at this level is as varied as that of agricultural undergraduate offerings. Due to excellent student quality and staff support, reasonable demands with respect to scope and time requirements of student research and firm institutional regulations, some institutions succeed in keeping the duration of such programmes within a time span of two to two and a half years (Mexico, India, Kenya). In other institutions, students spend an average three and a half to four years (Thailand, Egypt) completing such programmes.

65. Once the two-year specialization programme is well-established, institutions tend to add a doctorate level of postgraduate work. Such programmes, requiring an average three to five years for completion, train researchers and university teachers. Advanced courses in the respective specialization and supporting subjects form part of the programme with primary emphasis on original research and preparation of a thesis.

66. In well-staffed and well-endowed institutions, most or all departments will offer doctorate programmes. Where specialization programmes were initiated only six to eight years ago, the first doctorate programme may be in the planning stages (Thailand). In Morocco, course work is being undertaken at a foreign institution of higher agricultural education while the research portion of the programme is at the home institution.

3 A striking example is the Mexican case institution with 500 high-level academic staff and 500 postgraduate students (no undergraduates).

67. Institutions in several countries additionally offer other special programmes of one to two years duration. These programmes prepare students for research activities (environmental studies, toxicology - Netherlands) or for professional work (agriculture and some of its branches - Egypt). Short courses of various types are available in most institutions.

68. Considering the financial input per student, postgraduate programmes are particularly costly in terms of staff and physical resources. The sharing of responsibility for postgraduate programmes between institutions would be logical. Apart from steps in that direction in a few countries (India, Mexico) and regions (East/Southern Africa, Latin America, Southeast Asia), initiatives at national and regional levels are less significant.

Agricultural Research

69. All institutions of higher education in agriculture included in FAO's case study programme are committed to fostering and executing research. Scope and volume of the institutions' research programmes vary according to institutional maturity and the availability of resources for staff, physical facilities and finances. The case institutions in Brazil, Canada, France, Mexico, Netherlands, Philippines, Sweden and the USA have fully integrated their research activities with co-equal status into their overall programme strategy. Their contributions to the national and provincial/state effort in research are significant. Other institutions of younger origin (Cameroon, Malawi, Morocco and Thailand) are actively developing research components as well, and several sister institutions in Africa, Asia, Latin America and the Near East are doing so, also.

Size of Research Programmes

70. On the average, a large number of the institutions' research activities are linked to their postgraduate programmes. The case institution in the Netherlands reports that 65% of its research activities is executed primarily by post-graduate students. In resource poorer institutions (Egypt), this percentage may be still higher, but the research volume is only a fraction of that in richer institutions.

71. The engagement of academic staff in the institutions' research activities which are outside the scope of postgraduate programmes varies widely. This depends on the institutions' personnel policies. Where research receives less importance than teaching, academic staff is not encouraged to engage in time-consuming research. They may contribute through supervision and guidance of postgraduate students, but no more than that. There are institutions, however, where up to one third of all academic staff are full-time researchers. The Hungarian case institution's Faculty of Agricultural Sciences is an example.

72. Another difficult issue is related to the support of junior staff, physical facilities and finances. Where funds are scarce, staff research is usually negligible. However, where core funding is ensured by the institution and supplemented through larger scale projects and contract research, staff enthusiasm, dedication and hard work is ensured.

73. In the Malaysian institution, financial support from the government (60%) and other sources (40%) quadrupled during the past five years. In spite of increasing demands on staff time for teaching, research activity and outputs have significantly increased. Several important research breakthroughs (development of a new feed-based Newcastle disease vaccine) secured recognition from local and international agencies and helped obtain additional research funds. In contrast, research activities in the Peruvian case institution have almost come to a standstill. During the past five years, financial support has dwindled, many research activities have had to be abandoned and results of some completed research could not be published.

Research Planning and Coordination

74. Who determines research priorities and how they are to be undertaken are important questions. Priorities may be set by the institution with or without external influence. Many case authors report that individual professors constitute the primary driving force. Government officers, high-level politicians, the national development plan, and grant regulations also influence priority setting. Institutions have to reconcile immediate staff interests and drive connected to postgraduate work and intellectual advancement, recognition, and national/state development policy. Lack of communication between governmental research organizations and educational institutions discourages collaborative efforts in planning and executing research.

75. Some institutions (Mexico) have an established internal procedure for the selection of research projects, staff decision-making, material and financial support, and evaluation and publication of research results. Such internal mechanisms are useful; but they do not necessarily ensure the integration of the institutions' contribution to research programming into national efforts with other agricultural research institutions.

76. A positive step in that direction is in Morocco where senior staff from institutions of higher agricultural education participate in determining national research priorities for socio-economic development. Within the Conseil d'administration, administrators, scientists and practitioners from the institution and outside bodies cooperate in refining set priorities and designing research programmes and projects. The excellent system of practical training also permits village-level inputs in the planning process.

More Stress on Inter-Disciplinary Research and Linkages

77. In recent years, the number and complexity of research topics requiring inputs and cooperation from scientists belonging to different disciplines has increased considerably. Farming systems development, agro-forestry, food preservation and human nutrition, desertification control and a host of other topics of crucial importance demand concerted inter-disciplinary research efforts. Socio-economic studies (baseline surveys prior to the initiation of regional development projects) belong to this category. Finding ways to encourage cooperation between individual scientists in different departments is a problem in many case institutions.

78. The experience of several case institutions shows that the organizational structure and procedures, leadership, and financial support determines success of the research activity. It is important to enlist and maintain full cooperation of all personnel involved. The externally-supported farming systems and rural areas research projects of the case institution in Thailand are successful interdisciplinary research endeavours. The small ruminants research programme of the Moroccan case institution, in which 29 national and foreign scientists cooperate, is another.

79. A common problem area in many case institutions is transferring institutions' research activities and application of results to farmers' fields. In view of prevailing personnel policies (criteria for promotion) and personal prestige, academic staff are primarily interested in publishing research results in reputable journals. Application of these findings is less significant. Contact with the national extension services and farmers' organizations is not sought, research results are not offered to primary producers, and valuable scientific reports remain on the shelves of the institutions, often without being tested or followed-up at the grassroots level.

80. In 1985, 18 institutions joined forces to foster the development of Mediterranean and tropical agriculture through research, education, training, and related activities in Southern France (AGROPOLIS, *Le Pôle international d'agronomie méditerranéenne et tropicale de Montpellier Languedoc-Roussillon*). With an annual budget of approximately US\$100 million and 2,000 researchers and teachers, inter-disciplinary research and teaching in selected priority areas within the mandate of AGROPOLIS was

actively promoted. While it is too early to assess impact and efficiency of AGROPOLIS, the concept is valid and the results obtained to date are encouraging.

Extension/Public Service

81. Mandates and activities in extension and public service vary from institution to institution. Among FAO's case institutions the most intensive extension efforts were reported by the U.S. institution. Under the direct control of a University Vice-President, all extension activities are combined into one separate unit within the university. Through the Centre for Extension and Continuing Education, staff stationed on campus of the College of Agriculture and Forestry, and extension agents assigned to extension offices in all counties of the respective state, training and extension are offered in agriculture, forestry, community development, home economics and rural youth work. This university-based extension programme is carried out in a cooperative manner with local and national support. In-service education for extension workers is also university-based.

Positive Extension Initiatives

82. The field level extension and training activities of the Mexican case institution are based in regional centres. These cooperate intensively with state agencies through situation analysis, advice to farmers, training of extension workers, etc. in seven districts. Research support to extension is given in eleven more districts of the country. This programme, known as "*Plan Pueblo*" reflects an integrated approach to rural development which has been successfully promoted during recent years.

83. The Indian case institution also operates an intensive training and extension programme. Coordinated by the institution's Director of Extension, it cooperates with state officers at all levels down to the village level through training workshops for senior personnel, extension supervisors, field agents, and demonstrations, field days, exhibitions, field research trials, and soil testing services. This programme draws particular strength from residential training conducted at the farm advisory centres throughout the state.

84. Intensive training and information activities, although excluding large-scale field extension work with farmers and other rural people, were reported from Malaysia. Counting on a definite structure at the highest level and at faculty levels, the institution works largely through its Centre for Extension and Continuing Education. The extension field laboratory (some 90 villages) serves as a training ground for students as well as for verification research with village farmers.

85. The institution in Sweden sifts through and disseminates research results through its Research Information Centre. In Germany, outreach activities are primarily conducted through affiliated technical institutes for testing soil samples, feed, etc. Agropolis and its member institutions in France conduct numerous training courses and seminars, from several days to two years in length, for upgrading and discovering new knowledge in various fields.

86. Many of the other institutions of higher agricultural education included in FAO's case study programme have been unable, in recent years, to carry out effective extension/public service activities. Some claim that the absence of a definite organizational structure which secures leadership for extension throughout the institution has been a limiting factor (Kenya, Thailand). In others, an elaborate management structure for extension is in place, but lack of funds (e.g. for transport) and/or low reputation of extension work among the institutions' academic staff are constraints (Brazil, Peru). Institutions in some countries state that they have not been given responsibility for extension work (Egypt, Germany, Netherlands).

87. A few of the younger institutions have made admirable attempts in cooperating with farmers in the vicinity of the institution. The case institution in Cameroon cooperates with the villagers in a research-development-training project, problem

identification, on-farm research and experimentation, and students' practical training. The Moroccan institution invites several hundred farmers, who host students in practical training, to the campus once a year for the demonstration of new farming techniques and dissemination of research results.

Current Problem Areas

88. Although extension/public service is a recognized function in many institutions of higher agricultural education, programmes are generally weak. In some instances, even the institutional objectives are ill-defined (Cameroon). The greatest shortcoming is the lack of commitment to extension and public service on the part of institution administrators and professors. In 1977, an FAO Expert Consultation on the Contribution of Agricultural Universities and Faculties to Development warned that such commitment by all members of the institution - administrators, academic and support staff, and students - is an indispensable precondition for the successful operation of outreach programmes including extension activities.⁴

89. Although more than ten years have passed, not much progress has been made in achieving changes of attitude and behaviour. This was confirmed in 1988 by a series of FAO-sponsored sub-regional seminars on the training of agricultural professionals for rural development, held in Chile, Mexico and Peru. Seminar participants agreed that many staff and students lack first-hand, practical knowledge of what conditions their training should address, particularly in extension work. The fact that 75% of the agricultural producers in the Latin American Region are small, resource-poor farmers, was considered a cause.⁵

International Development

90. The most common involvement in international development of higher agricultural education institutions is the training of foreign students. This carries prestige, makes the institution known outside the country, serves as a stimulus for national students and staff, and enriches teaching and research activities. All institutions included in FAO's case study programme reported enrolment of foreign students, with the exception of the Thai case institution, which has a deliberate policy of not accepting non-nationals.

91. Many institutions set quotas for foreign students which range between 5-25% of the total student population. Actual enrolment may be much less (Egypt). Where foreign students are required to pay high fees and fulfill other special conditions, enrolling can be difficult, unless the students' home country or some other agency provides financial support. Language barriers are important factors in Germany and Hungary)

92. In institutions with flourishing postgraduate programmes, foreign student enrolment is concentrated at that level (Brazil, Canada, Malaysia, Mexico). In order to attract postgraduate students from developing countries, a few institutions in more developed countries offer special post-graduate programmes with a language of instruction other than the national language (Netherlands, Sweden).

4 Report of the FAO Expert Consultation on the Contribution of Agricultural Universities and Faculties to Development, FAO, Rome, 1977.

5 Agricultura y Sociedad: formación de profesionales de las ciencias agrícolas para el desarrollo rural, Universidad Académica de Humanesimo Cristiano, Chile 1989.

Mutual Support Across Borders

93. Many institutions have a particular interest in collaborating with other institutions in the same geopolitical region or sub-region. The Brazilian, Mexican, and Peruvian case institutions look especially to other Latin American countries for this purpose; the Thai, Malaysian and Philippine institutions look to other Asian (ASEAN - Association of Southeast Asian Nations) institutions, and so on. The aims are similar: mutual support with exchange students and staff for training purposes, exchange of information, and collaboration in research. Cooperation agreements usually ensure that the host institution covers in-country expenses for board, lodging and tuition of exchange students. Funding for international travel, research equipment, etc., has to be obtained from other sources. In some instances, cooperation is focused on a specific theme, such as the Southeast Asian Universities Agroecosystem network (SUAN) for which the Thai case institution provides the secretariat.

94. Regional or sub-regional level cooperation takes place either within the framework of formal or informal agreements between institutions/countries, or within established regional/sub-regional organizations and institutions (associations of higher agricultural education in Africa, Asia and Latin America). The recently established European Network for University Cooperation in Tropical Agriculture, NATURA, with eight member institutions, including the case institutions in France, Germany and the Netherlands, deserve mentioning.

95. The Southeast Asian Regional Centre for Graduate Study and Research in Agriculture (SEARCA) is among the outstanding regional institutions. During the last two decades, it has contributed substantially to postgraduate education and research in its long-standing cooperation with the Philippine case institution and lately with others, also in the Asia region.

96. Some institutions have close working relationships with international agricultural research centres. Such cooperation, through staff training and secondments, collaboration in postgraduate work (research portion done at the international centre with joint supervision of students), research contracts, and information exchange, can be especially effective when the international centre is located near the educational institution concerned. The case institutions in Nigeria (with IITA), Peru (CIP) and the Philippines (IRRI) fall in this category. ⁶

97. Cooperation agreements between educational or research institutions in different regions are numerous. In most instances, one institution is primarily the provider and the other the beneficiary. Such agreements are difficult to implement, unless financially backed at least on a medium-term basis by sources outside the receiving institution's home country.

Project Support

98. Many developing country institutions have benefited from externally provided project support from bilateral aid agreements or international and private foundations or sources. Such funding may be used for temporary expatriate teachers or researchers, training fellowships abroad, equipment and literature, and, in some instances, infrastructure development. The case institutions in Malawi and Cameroon were supported for more than 10-15 years by large-scale inputs from bilateral and international sources (FAO/UNDP).

99. Some technical assistance projects have initiated linkages with foreign institutions. In a series of successive projects in India, the aim was to create and strengthen advanced centres for postgraduate education and research in selected priority subject areas: consultant advice, training support and equipment for an

⁶ IITA - International Institute of Tropical Agriculture; CIP - Centro Internacional de la Papa; and IRRI - International Rice Research Institute.

average of seven years, including close linkages with outstanding foreign institutions. The case institution in India hosts 2 of the 28 advanced centres which have reached maturity: one in soil and water management and one in seed technology. This project series has received a continuous flow of support from national sources, UNDP and FAO, for the last 18 years.

100. Recipient institutions want to be recognized as equal partners in project design and execution. While acknowledging the enormous benefits derived from project support, several case study reports reflect concern over institutional administrators and professors, inappropriate grant regulations, or technical assistance staff problems (Cameroon).

101. In several case institutions, international development is one of the primary institutional objectives; and suitable management structures have been set up (Canada, France, Netherlands, USA). The impact and efficiency of involvement in international work is sometimes hindered by lack of a coherent strategy, poor personnel policies (e.g. regarding promotion and tenure), insufficient financial outlays over long periods, inadequate economic incentives for staff, and inflexible bureaucratic procedures.

Student Services

102. Student services reported by the case institutions include the following elements: health service, housing and catering, counseling on academic and personal matters, financial assistance, and recreation facilities (social, cultural, and athletic). These items significantly influence work, life, and impact on the institution.

103. Most case institutions maintain efficient student services. Increased welfare of individual students and groups is the undisputed aim. The extent and quality of services and facilities between institutions varies according to the development status of the country.

Student Services in Developing Countries

104. In most case institutions in developing countries, the health services are, in general, of acceptable standard. The same is reported for outdoor sports facilities, indoor recreational facilities are, in some institutions, much too limited in relation to student numbers (Kenya, Malawi).

105. Student housing presents serious problems in many case institutions. Some started off with the provision of housing on campus for all students, but with increasing student numbers this was no longer possible (Kenya, Thailand). The Nigerian case institution reports, for example, serious squatting in its existing residence halls and enormous difficulties finding alternative housing off-campus. Ten years ago after incidents of student unrest, the Peruvian case institution closed all dormitories on campus. Now it operates a housing subsidy scheme which benefits only a small fraction of the student population. A negative factor of off-campus residence mentioned by the case institutions in Egypt, Malaysia and Peru is the exclusion of students from professional, social and cultural extra-curricula activities, which take place in the evenings or on weekends.

106. Some developing country institutions offer their students academic guidance and personal counseling. Each student is assigned an academic staff member as personal tutor. Some institutions complain, however, that many students do not avail themselves of the available counseling services (Nigeria, Malaysia, Philippines). A few institutions offer career guidance to help identify job opportunities for their graduates (India). Many institutional administrators expressed the view that more intensive career guidance would be beneficial for graduates, potential employers, and the educational institutions themselves.

107. Worsened economic situations in various developing countries and their institutions had a very negative influence on financial support to students. In

Malaysia and Nigeria, the amount of money per student from government subsidies was curtailed. The same measure is also planned in Kenya. While in some institutions student meals in the institution's cafeteria are heavily subsidized (Brazil, Egypt, Peru), in others this is not the case (Nigeria). Economic pressure is felt by students in many institutions because of limited opportunities for meritorious scholarships, teaching assistantships, and part-time temporary jobs on farms or in laboratories (India).

108. In many institutions, students are free to form and manage their own social, cultural and sports clubs. There is usually an office in the institution charged with various types of student services. There are also committees headed by a high level administrator with representatives from student organizations to monitor service quality, hear complaints, and make appropriate recommendations to the institution's authorities (Egypt, Malaysia).

Student Services in Developed Countries

109. Some of the case institutions in the more developed countries also have economic limitations too; but financial restrictions normally do not have such devastating effects on student services. In general, health and recreational facilities are excellent and student counseling on academic matters and career prospects is adequate. Student unions manage many social, cultural and sports events. In some institutions they levy membership fees and engage in small-scale commercial businesses (Germany, Sweden).

110. Existing financial support systems provide monetary security for many students. Such systems include: provision of grants and interest-free loans (Canada, Netherlands, Sweden, USA), grants only (France), loans only (Germany). The financial need of applicants is assessed, taking into account the students' financial resources and those of their spouses and parents. The Canadian case institution reported: *The philosophy of providing all students with financial resources on the basis of need is achieved for 99% of all applicants and literally no student is required to leave the university for financial reasons.* In the German case institution, about 30% of all students receive repayable loans.

111. The largest problem in some case institutions in developed countries is student housing, the dormitories absorbing only a fraction of the students enrolled. Students have to rent private accommodations; and this may not be available in the vicinity of the institution at reasonable cost (Germany, Sweden).

Physical Facilities and Finance

112. Institutional resources consist of students, staff, physical facilities and finances. Students are the most essential element, providing the *raison d'être* of any educational institution.

Students

113. In countries with large agricultural/rural sectors, the majority of students come from rural areas. This is particularly so in the developing countries where the degree of urbanization is still limited. On the other hand, 75-80% of the students who enter the case institutions in Brazil and Peru have an urban background. They usually receive better preparation at secondary school in terms of sciences and mathematics, but lack farm practice and an appreciation for farmers' problems and rural life.

113. Evidence in many case reports from developing country institutions shows the trend towards further urbanization of the agricultural student population is continuing; hence the necessity to provide ample opportunity for practical training. This implementation is lagging far behind. Similarly, with programmes giving preferential treatment to the entries of bright, resource-poor rural students

(Philippines), shortages of funds severely limit the number of students benefiting from this.

115. In most case institutions the enrolment of students with agricultural vocational diplomas, instead of general education certificates in *regular* undergraduate programmes, is limited. Some such students have deficiencies in basic sciences at the time of entry and may need extra tutoring in the beginning. They have some practical experience and understanding and many are strongly motivated to learn. Thus, a mix of students with different educational backgrounds provides challenges as well as opportunities for fruitful interactions.

Enrolment of Female Students

116. The proportion of women students varies from institution to institution. The highest proportion was reported from Sweden: in the Swedish case institution's undergraduate programme in Veterinary Science, more than 70% of the enrolment was female. From 40-50% of the students enrolled in agricultural curricula were reported as female in most European and North American case institutions, the Philippines, and Malaysia.

117. In many developing country institutions, especially in Africa, the Near East, and parts of Asia, female agricultural students are much fewer in number. Although, in most of these countries, women provide the bulk of the agricultural labour force and represent a sizeable proportion of farm household heads, the magnitude of the female student population does not correspond to women's importance in agricultural production, processing and marketing. As a result, too few women extensionists, researchers, administrators, and teachers are trained and employed to address women farmers and their specific problems.

Academic and Support Staff

118. Most institutions included in FAO's case study programme have highly qualified academic staff: at least 50% with doctorate degrees, often earned in prestigious foreign institutions. This is proof of vigorous staff development programmes over substantial periods of time. It also indicates the availability, in the past, of considerable financial resources for postgraduate training abroad and students qualified for entry into such programmes. Expatriate staff assistance to programme development and teaching has decreased to less than 20% in most developing country institutions. In fact, the highest percentage of expatriate academic staff was reported from Canada (37%). This high level of academic education is not necessarily synonymous with high quality teaching programmes. The quality of teaching at the university level needs further investigation.

Staff Development

119. Staff development is a continuing process. Several case authors reported that up to one third of all academic staff was actually (1988/89) in training at other institutions in the home country or abroad, financed from national and/or external funding sources (Brazil, Malawi, Malaysia). The temporary absence of such a large portion of staff presented problems: remaining personnel were hard pressed to cope with teaching loads, research and outreach programmes.

120. Some case institutions pride themselves on having a young, dynamic staff, trained at various foreign institutions (Cameroon, Morocco). Ninety percent of the Moroccan institution's academic staff is younger than 40 years old. In order to retain its staff, they offer special incentives, including premiums for research and extension work.

121. The rather positive situation described above regarding staff training for service at case institutions in developing countries is somewhat atypical. There are many institutions, especially in very resource poor countries, which do not use sufficient funds from national or external sources for staff development programmes involving postgraduate training abroad.

Current Problems

122. In Peru, experienced teachers and researchers seek employment abroad because of extremely low remuneration in comparison with other countries (US\$100-150 equivalent, monthly). Unfortunately, since university salaries are fixed by government rules in that country, the institution has little opportunity for counteracting the staff exodus.

123. Poor staff salaries in comparison to salary levels in-country and/or abroad present threats to staff recruitment and retention in other case institutions. Better paid employment in the nation's private or parastatal organizations or higher salaries in neighbouring countries lure experienced staff away (Egypt, Malawi, Nigeria, Philippines, Mexico). Staff members not returning home after postgraduate studies abroad are lost to institutions as well (India, Philippines).

124. With variations depending on administrative and outside commitments/interests, academic staff spend an average 60-70% of their time teaching, supervising students and preparing classes; 10-20% conducting research; about 5% on extension/public service, and the rest on administrative and committee work. Ten to fifteen contact hours per week represents a normal teaching load. In institutions with active research programmes, the average time share for research may reach 30-40% (Malaysia). If such intensive research commitment is accompanied by time-consuming consultancy work (Philippines), attention to teaching and teaching quality can suffer seriously. Where extra remuneration is offered for increased teaching loads (Egypt) or where a large proportion of the staff are part-time (many Latin American institutions), teaching may take up to 90 percent of staff time.

125. With respect to many case institutions, staff time priorities do not coincide with institutional goals and objectives. They may not correspond to staff recruitment, evaluation and promotion criteria. While the ability to teach and perform extension/public service may be applauded, research publications may be more recognized. Only one of the case institutions (Brazil) has a comprehensive staff evaluation system in place, which claims to give equal weight to teaching, research and extension.

Support Staff

126. Support personnel (clerical, technical, farm, etc.) are in short supply in a few institutions (Thailand), excessive in others (Egypt). The shortage of qualified budget and accounting personnel is common to most developing country institutions. Several institutions expressed urgent needs for trained personnel to maintain, service and repair laboratory and farm equipment (India, Cameroon). Many institutions complain about inadequately trained technical staff, such as laboratory assistants. A few operate staff development programmes which include limited periods of specialized training abroad. The need for career development for support staff was expressed by several institutions.

Physical Facilities

127. In many case institutions, the development of physical facilities (classrooms, laboratories, library, equipment, books and farm facilities) has, in the past, been generously supported by government and external financing. With increased student numbers and postgraduate programmes conducting more research, this support has

fallen short. Due to financial constraints, maintenance and replacement of worn out parts has become a serious problem in many institutions and almost impossible to solve in some (Nigeria, Peru). Even essential supplies such as glassware and chemicals are difficult to obtain because of budgetary restrictions and foreign exchange problems in Malawi and Egypt.

128. Some institutions, while owning costly, sophisticated equipment like electron microscopes and large capacity mainframe computers, are short of simpler items, such as audio-visual equipment and materials (India, Egypt). Complaints about the inability to purchase enough computer hardware and software for teaching, research, and administrative purposes were voiced by many case institutions.

129. There are institutions which have been able to continue the build-up of essential infrastructure: the case institution in Cameroon has several classroom and laboratory buildings, as well as a new library under construction with financial support from external donors; the Thai institution is adding new classrooms; the Mexican case institution boasts a central library with 6 000 sq.m. of floor space and several branch libraries; the Malaysian institution uses closed circuit television facilities for teaching selected large classes.

130. Purchasing of new books and scientific journals, in spite of financial constraints, has been very difficult or even impossible in many of the case institutions in developing countries. Even more difficult has been the introduction of modern library services which are common in most developed country institutions. Computer assisted literature search is possible in some institutions (Cameroon, Malaysia, Morocco, Philippines, Thailand), but technology for accessing international data bases is unavailable in most developing country institutions included in FAO's case study programme. Malaysia, Morocco, and the Philippine institutions reported access to national documentation centres within the international AGRIS network. Even microfilm/microfiche readers and photocopying facilities are unavailable in the library of the case institution in Kenya. Inter-library loan capabilities are more widespread.

131. Most case institutions own sufficient farmland to support teaching and research activities. Some maintain substations in various ecological zones (Mexico, Morocco, Malaysia, Sweden). Usually, part of the facilities is shared out to individual academic departments for student practicals and research activities. Use of the farm facilities as a commercial enterprise is common practice. Questions of management are frequently under discussion: independent farm manager versus management committee, separate budgeting as opposed to farm budgets for teaching and research, etc.

131. A bone of contention is how to use revenue from the institutions' farming activities. In many institutions, farm revenue has to be paid to the institution's general fund or it disappears in government coffers. In such instances, incentives for increased production with better quality and better farm income are nil. Where regulations allow reinvestment of farm income on the farm (Hungary, Nigeria), outputs and staff morale rise, especially if economic incentives are given.

Financial Resources

133. The primary source of financial support for most developing country institutions is the national and/or state/provincial government. Income from tuition fees in resource-poor countries is often non-existent or limited. Only in the few private institutions of higher agricultural education and in some public institutions do tuition fees represent sizeable sources of income. Other sources, such as own revenue, donations and loans from private agencies and external donors, are usually of limited significance regarding recurrent teaching and overhead expenses. They are, however, important with respect to the financing of new infrastructure, training fellowships, selected staff positions, equipment and literature. Funds for research may come from a government block allocation to the institution, a separate public vote, and/or non-government sources.

134. All case institutions were reported as operating on the basis of annual budgets. The budget level depends to a large extent on numbers of students, previous budget levels, and government's capacity and will to support the institution. Case authors reported that, during the last five to ten years, the purchasing power of government funds received has declined considerably. Although nominal figures were kept constant or increased, inflation caused severe devaluation. In the Cameroon case institution, even the nominal budget total decreased by 25% between 1985 and 1989. A definite downward trend is also reported from the Nigerian case institution. In some countries/institutions, existing economic difficulties forced governments to decree austerity measures, such as the freezing of vacant posts in India, Nigeria, and Peru. Programme disruption, low staff morale, and decay of buildings have been other negative results.

135. Case institutions which represent separate administrative entities, such as agricultural universities based on the French educational system, receive government funds as lump sum allocations, leaving it up to the institutions themselves to divide the money among faculties, departments, etc. Where governments refrain from reducing approved funding and release the money due in regular annual or half-yearly instalments, institutional programme planning and execution can go ahead without undue financial hassles. Sudden unforeseen budget cuts or reduced allocations do occur unfortunately; and this represents a grave problem for the institution (Peru).

136. Case institutions which form part of comprehensive universities usually face the additional difficulties of one more layer in the budgetary and monetary allocation process. The central university administration which regards the agricultural faculty or college as one of many diverse units to be funded, takes longer to approve the budget and the results may be uncertain.

137. A clear separation of budgetary items by major programme is not practised: teaching and research are often lumped together so that the fraction earmarked for research can only be guessed; funds to cover extension/public service activities never appear as separate budgetary entries. Such expenses are supposed to be covered by the teaching vote as well. The result is that very little money or none at all is available for field visits, transport, etc. In many case institutions, farming operations are covered by a separate budgetary provision which is positive.

138. The bulk of institutional expenses is for teachers' salaries, with minor additions for teaching aids and materials. Up to 85% of the total budget is used for these purposes. In institutions providing students' lodging and/or board at government expense, these costs are included in the teaching vote. Funding of research from government subventions to the institution is usually very meagre and below 5% of the total budgetary allocation. Institutions have been trying to attract research funds from other sources.

139. Most case institutions have to adhere to government accounting procedures. Many complain that these rigid procedures do not serve the purpose of research activities (Morocco, Thailand). They also do not conform to the special needs of agricultural education institutions with production units and changing input requirements (Kenya, Malawi, Philippines). Changes from line item budgeting and accounting (government rules) to programme budgeting and accounting are advocated by many institutions. Such change promises increased programme flexibility according to diagnosed requirements, as well as improved efficiency of programme delivery.

Institutional Organization and Management

140. Institutional structure and procedures are to serve programme planning, implementation, and mobilization and use of institutional resources. Most institutions of higher agricultural education included in FAO's case study programme belong to one of three groups of institutions, each with different organization and management characteristics.

141. Institutional management is discussed below, by group, in the following order: agricultural universities, institutions based on the French educational system, and agricultural faculties/colleges belonging to comprehensive universities.

Agricultural Universities

142. The largest case institutions in terms of range of teaching programmes offered, staff, and student numbers are agricultural universities. Their organization, management tools, and procedures take into account these characteristics.

143. The institution's top administrator is the President, Rector or Vice-Chancellor. He or she reports to the University Council or Management Board which is the chief body governing the institution. In some institutions (India, Malaysia), membership in this body is dominated by government representatives with university staff in the minority. Other agricultural university councils (Sweden) have a majority representing society-at-large and agricultural industry-in-particular. In all these instances, linkage to the respective line ministry (mostly agriculture) is fairly close, except at the Malaysian case institution where the University Council, chaired by a representative of the Ministry of Education, has no representative from the Ministry of Agriculture among its members.

144. In Germany, Hungary, Netherlands, and Peru, the University Council is largely an internal body, with academic staff representatives. Student representation is scarce in most case institutions, but reaches one-third in Hungary and Peru; and active and effective student participation in institutional decision-making is achieved. In some Latin American institutions, students occupy 50% of the total membership of university councils/senates. The other 50% is usually made up of professors, junior teachers and non-academic staff. Their influence on institutional policy, programme structures and content, staff appointments, etc. can be excessive and may have destructive rather than positive effects.

145. Internally, the basic structural unit is the Department, the next higher level the Faculty or College. In institutions with large numbers of academic departments (70 in the Netherlands, 52 in Sweden), improved coordination of teaching and research and related budgetary questions have been under discussion for some time. The Dutch case study institution recently introduced a two-tier, mid-level structure between departments and central university administration. The 70 departments have been grouped into 12 clusters and these into 5 sectors: crop production, animal production, land use and environment, product and biotechnology, and agriculture and society. The aim was to create units where integrated programmes concerning entire sectors, as opposed to narrow subjects, could be planned and executed more effectively and inter-sectorial cooperation could be fostered.

146. In the Dutch institution, the bottom-up decision-making process on academic matters, research and extension activities, staff, and students and institutional resources in terms of physical facilities and finance starts at department level, passes through faculty/college level committees to the Faculty Board and, where necessary, through Senate committees to the University senate. In the Netherlands, and Sweden, bodies equivalent to the university senate do not exist: faculty/college level decisions or recommendations reach the University Council through the Council's committees.

147. Membership in decision-making bodies below the level of the University Council and its committees is from within the institution. In general, student representation is scanty. In the Malaysian case institution, student representatives are not even on the Boards of Student Affairs and Student Residence. In the Hungarian, Peruvian and Latin American institutions, student representation is from one third to one half. In some institutions, advisory boards at institutional, faculty, or departmental levels include government representatives and private citizens. Such boards provide useful feedback from employers, farmers organizations, etc. to the institution (e.g. teaching programmes or extension).

Institutes of Higher Education in Agriculture (French-based systems)

148. Governance of such institutions (Cameroon, France⁷ and Morocco) is similar to that of agricultural universities: the top administrator is the *directeur* instead of president or rector, and the highest body is the *conseil d'administration* or *conseil général* in place of university council. Instead of the university senate several committees/councils may be in place: *conseil des enseignants* (dealing with questions affecting the teaching staff), *conseil de l'enseignement et de la pédagogie* (discussing teaching programmes, methods and study results), and *conseil intérieur* (institutional management questions not taken up in the other two councils). Depending on the size of the institution, departments and sections exist instead of faculties/colleges, as well as specialized committees at all levels.

149. The special characteristic of these institutions' governance is their close linkage with the parent sectoral ministry or ministries: agriculture, agrarian reform, livestock development, etc. The *conseil d'administration* of the case institution in Morocco is composed of the Ministers of Agriculture (Chairman), Education and Finance and five Directors of the Ministry of Agriculture. The *conseil de perfectionnement* dealing with teaching programmes includes six representatives of the Ministry of Agriculture, one from the Ministry of Education, one from a university and seven from the institution itself. The Secretary General of the Ministry of Agriculture chairs this important *conseil*. Teaching programmes and other activities of these institutions are often narrow-based and respond closely to the parent ministries' policies and specific requests for training, research and extension/rural development activities.

Agricultural Faculties/Colleges as Part of Comprehensive Universities

150. Agricultural faculties/colleges are headed by a dean or principal who reports to the university president, rector or vice-chancellor. The faculty board represents the top level decision-making body on matters concerning the faculty/college: teaching programmes, examinations, personnel matters, physical facilities, and research and extension. Membership of the faculty board and its statutory committees is usually from within the institution, the majority being heads of departments and senior professors. Student representation on faculty boards and their committees is, in many institutions, very limited but it may reach up to 50% in some Latin American institutions. One case author reported that student membership in faculty and departmental councils is institutionalized, but since these bodies never meet, students are deprived of participation in decision-making (Egypt).

151. The decision-making process from departmental level through faculty/college level to the University Senate and Council is usually as described for the agricultural universities. While the type of institutional structures and procedures is similar, the situation for the agriculturally-oriented units is quite different. In comprehensive universities, agriculture may be represented by one faculty/college among five to ten others, all trying to get as large a share as possible from the institution's resources, each one guarding jealously the boundaries of what they think is their physical and intellectual property. Many of the universities' top administrators above faculty/college level have a law, arts or social science background and may not fully understand the special requirements of agricultural faculties/ colleges. In addition, support from the respective sectoral ministries does not reach the university council level. If at all, it can only be articulated through advisory committees at faculty/college level. The existence of various different disciplines, side by side, provide opportunities for fruitful curricular integration and inter-faculty/college research cooperation.

⁷ The French institution taken as an example is the Ecole Nationale Supérieure Agronomique de Montpellier which is a constituent institution of AGROPOLIS.

152. The aims of the U.S. case institution ensure better integration of related subjects, streamlining administrative procedures to increase staff efficiency in scientific work. Sixteen departments were merged into six divisions: animal and veterinary sciences, forestry, plant and soil sciences, resource management, family resources, and international agriculture. The results of this structural change are encouraging. As the U.S. case report puts it: *The combining of departments into a single division has brought about closer faculty cooperation of related disciplines, more faculty work on related projects, and provides the opportunity for the saving of funds.*

Problem Areas

153. An area mentioned by many case authors as a potential source of preoccupation is research coordination, monitoring, and leadership. While most of the research is centred in individual departments and departmental staff, more and more research is inter-disciplinary requiring inputs from various units. Some case institutions have appointed associate deans of faculties/colleges in charge of research affairs (Philippines, USA). In others, this function is lodged in the central university administration (vice president, vice rector, directors of research) or is handled both at faculty/college and university levels. In the German case institution, inter-disciplinary research coordination and cooperation is fostered through university-wide research centres, e.g. in regional rural development and in tropical agriculture. Similarly, the Swedish case institution has recently established research centres in plant protection, animal husbandry, biotechnology and environmental conservation.

154. Where extension/public service is taken seriously, officers providing leadership are in place at both faculty/college and university level (Philippines). In institutions placing little emphasis on extension/public service, institutional leadership positions do not exist.

155. Unfortunately, existing machinery for leadership provision in research and extension/public service does not guarantee effective internal research/extension planning and execution through efficient staff cooperation; nor does good coordination with government services in research and extension automatically follow. Reports suggest that better institutional leadership in both research and extension/public service could result in markedly improved efficiency and impact in these two important programme areas. The commitment of institutional administrators, staff, and students is even more important to research and extension/public service.

156. Other problem areas with management implications requiring urgent attention in FAO's case institutions, include the following:

- lack of strategic planning as a whole;
- inadequate communication between institutional administrators and government authorities on manpower demand, training requirements and quality of graduates turned out by the institutions;
- insufficient efforts to broaden the institutions' financial base and optimize the use of scarce resources;
- inadequate procedures and monitoring of educational efficiency to avoid excessive dropout rates and time taken to complete undergraduate and postgraduate studies; and
- lack of recognition of dedication and ability in teaching and extension for promotion purposes of academic staff.

ISSUES AND OPTIONS FOR THE FUTURE

Issues Confronting Institutions of Higher Agricultural Education

Ideas for the Design of Improved Programmes of Teaching,
Research and Extension/Public Service
Towards More Efficient Institutional Management

The Role of International Organizations and Donor Agencies in
Support of Higher Agricultural Education

157. Based on experiences, strategy debates and on emerging development trends in case institutions and international fora, six issues surfaced and specific questions were formulated to serve as a guide for discussion at the planned Expert Consultation.

158. Whatever the outcome of such discussions, certain options for the design of programmes and the management of institutions concern many countries and institutions. Some options are suggested in the following pages. The future role of international organizations and donor agencies in support of higher agricultural education was considered.

Issues Confronting Institutions of Higher Agricultural Education

159. All institutions of higher agricultural education are challenged most directly by specific problems related to their local situations. FAO's case studies and other information sources point to a number of emerging issues in common. The issues raised below have been selected because they are thought to be of considerable significance for the next ten to fifteen years, and because they affect sizeable numbers of countries and institutions.

Issue 1: How should institutions of higher agricultural education react to major, new developments in the world?

160. There are three major development trends in the world which concern institutions of higher agricultural education: changes in world agriculture, new developments in science and technology, and changes in population and society. World agriculture is characterized by growing international trade and wide ranging competition in the marketing of agricultural commodities, interchangeability of many commodities for industrial uses, changing patterns of production and processing due to

different dietary demands of consumers, and a growing concern for environmental conservation and sustainable agricultural development.

161. New developments in science and technology, important to institutions of higher agricultural education, relate *inter alia* to the fields of molecular biology, genetic engineering, information technology and computerization, and new agricultural management techniques. Relevant changes in population and society concern continued dramatic population increases in many developing countries, with consequential food, employment and other serious problems. They concern the adoption of different life styles and behavioural patterns and value systems, including an emphasis on ethics (e.g. in business management and animal welfare).

162. Institutions of higher agricultural education have to take note of such important developments and consider the potential short- and long-term impact on countries' and institutions' policies, programmes, and resources.

Questions:

163. *What criteria should be used to reflect on the significance of developments as indicated in paragraphs 160 and 161? Would immediate relevance to the countries' and institutions' local situations be the only criterion, e.g. when considering trends in international trade, technological advances or population growth?*

164. *To what extent would future agricultural graduates need to be familiar with world development trends and with short-term and long-term strategies to deal with problems at global, regional and national levels?*

165. *Should the institutions of higher agricultural education assume responsibility for related studies and educational/information campaigns, etc.?*

Issue 2: Different institutional goals in developing and developed countries

166. All institutions of higher agricultural education, whether they are located in a highly industrialized or in a lesser developed country, strive for academic excellence. Although endowed with staff, physical and financial resources of different magnitudes and quality, they all aim to produce adequately qualified graduates to undertake high quality research and contribute to various public service activities. These are legitimate aspirations which need to be recognized and supported.

167. In most developed countries, the agricultural production-processing-consumption chain is characterized by rapidly advancing technology. While costly, most developed countries and institutions can afford continuous heavy investment in new technology, training, and employment of staff to develop and handle such technology.

168. These institutions need to respond to the challenges imposed by the high level of technology required by agricultural and rural development in their countries. The relevance of agricultural teaching programmes is largely related to the sophistication of scientific methods employed by farmers, processing industries, and agribusiness firms. In view of rapid changes in the development and use of computer hardware and software, students' ability to deal effectively with new situations and unexpected problems has to be stressed.

169. Concerning research, new technology and scientific methodology must be developed and sound solutions implemented which are economically affordable, environmentally acceptable, and socially adequate.

170. Most developing countries are characterized by a large agricultural sector of a subsistence nature, with low input and productivity levels. There are large numbers of

resource-poor farmers with limited educational qualifications and negligible investment potential. Infrastructure in terms of roads, marketing facilities, and social services are usually poor; and economic incentives for production increases may be lacking.

171. In order to ensure the relevance of teaching, research, and extension/public service programmes, institutions of higher agricultural education in developing countries must address the needs of the rural masses. Agricultural students have to learn about specific problems confronting small farmers, their aspirations, development potential, current practices, and rural life.

172. Research should be oriented to help solve small farmers' problems. Extension/public service activities must strengthen production capabilities and gather feedback from small farmers for teaching and research programmes in institutions.

173. Developing country institutions need to be much more *development-oriented* than sister institutions in industrialized countries because of general socio-economic situations and needs of small farmers and their families. Because of the resource situations in many of the less well endowed developing countries, the national agricultural university, faculty, or college accounts for the largest corps of trained agricultural scientists and often has comparatively good physical facilities. These precious resources should be employed not only in regular teaching and associated research activities, but in other development activities as well.

Questions:

174. *Should developing country institutions limit themselves to current location-specific topics and activities, making contemporary programme relevance the overriding criterion for success?*

175. *Is there a danger that the technology gap between developed and developing countries widens further? If so, should the same level of technological sophistication be taught to agricultural students in developing countries as is done in developed countries?*

176. *If administrators, professors, and students recognise educational achievement and research performance as being linked to technological sophistication, what measures can be taken to counteract such beliefs and minimize their effects?*

177. *Would the exchange of trained agricultural manpower, professors and students be negatively affected if institutional programmes had markedly different goals and contents between countries of different development status?*

Issue 3: From narrow production orientation to farming systems, what are the consequences for institutions of higher agricultural education?

178. One of the most important elements within sustainable development (Issue 4) is the improvement of farm-household systems and rural communities on a sustainable basis, i.e. farming systems development (FSD). Because of its systems nature and its combined technical and socio-economic orientation, the FSD concept is gaining ground in many countries compared to the previous exclusive emphasis on production and profit maximization. FSD aims to improve efficiency in farm production, raise farm and family income, increase welfare of farm families, and satisfy basic needs for food, clothing, shelter, health, and education.

179. The principal focus of FSD is the farm household, placing primary emphasis on people and their environment rather than on commodities. There are three closely interlinked sub-systems: the household as the decision-making unit, the farm with its

crop and livestock activities, and the off-farm component. FSD views the farm household as a whole, not as separate parts; it recognizes interactions of components, and stresses a systems hierarchy whereby every system consists of sub-systems. FSD is multi-disciplinary (any activities are planned, executed and evaluated separately by persons of each discipline) and inter-disciplinary (activities are mutually planned, executed and evaluated).

180. Institutions of higher agricultural education have to take note of the change in favour of farming systems.

Questions:

181. *What modifications need to be considered with respect to programmes of teaching, research and extension/public service.*

182. *Is a radical change essential in the structure of curricula and in the balance between different discipline groups, e.g. technical agricultural subjects, basic sciences, social sciences and general education subjects?*

183. *What does the emphasis on farming systems require in terms of coordination and complementarity of related subject areas?*

184. *How should institutions' research programmes respond to the shift from production/profit maximization to the farming systems approach?*

185. *What can institutions of higher agricultural education contribute to popularize FSD among farmers and extension workers?*

Issue 4: Sustainable development: What is the role of institutions of higher agricultural education?

186. In many countries, the goals of agricultural and rural development are changing from the almost exclusive focus on production and income maximization to sustainable agricultural production and rural development. This concept requires a balanced approach to development, taking into account the relevant technological, resource related, economic, social, and cultural aspects. Sustainable development also requires a much more pronounced emphasis on the integration of environmental considerations into agricultural and socio-economic policies and programmes. As defined by FAO, sustainable development concerns natural resource management which *conserves land, water, plant, and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.*⁸

187. While in developed countries sustainability topics relate primarily to secondary effects of inputs into intensive production systems, in many developing countries the magnitude and variety of sustainability problems is much larger. Land degradation due to erosion, deforestation, overgrazing, faulty irrigation and drainage methods, mismanagement of rangeland and cropland in semi-arid areas, and consequential desertification and population pressure cause almost insurmountable problems.

188. The rural poor suffer most from unsustainable agricultural production practices. They find themselves at the centre of a vicious circle characterized by increased soil degradation, less availability of food, clean water and firewood, and increased poverty. Women in many countries carry particularly heavy burdens, finding themselves responsible for farm work, food preparation, processing, home management, mothering and being heads of households.

⁸ Quotation from the Report of the FAO Council, 1988.

189. There is widespread conviction among policy makers and agricultural experts that the current emphasis on sustainable development is not a passing fashion, but a permanent and essential element in agricultural and rural development. A list of topics which help explain the scope of sustainable agricultural development is given in *Appendix 2*.

190. Sustainable development encompasses many different scientific disciplines: agricultural sciences, including forestry, fisheries and veterinary sciences; agricultural product and food technology; basic sciences; economic and social sciences, including behavioural sciences, demography, etc.; law and public administration; communication sciences, and possibly a host of others. Since agriculture is the core element, institutions of higher agricultural education must not ignore the significance of sustainable development.

Questions:

191. *To what extent and how should institutions in developing and developed countries deal with this complex interwoven subject area which extends its influence to household, community, national and global levels?*

192. *Is it essential or desirable that all agricultural students learn about sustainable development, its underlying philosophy, basic planning and implementation techniques, or do they need specialized knowledge in subjects of particular local relevance instead? What are the curriculum review and revision implications?*

193. *Should institutions' research programmes contribute to identification of sustainable development problems and solutions, through socio-economic studies or elaboration of suitable methods for environmental accounting and impact assessment?*

194. *To what extent and how should the educational institutions assume responsibility for extension and training on appropriate environmental policies, programmes and practices?*

195. *Is there a role for the institutions in educating the general public about environmental conservation measures?*

Issue 5: Too few female agricultural professionals in many countries: how to achieve decisive breakthroughs?

196. In many developing countries and most of the developed countries, women play a significant role in agriculture. In the less developed countries, women provide essential farm labour, but an estimated one third of all rural households are *de facto* managed by women.

197. In addition to being responsible farmers, women in developing countries are primarily or even exclusively responsible for transporting fuel-wood and water supplies. Food preparation and processing and, in some countries, the marketing of food and other agricultural produce are important tasks too, as well as being mothers, home managers and income providers from off-farm occupations.

198. The burden of women's work is often unduly heavy. Many lack access to credit, farm inputs, property rights and extension advice. Household and farm productivity may be less than expected if there were a more equal distribution of labour and management tools between different family members.

199. An understanding of rural women's roles, problems, aspirations and potentials is in many countries inadequate, in particular at the political decision-making level.

This is due mainly to a general scarcity of reliable, detailed information and hard data. There are also extremely small numbers of female professional agricultural officers who serve at the decision-making level as programme administrators, researchers, teachers or extension agents. Specific problems of female agricultural producers are not sufficiently addressed. For socio-cultural reasons, communication with women farmers is difficult in many countries because of the scarcity of female field extension staff and inadequate understanding of the problems on the part of male extension staff.

Questions:

200. *What can be done to reflect the special concerns of women farmers in institutions' teaching, research and extension/public service programmes?*

201. *How can institutions of higher agricultural education help to increase the understanding of rural women's concerns by decision-makers and top administrators?*

202. *What can educational institutions do themselves to attract more female students into agricultural programmes? Should quotas or affirmative action plans be put into place?*

203. *How can other organizations (government departments, voluntary organizations, etc.) foster training and employment of more female agriculturalists?*

Issue 6: Relevance, quality and cost-effectiveness of the agricultural knowledge system: How can institutions of higher agricultural education contribute most effectively?

204. Institutions of higher agricultural education form part of national agricultural knowledge systems together with other educational institutions (e.g. vocational and technical agricultural schools), extension and information agencies, research institutes, etc. While each of these institutions and agencies has a particular focus, some of their functions are similar or they overlap (e.g. in the areas of research and of extension/public service). In some countries, national agricultural research centres and ministry of agriculture extension services are gaining strength. Where this is the case, the educational institutions should not only concentrate on education and training, but should collaborate in research and extension-type activities also.

205. Higher agricultural education based on only formal teaching programmes, whatever the standard of performance, cannot maintain relevance and quality in the long run. Complementary research and extension/public service activities are essential elements of institutional endeavours.

206. The important issue is not whether institutions should engage in non-teaching activities, but in which specific activities, in what manner, and in what proportion in relation to the teaching functions of the institution should they be engaged.

Questions:

207. *What non-formal training or outreach activities can be recommended to improve and complement formal teaching programmes? How can effective feedback from policy makers, farmers organizations, main employers, and graduates be ensured during planning and evaluation processes?*

208. *How can institutions' participation in national or provincial/state research planning and coordination of research programmes between institutions be ensured?*

Questions (cont.):

209. *To what extent should institutions of higher agricultural education engage in extension/public service activities, considering their mandates, resource situations and commitment to development actions?*

210. *How can effective cooperation with other institutions/organizations which also operate extension/public service programmes in rural areas be achieved?*

211. *How can institutional administrators and professors be persuaded to take first steps in seeking cooperation with agricultural ministry departments, extension services and research institutes?*

Ideas for the Design of Improved Programmes of Teaching, Research, and Extension/Public Service

212. In both developing and developed countries, institutions of higher agricultural education find themselves called upon to produce trained agricultural manpower, assist with relevant research studies, and help educate farmers, other rural people, and society. In the delineation of feasible options for new programmes or the modification of existing ones, many valuable suggestions and proposals coming from the 20 case institutions (*Appendix 1*) have been considered. Suggestions from other information sources were also taken into account.

Teaching Programmes

213. Prevailing characteristics and emerging curriculum development trends of undergraduate and postgraduate programmes in agriculture have been discussed. Proposals for change of programme structures, contents, and teaching methods arise from international and national levels (sustainable development and natural resource management) and from governments and institutions (suitability of existing programmes and the need for changes).

Diverging Programme Development Trends

214. In the majority of countries, senior extension personnel and field staff have been educated largely through educational programmes in general agriculture. As the sophistication of the agricultural sciences advances and farmers demand more advice in specialized subjects, the existing trend towards more specialization continues. The trend towards more separate programmes focusing on specialized subjects may continue, too.

215. Increased stress on complex inter-related areas (e.g. sustainable development and natural resources management, post-harvest technology, farming systems development) demands completely different approaches to curriculum design, teaching/learning and resource use. Teaching programmes have to be geared to agricultural and rural development by adopting a systems approach. Although a series of different disciplines are involved, these must be seen as elements which complement each other and form a whole. The interdisciplinary characteristics of agriculture need to be fully reflected in agricultural curricula, especially at undergraduate level. Every agricultural graduate should be able to comprehend agriculture as an organic system comprised of technical, economic, social, and cultural elements.

216. An important strategy question emerges from trends towards more pronounced subject specialization or the systems approach to agricultural undergraduate curricula: what conditions favour one or the other, and to what extent is it feasible to combine these trends?

217. Many small, resource-poor countries will need to train graduates with solid grounding in general agricultural sciences. While in the past most agricultural curricula were discipline centred, in the future their systems and interdisciplinary traits need to be emphasized. Students' versatility, intellectual initiatives and problem-solving skills will be more important than detailed specialized knowledge in one or two narrow subjects.

218. In Malawi, a small, densely populated, landlocked, less developed country (LDC), B.Sc. programmes in general agriculture should continue to be offered. In order to accommodate the wishes of main employers, government departments and private agribusiness and to have more post-graduate programmes and students, only a few subject specializations within the B.Sc. Agriculture programme should be considered.

219. Versatility and problem-solving skills are advocated by employers in developed countries also. The employers of agricultural graduates from the Canadian case institution suggest that the curriculum should become more concept and process oriented with an emphasis on skill development and a de-emphasis on technical competence and narrow subject specialization at the undergraduate level.

220. The Faculty of Agriculture, University of Western Sydney, Richmond, Australia, has applied the systems approach to agricultural teaching programmes. While these efforts are laudable, more experimentation seems to be needed in other institutions in order to identify appropriate curriculum structures, staff training requirements, resource needs, constraints and limitations. The question of subject specialization within the framework of a systems curriculum needs to be explored.

221. In the agricultural undergraduate curriculum, how can a proper balance be maintained between the technical content of broad subject areas and specialization in selected subjects? What consideration should get preference: the emphasis on versatility and skill development through a general curriculum, or the coverage of as many specializations as the job market may be able to absorb? How can problem solving skills be developed?

222. In the German case institution, the debate on the future structure and content of the agricultural teaching programmes is concentrating on two opposite proposals. Some administrators advocate that with declining student enrolment every possible niche in the job market needs to be filled by a tailor-made specialization programme. They want to add ecology and tropical agriculture to the existing four specializations. Others believe that versatility should receive priority and propose a reduction of the existing specializations to a maximum of three.

223. In small, resource poor countries, undergraduate specializations could cover broad subject areas: plant production, animal production, agricultural economics/farms management, agricultural engineering, and home economics/human nutrition. An additional specialization in the interdisciplinary area of sustainable development/natural resource management could also be considered.

224. Such specialization programmes are already being offered or are in the planning stage in a few of the case institutions. In the Canadian case institution, these include new majors in environmental protection and environmental soil science.

225. It appears that the offer of rather narrow subject specializations at undergraduate level should be discouraged because of the graduates' inability to comprehend agriculture as a broad organic system and because of limited job opportunity. Specialization in subjects such as plant virology, forest entomology, or poultry nutrition could more effectively be offered at the postgraduate level rather than in separate undergraduate specialization programmes.

How to Integrate Sustainable Development Topics

226. One of the most important new composite and interdisciplinary subject areas is sustainable development. It is advocated that all undergraduate students aiming for a

B.Sc. degree in agriculture should gain a thorough understanding of the relevant principles and practices of sustainable development. This is considered important since many agricultural graduates are expected to be employed in directly concerned occupations or those which are indirectly related to the conservation of natural resources.

227. Sustainable development could be taught as a separate course in the agricultural curriculum, a training course outside the normal curriculum, or a topic within existing courses.

228. A separate course or courses on sustainable development would draw on subject matter relevant to the particular local situation concerned (land stewardship and environmental management - Canada). It could be taught as one subject area among many others (basic sciences, applied sciences, agricultural professional subjects, behavioural and communication skill subjects). However, general agricultural curricula are usually overloaded in terms of subject matter coverage and teaching time requirements, making the addition or substitution of new courses is difficult.

229. The subject area, *sustainable development and natural resource management*, reaches into many diverse disciplines. Most of these disciplines already form part of agricultural curricula. The integration of appropriate environmental education topics within *traditional* agricultural courses is a strong alternative to offering a separate course. While this solution would emphasize the interdisciplinary character of sustainable development, implementation would require full support, understanding, and the integrative skills from all teaching staff involved.

230. A special intensive training course on sustainable development and natural resource management could be mounted between semesters or terms. Towards the end of the programme, preferably in the fourth year, six to eight weeks could be set aside for this purpose during holidays. The teaching of sustainable development would provide a perfect opportunity for re-emphasizing the interdisciplinary nature of this important subject area and its interlocking with traditional agricultural subjects.

Separate Undergraduate Programmes in Sustainable Development

231. Some of the case institutions in larger and more prosperous countries (Malaysia) have already started to offer B.Sc. programmes in environmental management which are separate from general agriculture programmes. With the expectation of increased job opportunities in this area and/or in specialized sub-areas, more separate undergraduate programmes focused on sustainable development and natural resource management may be offered. The vastness and diversity of the scientific components of such programmes will necessitate choices:

- introduction to the entire range of relevant scientific knowledge and methodology at undergraduate level, with subsequent specialization in selected specific areas (e.g. suitable farming systems, soil conservation, nutrition aspects) at postgraduate level;
- specialization/concentration on selected priority subjects within the last two years of the undergraduate programmes, following familiarization with the scope of sustainable development and important underlying scientific processes.

Management Skills

232. Another subject area needed for agricultural students is agricultural business management. Many case institutions indicated this area as important in relation to job opportunities offered by the private sector. Familiarity with planning techniques, decision-making skills, and use of suitable technology (computers) is called for. During undergraduate studies, agricultural students should gain at least a basic understanding of key management principles.

233. There is increased demand for computer literacy. Computers are used in modelling to simulate dependent and independent variables, allowing predictive capabilities in decision-making in agricultural subject areas. Computers facilitate on-farm decisions, help guide experimental research, and make the operation of mechanized systems possible (e.g. irrigation systems, controlled-environment housing for plants and animals).

234. Computers can also be used to assist in the learning process, e.g. auto-tutorial instruction involving drill, question and response situation, simulation and problem-solving. They help in evaluating instructional processes and in managing administrative aspects of education and training.

Teaching/Extension/Information Techniques

235. Most of the new agricultural development concepts with broad application potential (e.g. natural resources management, farming systems development) are still not well understood by policy-makers, administrators, farmers, research and extension workers, and the general public. Agricultural graduates knowledgeable in these subject areas will be called upon to explain principles and programmes and practical implementation measures. Their ability to recognize salient points and communicate them in a convincing manner to different target audiences will be of paramount importance. They have to learn appropriate behaviour and communication techniques during their studies. Careful attention must be given to the inclusion of relevant courses and practical experience in the agricultural programmes concerned.

Postgraduate Programmes

236. Job market trends seem to indicate the need for more high-level specialists in agriculture and its sub-branches, especially in the area of sustainable development/natural resource management and its scientific components. Specialists in these fields will have to be trained primarily at postgraduate level. Various programme structures need to be considered:

- short courses to learn particular survey/assessment techniques or experimental methods;
- specialization programmes of one to two years duration which combine the acquisition of knowledge with original research or survey work; and
- doctoral programmes following specialization which require theses and further scientific methodology and research in a sub-branch.

237. One important subject area for specialization at postgraduate level is environmental accounting and impact assessment. Suitable methodology is not yet fully developed and qualified specialized staff are scarce. Specialists should be trained without delay.

238. Depending on the particular country situation, other subjects of a more technical nature will require specialists: desertification control, marine pollution, food and water contamination, and socio-economics of natural resource management, etc.

239. More high-level specialists will be needed in plant and animal biotechnology and genetic engineering. Some case institutions offer new programmes of teaching in these fields, at both undergraduate and postgraduate levels. The Canadian case institution, for example, offers a new specialization (major) at B.Sc. level in plant science/plant biotechnology which focuses on the basic plant sciences and their application to plant biotechnology, genetic engineering and cell tissue culture. In India, the recently created advanced centres for postgraduate education and research in animal and plant biotechnology are being strengthened.

Student Recruitment

240. Increased access to higher agricultural education for young people from rural areas and female students needs to be considered through preferential treatment in entry exams, special tutoring and/or financial support schemes.

Improvement of Teaching and Learning

241. Quality of teaching needs to be improved in almost all institutions. The teacher must approach farming and rural life with a positive attitude, appreciating agriculture, sustainable development and natural resource management as integrative systems in which the subject/s taught form relatively small but essential parts. The teacher should master the subject area and teaching methods to be employed in the classroom, laboratory, field situations, etc.

242. In order to bring about marked improvement, teaching quality has to be a decisive factor in staff training, promotion and academic status within the institution's community and beyond. This can be achieved through pre- and in-service training in teaching methodology, peer reviews, competitions, and/or official recognition or awards, as decided by each country/institution. The pioneering experiences of some institutions (Ohio State University, U.S.A.) could be used as good examples for improving the quality of teaching and giving recognition to outstanding agricultural teachers.

Research Programmes

243. Most of the institutions included in FAO's case study programme indicated they wish to engage more forcefully in agricultural research. This confirms their commitment to contribute to national development through the scientific search for solutions to urgent problems. What are the most important research directions which institutions of higher agricultural education should follow?

244. Research priorities need to be determined on the basis of local conditions, taking into account policy directives, resource availability and other factors. Research components of sustainable development and natural resource management may include the following priority areas:

- suitable methods for environmental accounting and impact assessment;
- farming systems development, especially for arid and semi-arid regions;
- socio-economic research focusing on the rural poor, to identify specific problems, design survival strategies and experiment with alternative approaches to practical solutions, and
- studies to support the above on the significance and dynamics of population/rural development relationships in selected geographical areas and on socio-economic/cultural situations of rural women.

245. Other areas where increased research efforts are expected are: biotechnology, food science and food product development; business management, agro-forestry and community horticulture (ornamentals and nursery crops).

Increased Participation in National Agricultural Research

246. Institutions of higher agricultural education must be brought within the mainstream of national agricultural research. This entails participation in prioritizing and executing research activities which are of national significance. The FAO Expert Consultation on the Role of Universities in National Agricultural Research Systems (NARS) of Developing Countries (Rome, March 1991) strongly highlighted these points.

247. This Consultation further suggested increased emphasis on the development/strengthening of postgraduate programmes in relevant fields for the training of research scientists to enlarge the institutions' research activities. Detailed suggestions were made on how to achieve better institutional linkages with research and extension agencies belonging to ministries of agriculture, international agricultural research centres and international organizations and donor agencies.

Extension/Public Service Programmes

248. Many of the case institutions in developing countries reported that they intend to expand their outreach activities through contact and cooperation with extension workers, farmers and other rural people. Institutions in developed countries will do so through wider ranging communications comprising society-at-large.

249. In line with positive experiences in other countries, the case institutions in Egypt and Thailand plan to establish centres for continuing education. These centres will facilitate cooperative staff efforts and provide integrated bases for expanded human resource development outside campus, encouraging inter-disciplinary approaches to a better quality of life.

250. One of the important vehicles for effective outreach programmes has been staff and students working with farmers in nearby villages which serve as field testing and student training grounds. The success of these social laboratories in various Asian universities suggests that the *adoptio* of a limited area - one or several villages with few farmers and their families - benefits both the villagers and institutional staff and students. Feedback from field to laboratory/classroom is but one of the many positive results which advocates wider application of the social laboratory concept.

251. Another way to establish and maintain contact with farmers in the vicinity of the institution is to invite them for field days, demonstrations and short training courses (Morocco). Issuance of leaflets, radio broadcasts and rural newspapers is another means to serve farmers.

252. Of equal importance is contact and cooperation with officers and field staff assigned to the national/state extension service. To them the institutions can offer training courses of various kinds: short courses to upgrade technical competency in particular subjects, and training on suitable extension methods, computers and teaching/training aids.

253. Previous experience suggests there is an urgent need in many countries to bring teachers and researchers from institutions of higher agricultural education together with extension supervisors, subject matter specialists, and extension field staff. Talking to each other with the aim of improving research/extension services to primary producers and the rural poor is essential. Joint verification of research results in farmers' fields, joint supervision of extension students, joint training sessions, and demonstrations should follow.

254. Such cooperation will happen only if there is goodwill and pressure from both sides. Institutional commitment to extension/public service must encourage staff and students to initiate beginning cooperative efforts with extension service personnel. Sometimes formal agreements between institutions of higher agricultural education and government extension agencies can help by providing a proper framework (India). Institutional administrators should not wait until agreements are drawn up and sanctioned. Field action is what counts, not paper work.

255. In order to bring about enthusiastic staff participation in extension/public service activities, two prerequisites are important:

- a small working fund, covering essential expenses for transport, farm inputs, wages for extra support staff, etc; and
- full recognition of extension activities alongside research and teaching for staff promotion purposes and allocation of staff time.

256. Providing for or contributing to training courses for extension personnel is not new, but the content could be different. The quest for sustainable development and better natural resource management should encourage institutions of higher agricultural education to offer courses to programme administrators, trainers, field supervisors and other extension staff on appropriate environmental policies, programmes and practices.

257. Should institutions of higher agricultural education also be in the forefront to educate the general public on environmental conservation measures? Many institutions will be able to count on qualified staff and ongoing or planned environmental education programmes at undergraduate and postgraduate levels. They are well equipped to offer special short courses for school teachers, personnel of local administrations, political leaders, and other interested people who may be able to transmit relevant environmental messages to their clients and friends.

258. Institutions could also organize demonstrations of good natural resource management (e.g. in organic waste recycling, energy saving, maintenance of living space for threatened animal and plant species, and biological pest control).

259. In most developed and some of the more affluent developing countries, new client groups for the institutions' public service activities are emerging. These include hobby farmers, small-scale horticulturists, nature lovers, and others interested in rural life and/or in natural resource management. Should institutions of higher agricultural education try to cater to such groups by offering training and information to them?

Towards More Efficient Institutional Management

260. An important prerequisite for efficient institutional management is the availability and continued updating of a strategic master plan for the institution as a whole. Such a master plan should indicate, over 5-10 years, envisaged programme changes, resource needs, and potential sources and proposals for new infrastructure, organizational/administrative adjustments, and time necessary for implementation of the various elements. Institutional master plans are valuable, not only for internal use, but for negotiations with government authorities on subsidies, collaboration with research and extension departments, and cooperation and support from foreign institutions and donor agencies.

Balance between Programmes

261. Achievement of a proper balance between the institutions' three main programme areas - teaching, research, and extension/public service - is of utmost importance. National and institutional policies, programme priorities and resource availability are significant criteria in the determination of a *proper* balance.

262. How can it be ensured that extension/public service activities are supported by adequate staff, physical and financial resources? How can the quality of teaching be maintained in light of increasing requests on staff time by consultancies, contract research and administrative work?

Impact and Efficiency of Teaching Programmes

263. Impact of teaching programmes depends primarily on their relevance and quality as perceived by institutional administrators, professors, students, employers, and the general public. In order to achieve and maintain adequate levels of relevance and quality, curriculum development and regular curriculum reviews have to be carefully monitored. Systematic feedback from main employers and former graduates is of vital importance.

264. In many institutions of higher agricultural education, dropout rates and the time taken to complete programmes of study need to be drastically reduced. Measures for achieving this may be the adoption and enforcement of strict examination rules, but of *student friendly* exam procedures, proficiency tests of incoming students, and avoidance of excessive staff requests on students' time, etc. These measures promise significant improvements of programme efficiency, if reasonable staff-student ratios prevail. The achievement of a more favourable staff-student ratio is a first step towards greater efficiency in teaching.

Programme Leadership

263. The basic institutional structure (department - faculty/college - university) is still in place in most case institutions. Some have changed already, and the initial results in terms of improved programme coordination, staff cooperation, and administrative streamlining have been encouraging. The creation of larger academic base units, instead of the traditional departments, is debated in some institutions, and needs to be encouraged.

266. Research programmes are becoming increasingly multifaceted, requiring inputs from different disciplines. Biotechnology, natural resource management, and rural development are striking examples. The need for more forceful integration of basic research (molecular biology, genetics, microbiology) into programmes which emphasized almost exclusively applied aspects is also supporting those institutional administrators who insist that the traditional structures are no longer adequate. Similarly, programmes of teaching which concentrate on the same interdisciplinary areas as research does are bound to reach across departmental frontiers. In extension/public service this tendency is also obvious and increasing.

267. There is no doubt that programme coordination and cooperation of staff representing different disciplines cannot be left to the discretion of individual academic departments. Larger units have to assume the essential integrative functions. The level at which decisions are made on programme planning and execution will have to rise correspondingly with the increasing focus on inter-disciplinary work. If base units are involved which belong to different faculties/colleges, it is doubtful they can be effectively managed at that level. The Swedish case institution's report comments candidly, *It may then be questioned whether the current faculty organization is suitable.*

Centralization versus Decentralization

268. If the notion that the faculty/college level may no longer be appropriate for the leadership role regarding future programme development and implementation is accepted, different management structures and procedures will have to be designed. This would entail more centralization of decision-making and more concentration of power in the institutional upper layers. It could also lead to less effective participation of staff and students in institutional management. Some programmes of research and teaching may no longer be identified with a particular organizational unit (e.g. an undergraduate programme in biotechnology with the faculty or college of agriculture).

269. Increased centralization of decision-making runs counter to the drive of department heads, professors and support staff towards more decentralization. In many institutions, they already complain about high-handed decision-making without proper consultation, excessive red tape and bureaucracy, and increasing difficulties getting requests for appropriate resources approved and honoured. Would further increased centralization aggravate this situation?

Ideas for Structural Change

270. What then are the options which promise reasonable results? Teaching, research and extension/public service may be handled separately; by the same organizational unit, or partially separate.

271. Handled separately, the departments or other base units would be reduced to teaching only. For research purposes, the same and/or additional staff would be organized in institutes or centres to cover broader subject areas. Extension/public service work would be conducted through one or more continuing education centres, again drawing on the same and/or additional staff.

272. Handled together, the units with budgetary and programming power have to be large enough to cover several related subjects (clusters and sectors in the Dutch case institution; divisions in the U.S.A. institution). In addition, procedures must encourage interaction between units. Otherwise there is danger of segregation, especially in institutions where the central administration limits itself to setting institutional policy and guidelines for programme planning.

273. Partial separation could take the following forms:

- strict disciplinary teaching, research and extension could be the responsibility of base units (e.g. plant nutrition or entomology), while all inter-disciplinary work would be managed at the central institutional level through vice-presidents/vice-rectors/directors in charge of academic affairs, research and extension/public service and/or institutional centres (e.g. one for research and one for extension/public service);
- similar to above, but with organized research management for interdisciplinary work only in particular priority areas (e.g. natural resources conservation and rural development), with separate institution-wide centres, each focusing on a particular subject area and assuming the management function; or
- centres or staff groups focusing on specialist training programmes (*third cycle* programmes - French system) or on post-graduate work in a priority area with inter-disciplinary dimensions.

274. There are advantages and disadvantages inherent in each management structure. Much depends on the general character of the institution. What ultimately decides on success or failure of a system which seems viable in theory is the way the administrative frame is filled with life by those who command and serve in it.

275. The following principles should be considered: (1) as much decentralization, staff, and appropriate student participation in decision-making as possible, (2) delegation of responsibility for resource allocation (staff, physical facilities, finance) and use to the lowest feasible level, and (3) provision of incentives to academic/support staff and students to encourage good teaching and effective participation in inter-disciplinary research and extension/public service.

276. Institutional structures and procedures do not only concern internal management at the institution's headquarters. Outlying facilities may form part of the system, too (Moroccan case institution's centres for training, research and development in agronomy for the Sahara or mountain regions). In order to make optimum use of such facilities, appropriate management structures and procedures have to be designed as directly and simply as possible. Where an outlying centre focuses on animal production only, this could be linked to the respective academic department/base unit, provided the department/unit is willing and able to marshal other units for cooperation in students' practical training, postgraduate work and extension. However, if the centre's focus is markedly inter-disciplinary, it needs to be attached to the headquarters unit which carries the main responsibility for inter-disciplinary work in the particular subject areas concerned.

In-Country Linkages

277. As indicated by many of FAO's case institutions, there is a need for closer linkages with policy makers, government departments, main employers, other educational and research institutions, extension services, local leaders, former graduates, the rural communities in the vicinity of the institution, and the general public. Through information and dialogue with policy makers at national and provincial/state levels, the potential of the institutions as partners in socio-economic development can be demonstrated and improved.

278. Good relations with those government ministries which provide programme supervision (education and/or agricultural ministries) and financial support are of paramount importance. Showing a spirit of cooperation rather than confrontation helps to remove prejudices and wrong impressions. It may also help to ensure material and financial support beyond what may be expected.

279. Regular feedback from main employers of graduates is extremely helpful in the design of new study programmes, as well as in the monitoring and adjustment of existing ones. Their indications of personnel requirements (numbers, quality, subject specialization, special skills) should be seriously considered. Appropriate channels of communication with public and private employers should be established.

In-Country Cooperation Networks

280. In larger countries with more than one institution of higher agricultural education, the joint setting of priorities for postgraduate programmes and research and sharing of responsibility for programme execution can bring immense benefits to the nation. Establishing in-country centres for advanced training and research in key subject areas helps train specialists at master and doctorate levels, who become top level professors and researchers in their field of competence (India). The combination and use of available expertise in neighbouring educational and research institutions for training and research in selected key inter-disciplinary subject areas (Agropolis, France.) is a successful in-country linkage arrangement. National associations of higher agricultural education and other professional groupings can assume monitoring and coordinating functions regarding the sharing of responsibilities among educational institutions.

281. Closer cooperation with research institutions under sectoral ministries is another point of concern. Participation of educational institutions in decision-making on national research priorities, which may be the prerogative of government research departments and institutes, is one important aim. Actual sharing of responsibility for certain research projects and active cooperation is another. Through staff secondments, joint supervision of postgraduate students, and sharing of laboratory space and expensive equipment, benefits accrue to both parties in terms of education and research achievements, use of resources, and saving of funds. Contracting institutions of higher agricultural education to implement specific government and private research projects should be considered.

282. Many educational institutions would derive rich benefits from closer links to national and/or provincial/state extension agencies. Memoranda of understanding, or other formal agreements, could be drawn up. More important than the creation of a proper administrative frame would be joint action at field level (e.g. through the testing of research results in farmers' fields; participation in training extension supervisors, subject-matter specialists, and field agents; the preparation of extension materials, or the joint organization of extension practicals for students, etc).

283. Closer linkages with other organizations and institutions do not come about automatically. They must be solicited, cultivated and maintained with determination, ability, and zeal. Without initiatives taken by the educational institutions themselves, little can be achieved. Where there is strong commitment to cooperative action, rich benefits can be gained by all.

Linkages Across Borders

284. The potential for fruitful cooperation with agencies and institutions abroad has not been fully put into practice. The array of existing possibilities is vast and more are expected to present themselves in the coming years. Taking advantage of institutional and geographical strengths should be a high priority.

Specialized Centre Networks

285. In education and training, the sharing of responsibilities for specialist postgraduate training lends itself to cooperative arrangements between countries and institutions within the same geographical region, ecological zone, or language area. As in India, mature institutions in country groupings can share responsibility for specialized high-level training in selected subject areas. The recently created Southeast Asian University Consortium for Graduate Education in Agriculture and Natural Resources, with five member institutions in four countries, is an excellent example of such networking. In Southern Africa within the framework of the Southern African Development Coordination Conference (SADCC), similar cooperative efforts have also started (Malawian case institution, with its postgraduate programme in animal science). Programmes in other subject areas are in the planning stages elsewhere. The ultimate success of such endeavours will largely depend on the continuous inflow of financial and staff resources from abroad.

Exchange Programmes

286. While cooperation through training and research at specialized centres is important, other forms of collaboration involving staff and students are equally important. Exchange of information on teaching programmes, research breakthroughs, important international conferences, new textbooks and scientific journals, and the regular exchange of institutional periodicals help to improve communication among institutions in different countries. Staff secondments and student exchanges have similar positive effects. All possible vehicles for such exchange programmes should be exploited: existing regional institutions and associations, voluntary agencies, and private foundations, etc.

Financial Management

287. In many institutions the most pressing problem is how to reduce the dependency on government financing and how to increase financial self-management.

288. Most institutions depend largely or almost exclusively on government financing of current expenditures and capital outlay. How can funds from non-government sources or from government sources beyond regular subsidies be attracted and controlled (e.g., to finance new infrastructure in support of a particular teaching or research programme, or simply to increase the working fund covering current expenditures, such as staff salaries or the replacement/repair of equipment)?

Marketing of Services

289. In order to reduce dependency on government financing for current expenditures, the *marketing* of services which the institution offers could be considered. For example, money could be earned through testing of soils, water, or food in the institutions' laboratories. Some case institutions expect the potential for selling such services to grow considerably in the coming years. Similarly, there may be increased demand for library services using modern technology and documentation networks for literature search.

290. In many institutions, increased income could come from farming operations, not only through better management of existing enterprises, but through contract farming (large-scale seed multiplication, animal breeding, and processing of agricultural produce).

291. There will also be wider scope for contract training. Institutions should consider offering training programmes against payment (the commercial marketing of training services). This would be unsuitable for small, resource poor farmers who are unable to pay, but agribusiness firms, parastatal corporations, processing industries, large and wealthy cooperatives, and farmers associations are potential clientele to whom specific training courses (e.g. from one day to one week) could be offered at commercial rates.

292. Contract research offers opportunities for increased income earning. Research that concerns a particular problem (e.g., the combat of a specific pest or socio-economic survey work in a group of villages) lends itself to this approach. Applied research of a short-term nature is probably more suitable for execution under contractual arrangements than basic research which might require longer periods.

293. Customers for contract research could be government departments (including agricultural research institutes), commodity-oriented groups of large-scale producers, marketing organizations, commercial companies, philanthropic agencies, external aid organizations, and international research institutes, etc.

294. Consultants are another avenue of service to be marketed. Individual staff members may author scientific papers or contribute to conferences and seminars. Many case institutions do not encourage this, as the choice of assignments and corresponding reward is left almost entirely to the staff member/s concerned.

295. Institutional administrators propose that contract training, contract research, and consultancy services would receive better support if a central office handled the respective negotiations. The administration of such services at central institutional, or at least at faculty/college, level would ensure similar levels of remuneration for similar types of work, and the assignment of those staff members who would be able to perform best. A proper balance between teaching *ordinary* research and extension/public service and contract/consultancy work could be monitored.

296. However, over-centralization of decision-making on contractual services is not good either. If individual staff members have little say and receive only a fraction of the money earned, they will soon lose interest in performing extra work.

Tapping Other Resources

297. In some developing countries where no or very low tuition fees have been levied, the introduction or increase of tuition fees is a volatile issue. University level institutions may regard tuition fees as a legitimate source of income, but the social dimension of this question needs to be fully explored. This is most important in order to devise a fee-paying system which does not overtax the majority. Reductions or grants would need to be considered for able students from resource poor rural families; otherwise the urbanization of the student population would soon reach excessive proportions.

298. Marshaling of extra resources can be promoted in various ways: agribusiness firms or processing industries could finance a professorial position; the institutions' alumni association, some scholarships; an engineering company, machinery; a voluntary agency, an added classroom or laboratory, etc. It would be necessary to have an up-to-date strategic development plan for the institution as a whole so that potential benefactors could see how their contributions would be utilized.

299. All measures described above would be successful only if the institution could demonstrate the impact of its programmes, the dedication and quality of its staff, and the efficiency of its management. For this purpose, well planned and organized public relations efforts are absolutely essential. Most institutions will have to give more

attention to this. The image of the university as a foremost development institution and scientific centre needs to be cultivated and planted in the minds of politicians, public administrators, local leaders and all other people who might be able to contribute and/or benefit from the institution. Promotional meetings, attractive bulletins, informative video programmes, occasional press conferences, and radio and television broadcasts could help in this respect.

Financial Self-Management

300. Increased financial self-management implies loosening the rigid budgeting and accounting procedures imposed by governments which most case institutions have to follow. What is advocated here is not to leave the handling of the institutional finances to the discretion of the top administrators. There have to be rules and regulations which need to be followed meticulously.

301. Governments should provide annual lump sums without prescribing how and for what specific purpose the money is to be used. Institutions should be permitted to establish budgets by programme, as opposed to line item budgeting, and to sub-divide the available funds according to their own criteria. Accounting should be handled in the same way. This would encourage efficient programme delivery. It would also strengthen the sense of responsibility inside the institution for its accountability *vis-à-vis* government authorities.

302. In many institutions, government rules do not allow immediate reinvestment of money earned from farm operations, etc. There are therefore no incentives to produce more in order to buy new equipment, transport, literature, or other essential items. An allocation of funds must be applied for, if an investment is to be made. Approval of the application and actual money transfer is sometimes uncertain and untimely. Under such circumstances, a commercial enterprise like a farm cannot be managed properly.

303. Change is needed. The commercial farm should be managed like any other business, with separate budgeting, balance sheets, and profit/loss accounting. A professional farm manager should have full control and financial responsibility, auditing accounts regularly. Such change would be beneficial: income would be increased due to increased staff enthusiasm, students could learn techniques of commercial enterprise management, and the image of the farm would improve due to increased maintenance of grounds, buildings and equipment.

304. The issue of internal governance and fiscal autonomy was discussed extensively by the Regional Round Table on Strategies for Agricultural Education and Training in Asia and the Pacific in 1990⁹. The meeting recommended that institutions should develop models of autonomy and accountability for consideration and eventual approval by the national government authorities. Such models could then be implemented on a trial basis. A similar model is currently being tried in two German comprehensive universities over a six year period.

305. The advice given by the Regional Round Table is valid. Since the institutions want prevailing systems changed, they have to develop appropriate proposals and promote these in formal and informal discussions. To make governments change their financial rules is not easy, but, in the interest of increased impact and efficiency, it is worth working on until a reasonable solution is found.

⁹ Report of the Regional Round Table on Strategies for Agricultural Education and Training in Asia and the Pacific held jointly by AAACU, SEARCA, Kasetsart University and FAO, Bangkok, August 1990.

Modern Management Tools

306. Many administrative measures can be aided by appropriate tools and equipment. Computers are in the forefront of a worldwide drive towards more efficiency in administrative procedures. They represent an extraordinary resource for processing, storage and retrieval of vast amounts of data and information. Their mathematical capacities, diverse programming facilities and desk-top publishing capabilities add to their versatility and usefulness for management purposes. Information on teaching programmes, students, staff, budgets, and accounts can be processed and presented in an attractive form much faster and more accurately than before.

307. Institutional administrators, financial managers, and accountants call for office automation. This call is legitimate given the enormous advantages of computerization. Such a move is very expensive. It requires a secure flow of electricity and a group of well-trained people to take advantage of the hardware installed. A series of appropriate computer programmes geared to the needs of institutions of higher agricultural education need to be purchased or developed.

The Role of International Organizations and Donor Agencies in Support of Higher Agricultural Education

308. International organizations such as FAO, UNESCO, the World Bank, and others have supported agricultural education and training in various ways: the collection and spreading of relevant information, policy advice, training programmes, and project support for institution building purposes. Donor agencies (in particular funded by national governments), foundations, as well as national and international voluntary organizations have supported the strengthening of agricultural education and training in numerous developing countries. Would such assistance still be essential or desirable, maybe on a reduced scale, in the future; or are there new roles to be performed by international organizations and donor agencies?

309. The continuous quest for relevance and excellence, new programme directions, institutional structures and management procedures, increased linkages between institutions, both in-country and across borders: these are just a few of the factors which will influence the need for help by the international community in the future. International organizations spearheaded by FAO and donor agencies will be challenged to step up their contributions, in technical and managerial expertise and financial assistance.

FAO's Future Role

310. Carrying the technical responsibility for agricultural development in the family of United Nations agencies and, as lead agency for rural development within the UN system, FAO appreciates and supports the paramount importance of higher agricultural education as an essential element of agricultural and rural development in its widest sense. The challenges posed by new developments encourage FAO to increase its efforts towards the improvement of higher agricultural education. Because of the Organization's long-standing experience, its expertise drawn from many different countries and institutions, and in view of its technical nature without linkage to any political system or organization, FAO is in an ideal position to play an important catalytic role.

Policy Formulation and Programme Advocacy

311. One main task will be to continue to act as forum for the discussion of policies, alternative strategies and programmes in agricultural education and training. The Expert Consultation on Strategy Options for Higher Education in Agriculture is a striking example. An ongoing series of regional round tables on agricultural education strategies, national programming conferences and expert panels focus on particular

technical subjects and provide valuable opportunities for the consideration of policy and programme options.

312. The advocacy and promotion of specific programme concepts which promise significant benefits to countries and/or institutions also belongs here. FAO will continue to advocate the validity of the specialized centre concept. This concept encourages the creation/strengthening of regional or sub-regional networks of centres for high-level, specialized training and research in selected key agricultural subject areas. Smaller and resource poorer countries and institutions which cannot afford to establish expensive training and research facilities in every specialized subject are particularly interested in the sharing of responsibility for such centres.

Collection and Spreading of Useful Information

313. A second continuing task for FAO will be the collection and spreading of information which is of wider interest to policy makers, institutional administrators, and others concerned with higher agricultural education. This task entails, for example, information on promising experiments with new types of curricula, experiences with different institutional structures, and alternative approaches to staff training and institutional management. The case study programme implemented prior to the preparation of this paper provided such information. It may be expected that FAO's efforts in the collection, sifting and distribution of valuable information and data will need to be enhanced in the future. The Organization's access to all its member nations and their institutions will make it possible to detect interesting experiences and approaches; perform comparative studies on curricula, research and extension/public service programmes; and inform governments, educational institutions, and aid agencies throughout the world, accordingly.

Experimentation Support

314. Encouragement and support to experiments with agricultural curriculum structures will be a third important area for FAO's future work in higher agricultural education. Pilot implementation and testing of the systems approach to agricultural undergraduate curricula in a few selected institutions could be one specific focus. Alternative curriculum structures in the area of sustainable development/natural resource management and the recognition and reward of good teachers could, among others, also be foci for FAO's experimentation support.

315. However, FAO's interest will also concern the search for viable approaches to the institutions' research planning and implementation, the establishment and maintenance of functional research-education-extension linkages, the design and performance of appropriate extension/public service activities, and the testing and evaluation of alternative institutional management structures and procedures.

316. Encouragement and support of experimentation (e.g. with institutional programmes and management structures in higher agricultural education) will be a relatively new area of concentration for FAO. The Organization is in a unique position to perform this vital function and communicate the results of these endeavours to interested policy makers, institutional administrators and others concerned.

Project assistance

317. Some of the policy formulation, information, and experimentation functions may be performed within the framework of the Organization's Regular Programme, or under specific trust fund arrangements. Other such activities may form part of project-type assistance packages with more comprehensive institution building objectives.

318. Assistance in the assessment of training requirements, the design of location-specific curricula, and staff training will continue to characterize FAO's project support to institutions of higher agricultural education. While the provision of expatriate

expertise, on a long-term basis, and of equipment for laboratory and farm use may be expected to further decline, FAO project assistance will concentrate more and more on short-term policy and programme advice. Such advice might concern the preparation of a strategic institutional development plan, the design of a postgraduate programme in a particular subject, the evaluation of an institution's extension/public service programme, or the preparation and testing of specific teaching/training manuals.

Other International Organizations and Donor Agencies

319. International Organizations such as UNESCO, World Bank, and others may be expected to continue their support to higher agricultural education in accordance with their mandates and policies. FAO will encourage these organizations to fully participate in the discussion of development trends, issues, and options. They will also be invited to join forces with FAO and coordinate their support programmes with those of FAO.

320. UNESCO, for example, may wish to continue its emphasis on the improvement of teacher training and teaching methodologies. The World Bank would probably concentrate, as in the past, on the provision of infrastructure for selected institutions; UNEP, on measures improving environmental education, and so on.

321. Donor agencies, such as government supported bilateral aid organizations, foundations, and voluntary organizations are expected to continue their aid programmes to improve higher agricultural education. Their main thrust would probably be fellowship training and infrastructure provision, in order to strengthen the agricultural training capability of selected countries and/or institutions. They would also contribute to the implementation of assistance programmes benefiting groups of countries with centre networks. For reasons of programme efficiency and impact, FAO would offer to coordinate planning efforts and inputs from the various interested parties.

Common Goals of External Assistance

322. The main goal of external assistance to higher agricultural education is to help build-up institutions with first-class programmes, resources and management, regarded as equal-level partners by already-renowned institutions. In the quest for improved quality of teaching, research and extension/public service programmes of developing country institutions, linkages with outstanding educational and research institutions in neighbouring countries and in other regions can be of immense benefit to both parties. This is a concept which has worked in the past and is expected to bear rich fruits in the future. Renewed efforts should be made by all external aid agencies to help establish and maintain such linkages.

323. The establishment of lasting institutional partnerships should aim at three directions: staff exchanges, student exchanges, and research cooperation. For some developed country institutions, inviting staff from developing country institutions as visiting professors to teach postgraduate courses or give advice on research methodology may require new thinking and a change of attitude. Similarly, developing country institutions must act with confidence and contribute goodwill, motivated staff, physical and financial resources according to their capabilities to the cause.

324. International organizations and donor agencies can contribute significantly through technical advice and/or finance. While relatively small sums of money will be required from external sources, their availability must be ensured for a minimum of five years. This is essential to achieve a reasonable degree of financial security and cover the cost of air travel, small research grants, etc. FAO will contribute whatever is in its capacity and will encourage the international community at large to increase its assistance to facilitate institutional linkages and support higher agricultural education in general throughout the world.

APPENDICES

1. Institutions of Higher Agricultural Education
Included in FAO's Case Study Programme
 2. List of Topics Concerning Sustainable Development
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Institutions of Higher Agricultural Education Included in Fao's Case Study Programme

Brazil	Centro de Ciencias Agrarias, Universidade Federal de Vicosa
Cameroon	Institut National de Développement Rural, Centre Universitaire de Dschang
Canada	Ontario Agricultural College, University of Guelph
Egypt	Faculty of Agriculture, University of Alexandria
France	Agropolis, Montpellier
Germany	Universität Hohenheim, Stuttgart
Hungary	University of Agricultural Sciences, Gödöllő
India	Haryana Agricultural University, Hisar
Kenya	Faculty of Agriculture, University of Nairobi
Malawi	Bunda College of Agriculture, University of Malawi, Lilongwe
Malaysia	Universiti Pertanian Malaysia, Serdang
Mexico	Colegio de Postgraduados, Chapingo
Morocco	Institut Agronomique et Vétérinaire Hassan II, Rabat
Netherlands	Wageningen Agricultural University
Nigeria	Faculty of Agriculture and Forestry, University of Ibadan
Peru	Universidad Nacional Agraria La Molina, Lima
Philippines	College of Agriculture, University of the Philippines at Los Baños
Sweden	Swedish University of Agricultural Sciences, Uppsala
Thailand	Faculty of Agriculture, Khon Kaen University
United States of America	College of Agriculture and Forestry, West Virginia University, Morgantown

List of Topics Concerning Sustainable Development

The list of sustainable development topics given below refers primarily to subject areas related to agricultural and rural development. The list is not exhaustive. Agricultural students would need to study those subjects which are of importance in the local context.

1. Environmental accounting, impact assessment and respective survey techniques.
2. Population dynamics, population-rural development relationships, population and natural resource management.
3. The rural poor: characteristics of households and of their members, special roles of women, access to productive resources, survival strategies.
4. Farming systems: low input farming systems, high rainfall and irrigation systems, land utilization in marginal areas, integration of crops and livestock, agro-forestry and aquaculture, recycling of farm waste.
5. Good crop production practices: efficient fertilizer use, efficient use of agricultural chemicals and integrated pest management, control of soil degradation through soil treatments (e.g. farmyard manure, compost, cover crops, green manure), rotations, good cultivation and mechanization techniques.
6. Irrigation and drainage practices: efficient water use, control of salinity.
7. Soil conservation: erosion control through appropriate farming practices and barriers against wind and water erosion, desertification and its control.
8. Water conservation: water as a renewable source, services, dams, lakes, underground water, watershed and catchment management.
9. Forestry: deforestation control, agro-forestry, wild life management, pollution by forest industries e.g. pulp and paper industries.
10. Fisheries: conservation of important fish species, marine pollution.
11. Human nutrition: contamination of foods and feeds, water contamination through misuse of pesticides, excessive fertilizer application, farm waste, rural industries.
12. Agricultural productivity and income versus sustainable development.
13. Philosophy and practices of environmental education.

TIMETABLE

Expert Consultation on Strategy Options for Higher Education in Agriculture

16 TO 20 DECEMBER 1991, ROME, ITALY
Food and Agriculture Organization of the United Nations

ANNEX 3

**Expert Consultation
Strategy Options for Higher Education in Agriculture
Rome, 16 - 20 December 1991**

TIMETABLE

Monday, 16 December

0915 - 1000	Registration
1000 - 1215 (Session 1)	Opening Session Chairman - W. Maalouf Rapporteur - H. Hoffmann
1000 - 1015	Keynote Address - Mr. A. Cortas, Officer-in-Charge, ES Department
1015 - 1030	Introductions of Participants and Staff
1030 - 1100	Coffee/Tea
1100 - 1110	Aims and Objectives of the Consultation: T. Contado, Senior Officer, Agricultural Extension and Training
1110 - 1120	Working Arrangements: W. Lindley, Senior Officer, Agricultural Education
1120 - 1230	"Higher Education in Agriculture: Status, Issues and Ideas for Future Development", Presentation of main paper by H. Hoffmann
1230 - 1430	Lunch
1430 - 1700 (Session 2)	Higher Education in Agriculture: Status, Issues and Ideas for Future Development (continued from session 1) Chairman - K. Raman Rapporteur - W. Lindley
1430 - 1445	Discussant - E. Johnson
1445 - 1500	Discussant - O. Bentley
1500 - 1515	Discussant - J. Djoukam
1515 - 1545	Coffee/Tea
1545 - 1700	Plenary Discussion

Tuesday, 17 December

0900 - 1200 (Session 3)	Major New Developments in the World: How Should Institutions of Higher Agricultural Education React? Chairman - A. Conésa Rapporteur - R. Adhikarya
0900 - 0920	Presenter - L. Sánchez
0920 - 0935	Discussant - R. van Haarlem
0935 - 0950	Discussant - K. Kocsis
0950 - 1020	Coffee/Tea
1020 - 1200	Plenary Discussion
1200 - 1400	Lunch

Tuesday, 17 December (cont'd.)

1400 - 1515 (Session 4)	Different Institutional Goals in Developing and Developed Countries Chairman - O. Bentley Rapporteur - N. Doron
1400 - 1420	Presenter - Sam-Arng Srinilta
1420 - 1430	Discussant - T. Contado
1430 - 1440	Discussant - G. Jenkinson
1440 - 1515	Plenary Discussion
1515 - 1545	Coffee/Tea
1545 - 1700 (Session 5)	From Narrow Production Orientation to Farming Systems: What are the Consequences for Institutions of Higher Agricultural Education? Chairman - O. Bentley Rapporteur - W. Lindley
1545 - 1600	Presenter - M. Hamzé
1600 - 1610	Discussant - K. Raman
1610 - 1620	Discussant - A. Conésa
1620 - 1630	Discussant - H. Jain
1630 - 1700	Plenary Discussion

Wednesday, 18 December

0900 - 1200 (Session 6)	Sustainable Development: What is the Role of Institutions of Higher Agricultural Education? Chairman - M. Hamzé Rapporteur - R. Adhikarya
0900 - 0920	Presenter - M. Firdawcy
0920 - 0935	Discussant - M. Rolls
0935 - 0950	Discussant - P. Górecki
0950 - 1020	Coffee/Tea
1020 - 1200	Plenary Discussion
1200 - 1400	Lunch
1400 - 1515 (Session 7)	Too Few Female Agricultural Professionals in Many Countries: How to Achieve Decisive Breakthroughs Chairman - M. Rolls Rapporteur - N. Doron
1400 - 1420	Presenter - M. Randriamomonjy
1420 - 1430	Discussant - R. van Haarlem
1430 - 1440	Discussant - W. Lindley
1440 - 1515	Plenary Discussion
1515 - 1545	Coffee/Tea

Wednesday, 18 December (cont'd.)

1545 - 1700 (Session 8)	Relevance, Quality and Cost-Effectiveness of the Agricultural Knowledge System: How Can Institutions of Higher Agricultural Education Contribute Most Effectively? Chairman - H. Jain Rapporteur - W. Lindley
1545 - 1600	Presenter - R. Musangi
1600 - 1610	Discussant - A. Gebre-Hiwot
1610 - 1620	Discussant - G. Hang
1620 - 1700	Plenary Discussion

Thursday, 19 December

0900 - 1200 (Session 9)	Outlook Towards 2000 - Suggested Future Strategy Options of Higher Education in Agriculture and Suggestions for Action at the National and International Levels Chairman: W. Maalouf Rapporteurs- H. Hoffmann, T. Contado and W. Lindley
0900 - 0920	Introduction - W. Maalouf
0920 - 1230	Plenary discussion focussing on three themes: 1. The development of new programmes 2. Improving Institutional management 3. The role of international organizations and donor agencies in support of higher education in agriculture
1230 - 1400	Lunch
Afternoon and evening	Individual Activities (including review of the first part of the draft consultation report)

Friday, 20 December

0900 - 1230 (Session 10)	Discussion and Adoption of Draft Report Chairman - W. Maalouf Rapporteur - H. Hoffmann
1230-1330	Lunch
1330-1430	Final Discussion and Adoption of Draft Report
1430	Closing Session

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**Expert Consultation on
Strategy Options for
Higher Education
in Agriculture**

**16 TO 20 DECEMBER 1991, ROME, ITALY
Food and Agriculture Organization of the United Nations**

ANNEX 4

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S. Mohor, Sociologist

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Food Policy and Nutrition Division
F. Egal, Nutrition Officer

Commodities and Trade Division
M. Castejon, Commodities Specialist

Fishery Industries Division
R. A. Maine, Fishery Industries Officer

Fishery Policy and Planning Division
D. Doulman, Senior Fishery Planning Officer

Forest Resources Division
F. Schlegal, Forestry Officer (Education)

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L.V. Emerson, Senior Officer, Staff Development Group
T. E. C. Elliott, Staff Development Officer
F. Farinella, Staff Development Officer

Information Division
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