University education for the agricultural development of East Timor

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Abstract

The agricultural sector remains the dominant component of East Timor’s economy and its importance demands a range of educational services in agriculture at primary, secondary, tertiary and adult levels to build capacity in the sector. University undergraduate teaching in agriculture is based on the previous Indonesian curriculum which is fragmented and content orientated and uses an educational approach in which little attempt is made to relate theory to the problems encountered in local farming systems. This abstract approach to the presentation of information leads to rote learning rather than encouraging a deep learning experience that develops in students’ capacities to identify and solve problems.

The Faculty of Agriculture of the National University of Timor Loro Sae aspires to teach a modern agriculture curriculum based on the sciences and technologies, and which is designed to service a developed industry. However, graduates from the faculty will be dealing with traditional agriculture where farmers depend on their own experience and that of their forbears as a basis for their decision making. The degree courses should produce graduates who have the capacity to understand the traditional animal and crop production systems and who will also be able to conduct scientific research and apply research to improve the performance of local agricultural systems. Comparative studies of relevant traditional and local farming systems which include case studies of successful and unsuccessful interventions intended to improve the productivity of traditional systems is one means of developing graduates who understand how to apply science and technology in their work with farmers to improve production and system sustainability. This approach would foster deep learning experiences that would bring to the students more holistic views of the discipline which, in turn, would change the way in which the learner visualises the farming systems.

Internal and external factors that impact on the quality of teaching and learning are considered. The importance of research activity and its nexus with quality learning is discussed. To sustain research at the university there is a need for a cooperative research model to be developed between the university and other agencies so that significant agricultural problems are identified, and to achieve efficient use of scarce resources.

University of Timor Loro Sae staff have made considerable headway in identifying the strengths and limitations of their present curricula, and in setting graduate attributes for their students. Further development of these issues is anticipated in 2004.
Introduction

PRIOR to the 1999 referendum, agriculture and related activities such as agroprocessing and agricultural input industries employed 85% of the population, contributed 40% of GDP, and accounted for 90% of foreign exchange (World Bank, 2000).

The importance of the agricultural sector in the economy suggests that agricultural education should form a component of primary, secondary and tertiary education. Adult education and agricultural extension are important in assisting the development of human resources in the agricultural sector.

This paper focuses on the development of university education for agricultural development. This will be considered from the viewpoint of 1) Teaching and Learning and 2) Research and Development.

Undergraduate course structure

Undergraduate agricultural courses at universities in developing countries have frequently been modelled on degree course structures found in Europe or America. Typically, the undergraduate agriculture syllabi in the early years are based on basic science or basic economics units. Content orientated units are often taught in isolation with little or no reference to other units or to agriculture. The learning process is teacher-dependent, focused on small bodies of knowledge, and the assessment emphasises recall of the material that has been taught. Many undergraduate courses in agriculture neglect to encourage students to actively learn about the environment, resources and farming systems of the locality. This denies the student the opportunity to actively use their newly acquired knowledge because it is not being related to agricultural problems.

Until recently, the development of curricula in western universities revolved around arguments about what additional content needed to be added and what could be taken out. The curriculum is often developed by the addition of new subjects based on developments in science, technology, economics or sociology. We have heard the calls to make space in the modern curriculum for biotechnology, molecular biology, and information technology in an already crowded timetable. Professor Lindsay of the Animal Science Department, University of Western Australia acknowledges the dilemma faced by academics “if knowledge is increasing exponentially while, on the other hand, students’ capacity to absorb it appears to be relatively constant.” He says that, therefore, “lecturers must make judgements about what information they can afford to ignore in order that they can consider new information” (Lindsay, 1986). Questions are rarely asked about the impact of crowding the curriculum on the quality of educational outcomes. We need to be aware that it is not possible for students to learn all the knowledge available in the public domain and that much of it will be learnt after graduation.

The Indonesian curriculum

The Faculty of Agriculture, University of Timor Loro Sae, has been using the former Indonesian Department of Higher Education curriculum. The curriculum is a unit system strongly influenced by United States and European systems. The curriculum is fragmented with an average seven units being taught per semester. The units are frequently presented as bodies of knowledge with little reference to the local farming or animal production systems. The presentation of information in this way encourages shallow learning rather than deep learning experiences.

Viewpoints on curriculum development in agriculture

There are various approaches to curriculum development and delivery of undergraduate education. The approaches outlined below serve as an illustration rather than a recommendation for adoption.

Harmon (1992) expresses a traditional approach to the development of curriculum. He states that basic science is essential for animal science professionals and that animal science depends more than previously on the classical basic sciences to explain and to apply technologies.

McColl et al. (1991) considered that as far as curriculum is concerned, courses in agriculture need to cover soils, plants, animals, economics and business but also need to develop a perspective of a total food and fibre system and that graduands should graduate with well-developed communication skills.

According to Pearson and Ison (1992), members of the Department of Crop Science at the University of Sydney are of the opinion that knowledge in the sciences is only one of the learning outcomes required in producing professionals for the agriculture and animal industries. They contend that “Educators have been too preoccupied with technical content and what has been an exponentially expanding base of information rather than the purpose of education.” They suggested a list of qualities that educators should assist agronomy graduands to develop:

a) empathy or identification with their client industry, namely agriculture, including horticulture and environmental management
b) capacity to be self-starters and steerers, not dependent on others for ideas and information, however, they should develop a network of information sources

c) a problem-solving approach: keenness and methodology to identify situations which may be improved, and to seek solutions to problems

d) a rigorous knowledge base in scientific, technological, social and economic disciplines

e) humility: appreciation of what they don’t know and where to get help, which is more important than graduates appreciating what they do know.

Staff at Curtin University’s Muresk Institute of Agriculture have developed agribusiness and science courses that provide students with a balance between content and opportunities to develop the skills required by the industry and the profession. Some years ago, an education model was developed which reflected the content and skill needs of a farm manager or farm management consultant. The course aimed at producing graduates with the capacity to identify problems, find solutions, evaluate outcomes and revise plans, and who had good communication and interpersonal skills.

In the last few years, the course perspective has changed from a focus on the farm, where the farmer and farm family integrate inputs to achieve efficient production outcomes, to a wider view where the farm is seen in the context of the agribusiness system. The current courses are based on a generalised model of agribusiness systems. This model is used as a basis of curriculum design and assists in the definition of the learning outcomes of the course. During the course, students are encouraged to develop their critical and creative thinking (analysis, synthesis, evaluation) skills as well as professional skills, capacity for effective communication, information technology, teamwork and a cross-cultural business capacity.

Information transfer through the agribusiness system in both directions and logistics are seen as important elements that affect curriculum development in agribusiness courses.

As further elaborated below, course content and learning outcomes may be determined by considering the required knowledge and skills of a graduate entering the profession or industry. There is a lack of local information on community requirements to guide curriculum development at the National University of Timor LoroSae.

The implementation of curricula ultimately requires funding for new books and laboratory facilities, and sometimes new staff with particular expertise. This may impact on curriculum development because agencies that fund university development, such as the World Bank, give preference to proposals that seek to develop courses that will prepare graduates who understand the local agro-ecological environment, socio-economic conditions and agricultural systems.

### Comparison of the impacts of modern and traditional agriculture on university education

Modern farming systems are supported by scientific, economic, management and marketing research and a support infrastructure of extension personnel and literature. There is a wealth of information in books, journals, bulletins and online available to practitioners, academic staff and students studying developed agricultural systems. Over the last 20 years, researchers and academics in agriculture have shown increased awareness of the importance of understanding farming systems in the locality where they are working. University research is funded by major industry bodies that are represented on undergraduate course and research advisory committees.

Traditional farmers, by contrast, are guided by the accumulated wealth of experience over generations that develops their convictions about what species to select as crops, where the crop should be placed and how it should be managed. Until recently, traditional agricultural and animal production systems have not received much attention from the scientific community (Fernandes and Nair, 1986) as they have been considered inefficient producers of harvestable yield. Much of this experiential information is poorly documented. Traditional farmers make little contribution to research funding but wealthier farmers (who may use less traditional systems or at least be more open to modern methods) may fully or partially fund their children’s university fees and living allowances. There has been relatively little research into traditional farming systems.

In order to increase harvestable production per unit area some traditional farming systems have been replaced with more intensive and less biologically complex systems. Some traditional systems appear to be unsustainable. For instance, it is generally recognised that the traditional dryland farming systems in East Timor have contributed to environmental degradation. There are examples of good practice in the region, which have reversed the process of degradation in Amerasi in West Timor and Sikka in Flores (Metzner 1987a, 1987b). The inclusion of units such as comparative agriculture or comparative animal production systems would encourage students to evaluate local production systems against those in similar agro-ecological zones elsewhere.
Agronomy

In the project inception report the following curriculum design issues were identified:

a) Basic plant science — basic morphology, anatomy and physiological processes (photosynthesis, respiration, metabolism, dormancy, senescence, role of growth regulators, transpiration) of growth, development and reproduction.

b) Farming systems — there is need for graduates who understand the farming system and are able to identify constraints which limit performance of the whole system. The capacity of the graduate to assess the strengths and weaknesses of various farming systems within the agro-ecological zones of East Timor will be important.

c) System variables — graduates will need to understand which systems variables are manageable and which are not. Agronomy graduates should understand the action of variables on plant physiological processes, particularly those that determine the rate of crop growth and development, final yield and quality.

d) Cropping systems — graduates should understand the impact of changes in the cropping system on other components of overall farming systems and on the environment.

e) Crop protection — weeds, pests, diseases, and the various methods of control including integrated management methods.

f) Sustainable systems — a comparative study of farming systems used in similar agro-ecological zones to those of East Timor.

g) Water balance — soil water balance and water use efficiency are key issues within agronomy.

h) Research skills — graduates will need to be able to define agronomic and related problems within the cropping and horticultural components of farming systems and design and implement research to investigate these problems.

i) High value crops — a range of potential agricultural and horticultural plant crops should be explored as a possible means of improving human nutrition during the dry season and also improving cash income through marketing surpluses.

j) Biotechnology — the impact of biotechnology on improving yield, quality and disease and pest resistance needs to be understood by graduates but the cost of developing a laboratory is beyond the capacity of the university.

k) Information literacy — information literacy will be an important attribute of graduates in future but online facilities are unlikely to be available to staff for some time. However, students require training in accessing and interpreting information.

l) Communication skills — the graduate needs to be an effective communicator in Tetum and in languages such as Bahasa Melayu, English and Portuguese. To be an effective communicator the graduate will also need to be sensitive to cultural issues.

Animal science

a) Basic animal studies — need to understand the basic workings of animals, and of animal disease and production, through knowledge of anatomy, physiology and biochemistry.

b) Farming systems — understanding of animal production requirements (nutrition, water, shade, etc.) throughout production cycles, and how these can be met within the constraints imposed by crop (maize, rice, vegetable) systems.

c) Disease control and basic veterinary procedures — recognition of common diseases, parasitology (internal and external parasites, effects on animals, parasite lifecycles, control treatments), introductory epidemiology (how disease may spread between animals and between farms).

d) Genetics and breeding — evaluation of the productive and stress-resistance characteristics of existing genotypes, assessment of the potential (if any) of exotic genotypes within the context of the existing feed supply, disease regimes and environmental stresses.

e) Husbandry practices — including methods of confinement (stalls, effect of tethering on animal behaviour), product harvesting (milking, butchering), animal restraint methods, training and use of animals for draft/riding purposes, design and use of husbandry equipment (stalls, pens, shade, water, crushes, fencing, etc.).

f) Nutritional management — seasonal changes in forage nutritive value, nutritional enhancement methods, and nutrient supplementation methods.

g) Animal farming skills — graduates need to be able to demonstrate Timorese best practice to farmers (note that this may be different from best practice in the western or temperate world).

h) Humans and animals — need to appreciate the nexus between animal production and human health (animals as sources of essential nutrients, and the risk of passage of animal diseases to humans), the role of companion animals, and the role of animals for recreation (e.g. safari hunting).

i) Animal quarantine issues — recognition of exotic diseases (foot and mouth disease, Newcastle disease, Petit P Ruminants, etc.), control measures, legal issues.
j) Fisheries protection issues — recognition of fish species, knowledge of law and enforcement procedures.

k) Aquaculture and marine sciences — fish farming techniques (construction and maintenance of ponds, choice of species, feeding techniques, diseases, harvesting and processing methods).

Teaching is about facilitating quality learning

In surface approaches, the teacher transfers to the learner large quantities of “precise knowledge, inert and unutilised” which is later reproduced by the student to pass exams for “pleasing the teacher” (Whitehead, 1967). On the other hand, deep learning approaches “change the way in which the learner conceptualises the world,” in other words “how an individual makes sense of something” (Ramsden, 1992). An academic institution using the deep approach strives to bring to the learner more holistic views of the discipline studied. The structure of the discipline is kept intact as the learner focuses overall in relation to the parts, rather than on the parts themselves (Ramsden, 1992).

The teaching/learning process calls for the abandonment of shallow learning and its replacement with approaches which foster deep learning experiences. Research distinguishes between the two types of learning (Radloff and Murphy, 1992; Ramsden, 1992) as described in Table 1.

Factors which influence learning to consider in curriculum development

It is important to recognise the factors that may influence the development of a high-quality learning experience for students.

A. Internal factors

The qualifications, training and experience of existing staff are important factors. The capacity to teach their discipline, and to facilitate active learning by students, is influenced by their own university experience.

The capacity of staff to write learning outcomes relevant to the needs of agriculture is influenced by their understanding of the industry and employment. Availability of literature and access to information are influenced by lending information systems in place at the university.

B. External factors

External factors that need to be considered include the following: the needs of farming and animal production systems in East Timor; government agricultural policies on issues such as food security and generation of disposable income; and the nature of the physical, biological and socio-economic environment.

Funding of tertiary agricultural education by the government and donors and employment opportunities for graduates in relation to other areas of the national economy are also important.

The quality of students entering the courses, inappropriate recommendations from visiting experts who do not fully understand the local environment and agricultural systems and the availability of scholarships for postgraduate studies must also be taken into account.

Enhancing the research capability of staff and students

Research is an important activity in universities. There is a nexus between teaching and research which, if developed, enhances the quality of learning outcomes. At present, the National University of Timor Lorosae has a limited number of staff with

Educational support services that demonstrate good practice and assist staff capacity are ones that improve the quality of lectures, practical classes and field tours.

Laboratory and field equipment that support educational activities relevant to the needs of the agricultural and related industries of East Timor are important. This ACIAR project is making a significant contribution to the rehabilitation of the field station and laboratories at Hera. Access to farms, animal production enterprises, and rural communities for study and research purposes help reinforce information and concepts in a practical environment. The ACIAR-funded project provided a pickup and motorcycles to assist staff in the supervision of field research being undertaken by final-year students.

Availability of teaching resources, including model methods of practising in-depth learning, are also important. Dryden (1996) has designed several exercises which develop a deep-learning approach in the agricultural sciences.

The ACIAR Project No CTE 2000/164 ‘Rehabilitation of the Agricultural Faculty of the National University of Timor Lorosae’ commenced in June 2001. The commissioning organisation is Curtin University of Technology, Muresk Institute of Agriculture, and collaborating organisations are the Northern Territory University Darwin, the University of Queensland Gatton, James Cook University Townsville and Sydney University, working together with the National University of Timor Lorosae.

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postgraduate qualifications. In the short term, local staff require support from Australian university staff to develop a suite of applied research projects which address significant problems in agricultural systems, cropping systems, post-harvest handling, estate crops, animal production, soil fertility, rural development, agricultural economics and so on. Faculty of Agriculture staff should seek to collaborate with government and non-government agencies working in agricultural and rural development in East Timor. In this way, staff and students will research significant problems limiting production or affecting the welfare of the rural population.

**Development of a new agricultural curriculum suitable for East Timor**

In 2002, the ACIAR project supported a curriculum development workshop aimed at revising the curricula of the programs offered by the Faculty of Agriculture at the University of Timor Lorosae. The workshop was conducted at Maubara on 12–15 July 2002 and was very well attended by staff from each of the three departments of the Faculty of Agriculture. The workshop was opened by the Rector of the University, Dr Benjamin de Araunjo e Corte-Real. The Deputy Rector (Academic) Dr Francisco Martins, S.Hum also addressed the workshop.\(^2\)

The Rector said that curriculum development was important to the development of quality higher education at the university. He said that two aspects of curriculum development were important: the capacity of staff to understand and teach up-to-date technology originating from advances overseas; and the capacity to develop graduates who are able to apply this technology to the solution of local problems.

The aim of the workshop was to develop a shared understanding of the meaning of curriculum, to consider the strengths and weakness of the Indonesian curriculum model and to revise the curriculum for 2003.

**Strengths and weaknesses of the current curriculum**

The staff identified the strength of the Indonesian curriculum as being its scope. Each course presents 50+ units over a four-year period. However, the staff considered that the large number of small units resulted in a high workload for both staff and students, led to a shallow learning experience for students, and resulted in a fragmented curriculum that provides a poor understanding of local agricultural and animal production systems.

Departmental staff identified the strengths and weakness of the current animal science, agronomy and socio-economics curriculum (Table 2).

| Goals and broad learning outcomes for the undergraduate programs conducted by the Faculty of Agriculture were developed and agreed upon by staff from the departments of agronomy, animal science and |

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\(^2\) The workshop was conducted by The Dean of the Faculty of Agriculture, Ir flaviono S. Soares and organised by the Project Officer, Ir Yohanes Usboko M. Agric.
socio-economics. The staff described a high quality curriculum as having the following characteristics:

- Relevant to current and future needs
- Capacity to develop human resources that possess excellent knowledge and skills upon graduation which drive development and national development
- Student centred, stimulating students to learn, value the experience of others and respond to the needs of the community
- Promotes critical and creative thinking and encourages logical, analytical, holistic and lateral thinking
- Develops capability to adjust to changing employment and work environments.

**Learning outcomes identified**

The staff from each department developed a number of desired learning outcomes for each of the fields of study as a basis for curriculum development (Table 3).

**A second curriculum conference**

A second major revision of the curriculum is scheduled in 2004. We recommend that staff, students, representatives of relevant government ministries, professionals and representatives of farmer groups in East Timor participate in this second workshop to develop curricula appropriate to the professional human resources needs of the agricultural and related sectors of East Timor.

**Conclusion**

The current curriculum does not have a good framework. It is fragmented and deals with many small bodies of knowledge that are poorly linked to other components of the course and to the needs of agricultural industry. The linkage between the taught knowledge and its application to agricultural or animal production systems tends to be neglected. The curriculum framework and teaching/learning process are not aimed at producing outcomes that result in the development of higher-order cognitive skills such as analysis, synthesis and evaluation but rather the educational system produces graduates with lower-order cognitive skills of awareness and comprehension. A way of introducing students to the study of agronomy is to schedule an introductory unit that has a focus on the plant and soil resources of East Timor, followed by a unit that looks at the plant and soil systems of the nation. Introductory units of this kind would enable the science components to be related to the ‘real world’ context. The importance of linking theory to the real world is essential to students achieving deep-learning experiences (Ramsden, 1995; Biggs, 1989). Required skills for private-sector employment can be achieved by the further development of current units such as agribusiness, entrepreneurship, community service, farm

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<th>Strengths and weaknesses of current curriculum.</th>
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<tr>
<td><strong>Agronomy and socio-economics</strong></td>
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<tr>
<td>Strengths</td>
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<tr>
<td>Graduates rich in knowledge and theory</td>
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<tr>
<td>Weaknesses</td>
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<tr>
<td>Out-of-date curriculum</td>
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<tr>
<td>Appropriate to the wet tropics of Java and Bali and inappropriate to Timor</td>
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<td>Overcrowded with content promoting surface learning</td>
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<td>Theory does not leave enough room for practical work</td>
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<td>Surface approaches do not develop sufficient depth of understanding and skills and do not satisfy community needs</td>
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<td>Syllabus of units does not keep pace with scientific and technical development</td>
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<tr>
<td>Needs a unit which covers interaction between animals, plants and economics</td>
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<td>Not adequate specialisation in the fields of study; courses too general</td>
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Table 2. Strengths and weaknesses of current curriculum.
practice, and project management. The academic staff of the Faculty of Agriculture have identified the strengths and weaknesses of the former Indonesian curriculum and have made an excellent start to the revision of the curriculum. This revision aims to make the teaching–learning process and resulting learning outcomes at the university relevant to the development of the rural community and industries in East Timor.

References

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Radloff A. and Murphy E. 1992. Teaching at University, Curtin University of Technology, DDET National Priority reserve fund, pp. 75–85.


Table 3. Desired learning outcomes.

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<tr>
<th>Agronomy</th>
<th>Animal science</th>
<th>Socio-economics</th>
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<tr>
<td>Able to identify conditions which are limiting plant production</td>
<td>Able to advise farmers on how to obtain a living from livestock systems</td>
<td>Graduate professional agriculturalists who are reliable</td>
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<td>Able to market farm products and develop value adding</td>
<td>Able to apply technology to improve animal nutrition, artificial reproduction, breeding, husbandry and marketing</td>
<td>Able to use conventional technology</td>
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<td>Able to effectively transfer knowledge and associated technology</td>
<td>Able to produce meat products from animals that are of good quality and do not pose a health danger</td>
<td>Able to give guidance to farmers and the rural community</td>
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<td>Able to use resources and develop sustainable production systems</td>
<td>Able to search, organise, file, access and elaborate on information and provide it to farmers, government agencies and professionals</td>
<td>Able to work together with farmers to identify problems and develop solutions</td>
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<td>Capable of starting own enterprise</td>
<td>Be a self-directed learner who will search for up-to-date information</td>
<td>Display excellent communication skills appropriate to the area and place of work</td>
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<tr>
<td>Work together with farmers to identify agronomic problems and develop alternative solutions</td>
<td>Work together with farmers to identify animal production problems and develop solutions</td>
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<tr>
<td>Display capacity to work together with farmers</td>
<td>Display high-level communication skills</td>
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