STAKEHOLDER VIEWS ON AGRICULTURAL EDUCATION IN AUSTRALIA

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Abstract

Australian research funders, research providers, educators and agricultural producers were surveyed to elicit their views on future directions and needs of agricultural education. Information was gathered concerning the missions, challenges and likely major changes facing universities and state government agencies associated with agriculture over the next decade. An overriding focus on environmental management and sustainability was evident in answers with a need for closer interaction between providers of education and research and users of knowledge, particularly agricultural producers. Attracting high-performing students to fields servicing agriculture, and integrating agricultural and environmental knowledge, were highlighted as particular needs. It was concluded that existing provision of educational services is failing to meet expectations of producers in terms of information delivery, creation of attractive learning environments, and involvement of stakeholders in decision making. An education and research provider partnership with industry was seen as a logical outcome of current debates.

Introduction

Changes in Australian agricultural education over its 130-year history have mainly followed developments in the agricultural industries. From the 1880s to the 1970s, increasing production from available resources was the basis for agricultural courses. An initial focus on land productivity gradually shifted to a focus on labor and capital productivity. Management practices and social sciences in agricultural courses were expanded in the 1970s with graduates realizing the importance of communication skills to back up technical knowledge (Dunn, 1990).

Social and demographic changes in Australian society may have also influenced changes in attitudes of the general population towards agriculture. The effect of goldmining in the latter half of the 19th century which supported towns in inland Australia has been largely lost, causing a drift to a predominantly urban population (Lees, Da Roza & Carey, 1982). In 1921, the proportion of the Australian population living in metropolitan areas was 43%; other urban areas, it was 20%; and 37% in rural areas. In 1976, the proportions were 65%, 21% and 14%, respectively (OECD, 1987). With the greater proportion of the population living in metropolitan areas, there is less general empathy and a rising level of ignorance about rural life and agriculture.

Industry and educators have expressed concern at the low proportion of the agricultural workforce which is tertiary qualified (Ferguson & Simpson, 1995; Kilpatrick, 1996). A survey found that the costs involved with living away from home, lower parental income, and inconsistencies of government subsidies based on asset testing were the main reasons restricting young farmers from engaging in further studies (Dent, 1995). A survey of

young farmers determined that the decrease in number of young farmers undertaking tertiary study was due in most cases to their preferring to enter the workforce. Other farmers thought that tertiary study was not necessary to be a Agood farmer@ (Hamilton, 1995). A survey of farmer clients of consultants found that 43% had tertiary qualifications, compared to 16% of all farm operators (Hamilton, 1995). Surveys of Tasmanian farmers found a significant correlation between attendance at structured courses and farm cash operating surplus which confirmed earlier findings that most farmers believe that further education leads to improved farm business management (Kilpatrick, 1996). A more educated and trained workforce may be better equipped to address issues such as environmental problems and may in the long run present a more positive picture of agriculture to the rest of the community (Dunn, 1990). However, Australian farmers have traditionally placed little importance on formal tertiary education (Bell and Pandey, 1987).

The need for courses to be both relevant to industry needs and accessible is widely recognized. Some suggest that employers need to be directly involved in the development of course curricula (Lees et al., 1982). They claim that previous changes to agricultural and related curricula have been due to stimuli from within the educational system rather than as a response to industry needs. As the number of Australian students selecting studies in agriculture as their first preference declines, such impetus of industry has become more important.

According to McColl, Robson & Chudleigh, (1991), attributes sought by private sector employers include the ability to work in a team situation, think critically and conceptually, communicate effectively, and plan and manage time. Other attributes sought by employers include problem-solving, flexibility, entrepreneurship, interpersonal skills, loyalty, integrity, and lateral thinking (Anderson, 1994). According to Derera, (1994), specialization in courses is viewed as a necessary component for Australia to be

internationally competitive, but at the undergraduate level there is a need for generalist teaching to ensure a strong knowledge base. McColl et al. (1991) determined that while there was some specialization in agricultural science, courses overall provided opportunities to develop general knowledge in other areas. Nevertheless, they reported shortages of graduates with specific training in soil science, production horticulture, agricultural economics, and food science and technology. Current community concerns include the environment, product quality, chemical residues, and food safety (McColl et al., 1991), as well as animal welfare, biotechnology, and rural infrastructure decline (Wilkins, 1995).

Various analyses of agricultural education in the U.S. provide indications of issues which may be of relevance to Australia insofar as cultural similarities allow comparisons. Issues elicited from current U.S. studies include: the need for a focus on customer needs; increased linkages with industry; formation of partnerships among government, industry, and the general public; the need to meet demand for lifelong learning in the general public and for upgrading in industry; creating greater community awareness of agriculture; and decreasing the gap between rural and urban understanding (NRC, 1995 & 1996a & b; WK Kellogg Foundation, 1994; Dillman et al., 1995; CAST, 1996; NASULGC, 1996; RMF, 1995; NCAE, 1997). The need for closer involvement of stakeholders from industry, government, and the public in planning and delivery of agricultural education echoes opinions and anecdotal studies in Australia.

Recommendations of the U.S. studies are reflected in a review by Meyer (1997) and provide a basis for comparisons with Australia. Using U.S. findings as a basis for comparison, a study of stakeholders of Australian agricultural education was conducted in cooperation with the National Farmers= Federation (NFF).

Purpose and Objectives

The purpose of the study was to determine whether the issues which have been and are being identified in the U.S. are similar to those facing Australian institutions. Specifically, the survey sought the opinions of informed agricultural producers, government officials, researchers, research funders, and educators about the mission and challenges of universities and government with respect to agriculture, and challenges currently facing education, research and extension programs.

Methodology

The study was based on surveys of informed persons to gather information of direct relevance to currently perceived problems. The initial questionnaire included persons involved in funding, use and policy setting of education and its linkages to research and extension. Eighteen leading persons were selected from NFF Round Table Conference leaders and surveyed as Informed Respondents to answer questions drawn from the literature about perceived issues in agricultural and related education (round one). Their replies were consolidated and resubmitted to the same persons for ranking in order to determine the main issues and possible solutions for each of the six critical areas (round two). Once these were ranked, surveys were circulated to 156 persons from production, research funding, research provider and education backgrounds (round three) these being the full list of participants in the NFF meeting.

The survey technique was a modified Delphi process as described in Delbecq, Van de Venah & Gustafsondh, (1975). The methodology followed that of Meyer (1992) in which opinion leaders were selected to provide the initial information for a wider survey. In an attempt to reduce bias, the Table Coordinators selected by the NFF for their Round Table Conference on Research and Education were engaged as participants for round one. The NFF had selected table coordinators as informed leaders within the wider agricultural research and producer profiles of the private and public sectors. In that selection, some agricultural educators were represented, these

were omitted from round one in the methodology as a further measure to reduce bias in a questionnaire related to agricultural education.

The survey was conducted by mail with provision for reply by fax, email or mail within a six-week deadline. In rounds 1 and 2, follow-up by telephone was conducted while for round 3, follow-up letters were sent by mail with the survey instrument on two occasions.

A comparison of respondents and non-respondents indicated no compositional differences between the groups.

The survey instrument was based on the questions:

1. What should be three major components for mission statements for universities and state government agencies involved in providing research, education and/ or extension for the next ten years?
2. What will be the major challenges faced by agricultural units in universities in the next 10 years?
3. What will be the major challenges faced by state government agencies concerned with agriculture and the environment in the next 10 years?
4. What will be the major changes facing undergraduate and postgraduate programs relating to agriculture in the next 10 years?
5. What are the major challenges which should be addressed in agricultural and related research programs in the next 10 years?
6. What are the major challenges which should be addressed in agricultural and related extension programs in the next 10 years?

Responses from round one were collated and similar statements summarized to generate single statements, using the original wording suggested by the respondents wherever possible. Prioritizing the key issues in round two allowed three major points and three

subsidiary points to be elicited for each of the six survey questions. In round three, the points were ranked by the wider group.

Chi-square tests were employed to analyse data generated from round three to determine whether the differences found between responses and responding groups were significant. For each test only the top responses (that is, number one ranking) were used. Differences were considered significant at $p < 0.05$.

The number of respondents by employment category for each of the rounds is presented in Table 1.

Table 1

Number of Respondents by Employment Category for Each Round of Questionnaire.

Employment Category	Round One	Round Two	Round Three
Educator			16
Producer	9	9	41
Researcher	4	4	20
Research Funder	5	5	16
Total	18	18	93
Total as Percentage of Those Sent	82.0%	100.0%	60.0%

Round One: Eighty-two per cent of respondents replied to round one of the questionnaire. Replies received were diverse and, in the case of question one for example, included 53 statements. These were classified into seven general statements of: competitiveness and responsiveness to change; sustainability; relevant skills; research development and extension; excellence; customer-focus, and delivery. The content of each of these categories was distilled into short explanatory statements for round two of the survey. This process was followed for each question.

In the case of question two, the 50 reply statements were categorized into the five groupings of; attracting students; structures; information; funding, and customer needs. For question three, 49 replies were categorized into the four groups of: sustainability, research and

extension; structures and management systems, and resources and funds. For question four, 48 responses were categorized into five groupings: sustainability; excellence; structures; programs, and funding and resources. Question five grouped 51 responses into the five areas of: sustainability; research and development; production, producers and products; funding, and customers. In question six 47 responses were grouped into the five areas of: funding; technology transfer; extension; education, and innovation.

Round Two: Round Two of the survey allowed the same respondents to rank the succinct statements relating to each grouping in order of priority. This process elicited minimal comment as the respondents were effectively ranking comments which incorporated their own views from round one. Response rates and timeliness were of a high level; all respondents

replied with only 5.5% requiring follow-up. In all questions, ranking allowed the selection of six areas (in two groups of threes) above others for inclusion into Round Three.

Round Three: Round Three was circulated to 156 persons and had a 60% response rate. Respondents overwhelmingly nominated points within the three top issues, even though they had provision to treat the three subsidiary points on an equal basis, and to make additional comments.

Results

In addressing the question ⌐What should be the three major components for Mission Statements for universities and state government agencies involved in providing research, education and/or extension for the next 10 years?⌐-the three responses ranked above others by the respondents were:

1A. To attract adequate investment to ensure that agricultural production in Australia continues to be globally competitive.
1B. To ensure that the management of natural resources is productive as well as ecologically sustainable.
1C. Providers of services to Australian agriculture need to be able to adjust to the needs of their clients.

The proportions and Chi-squared analysis of the sample ranking these three as most important is presented in Table 2. Chi-squared analysis indicated that there were significant differences ($p < 0.05$) between the number of responses to each statement. However, when divided into the four general employment categories of producers, educators, researchers, and research funders, there were no significant differences found between their responses to each statement (Table 3).

In terms of assessing ﹥the major challenges faced by agricultural units in universities over the next 10 years﹦, respondents answers were:

2A. To attract quality students and increase levels of enrolment in agricultural

disciplines.
2B. To deliver quality courses and foster development of leadership and management skills.
2C. To adopt a closer, more integrated structure with other agricultural agencies to ensure networking and collaboration.

There was a significant difference ($p < 0.05$) between overall responses for each statement in Question 2 (Table 2); this favored the delivery of quality courses and leadership and management. In terms of employment categories, however, a greater number of researchers ranked the challenge to attract quality students and increase levels of enrollment first (not significant), and in the case of educators, no respondents selected the option of adopting a closer, more integrated structure with other agricultural agencies (Table 3).

In terms of ﹥the major challenges faced by state government agencies concerned with agriculture and the environment in the next 10 years, these were seen to be:

3A. To ensure agricultural practices and processes are environmentally friendly to allow for a sustainable future.
3B. To have greater involvement with industry in research and extension for more cooperative research ventures.

Table 2

Proportions and Chi-squared Analysis of Respondents Ranking Each Statement First.

Question	No. ranking 1	Percentage of total respondents
1A	16	13.9 *
B	47	40.9 *
C	23	20.0 *
2A	32	26.7 *
B	41	34.2 *
C	19	15.8 *
3A	38	35.2
B	26	24.1
C	28	25.9
4A	33	30.0
B	30	27.3
C	25	22.7
5A	38	34.9
B	21	19.3
C	34	31.2
6A	14	12.7 *
B	44	40.0 *
C	32	29.1 *

* $p < 0.05$

3C.   To be able to change their focus from supply to one of demand within a quality ethic; for example through flexibility and adaptation to customer needs.

While ensuring that agricultural practices and processes are environmentally friendly received the greatest number of responses (Table 2), there were no significant differences between the responses to each statement. Differences between employment groups were not significant, although more educators appeared to feel most strongly about environmental and sustainability matters while producers focused more on the ability to change to a demand focus with improved quality (Table 3).

In terms of ≯the major changes facing undergraduate and postgraduate programs relating to agriculture in the next 10 years, these were ranked as:
4A.   Assisting industry to meet the challenges posed by sustainable land and water use.
4B.   Increase flexibility to address industry needs and keep up with the rapidly expanding changing information technology.
4C.   Attracting bright young people by improving the image of agriculture and professionals in the industry will become essential.

There were no significant differences between responses for each statement (Table 2). More educators allocated Aattracting bright young people by improving the image of agriculture and professionals in industry@ as most important (Table 3), varying from the other groups who ranked this statement last (not significant).

Table 3

Chi-Square Test Between Various Employment Groups in Response to Questions 1-6 of the Questionnaire.

Employment	A	B	C
Question 1			
Educator	2	8	5
Producer	10	17	11
Researcher	2	12	4
Research Funder	2	10	3
Question 2			
Educator	6	10	0
Producer	11	17	12
Researcher	11	5	4
Research Funder	4	9	3
Question 3			
Educator	10	2	4
Producer	11	17	13
Researcher	9	3	8
Research Funder	8	4	3
Question 4			
Educator	6	3	7
Producer	16	15	8
Researcher	5	7	6
Research Funder	6	5	4
Question 5			
Educator	9	3	3
Producer	12	10	20
Researcher	13	3	4
Research Funder	4	5	7
Question 6			
Educator	2	8	5
Producer	3	20	16
Researcher	6	8	7
Research Funder	3	8	4

In terms of the Amajor challenges which should be addressed in agricultural and related research programs in the next 10 years,@ these were ranked as:

5A. Sustainability, environmental issues and long term resource stabilization.
5B. To provide producers with technology to enable them to be competitive.
5C. To improve productivity, profitability and efficiency.

While there were no significant differences between the statements responded to, a very low proportion of responses were given to the statement regarding the provision of technology to improve competitiveness. Within employer groups, there was little consistency, with more educators and researchers ranking sustainability issues first while producers and research funders focused on the improvement of productivity and efficiency.

In terms of Athe major challenges which should be addressed in agriculture and related extension programs in the next ten years,@ these were ranked:

6A. Developing an understanding of the innovation process in agribusiness.

6B.　　Developing a learning ethos throughout the industry.

6C.　　Integration with research and consultation with industry.

There were significant differences ($p < 0.05$) between overall numbers of responses, to each statement in Question 6, with the highest priority being given to developing a learning ethos throughout industry. The same trends were evident in each employment category (Table 3).

Implications

Suggested Mission Statements for Universities and State Government Agencies: The majority of respondents believed that the roles of universities and state government agencies are related and require further integration. However, some respondents thought that the roles of these institutions differ and should remain separate. Most respondents were concerned with sustainability and natural resource management, servicing clients, and investment. Overall, the emphasis was on integrating productivity and on ecologically sustainable management, in order to provide an appropriate resource base for the next generation. This finding is consistent with studies conducted in the United States (RMF, 1995; NRC, 1996a; NRC, 1996b) which found that stewardship of resources was a unifying theme between institutions and the public thereby suggesting that there may be benefit in following the U.S. debate of agricultural education. An orientation to environmental sustainability and natural resource management in agricultural education in Australia has likewise been widely advocated.

The second ranked choice highlighted the need for universities and state government agencies to meet client demands. Clients were seen to include students, government and industry, the same grouping proposed by Falvey and Bardsley (1995). Both state government agencies and universities were seen to need to increase accessiblity and orientation to the needs of their customers, including industry.
Increased client orientation was a main concern of stakeholders in the U.S. studies (W. K. Kellogg Foundation, 1994; RMF, 1995;

NASULGC, 1996), one of which reached a conclusion remarkably similar to that expressed by Australian stakeholders (NRC, 1996). From that study, recommendations were made for increased links between universities, the government, customers, and units within universities. This broadens the view expressed in earlier Australian literature, to design courses to meet the needs of the wider community (Dunn, 1990; McColl et al., 1991).

Attracting adequate investment to ensure that agricultural production in Australia continues to be competitive was ranked third. Respondents emphasized the need for adequate investment in research, education, and extension to ensure that Australian agricultural industries remain competitive. This was also said to include being profitable and responsive to market changes and the changing needs for Australian agriculture.

Challenges Faced by Agricultural Units in Universities: Delivering quality courses and fostering the development of leadership and management skills was considered the most significant challenge over the next decade. Researchers tended to differ from the other employment groups by placing the attraction of high-achieving students first, above the delivery of quality courses, and leadership and management.

The need to develop generalist skills in leadership and management has been expressed by Anderson (1994) and McColl et al. (1991). This contrasts with studies in the U.S. which placed greater emphasis on environmental awareness and natural resource management being introduced into curricula to improve the quality of courses (RMF, 1995; NRC, 1996a and b). An earlier study in the United States called for generalists rather than specialists in agricultural and related education (Lucas, 1986).

In a global context, Falvey and Maguire (1997) note that today≈s agricultural graduates must compete with scientists, MBA graduates, sociologists, and marketing specialists. In the broad field of agriculture, this may indicate the benefits of producing competent, motivated agricultural graduates with broad-based skills.

These results may also represent the evolution of thought over the past decade, and suggest the need to consider postgraduate education in future analyses of the relative needs for generalists and specialists.

Adopting a closer, more integrated structure with other agricultural agencies ranked significantly lower than the two more frequent responses and was not ranked first by any educators. Some respondents emphasized integration between universities, industry and the community. It was also suggested that universities improve links to federal and state government research agencies for better collaboration in addressing industry needs, particularly in view of reduced government funding. Such conclusions are consistent with views in Scotland which gave rise to the formation of the Scottish Agricultural Colleges with its integration of industry, government, and the community (SAC, 1996).

Studies in the U.S. noted a need to strengthen the present structure of research, education, and extension across institutions, along with greater linkages with business, industry, government, and communities (W.K. Kellogg Foundation, 1994; RMF, 1995; NASULGC, 1996 NRC, 1996a). There have also been several supporters of an integrated system in Australia, notwithstanding the historical separation of these elements (Lees et al., 1982; McColl et al., 1991; Falvey and Bardsley, 1995; Wilkins, 1995). With research, education, and extension functions often developing in isolation from each other, Bawden (1992) described the Australian system as uncoordinated, inefficient and one which creates professional tensions. The results of this survey suggest that leaders in the field may share these views while those involved in service delivery, especially educators, disagree, or are perhaps less informed or concerned with the broader philosophy of integrated service delivery.

Challenges Faced by State Government Agencies: The highest ranked challenge faced by state government agencies was that of ensuring environmentally sound agricultural production for sustainable agricultural production in the future. It seemed to be assumed by respondents that producers need to raise the priority they give to environmental and sustainability issues, and to balance these with development. Certain respondents noted difficulty in convincing people in business to invest in long-term environmental benefits when incentives favored short-term decisions. It was suggested that one of the challenges to state government agencies is to reverse the trend to isolate research within institutions and bring about greater involvement by industry in the research process with increased emphasis on economic and environmental issues. Conflicts between production and conservation industries were noted, as was the need for state government agencies to balance these needs.

The finding that more importance needs to be placed on responsiveness to environmental and sustainability concerns by both industry and educational sectors aligns with U.S. studies (NASULGC, 1996; W.K. Kellogg Foundation, 1994). While Australian educators tended to place importance on environmental and sustainability matters, producers thought they should focus on customer needs.

The third-ranked challenge, to have greater involvement through cooperative research ventures with industry in areas of research and extension, suggests the benefit of merging research and extension into one function. This finding is consistent with those of the United States which confirm the strength of that system=s commitment to maintaining research, education and extension in a single organization (Danbom, 1992; NASULGC, 1996).

Changes Facing Undergraduate and Postgraduate Programs: The major change seen to be facing undergraduate and postgraduate agricultural programs over the next decade was confirmed through this question to be sustainability. In this case, it was expressed in the form of assisting industry to meet the challenges posed by sustainable land and water use.

The major concern of educators was that of attracting bright young people to undergraduate

and postgraduate programs, through courses attractive to high achievers who would subsequently make a valuable contribution to the sector. Comments from those surveyed included the need to change the perception of agriculture as a declining industry, and to focus on primary and secondary educational levels which were said to exert influence on interests and attitudes to a greater extent than tertiary education. Overall, attracting excellent and appropriate students was ranked third.

Attracting more students to agriculture and improving the image of agriculture was a major emphasis of studies in the United States and Australia (McColl et al., 1991; Wilkins, 1995; NRC, 1996a). The disparity between rankings of educators and others may suggest that the problem has not been experienced by users of the services of graduates. It is possible that the strong emphasis on student achievement, as measured by academic entrance scores may not be an appropriate measure in terms of capability of graduates in the eyes of producers.

Addressing industry needs and using information technology was seen overall as the second major change to agriculture programs. Traditional methods of teaching will not be able to meet future demands in either the U.S. and Australia (Dillman et al., 1995). This is supported by the analysis of Falvey (1996) that electronic learning aids will increase both quality of and access to agricultural education. The need for greater interaction with industry was again noted in responses from the stakeholder survey although few respondents linked information technology to communication with industry.

Major Challenges Which Should Be Addressed in Agricultural and Related Research Programs: In responses to the major challenges to research programs, sustainability again ranked first overall, along with general environmental issues and long-term resource stabilization. Responses in round one included the need to bring productivity and sustainability together in a systems approach; to improve understanding of environmental processes for soil, water, contaminants, and the impacts of agriculture on urban areas; and the need to address the practical economics of sustainable agriculture for the long-term with particular attention to the proper balance between economic viability and sustainability.

While educators and researchers tended to rank sustainability issues first, producers and research funders saw the major challenges to be addressed as the improvement of productivity, profitability and efficiency of research programs, a finding similar to that of U.S. studies (RMF, 1995; NASULGC, 1996). Some survey respondents also noted the need for uniform measures of quality, predictability of quality and market relevance of agricultural output. Research programs were seen to require a shift towards improved communication between producer, processor, and consumer and to be directed towards the promotion of differentiated, quality-specified, consumer products. The need for investment in research to be maintained or increased was again mentioned, as in responses to previous questions. An increasing trend of contracting out research and extension services was seen to stimulate greater private sector investment in fields previously the responsibility of the public sector (Marsh and Pannell, 1997). Review of the SAC indicated benefits from the ›user-pays‹ system in Scotland (SAC, 1996).

Major Challenges Which Should Be Addressed in Agricultural and Related Extension Programs: The challenge ranked as being of greatest importance to extension was to develop a learning ethos throughout industry. This was followed by integration with research and in consultation with industry. The view that greater integration with research and linkages with industry is necessary is supported by

Prinsley et al. (1994) who reported a lack of private sector input into public sector policy and research. They note that most communication and dissemination of information between input and output sectors and between the public sector and agribusiness is at an informal level based on personal relationships. Marsh and Pannell (1997) note that state departments of agriculture are beginning to orient activities to the needs of their clients.

The lowest ranked challenge to agricultural extension was the development of an understanding of the innovation process in agribusiness. Innovation, it was suggested, is being blocked or constrained by extension activities as well as statutory and cooperative marketing arrangements. Responses to this question were similar to those for question five, including acknowledgment of the needs of customers and sustainable practices. This finding appears to challenge the assumption of many extension programs that producers do not understand the relationships between research and development programs and their potential benefits.

Recommendations

From these findings, we recommend that:

- Australian institutions should participate in the global debate concerning future directions of agricultural education, especially that in the United States.

- University administrators should involve stakeholders in regional planning to ensure that their requirements of university courses, staff, and graduates are known and observed, and that a common understanding of social issues including sustainability is developed.

- Curricula should be redeveloped to present agriculture in a broader context of natural resource management and to attract high achieving students.

- Policy makers should acknowledge the benefit on linking research, education, and extension functions in Australia, and the environmental management context of agricultural education,and that universities should grasp opportunities which may arise as a consequence of government restructuring.

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