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Contemporary issues in the provision of tertiary agriculture programs: a case study of The University of Queensland

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Abstract

The University of Queensland (UQ) has a long history as a provider of tertiary programs in agriculture and agricultural research. The rapid decline in enrolments in its core undergraduate programs over the past five years has placed the future of these programs in doubt. This paper identifies four key issues that UQ and the Faculty of Natural Resources, Agriculture and Veterinary Science (NRAVS) must address if it is to meet its aspirations to be recognized for excellence and leadership in agricultural education and research. The four issues relate to collaborating more closely and effectively with the employers of its graduates, collaborating with other universities and agencies in the delivery of its programs, integrating the four disciplinary streams of its programs and widening the appeal of its programs.

While this paper concentrates on the analysis of these issues and their management in the context of the agriculture programs at UQ, the issues are relevant to other universities in Australia as they address the impact of declining enrolments and the adequacy of their agriculture programs to meet the challenges that confront the agribusiness sector in the 21st century

Background

The University of Queensland (UQ) was founded in 1909 and is currently ranked in the top 50 universities in the world according to the Times Higher Education Supplement (2008). Agricultural Science has been taught at the University since 1927 and its agriculture programs were broadened and enhanced through an amalgamation with the Queensland Agricultural College (est.1897) in 1990. The university is the sole provider of Higher Education agriculture programs in Queensland and one of the major providers in Australia.

For the purpose of this paper, the term agriculture programs refers to undergraduate degree programs that are primarily focused on training scientists, technologists and management professions for employment in the agribusiness sector or its relevant research institutes and government agencies. Currently at UQ there are three programs that fit this definition:

- The Bachelor of Agricultural Science – a four year program
- The Bachelor of Applied Science – a three year program with majors in animal science and plant science
- The Bachelor of Agribusiness – a three year program that can be combined with the Bachelor of Applied Science in a four year dual degree program.

The Faculty of Natural Resources Agriculture and Veterinary Science (NRAVS) is responsible for the administration of these programs while the delivery of individual courses is the responsibility of the relevant School – Animal Production, Land Crop and Food Science, and Integrative Systems. From 2010 all programs will be delivered from the Gatton campus of the university.

The implications of declining enrolments

Since 2004 there has been a dramatic decline in enrolments in agriculture programs at UQ as shown in Table 1. While there has been an increase in enrolments in 2009, the pipeline effects of low enrolments over the past four years has immediate impact on the short term financial viability of some programs and a longer term impact on some Schools to adequately resource the programs that they are responsible for. The net impact has been a reduction in the breadth and depth of programs at the university resulting in fewer and less specialized graduates as shown in Figure 1.

The decline in enrolments in agriculture programs is not new or exclusive to UQ. Falvey (1998) noted that there had been a slowing in the growth of enrolments in the broad field of agriculture from 1992-97 - the period immediately following the restructuring of the higher education system in Australia which resulted in the former Colleges of Advanced Education that specialized in agricultural education and training amalgamating with the more research intensive established universities. The view expressed by Rayner *et al* (2009) was *that this reform probably emerged as the critical starting point in the rapid and continued rationalization of tertiary horticulture and related education programs* (p.186). Pratley and Copeland (2008) reported that there was a decline of approximately 30% in the graduates from agriculture programs across Australia in the period 2001-2006 which reflects the trend in reduced enrolments that has persisted throughout this decade.

Table 1 Full Time Internal Enrolments 2004-2008

Program	2004	2005	2006	2007	2008
Agribusiness	56	43	39	34	20
Agribusiness/Applied Science	41	30	29	23	23
Agricultural Science	108	92	68	54	36
Applied Science (Animal Major)	151	77	68	63	40
Applied Science (Plant Major)	49	23	24	35	28
Total	405	265	228	209	147

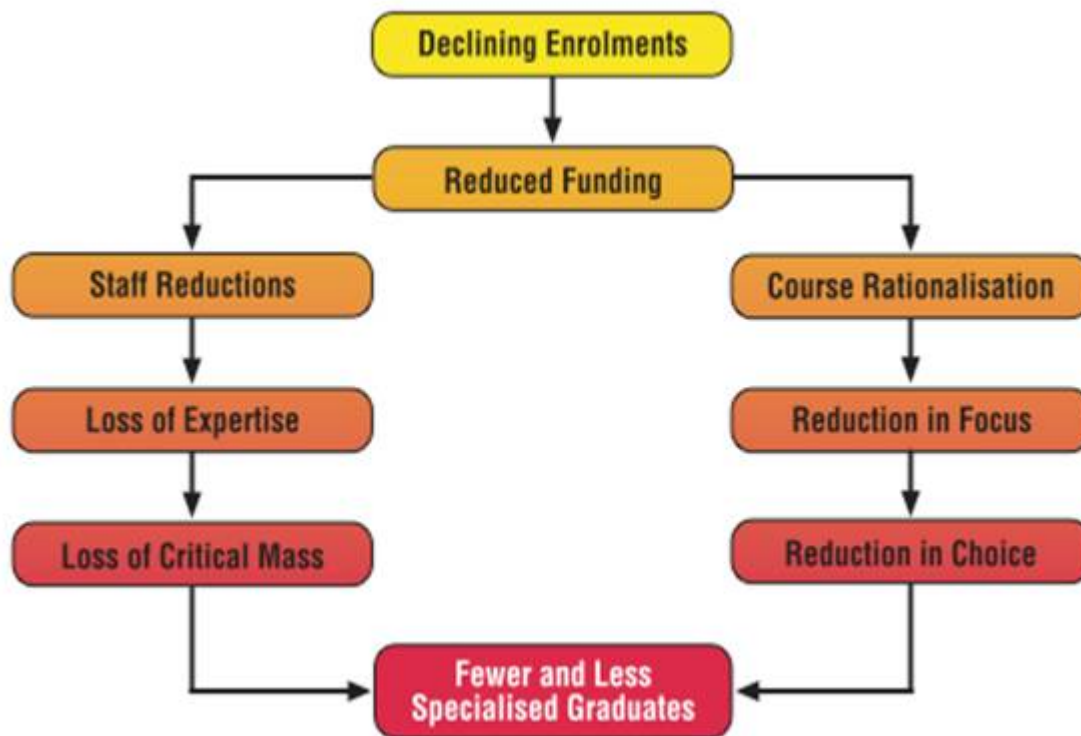


Figure 1 The implications of declining enrolments on agriculture programs

Paradoxically, the demand for agricultural graduates appears to be strong. Pratley and Copland (2008) estimate that the current demand for new graduates is in excess of 2000 *per annum*. Dunne (2009) in a survey of 27 employers of UQ agricultural graduates reported that the demand for new graduates was strong across all sectors - agribusiness, government agencies and research institutes. The strong demand for agricultural graduates will be exacerbated by the impending retirement of the 'baby boomers' over the next 10 years. Pratley and Copland (2008) conclude that the shortfall in demand for agricultural graduates will be met by non-agricultural graduates but *the extent to which these graduates have the necessary interdisciplinary and integrative skills needed in agricultural resource management remains an open question* (p.9).

The University of Queensland's response to declining enrolments

The Faculty of NRAVS has reacted to the drop in enrolments and its subsequent decline in revenues in a way that is consistent with how many businesses faced with a cash flow crisis – reduce staff numbers through redundancies and natural attrition, and rationalize its product range in breadth (academic programs) and depth (course offerings). The consequences of these actions on agriculture programs have been consistent with that outlined in Figure 1. ^[1]

- There has been a loss of expertise in specific areas for example in plant production and horticulture
- There has been an erosion of critical mass for example in agribusiness.
- There has been an increase in the number of casual part-time staff.
- There has been a reduction in specialist courses and electives.

These actions coupled with the university's priority to retain 'research active' staff have impacted on the educational experience of current students. Dunne (2009) provided examples of students' perceptions of their 'UQ experience' based on the responses obtained from nine program specific focus groups. The most encouraging aspect of these student responses was the consensus that their overall educational experience was positive. Two main reasons were cited for this:

- The relatively small class sizes which allowed for more individual attention and closer contact with academic staff - *There is definitely more one-on-one time because we are in smaller classes.*
- Being part of a small cohort of students on the campus that allowed the development of a sense of belonging - *Socially ag is good because there is a small bunch and we all know each other, so we all help each other out and stick together.*

However, there were some clear areas of dissatisfaction with respect to:

- Non-specialist staff - *They just throw whoever they can out here to just read the lecture slides with no understanding of what they are doing – that's frustrating.*
- The conflict between teaching and research - *Lots and lots of lecturers have been given the sack but they are only keeping lecturers who are doing research'. 'A researcher knows their stuff but they are not a good teacher.*
- Non-availability of suitable specialist courses/electives - *We come to third year and we need to pick electives, however all the electives we come to pick they are cancelled. We keep on trying to find other subjects but they are none about – they are all animal based.*
- Insufficient contact with industry - (if industry placement was longer) *you could have a bit more of a range of choices or experience in different fields throughout your degree.*

Meanwhile, the Senior Management of the university have reacted to the decline in enrolments in a more fundamental way.

In an address to staff in May 2009, the Vice Chancellor, while acknowledging the important role sustainable agriculture and food innovation has in the activities of the university, made the observation that *the traditional agricultural disciplines are no longer attractive to talented school leavers; it is also apparent that the agriculture and food industries are increasingly drawing on a much wider range of disciplines and expertise than they have in the past.*

In articulating this position the Vice Chancellor raised the question – *it (the university) must ask itself whether the current structure is appropriate for the challenges we face.* Subsequently, he announced the establishment of a Working Party *to examine the options and implications for and the merits of incorporating relevant disciplines or schools currently in the Faculty of Natural Resources, Agriculture and Veterinary Science with those of the Faculty of Science.*

This is the same issue that Falvey (1998) addressed when he posed the question – are faculties of agriculture still necessary? His answer to this question was YES for reasons that are even more valid ten years on – the continued increase in the global demand for food and food security coupled with increasing awareness of the need for sustainable production systems. Falvey (1998) concluded that one of the major reasons why enrolments in agriculture programs had declined in an environment that should foster student interest related to program structure, content and delivery was how such programs are promoted to prospective students. If Falvey's conclusions hold in the case of UQ, then a

review focused on structural reorganization will offer little in terms of addressing the problem of declining student enrolments.

There are two other compelling reasons for a continuing clearly identifiable focus for agricultural education at UQ:

1. A large cohort of the Faculty's postgraduate students is funded under government projects administered by AusAid. The Faculty is also highly regarded by the Australian Centre for International Agricultural Research which funds research projects in the developing countries of Asia and the Pacific as well as funding postgraduate training and capacity building. In addition, Rural Industry Research Organizations are important sources of research funds across a wide range of rural industries. These agencies are valuable partners in funding bids for Collaborative Research Centres and postgraduate scholarships.
2. Under the Queensland Primary Industries and Fisheries 'fresh approach' strategy it intends *to commence innovative partnerships with secondary schools (the Gateway Project) the Australian Agricultural College Corporation and the university sector to create and strengthen career paths for the next generation* (Queensland Government 2008). Without a clearly identifiable articulation pathway from this initiative to the agriculture programs at UQ, the university's capacity to make a meaningful contribution to this partnership is diminished.

The recent decision by UQ to establish, in partnership with Queensland Primary Industries and Fisheries, a research institute with a focus on agriculture and food innovation makes a positive contribution to addressing the former issue described above but not the latter.

The Faculty of NRAVS vision statement emphatically states that the Faculty will provide national leadership and be recognized for excellence in teaching and research in natural resources, agriculture and veterinary science. The intent of this vision is consistent with the findings of a report commissioned by the National Research Council (2009) in the United States which concluded that universities with existing undergraduate programs in agriculture are in a perfect position to show leadership in confronting the challenges facing agriculture in the 21st century provided that they *position themselves at the cutting edge and offer students the opportunity to learn about the complexities of agriculture, grapple with its emerging challenges and find their opportunity to contribute as leaders and participants* (p.1).

The report concludes that *transforming and sustaining education in agriculture requires an on-going commitment with strong leadership from many with a strong interest in agriculture* (p.5). This commitment and leadership is unlikely to be forthcoming from a faculty of science where the interest in agriculture *per se* could be questionable and where the challenges associated with sustainable food and fibre production extend well beyond that of the science disciplines.

Having made a case for the retention of a visible focus for agricultural education to be retained at UQ, the question remains – how to make this focus relevant and viable especially at the undergraduate level?

This challenge requires UQ to address three interrelated issues:

1. the leadership, culture and structure of the Faculty,
2. the design, content and delivery of the agriculture curriculum, and
3. the promotion of its programs to prospective students.

Creating a supporting environment for curriculum rejuvenation

Schein (1992) describes organizational behaviour as *how things are done around here* reflecting an organization's leadership, culture and people as well as its structures and processes. Senge *et al.* (1999) observe that in undertaking organizational change, senior management are trying to respond to changes in their external environment and think more imaginatively about the future. However, Kotter (1996) claims that most organizational change initiatives fail because management fails to create an environment that promotes and nurtures change and/or fails to execute an effective change management process.

A cursory examination of the organizational behaviour within the Faculty of NRAVS would suggest that its present culture, structure and processes are not conducive to organizational change. For example, over the past five years there has not been any apparent proactive response to declining undergraduate enrolments in its agriculture programs, while the structure and reward processes promote self interest in individuals and within Schools. A typical example is provided in recent reviews of the Applied Science and Agricultural Science programs where individual Schools have sought to maximize their share of the curriculum so as to maximize their share of the Faculty's student income stream.

The organizational change literature clearly indicates that it is virtually impossible to change an entrenched culture of an organization, in this case the faculty, without a radical change in its culture and structure. With respect to structural change one possible solution to the silo mentality that currently exists would be to amalgamate existing Schools, with the exception of Veterinary Science, to form a single School of Agriculture that would be responsible for the delivery of the Faculty's rejuvenated agriculture programs.^[2]

Rejuvenating the agriculture curriculum

Traditionally, the curriculum design of agriculture programs at UQ, and possibly throughout Australia, has been driven by academic staff, with an inherent disciplinary bias, in the absence of any meaningful market research and with scant recognition of the principles of curriculum construction or pedagogical practice. Consequently, the curricula of agriculture programs have remained predominantly disciplinary based and content focused while employing outmoded pedagogy centred on passive information transfer in a traditional lecture setting.

Yet, as discussed previously, the issues associated with environmentally sustainable and economically viable food and fibre production are cross disciplinary. Heiman *et al.* (2002) provide a timely reminder that *scientific disciplines, like the subjects of their studies, evolve continuously. In fact, if their research agenda and educational curriculum were static, they could not claim their work reflected the ever-changing world* (p.1).

Research has indicated that employers require graduates who are equipped to investigate and manage these issues (Boland & Akridge 2004, Dunne 2009, Fairnie *et al.* 1989, Litzenberg & Schneider 1987). Consistently employers have expressed their desire for graduates who have the following attributes:

- Attitudes - enthusiasm, passion, positive, willing to learn, empathy with rural people
- Characteristics - professional, proactive, collaborative, resilient, flexible
- Skills - inter-personal skills, communicational skills, technical and commercial skills

Graduates need to be flexible people who can show they will be innovative, previously engaged within the workforce, like to learn, have good communication skills and work well in

a team. Graduates need to be able to react to change quickly and positively and be tolerant of the situations they need to adapt to (Dunne 2009, p. 5).

These attributes are very similar to the generic graduate attributes developed by UQ and could form the foundation for implementing the backward design of a curriculum as outlined by Wiggins and McTighe (1998). This curriculum design model is a three stage process that firstly identifies the desired results of the educational process (graduate attributes) then determines how the attainment of these attributes can be assessed (assessment procedures) and finally concentrates on planning the learning experiences and instruction that will develop these attributes.

When this process is developed within the framework of Bruner's spiral curriculum (Bruner 1960) the fundamental knowledge and attributes required of a 21st century agricultural graduate can be developed and consolidated. This process was adopted in the design of the curriculum for the Bachelor of Agribusiness program at UQ (Dunne & Collins 1995) and could be used as a template for the design of an innovative agricultural curriculum at UQ that is grounded in disciplinary knowledge, integrative in its approach to problem solving and engaging in its pedagogy.

Maintaining curriculum breadth and depth

One of the major consequences of the reduction in enrolments in the agriculture programs at UQ has been the reduction in the number of academic staff, particularly in the area of agronomy and horticulture where full time academic staff numbers have declined from 20 to 8 since 2004. The impact of this reduction on UQ's ability to effectively mount credible programs of adequate breadth and depth in these disciplines is exacerbated by the fact that 50% of these staff are aged 60+ and would be expected to retire within the next 5 years. A similar situation exists in the agribusiness/rural management area.

There are three possible solutions to this problem of maintaining curriculum breadth and depth. The first of these is a consolidation of undergraduate programs in agriculture as first proposed by in the McColl Report 20 years ago (McColl *et al.* 1990). The second option is to form closer relationships with State Government Departments of Agriculture as proposed by Falvey (1998) and as recently adopted in Western Australia and Tasmania. The third option is a combination of the two options presented above plus university specialization in particular disciplinary areas and cross-institutional access for specific courses. An example of this university specialization exists with the suite of wool courses offered by the University of New England that are financially supported by the Australian Wool Education Trust.

A model of an integrative agricultural curriculum

Broadly there are three streams of agricultural education at UQ – agricultural science, agricultural technology and agribusiness. Within these streams issues associated with the environment and sustainability are addressed to varying degrees.

The development of a relevant agricultural curriculum involves change and therefore requires sensitive management of the process to ensure widespread acceptance and commitment by staff (Kotter 1996). Central to gaining acceptance is the retention of a strong discipline identity in the new curriculum

Feedback from employers, recent graduates and current students has indicated that a rejuvenated agriculture curriculum must reflect a closer engagement with industry, be presented in the context of the commercial environment and be balanced in terms of theory and application (Dunne 2009).

Engagement with industry has been historically achieved through a combination of guest lecturers, field visits and vacation work experience. Student feedback reported by Dunne (2009) indicated that students would prefer a longer period of vocational work experience and more field visits – suggestions supported by potential employers and past graduates.

The traditional forms of industry engagement could be augmented by a series of industry based cross disciplinary projects to provide students the opportunity to confront and solve problems in a commercial context. These projects could be designed to develop and consolidate the key graduate attributes of effective communication, cross disciplinary team work, critical thinking and problem solving in a commercial context. The intermediate and final capstone courses that are the distinguishing feature of the Bachelor of Agribusiness program are an example of how industry based projects could be incorporated into the spiral curriculum template.

A possible model of a new integrated agriculture curriculum is shown in Figure 2.

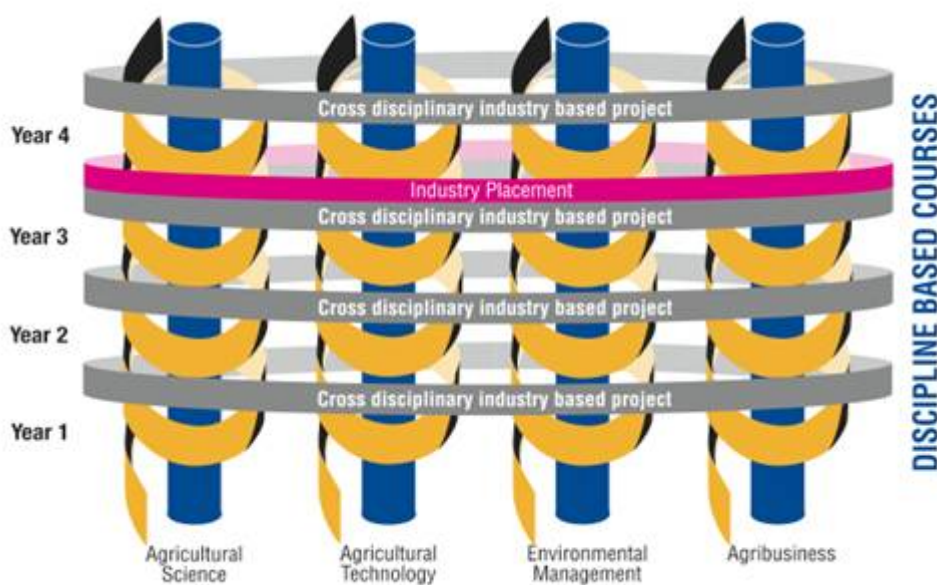


Figure 2 A model of an integrated agriculture curriculum

The development of such an integrated curriculum would not be easy. One possible way to achieve this outcome is to appoint an independent panel of employer representatives and curriculum design specialists to set the parameters of the curriculum and oversee the process of its development and implementation. Academic staff in the various disciplines and where appropriate cross disciplinary teams, would be responsible for the development of specific courses within the curriculum. An important aspect of this oversight would be mapping the curriculum to identify where and to what depth its graduate attributes are being developed (Jacobs 1997; Savocchia *et al.* 2009).

Engaging Students

Rejuvenating the curriculum in itself will not produce graduate with the attributes necessary for the next generation of professional agriculturalists without the presence of academic staff to deliver it in a way that is pedagogically sound and engaging for students.

Despite recent advances in the understanding of how people learn, university faculty do not generally receive much training in effective teaching, and universities still tend to use an outmoded method of teaching focused on facts and lecturing. As a result many classes fail to engage students (National Research Council 2009 p.2).

The establishment of the Learning and Teaching Performance Fund by the Federal government in 2003 has lifted the profile of student learning and its outcomes at UQ particularly at the undergraduate level. One of the five eligibility requirements associated with this Fund is evidence of systematic student evaluation of teaching and subjects that informs probation and promotion decisions for academic positions.

UQ has long standing course (iCVAL) and teaching (TVAL) evaluation processes in place. Both evaluation instruments are surveys consisting of standard items that students are asked to rate on a 5 point Likert scale. UQ has mandated that 70% agreement (agree, strongly agree) is the minimum acceptable standard and 80% agreement is the expected standard for both instruments.

In the 2008 Student Feedback Report, 73% of the NRAVS students surveyed considered the individual course were above average/excellent while 88% considered the individual lecturers' effectiveness as a teacher as above average/outstanding. These overall ratings would seem to suggest that the Faculty of NRAVS has few problems with the quality of its academic staff as teachers or their ability to engage students in individual courses, which is at odds with the focus group feedback reported by Dunne (2009). Furthermore, on the two items relating to developing specific graduate attributes (iCVAL item 9) and development of learning skills (TVAL item 10) the student ratings were marginally below UQ's minimum standard.

These student perceptions would suggest that there is room for improvement in the way the curriculum is delivered and the context in which it is delivered rather than the content of individual courses and the disciplinary expertise of academic staff.

UQ has a wide range of staff development programs that can be accessed by academic staff on a voluntary basis to improve their teaching skills. However if UQ is committed to improving the teaching expertise of its staff it might consider mandating the attainment of a professional teaching qualification as a requirement in the tenure and promotion process. Such a requirement is in line with the Australian Universities Quality Agency recommendation that UQ *take stronger action to ensure that all those who teach on its programs are adequately prepared and supported to meet the teaching responsibilities expected of them* (AUQA 2009, Recommendation 2, p.23).

Attracting high quality students

In marketing terms the process of curriculum regeneration and developing staff commitment to its delivery in a way that engages students in active learning is *getting the product right* in terms of producing graduates with the attributes desired by employers. The challenge then becomes to successfully promote this 'new and improved' version of the agricultural curriculum to potential students the majority of whom are generation Y school leavers.

At the institutional level UQ has an extensive and successful student recruitment and promotional program. Its focus is to attract high performing school leavers to UQ in general rather than to any particular Faculty or Program. The Faculty of NRAVS has an Engagement Committee that oversees the promotion of the Faculty and its programs but its activities are constrained by University wide policies, tradition and funding.

In the case of its agriculture programs, student recruitment over the past five years has clearly failed to arrest the decline in enrolments. Dunne (2009) identified three major deficiencies in the current promotional program based on the results of 10 focus groups conducted with year 12 students from feeder schools in south-east Queensland:

1. it failed to convince prospective students that there were interesting and well rewarded careers for graduates from UQ's agriculture programs – *I know that there are a lot of different jobs associated with Ag but we don't know what they are.*
2. it failed to convince prospective students that UQ's agriculture programs were quality professional programs and not farmer training courses – *I'm from the city and agriculture is seen as something for country bumpkins.*
3. the 'Trade Fair' approach to promotion involving open days and career expos is an effective means of increasing awareness of UQ but there is little empirical evidence to support its effectiveness in terms of student recruitment – *we have a career market and UQ has a stall but its mainly Brisbane courses; didn't really have any information about Gatton courses.*

This feedback from prospective students would suggest that a more proactive targeted approach to promotion of agriculture programs, and the professional careers that they lead to, is required. One such initiative has been the involvement of UQ in the Gateway Schools to Agribusiness program that has been initiated by the Queensland government.

Conclusion

The rural sector is a small but significant component of the Australian economy in terms of domestic food security, export earnings and regional development. To highlight this point, the National Farmers' Federation claims that the sector generates in excess of \$100 billion in revenues each year which underpins 12% of GDP (NFF 2009). To sustain this contribution, the sector will need to continue its investment in the intellectual capital and skills that are its foundations. It is in the development of intellectual capital that universities such as UQ have an important role to play.

However, as this case study has shown, universities face serious challenges in revitalizing their agriculture curricula, resourcing them adequately and promoting them to prospective students. This is not just a problem for UQ but for all of the 23 Australian universities that offer agriculture programs.

Four important issues emerge:

1. Declining undergraduate enrolments coupled with the reduced capacity of individual universities to mount a broad range of agriculture programs that have sufficient depth of specialization indicates that there needs to be a rationalization in the number of providers of agriculture programs in Australia or at least a higher degree of specialization and cooperation between providers. To date the debate concerning institutional specialization has been focused on research capacity that now needs to be expanded to include program delivery.
2. There has to be closer engagement between universities and the employers of their graduates. The traditional focus of engagement with industry has been with the farm production sector rather than with the businesses and agencies that support production and employ the majority of university graduates of agriculture programs. This engagement can take many forms ranging from meaningful involvement in curriculum design, commissioning of projects and provision of internship to endowment of scholarships. Closer engagement with employers will ensure that the curriculum remains relevant while providing students with opportunities to develop their knowledge and skills in a commercial context.
3. There has to be a greater degree of integration between the four strands of agriculture programs – science, technology, environment and business. While disciplinary knowledge is

important, it is the integration of this knowledge and the associated skills that is critical for a viable and sustainable agribusiness sector. The present structure of faculties based on disciplinary focused schools and departments is a potential inhibitor to curriculum integration.

4. Traditionally, agriculture programs have been targeted at prospective students located in regional areas because of their natural affinity to production agriculture and the businesses that support it. However, with the rapidly increasing awareness and interest in food security, health and nutrition and sustainability there is an opportunity to broaden the appeal of agriculture programs to urban and metropolitan based students. There are two important elements associated with broadening this appeal – it must be based on clearly identifiable and exciting careers that provide an opportunity for prospective students to make a difference; and it must be delivered in a format and by people to whom they can relate. Social networks such as Facebook and Twitter are important communication channels for prospective students while present students and recent graduates are credible sources of information about university life and career options.

The future of agriculture programs at UQ and other universities is at a crossroad. The issues outlined in this paper need to be addressed and addressed relatively quickly if UQ is to build on its proud history of agriculture education and research into the 21st century and beyond.

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^[1] In December 2008, there were 8 graduates in Agribusiness, 4 with dual degrees, 15 in Agricultural Science, 21 in Animal Science/Production, 5 in Plant/Crop Science and 3 in Horticulture from UQ agriculture programs.

^[2] The importance of environmental impact on the sustainability of agricultural systems would also require a strengthening of the environmental research and teaching capabilities within the Faculty, especially with respect to water, land and ecosystem management.