The Allen Consulting Group



Rebuilding the Agricultural Workforce

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Report to the Business/Higher Education Round Table

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Executive Summary

Introduction

The Business/Higher Education Roundtable commissioned the Allen Consulting Group to conduct a scoping study that reviews the effectiveness of current interventions designed to increase the number of people with higher education qualifications in the agricultural workforce.

Skill shortages in agriculture

Although employment levels in on-farm agriculture have not been growing, there is a shortage of skilled labour across the agriculture sector, particularly when agribusiness is taken into account. Based on current projections, this problem is expected to get worse.

Although focussed on occupations requiring VET (vocational education and training) qualifications, AgriFood Skills Australia (ASA) (2011) has identified that new and emerging skills for agriculture and horticulture will occur in a number of areas spanning many types of agricultural production.

There are a number of factors contributing to skill shortages in agriculture, related to both the supply of and demand for skills. These include: labour competition from other industries, poor promotion of the industry, an ageing population and declining rural population.

The barriers to meeting industry need for labour and skills include: low levels of industry involvement in education and training, poor promotion of agricultural pathways and the limited capacity of the current education and training system to deliver innovative training solutions (Industries Development Committee Workforce 2009).

The age profile of the workforce is a structural factor that is particularly significant. It is potentially the most serious and intractable cause of skill shortages in agriculture. The on-farm agriculture sector is forecast to lose at least 30 per cent of its workforce over the next ten years, mainly due to ageing (AFI 2010).

Declining enrolment in agriculture higher education

Since 2001, there has been a trend of declining enrolment in higher education qualifications in agricultural science and related fields, contributing to a shortage of qualified professionals in the agriculture sector. Data from the Department of Education, Employment and Workplace Relations (DEEWR) specifically related to agriculture qualifications shows that over the last decade, enrolments in agriculture have declined from approximately 4,500 to below 2,500 students nationally. Clearly, this is heading in the wrong direction given the skill shortages confronting the sector, which are expected to worsen.

Although it has been observed before, there is a need for immediate and effective action in addressing the workforce challenges facing the sector. In particular, the sector requires more people with higher education level qualifications.

This is particularly urgent because declining enrolments affect the viability of providers. Where course provision is no longer viable the future of relevant departments and faculties will be called into question. If this occurs on a widespread basis, then the sector would be unable to respond to the shortage of skilled labour, thus consigning it to a permanent shortage of skilled workers and curtailing the ability of the sector to innovate and grow.

Intervention strategies identified

With this in mind, the project has identified 12 intervention strategies, which have been applied by Australian universities, grouped in three broad areas:

- next generation targeting young people through schools and other activities;
- product development involving development of the product offerings of education providers; and
- industry focussed based on stronger links with industry.

The interventions are not mutually exclusive: they can and have been used in combination and may overlap.

Table ES 1.1 INTERVENTIONS IDENTIFIED

Type of intervention	Activities
Next generation (chapter 4)	
School outreach and engagement	University scientists working with schools to include agriculture in the curriculum
Science teacher professional development	Development of school science teachers to include agriculture knowledge and teaching materials
Agriculture career awareness	Promote agriculture career pathways through agricultural shows and expo type events
Product development (chapter 5)	
Rebranding of degree programs	Branding degrees with areas of greatest areas to students, rather than as 'agriculture'
Reorientation of course content	Course redesign and restructuring to better meet market needs and requirements
Flexible delivery	Support for part-time or online course delivery while students remain on the farm or in industry
Fee discounts	Reduce fees for agriculture degrees
Industry focussed (chapter 6)	
Industry engagement	Substantive engagement with industry regarding degree content and graduate attributes
Industry experience and projects	Industry projects included in degree programs
Scholarships	Offer scholarships for agriculture degrees
Cadetships and mentoring	Offer cadetships and mentoring for school leavers, to combine work with a degree
Pathways to higher education	Rethink the pathway from school to agriculture programs at university, including entry requirements
Source: Allen Consulting Group 2011	

In describing the interventions, the report is not suggesting all are appropriate in all circumstances. Rather, the purpose of the project has been to identify interventions and subject them to a form of evaluation as a precursor to the development of detailed recommendations in the final chapter.

Review of interventions

As the detailed description and review of these interventions indicates, there has been no shortage of efforts designed to draw more people towards agriculture qualifications and career. The Primary Industry Centre for Science Education (PICSE) submission to the Senate inquiry stated:

For at least the last four decades, the major strategies employed to improve public perceptions of agriculture and increasing enrolment in agriculture courses has been to provide isolated media stories of agriculture, provide stand alone teaching resources in agriculture and teach agriculture in some high schools. ... these strategies in themselves, patently have not been effective.

By implication an approach that is limited to evaluating individual interventions to determine those which are most effective for further deployment, will not of itself be sufficient to address declining enrolments.

Strategy for agricultural education

Many of the challenges facing agriculture reflect broader economic and social trends. Interventions, such as those referred to above, have a part to play but they are not likely to change attitudes and behaviours.

A comprehensive strategic approach is required which is based on collaboration between industry, education providers and government. The Business/Higher Education Roundtable is well placed to provide leadership in pursuing this agenda.

This will incorporate a significant rethink of the current agriculture education model together with a sustained commitment by industry to renew and reimage occupations and professions across the sector.

As discussed in introducing this report in Chapter 1, the problem being responded to and the resultant objectives related to addressing that problem can be viewed at several levels:

- the broader problem is that the agriculture workforce has a shortage of appropriately skilled workers and this shortage is expected to worsen;
- university educated graduates are needed to address the shortage;
- the trend has been one of declining or stagnant enrolments in these programs at universities; and
- if this trend continues the viability of more of these programs will be threatened, undermining the capacity of the system to respond to the worsening shortage.

Governance arrangements

The focussed delivery of such a strategy requires a dedicated group to carry it forward. For this reason the establishment of Agriculture Education Council is recommended.

The council will have overarching responsibility for taking forward the recommendations of this report. Once the council is formed, this would require the development of a detailed plan, building on the formative strategy outlined here.

Agriculture Education Council

The council would comprise representatives of higher education, vocational education, school science education, industry and government.

The role of the council would be to finalise and implement an agriculture workforce strategy, based on the recommendations of this review. Specific actions of the council would include:

- embed agriculture in school curriculums through the Sustainability stream of the Australian Curriculum and through science subjects;
- lead implementation of the proposed cadetship program;
- involve more agriculture businesses in attracting people into agriculture and in the continuous improvement of agriculture education products; and
- contribute to new agriculture education products, including those based on non degree structures.

The ongoing need for a council would be reviewed once the strategy was implemented. A permanent role may not be required, but the council would be required for at least three years.

The council will also be well placed to take forward any complementary recommendations arising from current parliamentary inquiries into agricultural education, particularly the Senate inquiry, given that this is considering the issue at a national level.

Industry needs to have a high level of ownership of the future of agriculture education. While government needs to be at the table, it would be a mistake to wait for government to address the agriculture workforce problem. Industry representation needs to reflect both on-farm and agribusiness in order to address effectively workforce development and skills shortages.

Governments, at both State and Commonwealth level, also have an important role to play in supporting strategies and reforms proposed by the council. This is particularly so in the case of curriculum reform, support for raising education participation and attainment in rural Australia and ensuring the accurate and effective collection of data on the agricultural workforce.

A champion for agriculture higher education

Agriculture workforce and education concerns do not have a high profile, despite the persistence of skill shortages and related problems being well established. This suggests there is a need for an influential champion of the agriculture workforce to lead implementation of the strategy. Such a person would presumably chair the Agriculture Education Council. As well as raising the profile of the problem, the presence of a 'can do' personality would ensure that reforms were pursued with required urgency, and barriers to reform were overcome. Some of the recommended actions represent quite significant change, and clear leadership is required to effect this.

Priorities

Priority items in the agriculture workforce strategy to be taken forward by an Agriculture Education Council are:

- reconceptualise agricultural education as one diverse sector with shared challenges and interests;
- marketing campaign to change the image of agriculture;
- a national program of agriculture cadetships;
- expand the PICSE program; and
- resolve data issues.

Agriculture education sector

Agriculture related education takes place at the school level, through VET or through higher education. Regardless of the level of education and the age and capability of students, many of the same challenges apply. An expanded understanding of what agriculture comprises is necessary at all levels of education in order to increase interest in agriculture. Similarly, the crisis facing the agriculture workforce is not the making of any one of these systems. There are skill shortage problems for both high skill and low to mid skill employment. Many of the strategies to increase interest in agriculture require collaboration between systems and will benefit each system. For these reasons, it is timely to bring the different levels and forms of agriculture education together under a unified council and strategy.

To give this initiative practical effect, under the leadership of the Agriculture Education Council, it is recommended that the ASA environment scan be expanded to include higher education level qualifications.

A further suggestion is for the council to consider the feasibility of establishing agricultural education farm sites in regional areas which concurrently provide practical education opportunities to school students, VET and higher education. An existing under-utilised site or sites could be allocated for this purpose. The idea would be to improve the viability of existing sites and provide more students with access to agriculture education infrastructure throughout school and post school education.

Marketing campaign to change the image of agriculture

As a practical starting point, a marketing campaign to change the image of agriculture is required. In isolation, this will not change social attitudes to agriculture but in concert with a broader strategy it can be effective. This will not only benefit universities but agriculture education as a whole. The key messages of such a campaign would include:

- modern agriculture is high tech, diverse and interesting;
- in agriculture there are opportunities to help solve the big problems facing humanity: food security and global warming (see discussion in Box 7.4 regarding sustainability); and
- in agriculture there are many interesting jobs which would be demonstrated through case studies.

The campaign might choose not to feature the word 'agriculture' but that would be something for the experts in branding and campaign development to consider.

Implement a national program of agriculture cadetships

Cadetships are a clear opportunity to reform the school – university pathway. As the ASA has pointed out, agriculture is ideally suited to cadetships, in which a promising year 12 graduate with a demonstrated interest in agriculture is provided with an industry placement linked to a higher education place. There are no reasons why a relatively significant number of such placements could not be offered across Australia if all universities with agriculture programs agreed to participate. This could include the potential to expand the concept of a cadetship to encompass a full qualification.

Expand the PICSE program

While increasing agriculture based learning experiences in schools is critical, combined with related initiatives, it does not appear to be happening to a sufficient scale at present. PICSE is an established comprehensive program. While the cost barrier reported by some universities requires consideration, ideally a strategy to address the workforce problems in agriculture and increase enrolments over time would feature an expanded PICSE program.

Resolve data shortcomings and educate policy makers about agriculture education data

The inclusion of environmental studies in the agriculture broad field of education tends to mask the decline in enrolments and completions in agriculture specific degrees. At a minimum, the Agriculture Education Council should work to encourage better understanding of the true seriousness of the decline in agriculture enrolments. It may also be possible to change the classification, so environmental studies is not included. However, this should not detract from the main focus of effort which is to respond to the decline and increase enrolments. Data understanding is only urgent to the extent that it builds the case for change and forms the basis for industry and government buy in.

What individual universities can do

There are a number of initiatives which individual universities can and should pursue of their own volition. These will contribute to increasing interest and should lead to more enrolments in agriculture qualifications, and as such, are consistent with the thrust of the overall strategy.

Expand the market from which agriculture students are drawn

Universities should look to diversify the market they draw students from, including identifying 'new' segments in existing markets. For example, those in rural and regional areas who have a connection with agriculture, do not intend to move from their current location and who would be enthusiastic about increasing their agriculture knowledge through study. These individuals are not traditionally part of a university cohort but many of them could be if given appropriate support.

Rethink the first year at university

Another area, related to pathways into university, is attrition after the first year of agriculture programs. Students who do select agriculture programs generally want to do hands on work as part of the program. They are generally predisposed to practical problem solving and they want to have a practical experience within their studies. Generally, it appears that the practical elements of agriculture degree programs feature more strongly after first year. First year is focussed on foundational science. Agriculture degrees reportedly have a high level of attrition after first year and universities consulted cited this as being the main reason why this occurs. Students are not well prepared for this science heavy first year, a situation made worse because a high proportion of students would not have undertaken chemistry at year 12 level, despite chemistry being particularly important in agriculture programs at university level.

Encourage articulation with VET

Consistent with viewing agriculture education as a sector, there are opportunities to continue to build links between higher education and VET.

The project was advised of a number of initiatives to strengthen relationships between higher education and VET. Several of these have been encouraged by Australian Government grants to regional universities. However, it would be potentially beneficial to both VET and higher education providers to increase the formal links between the sectors and market this to students.

The ASA environmental scan stresses the need to provide incremental skills development in addition to full qualifications. It notes the importance of recognition of prior learning for entry to skills development and qualifications in an industry where hands-on learning or field experience is highly regarded (ASA 2011).

Reconsider ATAR scores

There is an opportunity for universities to closely consider their university entry requirements as a means of increasing enrolments, with particular reference to the Australian Tertiary Admissions Rank. While universities understandably do not want to compromise quality, some of the entry scores for agriculture related pathways are relatively high. It is not unreasonable to suggest that if universities are concerned about a shortfall in the number of agriculture graduates, then some relaxation of entry scores could be an effective way of addressing this, provided it is done in a managed way with related forms of student support in place as required.

Chapter 1 Introduction and background

1.1 This project

The Business/Higher Education Roundtable commissioned the Allen Consulting Group to conduct a scoping study that reviews the effectiveness of current interventions designed to increase the number of people with higher education qualifications in the agricultural workforce.

The study was asked to develop an 'intervention logic' with short and medium term actions that will significantly improve the supply of skilled people to the agriculture sector. The project brief also referred to workforce modelling. In finalising the project scope, modelling was removed but the project undertook to provide advice on modelling that could be undertaken and what that would involve. This advice is at Appendix A.

The project brief identified that a number of matters relating to the issue under consideration were well established, including:

- the crucial importance of a skilled workforce for the future of the agriculture sector;
- the increasingly strong demand for these skills; and
- the intransigence of response in supply of skilled people, despite a number of interventions by several relevant agencies.

Recognising this, the main purpose of the study was to identify what can be done to address the problem of declining enrolments in agriculture related qualifications.

Placing the project objective in a broader context

As the title of the project suggests, the project was conceived based on a recognised need to address the rebuilding of the agriculture workforce. The project purpose outlined above recognises that increasing the number of people with an agriculture related higher education qualification is an important part of this challenge.

However, it is clearly important to recognise the broader agriculture workforce challenge and the report outlines this in Chapter 2. The report has acknowledged this in calling for an overall strategy requiring extensive collaboration between universities, other education providers, industry and government.

1.2 Methodology

The methodology agreed with the Business/Higher Education Roundtable comprised five phases.

1. Desktop review — summarise policy documents and relevant literature on interventions designed to address skill shortages in agriculture, particularly those directed at attracting students into higher education level agricultural science and/or science, technology, engineering and maths (STEM) related disciplines more broadly.

- Consultation and data requests consultation with agriculture sector stakeholders and universities regarding intervention approaches and effectiveness. A request for data to the Department of Education, Employment and Workplace Relations (DEEWR) provided enrolment and completions data for agriculture-specific courses.
- 3. *Identification of intervention strategies* based on the desktop review and consultation, describe distinct intervention strategies.
- 4. *Evaluation of intervention strategies* analysis of the enrolment data and the intervention strategies. This is intended to enable findings to be made about which types of intervention appear most effective in attracting more students into agriculture pathway qualifications.
- 5. Final report, including analysis of the potential impact from adopting the most effective form of intervention the report includes recommendations for future action and identifies any impediments to such action. The report also provides advice on further analysis that could be undertaken but which is beyond the scope of this project.

Refinement of emphasis during the project

In undertaking the project, some aspects of the planned methodology have received greater attention than envisaged, while others have not featured as prominently. In particular, the report has placed more emphasis on the importance of a sector-wide response to the agricultural workforce and the role of universities within that response.

In undertaking the desktop review, it became apparent that there has been a paucity of evaluation of specific interventions that have sought to attract more students to agriculture or STEM qualifications. The emphasis within the report is therefore based on providing observations about specific interventions, including whether those interventions appear to have impacted enrolment levels. Overall comment on the effectiveness of the approach adopted in Australia is also provided as a precursor to the recommendations set out in the final chapter.

1.3 This report

This draft report has drawn on consultation with stakeholders and desktop review of literature and other documents related to the topic at hand. Some contextual data analysis also draws on publicly available datasets, such as those of the Australian Bureau of Statistics (ABS). Detailed unpublished data on agriculture-only enrolments was obtained from DEEWR. Where appropriate, this agriculture specific data has been compared to broad field of education data (including environment studies, horticulture, viticulture and animal science).

This comparison highlights the difficulty with much data on education and employment in the agriculture sector where the 'broad field of education' entitled agriculture obscures the actual number of people studying agriculture specialist qualifications, such as bachelor of agriculture or bachelor of agricultural science. Data issues are considered in this report, including a related recommendation. The remainder of this report is structured as follows:

- The remainder of this chapter provides contextual information on the agricultural sector in Australia;
- Chapter 2 provides an overview of the agriculture workforce challenge;
- Chapter 3 provides an overview of the challenges facing higher education agriculture enrolment;
- Chapter 4 describes interventions targeting the next generation of skilled agriculture employees;
- Chapter 5 describes interventions targeting product development by universities;
- Chapter 6 describes interventions based on an industry focussed approach;
- Chapter 7 provides findings and recommendations;
- Appendix A provides initial advice on modelling options;
- Appendix B provides an overview of themes emerging from current submissions to two parliamentary inquiries examining agricultural education; and
- Appendix C lists stakeholders consulted.

1.4 The agricultural sector in Australia

Agriculture is an important part of the Australian economy. Although the share of gross domestic product (GDP) contributed directly by the agriculture, forestry and fishing industry has reduced in relative terms over time (approximately 2 per cent), the contribution is significant when the value of the agribusiness food chain is taken into account (approximately 12 per cent). Agriculture has strategic significance because it supplies food and fibre to Australia and export markets. The sector is also a significant employer in regional Australia.

Industry structure

Within the broader industry division of agriculture, forestry and fishing (ABS 2008), the Australian agriculture sector includes:

- horticulture (including nursery, floriculture and vegetable growing);
- grain, sheep and beef cattle farming;
- intensive livestock farming (dairy and poultry);
- other livestock farming (e.g. deer);
- broadacre farming; and
- services to the agriculture sector.

These subdivisions cover a broad range of production activities which require specific skill requirements and expert knowledge (AFI 2010). The major determinants of demand related to specific types of agriculture products can be summarised as follows (IBISWorld 2009):

- food for human consumption influenced by consumer preferences, population growth, relative prices and disposable incomes;
- animal feed influenced by activity in livestock industries and seasonal conditions;
- fibre influenced by relative prices of substitute synthetic fibres, production efficiency and consumer preferences; and
- services to agriculture influenced by activity in cropping and livestock production, the extent of outsourcing by farmers and seasonal factors.

Agribusiness

When the agriculture related food chain is viewed as an inter-related sector, this is referred to as agribusiness. This includes businesses that are directly engaged in, or directly benefit from, agricultural activities. Businesses in this sector produce agricultural commodities, are primary buyers of agricultural produce, or supply goods and services to farms. The industry extends up to but does not include the point of sale, which is considered retail (IBISWorld 2011). It is this broader agribusiness sector that represents a significantly larger proportion of employment compared with those involved directly in primary or on-farm production.

Broad industry trends

The agriculture industry is at an important juncture. Significant issues such as global warming, food security and water scarcity place agricultural production at the forefront of public policy. The sector in Australia faces significant challenges and opportunities.

The following broad trends in Australian agriculture were recently identified (IBISWorld 2011):

- markets shifting towards the Asia-Pacific;
- shift away from livestock products to other agriculture products;
- new systems and technologies;
- shift of production northward to Western Australia, Queensland and the Northern Territory; and
- ownership and corporate structure moving away from land ownership, towards leasing or rental, although Australia retains a relatively high proportion of small farm holdings.

The above trends indicate that while the agriculture sector in Australia continues to have an important role in supplying the domestic market, the international market is of significant importance in shaping trends within the sector. This reflects that Australia is a major exporter of food and fibres. The value of the Australian dollar is therefore critical, as this alters the price of agricultural exports. The availability of water is another key sensitivity in agriculture. Periods of sustained low rainfall have a detrimental impact on production levels for many types of farming and this has a flow on effect to the agriculture related economy. The easing of the drought in many parts of Australia has somewhat reduced the impact of low rainfall which had been experienced throughout much of the preceding decade. Indeed, severe floods have impacted some regions.

Agriculture is also challenged by patterns of settlement. Among young people, there is a population drift to cities and large regional centres, away from more remote rural areas. This reflects a trend towards larger average farm size.

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES 2008) production estimates and forecasts indicate the agricultural sector will experience strong growth as it continues to develop adaptive technologies to overcome external impacts, such as drought, to increase overall productivity.

1.5 Qualifications subject to consideration

While bachelor of agriculture and bachelor of agricultural science degrees have traditionally been the flagship agriculture qualifications, there are many other degrees directly related to the agriculture workforce.

Qualifications within the scope of this study tend to be those offered through schools of agriculture (or equivalent) at Australian universities. These are the programs that have been subject to detailed consultation and desktop research. While trends in other degrees have been considered through the analysis of enrolment and completion data, they have not been the main focus.

Similarly, while the project has considered undergraduate and postgraduate levels, most attention has been directed to undergraduate enrolment, as this provides the initial cohort of people who may go onto postgraduate level study. Table 1.1 provides examples of agriculture related qualifications.

Table 1.1

AGRICULTURE HIGHER EDUCATION: EXAMPLES

Qualification group	Typical qualification	Fields of study
Agricultural Science	BAgSc BSci(Agr) BAppSc(Agr)	Agriculture, agribusiness, agricultural biotechnology, agricultural chemistry, agricultural entomology, agricultural genetics, agricultural microbiology, agronomy, animal science and production, biometry, crop science.
Agriculture	BAg	Animal nutrition, crop and pasture science, pasture agronomy
Agricultural Business or Management	BAgBusMgmt BAgriBus BBus(AgriBus) BBus(FarmMgt)	Agribusiness, agronomy, farm and rural management, equine management
Animal Science	BSc(AnimSc) BLivestockSc	Animal science, livestock science, animal health and nutrition, sheep, wool science, food science and technology
Plant Science	BSc(PlantSc)	Plant science, genomics, botany
Agriculture and Environment	BHort BNatSc(Ag) BSci(Ag&Env)	Horticulture, environmental horticulture, production horticulture, land management, rural environmental management, soil conservation, resource and environmental management, ecological studies, environmental biology, wildlife management

Source: Good Universities Guide 2011

Chapter 2

Agriculture workforce challenges

This chapter provides a profile of the agriculture workforce and describes agriculture workforce challenges.

2.1 Agriculture workforce

In 2007-08 there were approximately 306,000 people working on-farm in the agriculture sector (including owner-operators and contributing family members but excluding 'backpackers' on 417 working holiday visas). Almost half of these were employed in grain, sheep and beef cattle farming and almost a quarter were employed in horticulture. Approximately one in ten were employed in intensive livestock, with a similar proportion in services to agriculture. New South Wales, Queensland and Victoria accounted for over 70 per cent of total agriculture employment in 2007-08. Over three quarters of the workforce in 2007-08 was full time, with the remainder part time or casual. Employment numbers in the sector fluctuate by several thousand workers each quarter due to seasonal factors (AFI 2010).

Figure 2.1 shows overall employment levels in agriculture (predominantly on-farm with some agriculture support services) since 2001 compared with some other industry sectors. This shows that in the early part of the decade, employment in agriculture decreased each year whereas employment in most other sectors shown increased. In the mid to latter part of the decade there was a period of stabilisation in agriculture followed by a large drop in the last year. This contrasts with mining which has experienced significant increases in employment throughout this period, reflecting the current resources boom.



Source: ABS, Labour Force, Australia, Detailed, Quarterly, Aug 2011 (cat. no. 6291.0.55.003)

Looking specifically at the largest three occupation groups in agriculture, 'farmers and farm managers' have decreased from just below 250,000 in 1997 to almost 168,000 in 2011, as shown in Figure 2.2.



Figure 2.2 EMPLOYMENT TRENDS – LARGEST THREE OCCUPATION GROUPS

Of particular relevance to this project is the pattern of employment in selected occupations classified as requiring, 'a level of skill commensurate with a bachelor degree or higher qualification' (ABS 2011). This shows that the number of natural and physical science professionals has increased since 1997, while the number of agricultural technicians has declined.



Source: ABS, Labour Force, Australia, Detailed, Quarterly, Aug 2011 (cat. no. 6291.0.55.003)

While the above charts indicate lower employment overall, there has been a shift in demand towards higher skilled employees and there are constraints affecting the supply of these individuals. This has caused persistent skill shortages.

Agribusiness employment

Accurate estimates of the quantum of agribusiness employment are difficult to obtain. The Australian Farm Institute (2010) has observed that 'understanding current labour supply shortages across the agribusiness value chain is a key information gap in understanding the total demand for labour in the sector'.

There is a need to develop a better understanding of this issue because it is reasonable to assume that agribusiness and agriculture compete for the available supply of university agricultural graduates. While agriculture graduates might be more likely to take up careers in agribusiness rather than on-farm, there is a lack of firm evidence about this (AFI 2010).

It is also highly possible that agribusiness employers include agriculture graduates among their potential recruits but also cast a significantly wider net, including graduates from other science disciplines, for example.

The ASA Environment Scan 2011 reports the following employment levels across areas which include on-farm employment and other areas:

- food beverage and pharmaceuticals: 224,000 employed;
- meat: 55,000 employed;
- seafood: 17,200 employed; and
- agriculture, horticulture and conservation: 460,000 employed.

2.2 Skill shortages in agriculture

Although employment levels in on-farm agriculture have not been growing, there is a shortage of skilled labour across the agriculture sector, particularly when agribusiness is taken into account. Based on current projections, this problem is expected to get worse.

Areas of skill shortage

The 2011 Environmental Scan produced by ASA notes that the lack of relevant data affects training provision and the ability to track critical job roles. This last task is crucial to understanding the effect of workforce ageing in particular occupations and increasing demand in what were previously highly specialised occupations (ASA 2011). However, there are reportedly shortages across a number of areas, across the spectrum from low to high skilled.

Although focussed on occupations requiring VET qualifications, ASA (2011) has identified that new and emerging skills for agriculture and horticulture will occur in the following areas:

- carbon capture, storage and accounting;
- biosecurity;
- animal behaviour, health and welfare;
- natural resource management;
- water harvesting and water cycle management;

- supply chain management; and
- human resource management, marketing and business practice.

Furthermore, ASA reported current labour shortages in the following areas that may require higher education qualifications:

- agronomist;
- arborist;
- environmental scientist; and
- soil scientist.

Size of skill shortages

There are insufficient data to quantitatively measure the current labour and skills shortages with a high degree of accuracy (AFI 2010). However, based on a survey undertaken by AFI (2010), labour shortages in on-farm agriculture were estimated to be in excess of 101,000 workers as of June 2009.

Pratley and Hay (2010) undertook a detailed study of demand for agriculture employment based on a review of employment advertisements. Key findings related to the presence of a shortage of those with agriculture related degree qualifications were:

- approximately 15,000 discrete jobs were available per year over the three year study period;
- around 9,000 or these were likely to be on-farm with the remainder agribusiness;
- approximately 70 per cent of the agribusiness jobs (4,200) would presumably benefit from a degree qualification;
- a further 1,800 might be advantaged by having a degree, making a potential demand of 6,000 graduates;
- at best, Australian universities were graduating fewer than 800 per year in 2008 in agriculture and related courses;
- at that time, the Australian Council of Deans of Agriculture estimated a job market of 2,200 for people with such qualifications; and
- whether one accepts the higher estimate of 6,000 or a lower figure, there is clearly a significant gap between the number of people graduating with an agriculture qualification, compared to the level of demand or potential demand for those with such qualifications.

As skills shortages in agriculture are identified — particularly in agribusiness — it is important to note that graduates without agriculture-specific qualifications may fill these shortages.

2.3 Causes of skill shortages

There are a number of factors contributing to skill shortages in agriculture, related to both the supply of and demand for skills.

The Workforce, Training and Skills Working Group of the Industries Development Committee (2009) summarised these well, in reporting that workforce and skills shortages were in large part due to: labour competition from other industries, poor promotion of the industry, an ageing population and declining rural population. Furthermore, the barriers to meeting industry need for labour and skills were identified as: low levels of industry involvement in education and training, poor promotion of agricultural pathways and the limited capacity of the current education and training system to deliver innovative training solutions. Some of the key causes of skill shortages are considered further below.

Educational attainment in agriculture and rural areas

An over-arching issue is that educational attainment in agriculture, in terms of the overall levels of VET and higher education qualifications held, is generally low compared to other industries.

As Figure 2.4 illustrates, just over half of those people working in agriculture do not have a post secondary qualification, compared with 38 per cent overall. The gap in attainment is greater for bachelor degrees or higher, than it is for VET qualifications. For lower level VET qualifications, agriculture has a higher proportion than overall.



Figure 2.4 EDUCATIONAL ATTAINMENT IN AGRICULTURE

The difference in part reflects that a relatively high proportion of the agriculture workforce resides in regional areas and attainment in regions is relatively low compared to urban areas. This has been attributed to relative lack of access to education and training provision in rural areas (Alston and Kent 2003). Those in rural areas have also had relatively limited access to the internet and lower rates of broadband use, restricting access to information and the option of online study for many individuals. Recognising this, a current \$268 million Australian Government program of grants to regional universities is seeking to improve access to higher education for people in regional areas (Hon Chris Evans and Hon Simon Crean 2011).

In a farming context, lower attainment of bachelor degrees may also reflect cultural attitudes which value learning on the job and the development of specific practical skills that can be put to immediate use. This does not create an environment where all employers necessarily place a high value on formal qualifications. In many instances they are more likely to be attracted to skill sets or similarly targeted education and training.

For instance, extension programs of relatively short duration are a distinguishing feature of education and training in agriculture. These traditionally popular programs provide specialised training in topics designed to be directly relevant to farmers and related employees. They are often undertaken through collaborations involving industry associations and government departments of agriculture or primary industries.

Clearly, the relatively low proportion of people with a degree level qualification in agriculture has implications for higher education providers. Most directly, it means that the market of potential students is less than it might otherwise be. Furthermore, in marketing qualifications, the universities have an additional challenge of persuading prospective students of the benefits of a qualification, as well as attracting them to apply and enrol with their institution.

Apart from the general issue of low educational attainment, other reasons put forward to explain the shortage of appropriately skilled workers in agriculture include the attraction of other industries, conditions in the agriculture sector, population movement away from rural areas, technological advancement and ageing. These are considered in turn below.

Attraction of other industries

Mining is frequently cited as a sector that draws people away from agriculture (AFI 2010). Mining is an industry with a large presence in many regional areas. Consequently, mining and agriculture are effectively competing for labour. The scale of the current mining boom is such that wage levels are frequently higher than those on offer in agriculture. The growth of employment in mining may also contribute to a perception among some workers that agriculture has a less bright future compared with the resources sector.

Similarly, the agriculture sector has been less profitable overall than many other industries (Ruthven 2011). This may also discourage some young people — including those on family owned farms — from continuing in the family agriculture business. Some of these people may move from rural areas (which have a higher proportion of agriculture workers) to urban areas (or major regional centres).

An industry sector that is not perceived to be forward-looking and prepared to invest in human capital may be less attractive to school leavers contemplating course and career options. To attract and retain people in agriculture, ASA (2011) has identified a need for employers to more systematically support workforce development, and adopt new technology. There is an opportunity to increase skill assessment and recognition of prior learning, which will encourage participation in structured learning and increase attainment levels over time.

Population drift

There has been a population shift in Australia from inland areas to coastal areas and cities, resulting in the rural population decreasing. There is also a tendency towards a declining birth rate in rural communities (Argent and Walmsley 2008).

Analysis by Argent (2009) 'confirms that teenagers and young adults have indeed been exiting from rural areas over the past 20 years in large numbers'. While net migration is net positive for people aged 25 and above, for those aged 15-24, approximately 20 per cent of young people migrated away from inland statistical divisions between 1996-2001. Areas more likely to have a higher rate of young people leaving include those with drier climates which are more remote from cities and more dependent on-farming employment (Argent 2009). About half of those leaving went to capital cities, with the remainder tending to go to larger nearby regional centres, including coastal regions.

Limited full time work opportunities (Alston and Kent 2003) and relative lack of post secondary education and training opportunities (Halsey 2009) have been cited as reasons for young people leaving rural communities.

Technology

Although ASA has called for more farming businesses to embrace new technology, relative to other industries, the agriculture sector has performed well in terms of increasing productivity levels. IBISWorld (2011) has attributed this to a trend towards increased use of technology and mechanisation. This has shifted the demand for labour away from work that is low skilled and labour intensive, towards work that is high skilled.

The ageing of the workforce is a major factor contributing to current skill shortages. Given the potential significance of the impact of an aged agriculture workforce, this issue is considered in some detail below.

2.4 Ageing

The age profile of the workforce is a structural factor that is particularly significant. It is potentially the most serious and intractable cause of skill shortages in agriculture. The agriculture labour force is older on average than the rest of the Australian working population. Approximately 35 per cent of the sector is aged 55 years or older (ABS 2006 reported in AFI 2010). This will increase to 56 per cent of the labour force by 2018. At that point, one third of the workforce will be 65 or older. Half of all agricultural scientists are reportedly nearing retirement (ASA 2011). The on-farm agriculture sector is forecast to lose at least 30 per cent of its workforce over the next ten years, mainly due to ageing (AFI 2010). Figure 2.5 compares workforce ageing in agriculture with other industries and shows that the sector is older than the overall median.



Figure 2.5

Source: ABS, Labour Force, Australia, Detailed, Quarterly, Aug 2011 (cat. no. 6291.0.55.003)

Figure 2.6 compares the proportion of workers who are aged 45 or over (defined as 'mature aged') in agriculture compared with all industries since 2001. This shows that agriculture has a significantly higher proportion of mature aged workers and the proportion is increasing over time.



The Allen Consulting Group

Figure 2.7 is a state by state breakdown of the proportion of people who are mature aged in agriculture as of August 2011. It shows that at least 50 per cent of agriculture workers are aged over 45 in all states, with Western Australia having the highest proportion of mature aged workers.



In the context of the above factors, the discussion in Chapter 3 considers enrolment patters in agriculture higher education.

Chapter 3 Agriculture higher education challenges

This chapter provides an overview of enrolment and completions in agriculture higher education, a select comparison with international experience, examination of the market for agriculture students and agriculture graduate outcomes.

3.1 Enrolments in agriculture higher education

Since 2001, there has been a trend of declining enrolment in higher education qualifications in agricultural science and related fields, contributing to a shortage of qualified professionals in the agriculture sector. There are signs of slight recovery in the last two years but this remains a worrying trend that is causing widespread concern.

For instance, the Rural Research and Development Council (RRDC) (2011) has noted the decline in agricultural, environmental and related studies between 2003 and 2008 against a national trend of increasing course completions. The RRDC has nominated 'capacity in people' as one of the major themes in its current investment plan.

Others to have raised concerns about this problem include the Industries Development Committee Workforce Training and Skills Working Group (2009), the Australian Farm Institute (Pratley and Hay 2010) and ASA (2011), among others. The persistent nature of the agriculture workforce skill shortage and the inadequate level of enrolments in higher education courses is also a common theme in university submissions to two current parliamentary inquiries.

The agriculture 'broad field of education'

In Australia, enrolment and completion statistics are presented in a number of 'broad fields of education', which attempt to group similar disciplines. One such field of education is 'agriculture', which includes: agriculture; horticulture and viticulture; forestry studies; environmental studies; and other agriculture, environmental and related studies. Of these, environmental studies has the most enrolments. Enrolment in environmental studies courses has been increasing, while enrolment in the other more agriculture specific areas has been decreasing. Therefore, relying on analysis of broad field of education tends to mask the actual trend of declining enrolments in agriculture. The following charts show enrolment only for the agriculture qualifications, with only Figure 3.6 showing broad field of education data.

Enrolment and completion in agriculture courses

When this data is examined, the contrast between broad field of education and agriculture specifically becomes evident. Over the last decade, enrolments in agriculture have declined from approximately 4,500 to below 2,500 students nationally, as shown in Figure 3.1.



Figure 3.1 ENROLMENTS AND COMPLETIONS IN UNDERGRADUATE AGRICULTURE COURSES

Enrolments

When this national data is disaggregated by state, distinct variation appears. Tasmania has experienced a small increase in enrolment from a low base; all other states have declined though New South Wales has stabilised and South Australia displays some recovery, as shown in Figure 3.2.



Individual universities have also experienced different levels of enrolment growth and decline, as shown in Figure 3.3 on a deindentified basis. This is confirmed in submissions from universities to current parliamentary inquiries and based on consultation for this project, it is clear that enrolments are relatively flat overall and the long term trend has been one of declining enrolments.



Completions

Completions data shows a similar pattern but is less smooth, possibly indicating some movement out of agriculture courses prior to completion, as shown in Figure 3.4.



The pattern for completions can also be viewed on a deidentified institutional basis, as shown in Figure 3.5.

Figure 3.5

COMPLETIONS BY INSTITUTION



Source: Unpublished DEEWR data 2011

Australian agricultural education is not alone in experiencing reduced or stagnant enrolments, as the discussion of selected international experience in Section 3.2 suggests.

Broad field of education

The preceding charts show a clear pattern of overall declining enrolments in agriculture qualifications. However, review of the data for the agriculture broad field of education shows increasing enrolment in recent years. This is due to growth in environmental studies, as alluded to previously. While this presents a challenge for agriculture faculties in terms of data presentation and communication, it also highlights an opportunity. Specifically, if agriculture qualifications can be more closely associated with practical sustainability skills, it could benefit more directly from growing interest in studies related to the environment and sustainability. Figure 3.6 shows enrolment trends in agriculture higher education in Australia (total enrolment includes commencing and continuing students).





Source: DEEWR Higher Education Statistics (accessed November 2011)

3.2 Selected international experience

This project has considered the experience of comparable countries, both in completion trends and interventions attempted. Figure 3.7 provides an overview of agriculture related completions in several comparable countries, using 2003 as a base year.



This shows that the United States has modestly increased graduates after experiencing a downturn during the 1990s. The United Kingdom has experienced little change, though Canada, the Netherlands and Australia have all experienced declines. The decline in Australia has been less severe — in percentage terms since 2003 — than Canada and the Netherlands.

United States of America

The higher education system in the USA includes both institutions awarding two year associate degrees and institutions awarding four year bachelor degrees. Over the period 2005 to 2007 (AgCareers 2009):

- agriculture enrolment at two-year institutions increased from 80,797 to 95,525 students; and
- agriculture enrolments at four year institutions increased from 78,336 to 92,202.

A number of examples from the USA are referred to in the chapters describing intervention strategies.

Canada

Canada has experienced a decline in undergraduate agriculture enrolments over the period 2000 to 2009. Enrolment levels were at 3,084 in 2000, peaked at just over 3,400 in 2003 and have declined each year to 2,739 in 2009 (Statistics Canada 2011).

Canadian Agricultural Human Resources Council

The Canadian Agricultural Human Resources Council (CAHRC) was established to address human resources challenges facing the agriculture sector such as competing with other industry sectors to attract and retain skilled workers, dealing with an ageing workforce and combating the misperceptions associated with some agriculture careers (CAHRC 2011). Through its own research and through forums with farmers, the CAHRC is in the process of building a profile of skills development needs across the Canadian agriculture sector, to raise awareness of onfarm occupations and career pathways. To date, CAHRC's work in this area has focused on vocational education and training rather than agriculture higher education.

Netherlands

In the Netherlands in the late 1990s, most of the growth in agricultural education enrolments was in the vocational stream. However, enrolment in higher education agricultural education in this period decreased by 10 per cent (Mulder and Kupper 2006). OECD data indicates that Dutch completions in the field of agriculture higher education continued to fall during the 2000s (OECD 2009). This decline is concerning given the Netherlands' history of research excellence in agriculture fields (Spiertz and Kropf 2011).

United Kingdom

In the United Kingdom, enrolments in the agriculture sector have experienced a small amount of growth during the period 2003 to 2008. The *National Employer Skills Survey for England 2009* (UK Commission for Employment and Skills 2010) indicated that two per cent of agriculture employers were faced with skills shortage vacancies. These types of vacancies are due to the low numbers of applicants with the required skills, work experience or qualifications (UK Commission for Employment and Skills 2010). This is an indicator that there is a gap between the demand for higher education agriculture graduates and the supply of such graduates, even as the United Kingdom as a whole experienced recession.

3.3 The agriculture higher education student market

In the context of strategies and interventions to increase enrolments in agriculture qualifications, an understanding of the student market is required. Although it is beyond the scope of this project to undertake a market research study, the major segments that comprise the market for agricultural qualifications at university are briefly considered.

DEEWR (2011[d]) has reported that undergraduate applicants from metropolitan and non-metropolitan areas exhibit different preferences. In broad fields of education, non-metropolitan students are more likely to apply for courses such as education and nursing, along with agriculture, environmental and related studies.

A shrinking market?

The market for higher education students is less than it might be due to relatively low levels of educational attainment in the agriculture sector. Additionally, there are other trends which suggest that agriculture degree programs are competing for students from a pool that is shrinking in relative terms, within an environment of intense competition for students from all disciplines and possibly from the VET sector.

The population drift towards more urbanised centres along with increasing farm size and the changes in Australia's industry composition towards service industries, mean that community awareness and understanding of agriculture is diminished. Consequently, fewer people today understand where their food is sourced from and how it is produced. This has important implications for agriculture education. If people do not understand what agriculture is and what people who work in agriculture do, then they will not know the career options that exist. Nor will they know which courses qualify them for jobs in the industry.

Against this background, the following discussion briefly considers both the school leaver and existing worker market as sources of agriculture qualification enrolments.

School leavers

In broad terms, for undergraduate qualifications, the major group of potential students is school leavers. Among this group, there are school leavers who are familiar with agriculture and those who are less familiar. Those who are familiar are more likely to be from regional areas. Those who are less familiar are more likely to be from urban areas.

A recent but yet to be published survey of first year science student attitudes found that agriculture suffers from poor perceptions based on lack of understanding of what agriculture entails. The major factors influencing career choices among first year science students were: having interesting or challenging work; having a secure future; help/working with animals; good lifestyle; and working on important issues (Miller et al 2011).

Existing workers

Existing workers are another segment of the market. While this group is more likely to be considering postgraduate study, they may also be considering an undergraduate degree or shorter programs with immediate outcomes including those provided by VET. This group can be further divided into those looking to study on campus and those looking at distance education. This will depend on their employment arrangements, their distance from the campus and access to a suitable internet connection.

Among existing workers in the agriculture sector, there are many individuals who would benefit from undertaking a higher education qualification but who may not have ever considered doing so. Some of these individuals would be from groups who are traditionally disadvantaged in the labour market including Aboriginal people and people from non-English speaking backgrounds. They may currently be engaged in unskilled or semi skilled work, and they may have had poor experiences of formal education in the past.

Although solutions to the problem of declining enrolments are detailed in the final chapter, it appears clear that universities need to make their agriculture qualification product offering more attractive to a broader market. Within such a strategy, those who have not traditionally considered a university qualification generally, or study in agriculture specifically, will need to be engaged and supported. It will also extend beyond those who are applying or interested in applying for a university place, but who would not traditionally have considered studying agriculture.

This in turn will require innovative approaches to qualification content and design, along with models of student support and partnerships with VET providers.

3.4 Agriculture graduate destinations

In summary, the agriculture industry is changing to become more technology based. Although there has been a trend of overall employment levels contracting there are shortages of skilled workers with degree level qualifications. This trend is only going to worsen in the coming years if it is not urgently addressed. Reflecting broader social trends, the wider community has less understanding of agriculture and the range of careers involved. Tackling this problem is clearly an essential initial step if more people are going to be attracted to careers in agriculture and to agriculture related qualifications.

Job roles related to agriculture qualifications

Establishing the types of job opportunities for people with these qualifications is a precondition for better explaining and marketing these opportunities to students. The Australian Council of Deans of Agriculture have sought to address this problem through the Career Harvest website. A summary of occupations described on the website is provided in Table 3.1.

	Сгор	Livestock	Horticulture	Viticulture
	production			
Research and development	Biotechnologist, rural sociologist, environmental analyst, agribusiness consultant	Animal behaviourist, poultry scientist, agricultural economist, extension officer	Agronomist research, ecologist, agricultural statistician, market analyst	Chemist, engineer, plant nutritionist, soil scientist
Farm	Agriculture pilot, farm owner/manager, plant operator	Animal technician, horse manager, pest & weed controller, wool classer	Arborist, irrigation specialist, greenkeeper, horticulturalist, gardener	Viticulturist, vineyard owner manager
Post farm gate	Export manager, grain inspector, grain services manager, sugarcane analyst	Food distribution manager, livestock buyer, quality control officer, marketing coordinator	Export manager, food microbiologist, shipping coordinator, purchasing/ supply manager	Winemaker, marketing researcher, farmers' market manager, merchant

Table 3.1

SELECTED SKI	LLED OCCUP	PATIONS IN /	AGRICUL	.TURE
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Source: Career Harvest at http://www.csu.edu.au/special/acda/careers, accessed November 2011

The Jobs Outlook report published by the Australian Government also provides guidance on agriculture career pathways. Specifically, the reports on 'farmers and farm managers' (DEEWR[a] 2011), 'science professionals and veterinarians' (DEEWR[b] 2011) and 'skilled animal and horticulture workers' (DEEWR[c] 2011). A summary of the most recent outlook reports in these areas indicates that job prospects in each of these broad areas which may be destinations for agriculture graduates, are reasonably good¹.

- For farmers and farm managers, employment is projected to grow at an average rate of 0.9 per cent per annum (it has declined in recent years as shown in Figure 2.2) which equates to around 9,100 new jobs in the five years to 2014-2015. This compares with an annual average growth rate of 1.8 per cent for all occupations over the same period.
- Employment of science professionals and veterinarians has been growing by 3.2 per cent a year for the last ten years, compared to 2.1 per cent for all occupations. Employment of these individuals is projected to grow at an average rate of 2.7 per cent per annum, equating to around 12,800 new jobs in the five years to 2014-15.
- Employment for skilled animal and horticultural workers has been growing by 2.7 per cent a year for the last ten years. Employment of these individuals is projected to grow at an average rate of 1.3 per cent per annum, equating to around 7,000 new jobs in the five years to 2014-15.

The projections are based in part on economic models but also take into account recent employment trends and prospective occupational developments. A degree of uncertainty is attached to these projections.
If these projections are correct and employment is going to grow in these areas, then this seemingly makes the need for more agriculture graduates even more acute.

The AFI research report *Towards a Better Understanding of Current and Future Human Resource Needs of Australian Agriculture* (2010) undertook projections of workforce demand to 2018 based on a low, medium and high demand scenario. It found that:

- in the low demand scenario, labour demand was forecast to decline by 1.9 per cent per annum;
- in the medium demand scenario, labour demand was forecast to decline by 0.3 per cent per annum; and
- in the high demand scenario, overall labour demand was forecast to increase by 1.4 per cent per annum.

3.5 Graduate outcomes

In consultations conducted for this project, respondents indicated strong industry demand for graduates and high levels of employment straight after studies were finished. The project has considered data related to full time employment outcomes, type of employment gained and graduate views of the relevance of agriculture degree programs. This data is drawn from the annual survey of graduates conducted by Graduate Careers Australia.

Information surrounding course provision and the rate of entry to the agriculture sector from formal education and training has been described by AFI (2010) as 'incomplete'. The proposed Agriculture Education Council could take up this and other data related issues, as discussed in Chapter 7.

Agriculture bachelor degree graduates full time employment, long term trend

Figure 3.8 shows that compared with other occupations, agriculture has generally performed better than languages and physical sciences. It has had similar performance to chemistry, mathematics and geology. It has had lower performance than nursing, veterinary science, building and economics.





Agriculture graduate employment outcomes 2010

Figure 3.9 compares the employment outcomes of agriculture graduates with a selection of graduates from other bachelor degree programs. This indicates that in terms of full time employment, agriculture graduates had similar outcomes to most other science graduates but a somewhat lower proportion in full time employment compared with areas such as building, nursing and veterinary science. The average proportion in full time employment across all qualifications was 76 per cent while agriculture was 69 per cent. The proportion of agriculture graduates obtaining full time employment has generally been between 70 and 80 per cent. Generally, a further 10 to 20 per cent of graduates are in part time or casual work, with the remainder looking for work.



Figure 3.9 AGRICULTURE GRADUATE EMPLOYMENT OUTCOMES 2010, SELECTED QUALIFICATIONS

It is somewhat surprising that the employment outcomes for agriculture graduates are not even higher given the reported shortages of skilled labour. Assuming the data is accurate, this could suggest that employers currently do not value agriculture qualifications as highly as they might. This could be because there are many jobs for which an agriculture degree would be useful, without being viewed as a necessity. It is important that employers come to place a higher premium on agriculture degrees. However, this is likely to require closer engagement between universities and employers.

Field of education by type of employment for 2010

Review of graduate outcomes data of employment by broad field of education indicates that agriculture and related bachelor degree graduates had the lowest proportion in 'professional' (44 per cent), the highest proportion in 'management and administration' (13 per cent), the third highest proportion in 'technical' (7 per cent), the second highest proportion in 'trades' (6 per cent) and the highest proportion in 'manual' (9 per cent). This indicates that agriculture related graduates have a more diverse range of outcomes than other fields of education. It also reflects the broad range of work types in the agriculture sector, unlike service sectors for example.

Table 3.2 shows the results for a selection of broad fields of education, including the overall result for all graduates.

Field	Mgmt & Admin	Prof	Tech	Trades	Clerical	Manual	Other
Science	7.4	57.2	10	1.7	18.7	1.8	3.2
Veterinary science	0	84.6	3.8	6.4	3.8	0.6	0.6
Agriculture	13	44.3	6.5	6.0	18.6	8.9	2.7
Business, economics	12.6	54.1	0.8	0.6	26.3	1.2	4.4
Overall	6.5	66.6	2.8	0.9	19	1.1	3.1

Table 3.2 AGRICULTURE AND RELATED FIELDS OUTCOMES BY TYPE OF ROLE

Source: Graduate Outcomes Survey 2010, Graduate Careers Australia 2011

Relevance of agriculture qualifications

Agriculture graduates in full time employment are less likely on average to report that their degree is a 'formal 'requirement' of their job. However, they are more likely on average to report that it is 'important' to their job. Also, a higher proportion of those with agriculture qualifications report the degree is only 'somewhat' or 'not' important to their job compared with the average.

Table 3.3 provides a comparison between agriculture and science qualifications. Agriculture is less likely to be either a 'formal requirement' or 'important' than the other qualifications shown. Science qualifications generally are lower than the overall results (except veterinary science). The data suggest that overall graduate outcomes are reasonably good and satisfaction with degrees is reasonably high.

	Formal requirement	Important	Somewhat important	Not important
Agriculture	31.7	26.5	22	19.8
Life sciences	37.7	23.6	12.8	25.9
Mathematics	45.4	26.2	14.6	13.8
Chemistry	44.9	24.3	17.8	13.1
Physical sciences	40.3	19.3	20.2	20.2
Veterinary science	86.5	5.8	3.2	4.5
Overall	53.3	21.4	11.6	13.6

Table 3.3

IMPORTANCE OF SELECTED QUALIFICATION TO FULL TIME JOB

Source: Graduate Outcomes Survey 2010, Graduate Careers Australia 2011

The formal requirement category for other types of qualifications may reflect the accreditation requirements for those professions. Of the examples given, this can be observed in the results for veterinary science (87 per cent). The main area of potential concern is the degree of relevance they attach to the degree, shown through the proportion viewing the qualification as 'somewhat' or 'not' important to their job.

3.6 The agriculture workforce challenge requires urgent attention and universities are an important part of the required response

There is clearly widespread concern about agricultural education, as proven by two current parliamentary inquiries being undertaken by committees of the Australian Senate and the Victorian Parliament. This reflects that the concerns about agriculture education are long standing. Other reports into this and related matters include but are not limited to, the following:

- The Australian Farm Institute 2010: Towards a Better Understanding of Current and Future Human Resource Needs of Australian Agriculture;
- Hon Hendy Cowan 2010: Review of Post-Secondary Agricultural Education in Western Australia;
- Industries Development Committee Workforce, Training and Skills Working Group 2009: Workforce, Training and Skills Issues in Agriculture;
- Coutts Casey and Stone 2004: Strategy to Attract Young People to Horticulture, Business Plan; and
- Rural Industry Working Group 2001: Skill needs now and in the future in the rural industry.

Despite these reports and related research and analysis, the specific problems of skill shortages in agriculture and declining enrolments in agriculture qualifications persist (there has been an increase in the broad field of qualifications but this includes a broader range of qualifications).

Each of the above reports concluded that there is a problem which must be attended to. The Victorian Parliament and Senate inquiries will presumably make similar recommendations.

Collectively, the apparent lack of success so far in turning around the concerning trends in the agriculture workforce has significant implications. As the age profile of the industry shows, the rate at which people exit the industry is expected to increase. If enrolments cannot be increased across a broad range of skill levels, then an insufficient number of qualified people will enter the sector. While this can be observed both for vocational education and higher education based pathways, the lack of higher education qualified individuals is a particular problem.

The inability to fill positions partly reflects subdued demand from workers seeking agriculture careers. This, coupled with agriculture's declining share of GDP and declining levels of employment overall, does add to the importance associated with achieving growth in the supply of skilled graduates who meet the needs of today's agriculture sector. As ASA (2011) states, 'we risk waking up to regional Australia's potential just as its workforce becomes depleted beyond critical mass'.

This warning refers in part to the education institutions who provide agriculture related courses. Where course provision is no longer viable the future of relevant departments and faculties will be called into question as we have seen with rationalisation of courses and campuses. If this trend continues on a widespread basis, then the sector would be unable to respond to the shortage of skilled labour, thus consigning the sector to a permanent shortage of skilled workers which would curtail the ability of the sector to innovate and grow.

Although it has been observed before, there is a need for immediate and effective action in addressing the workforce challenges facing the sector. In particular, the sector requires more people with higher education level qualifications. Against this background, the following chapters examine the major interventions that have been applied by various institutions to try and attract more people to agriculture. This can also provide a basis for the development of a comprehensive and integrated response, involving the universities and, it is suggested, a continuing role for the Business/Higher Education Round Table.

Chapter 4 Intervention strategies: next generation

4.1 Summary of interventions identified

The project has identified 12 intervention strategies, grouped in three broad areas:

- next generation —targeting young people through schools and other activities;
- product development involving development of the product offerings of education providers; and
- industry focussed based on stronger links with industry.

The interventions are not mutually exclusive: they can be used in combination and may overlap.

Table 4.1 INTERVENTIONS IDENTIFIED

Type of intervention	Activities
Next generation (chapter 4)	
School outreach and engagement	University scientists working with schools to include agriculture in the curriculum
Science teacher professional development	Development of school science teachers to include agriculture knowledge and teaching materials
Agriculture career awareness	Promote agriculture career pathways through agricultural shows and expo type events
Product development (chapter 5)	
Rebranding of degree programs	Branding degrees with areas of greatest areas to students, rather than as 'agriculture'
Reorientation of course content	Course redesign and restructuring to better meet market needs and requirements
Flexible delivery	Support for part-time or online course delivery while students remain on the farm or in industry
Fee discounts	Reduce fees for agriculture degrees
Industry focussed (chapter 6)	
Industry engagement	Substantive engagement with industry regarding degree content and graduate attributes
Industry experience and projects	Industry projects included in degree programs
Scholarships	Offer scholarships for agriculture degrees
Cadetships and mentoring	Offer cadetships and mentoring for school leavers, to combine work with a degree
Pathways to higher education	Rethink the pathway from school to agriculture programs at university, including entry requirements

Source: Allen Consulting Group 2011

In each of the next three chapters, the description of interventions follows the following structure:

- strategy the main features of the intervention;
- logic the thinking behind the intervention;
- examples selected examples of the intervention in practice; and
- observations comment about the likely effectiveness of the intervention.

In describing the interventions, the report is not suggesting all are appropriate in all circumstances. Rather, the purpose of the project has been to identify interventions and subject them to a form of evaluation, as a precursor to the development of detailed recommendations in the final chapter.

4.2 School outreach and engagement

Strategy

Demonstrating agricultural science in schools is a strategy used to increase interest about agriculture among school students, give students a better understanding of what agriculture is and the career possibilities it encompasses, leading to increased enrolments in agricultural science qualifications. Other potential benefits include educating young people about the importance of food and fibre production and the need to respect those who produce these products in a sustainable way.

The specialised resources of the university — such as lecturers, students or outreach education officers — adds depth to the teaching of science and enables secondary students and their teachers to explore the links between science in the classroom and science as it is applied to agriculture. In doing so, the programs emphasise the relationship between study at the secondary and tertiary levels and progress into a structured career.

Forms of these programs may target children at any age, although the content is obviously modified to be age appropriate. However, it appears most common for secondary school children to be the main audience. This hopes to encourage these students to choose relevant senior secondary subjects and to select agriculture qualifications among their university preferences.

Logic

The rationale for such an approach is that if students are unaware of the possibilities offered in agriculture and related fields, and direct, hands-on experience can demonstrate a structured and interesting career.

Examples

The examples provided here should be read in conjunction with those described in the science teacher professional development intervention, as there are some programs which incorporate both components. Examples are described as part of the intervention they are considered most relevant to.

Primary Industry Education Foundation

The Primary Industry Education Foundation (PIEF) was established in 2008 as a not for profit organisation with representatives from government, industry and higher education. PIEF is focussed on school based primary industries education. Its objectives include:

- national leadership and coordination of initiatives to encourage primary industries education in schools through a partnership between industry, government and educators;
- commissioning, coordinating, facilitating and managing national projects to encourage primary industries education in schools;
- providing a source of credible, objective and educational resources for schools to maintain and improve community confidence in Australia's primary industries; and
- communicating primary industries research and development outcomes in a format accessible for schools and encourage interest from schools in primary industries related careers (PIEF 2011).

In addition to the identification of interventions specifically related to universities for this project, PIEF has conducted a national stocktake of education programs that seek to address declining interest and enrolment in agriculture science and related fields. This stocktake revealed at least 258 programs across all states and territories working at both primary and secondary school levels.

Scientists in Schools

Scientists in Schools is a national program that seeks to create and support partnerships between teachers and scientists. Although not dedicated to agricultural science, some of the partnerships formed under the program have been agriculture related, with the following examples of activities undertaken by participating scientists provided on the Scientists in Schools website:

- worked with a teacher on presentations for 200 students covering everything from DNA fingerprinting to genetic engineering;
- helped run 'Biotech in the Bush' in Kingaroy, around three hours north of the city and has hosted Kingaroy students for work experience in her lab;
- gave teachers and their students an opportunity to use the latest technology in their study of plant water usage;
- involved high school students in practical fruit fly and ant surveillance activities; and
- organised a visit to a laboratory for Year 6 students to complement classroom visits and activities.

Primary Industry Centre for Science Education

The PICSE program incorporates examples of school outreach and engagement. PICSE also has an industry placement component which is referred to in discussion of that type of intervention. The school-based component of PICSE is described further in Box 4.1. The University of Western Australia advised that PICSE works with its Aspire program which is a science outreach program for disadvantaged students in 24 schools across the state. Although Aspire aims to raise awareness about higher education more generally, combining it with PICSE allows for an agriculture focus.

Box	4	1
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PICSE

PICSE is led by the University of Tasmania and is based on a model of collaboration between universities, their regional communities and local primary industries. The aim of PICSE is to attract students into tertiary science and thereby increase the number of skilled professionals in agribusiness and research institutions. PICSE originated in Tasmania and now operates in at least one university in most jurisdictions. PICSE operates at both the middle school (Years 9-10) and senior school (Years 11-12) levels. For middle school students, science education officers operate in the classroom and assist students with planning their open-ended Science Investigation Awards. In the senior school classroom, the science education officers focus on demonstrating examples of current science applications using rich curriculum strategies and examples that reflect the local agricultural sector. Following this, students are invited to apply for the PICSE Industry Placement Scholarships. These scholarships consist of a five-day residential science/industry camp, an industry placement and a report back session.

Source: University of Tasmania submission to Victorian Parliamentary Inquiry, Meinke 2011

Science in the Bush

Science in the Bush is an initiative of the Australian Museum and the University of Sydney which has operated since 2006. Science in the Bush conducts workshops and activities for primary and secondary school students. These activities are focused on hands-on demonstrations and experiences and are designed to support the science curriculum. Science in the Bush operates in rural NSW with events so far held in Wagga Wagga, Albury, Orange, Newcastle, Mount Tomah and Coffs Harbour.

Tall Poppies Reaching Students Program

The Australian Institute of Policy and Science runs the Tall Poppies Reaching Students Program. The program engages the Young Tall Poppy Science award winners in activities to promote interest, study and careers in science among school students, teachers and the broader community. A variety of activities are undertaken under the program, including school visits, video conferences with schools, seminars and workshops for teachers. Although not exclusive to agriculture, a Young Tall Poppy is awarded annually in each jurisdiction across many fields of science, with agriculture related topics invariably being represented. The outreach program is operating in ACT/New South Wales, South Australia and Tasmania/Victoria. There are plans to expand this to other states.

Observations

While these programs undoubtedly have a number of important benefits for school students, teachers and university staff who are involved, there is a lack of evidence to suggest they are leading to a noticeable increase in the number of students selecting agriculture programs at university level. This observation is made since despite these programs being relatively widespread and mature, university enrolment levels have remained relatively stagnant. Of course it is likely that in some cases a student's experience in one of these programs led them to choose an agriculture degree or career pathway. The suggestion is not that these programs are not worthwhile, rather that of themselves they are unlikely to achieve a material increase in enrolments at university level. This may reflect that no one program is of sufficient scale to have a noticeable effect on enrolments, suggesting this approach requires more widespread adoption and complementary measures.

4.3 Science teacher professional development

Strategy

Professional development of science teachers in school is a strategy that recognises the importance of school based learning (as with school outreach and engagement). However, rather than having university lecturers as guest teachers, this involves developing the knowledge and tools available to current teachers, to ensure they use agricultural science in learning. It seeks to update and extend the pedagogy of the secondary school teachers involved. In the process, this intervention seeks to enthuse teachers about the learning opportunities afforded by agricultural science, in the course of teaching other sciences, such as biology, chemistry and physics.

Science teachers who are exposed to agriculture in this way will be able to provide supervised agricultural experience-based teaching (Newcomb et al 2004). Supervised agricultural experience (SAE) as it is known, involves the application of concepts and principles learned in the classroom in planned, real-life settings under the supervision of the teacher. Supervised experience is important because it improves student learning, personal development and occupational development.

A broader and related objective is to ensure that agricultural science retains its place in the school curriculum. In an Australian context, the most likely avenue for this is through the sustainability 'cross-curriculum priority' (ACARA 2011). However, a number of agriculture educators are concerned about the level of prominence given to agriculture in the curriculum, as evidenced through numerous submissions to the Senate inquiry.

Logic

The logic of this strategy is that if teachers are enthused about agriculture and use agriculture examples in teaching, this will increase interest in agriculture careers and study among students.

Examples

Some of the programs described in the school outreach and engagement intervention may include an element of science teacher professional development. The examples provided here are considered to have this as a particular focus of activity.

Get into Genes

Get into Genes is a hands-on curriculum linked workshop for secondary students that highlights the application of biotechnology to food production. Established in South Australia in 2004, the program now also operates in Victoria and Western Australia. Get into Genes incorporates professional development for secondary school teachers, so they can teach agricultural biology in the classroom, as detailed further in Box 4.2.

Box 4.2

GET INTO GENES

Get into Genes has delivery partners across the country: La Trobe University and University of Melbourne in Victoria and Plant Energy Biology at University of Western Australia. In South Australia, Get into Genes is delivered at the Waite Campus, University of Adelaide. More than 12,000 students have been through the program.

Get into Genes undertakes the following activities to achieve its objectives.

- Communication of the latest technologies and developments in agricultural biotechnology to secondary school students and their teachers, including those in rural and remote regions, by providing informal hands-on biotechnology workshops outside the normal school setting.
- Provision of accurate, contextual and curriculum linked agricultural biotechnology learning resources for secondary students and their teachers.
- Provision of professional development programs for secondary school teachers in the agricultural biotechnology field.
- Provision of role models for secondary school students by incorporating postgraduate students and early career scientists in the program.

Source: Get into Genes website accessed 21 November 2011, http://www.getintogenes.com.au/index.php?id=14

Prime the Pipeline (Arizona USA)

A notable example of this intervention is found in Arizona, USA. Referred to as 'Prime the Pipeline', it is a school based intervention directed at secondary school science teachers, as summarised in Box 4.3.

Box 4.3 PRIME THE PIPELINE

This program was developed at the University of Arizona and targets STEM subjects. Its target group is senior secondary school students and teachers and, to a lesser extent, the parents of the students involved.

This strategy works on the basis that changes to pedagogy will enthuse teachers, enrich students' knowledge and interest them in extension work such as the Prime the Pipeline project. The overall objective is increased university enrolment in STEM courses.

The inputs require strong support from faculty leaders and a commitment from university lecturers to develop and deliver courses over the university summer break and into the first semester of high school. Project mentors — tutors and demonstrators for the high school students — are recruited from undergraduate and postgraduate students. Learning materials are also sourced and provided by the university.

The Summer Institutes and Connections Courses run over a period of two weeks during the summer break. There are daily classes and demonstrations as students work towards the completion of a project. The curriculum employs a problem-based learning approach in an environment where students and teachers learn as peers. The Connections Courses are a professional development exercise for the teachers, extending their knowledge and application of problem-based learning and updating their subject content knowledge.

The Science Villages are an after-school program that runs for nine weeks each semester (approximately 20 contact hours per semester). At the end of the program, parents and the school community are invited for a showcase of student work.

Source: Greenes, C, Wolfe, S, Weight, S, Cavanagh, M & Zehring J 2011, 'Prime the Pipeline Project (P^3) : putting knowledge to work', *Contemporary Issues in Technology and Teacher Education*, vol. 11

Iowa State, USA

Some states within the USA have pursued strategies related to agricultural education. However, information about higher education specific programs is limited. Iowa provides an example of a secondary school program which has been reported in a peer reviewed journal (Retallick and Martin 2008). As the interventions described in Chapter 4 make clear, increasing school enrolment in agriculture programs is often viewed as a precondition of growth in higher education programs.

The study of agricultural education in Iowa looked at 15 year enrolment trends related to three components of agricultural education programs: Future Farmers of America membership (FFA); SAE and agricultural education enrolment (meaning classroom instruction in agriculture). Secondary school agricultural programs were seen as comprehensive if they included these three components. Significantly, the study observed annual growth of just over 4 per cent in agricultural education (classroom teaching), just over 2 per cent for FFA and just under 2 per cent for SAE. Overall, the study observed growth in agricultural education, with agriscience and agribusiness specific growth areas. Most of the growth was attributed to increasing female enrolments (Retallick and Martin 2008).

Rural Champion Program

The AgForce website describes the Rural Champion Program which has been operating in Queensland for several years. The program aims to promote agriculture to primary and secondary school students through volunteers who 'champion' the bush and rural industries. Using interactive media and Farmer-in-the-Classroom presentations, Rural Champions engage primary students to think about agriculture so they understand where their food and fibre comes from. The program also provides secondary school students with information on career options in rural industries and help and advice on career pathways for these positions — such as assistance in arranging work experience, school-based apprenticeships and traineeships and advice on studies at tertiary institutions.

Observations

There are a number of these initiatives in existence, although clearly they would not be reaching all, or even most, secondary science teachers. As with the intervention related to school engagement and outreach, while there are undoubted benefits to developing the agriculture related knowledge of teachers, there is a lack of evidence that such efforts have, of themselves, had a significant effect on enrolment levels in university degree programs.

4.4 Agriculture career awareness

Strategy

This type of intervention strategy seeks to overcome negative perceptions of a career in agriculture by informing young people about the range of careers available in agriculture. It is closely related to school outreach and engagement because that strategy has improved agriculture career awareness as one of its objectives. However, it can also be viewed as a distinct strategy because agriculture career awareness can be pursued in settings other than schools. The strategy can also involve attendance at agriculture field days and shows to provide information about career pathways and related education and training opportunities. Websites dedicated to providing advice on agriculture careers are also a feature of this approach.

Related to this and the school engagement strategies described, is the development of specialist agricultural high schools. While this is beyond the control of universities, there is a view among some stakeholders that establishing more such high schools would be an effective way of attracting more young people into agricultural careers, including university pathways.

Logic

The logic of this strategy, is that if young people have a well developed understanding of agriculture career opportunities, they are more likely to pursue these opportunities, by undertaking an agriculture related qualification at university.

Examples

Careers fairs and agriculture shows

The University of Adelaide and the University of Western Australia (UWA) both provided examples of initiatives focussed on raising awareness about careers in agriculture. The University of Adelaide hosted a stand at the Royal Adelaide Show, while the University of Western Australia attends the Dowerin Field Day each year. Charles Sturt University (CSU) also advised that it participates in career fairs and has held agriculture days on campus. They have also had some success in promoting CSU agriculture student outcomes through the local media.

Future Farmers of America

The FFA, which is now referred to as the National FFA Organisation to reflect its broader role, is a long standing institution:

... dedicated to making a positive difference in the lives of students by developing their potential for premier leadership, personal growth and career success through agricultural education.

The scope of activities undertaken by the organisation is extensive. While the organisation is focussed on school level agricultural education, a number of initiatives are designed to extend into post school education. These include the scholarship program and the Collegiate FFA Convention and Career Expo. The expo is attended by employers of agriculture related graduates from university level programs.

Career Harvest Website

The Australian Council of Deans of Agriculture has established the Career Harvest website which provides information about careers in agriculture, forestry and fisheries. It details the occupations in each sector, qualification pathways and presents case studies of each occupation. These case studies discuss the tasks involved, personal requirements and the types of qualifications required and where these can be obtained.

Dairy New Zealand

Dairy NZ has had a longstanding and well regarded approach to structured career planning and developing, including education and training, as summarised in Box 4.4.

Box 4.4

DAIRY NZ CAREER PATHWAYS

Dairy NZ, on behalf of the dairy industry of New Zealand, has a comprehensive electronic career pathways module which is provided by USB and can be ordered on the Dairy NZ website. The module enables those working in the dairy industry to:

- identify their current skills and strengths;
- review career options in the dairy industry;
- learn more about roles in the industry from farmers;
- develop a career plan; and
- use a range of tools and resources to assist in professional growth.

The Dairy NZ model has been recognised as effective in providing clear career pathways which have been institutionalised and entry and exit strategies are complementary.

Source: http://www.dairynz.co.nz/page/pageid/2145859962/Career_Pathways

Canadian Agricultural Human Resource Council

Similar to the established NZ dairy model, the Canadian Agricultural Human Resource Council has established an 'Agricultural Career Pathways' project. The CAHRC website explains that the project was developed to assist employers and employees in primary agriculture with career progression. The pathways will help farm workers make informed choices on the types of skills and knowledge to acquire and will also be useful to students and foreign trained workers who are exploring their potential entry into the on-farm sector.

Although the agricultural career pathways tool is under development, the intention is for the project to develop a series of agricultural career pathways for key on-farm occupations, along with their associated credentials and competency profiles. This will involve:

- selecting key on-farm occupations;
- identify necessary qualifications to carry out these occupations; and
- development of competency profiles, to map similarities in the occupations and draft career pathways.

Agricultural high school

The agricultural high school model is in place in Western Australia, South Australia and New South Wales. A number of submissions to the Senate and Victorian Parliamentary inquiries have advocated the extension of this model to other parts of Australia as a means of inculcating an appreciation of agricultural practice and careers.

Observations

While the work of individual institutions is a proactive response to declining interest, it is unlikely to substantially impact enrolments to the degree required to address skilled workforce shortages in agriculture.

While agricultural high schools undoubtedly help to raise awareness of agriculture careers among those who attend them, they do not necessarily lead directly to large enrolment levels in university programs. For example, a relatively small number of students from Urrbrae in Adelaide find their way into the University of Adelaide agricultural science degree.

A 1998 study of the New Zealand career path model by the Centre for Integrated Agricultural Systems at the University of Wisconsin found that it has been successful in normalising structured career pathways across the industry. This has important benefits, such as allowing farmers to defer land ownership until the middle stages of their career. The system features high quality training and farm apprenticeships which are effective in preparing people for each career stage. Also, industry and government work in partnership in supporting the model.

The NZ Dairy experience and our observations suggest interventions by individual universities are more likely to be effective within an agreed career framework. This is the objective of the CAHRC, as described in Chapter 2.

4.5 Summary and conclusions

Engaging with the next generation of skilled agriculture workers is clearly a critical part of a broader strategy to increase interest in agriculture careers and attract more people into agriculture degree programs. However, to be effective in achieving this objective, the programs need to be of a large enough scale to connect with a significant number of schools, teachers and students (including through the broader curriculum). Also, these efforts need to be part of a broader coordinated strategy which would include an agreed agriculture career framework agreed between education providers, industry and government.

Chapter 5

Intervention strategies: product development

5.1 Rebranding degree programs

Strategy

One of the barriers to increased enrolment in agriculture related qualifications is relates to perceptions and understanding of the term 'agriculture'. Agriculture is associated with being an 'old fashioned' industry which is constantly facing challenges and moving from one crisis to another. Additionally, the community understanding of agriculture careers is not well understood, beginning with lack of understanding of what comprises the work of a modern farmer. This issue has been discussed in some detail in recent reports into agriculture education which were referenced in Chapter 3 and this was also a consistent message in consultation for this project.

'Agriculture' is not the only term that appears to be a barrier to enrolment, with some universities reporting 'natural resources' presents similar issues. To overcome this problem, a number of universities have changed agriculture related degree titles or added degrees with new titles. Reportedly, degrees referring to 'animal science' have had some success in attracting enrolments. Similarly, the inclusion of 'sustainability' in degree names has been attempted.

Although not necessarily reflected in the name of the degree, universities are increasingly looking to market agriculture qualifications as a means of responding to the major global problems of food security and climate change.

Logic

The logic of this strategy is that 'agriculture' has a poor 'brand position' and is not a term that is well understood by the prospective student market. Conversely, other terms have more favourable connotations and are better understood. Therefore, selecting degree names with such names are more likely to attract prospective students than any program labelled with 'agriculture'.

Examples

The University of New England (UNE) and UWA provided examples where degrees have been rebranded. In the area of rural science and agriculture, UNE has retained a bachelor of agriculture but also offers a bachelor of animal science. The bachelor of animal science replaced the bachelor of livestock science which is no longer offered. UWA has had a bachelor of animal science program for a number of years which has sustained enrolment levels. A number of universities commented on the relative popularity of animal science degrees. UWA has also commenced a plant breeding and genetics discipline area as an option for science students. The branding of plant science in this way is expected to attract student interest. However, plant science reportedly does not have the same appeal as animal science.

Beyond the renaming of degrees, UNE has also placed the challenge of food security and climate change at the centre of its pitch to prospective students. At postgraduate level, CSU offers a Master of Sustainable Agriculture, an example in which the emerging interest in sustainability focussed qualifications has been linked with agriculture. This reflects that although agriculture in Australia is heavily directed towards sustainable practice, it is not necessarily perceived this way and individuals seeking a sustainability related career may not otherwise look at agriculture in the first instance.

Observations

There are examples where a change of degree name has led to a short-term increase in overall enrolments, or at least, a stabilisation of overall enrolments. This suggests that selecting degree names which are supported by market research, can slow the trend of declining enrolments in agriculture programs. However, this of itself would presumably be less effective if it were tried by all universities. There is at least one example of a second university in a particular market choosing to offer an animal science degree. This will probably not lead to a significant increase the overall number of students doing animal science but it will reduce the number at the established provider. There is a risk that such a situation can result in two providers having a less than sustainable number of students, instead of one provider with a sustainable sized cohort. Rebranding and adding programs is also contrary to the reported desire of industry for generalist agriculture graduates who can then develop specialisation through their employer and related training (and possibly, postgraduate study).

5.2 Reorient course content and structure

Strategy

While rebranding of degrees largely involves renaming an existing degree with minimal changes to the content and structure of that degree, some institutions have undertaken more significant changes to the content and structure of agriculture related programs.

In some cases, this has resulted in degrees being merged, or in an established four year degree model being altered. Merging may involve combining bachelor of agriculture and bachelor of agricultural science degrees into one program. A change in structure may involve providing an exit point after three years and making the fourth year optional. Content changes may include more clearly defined streams of specialisation, or a more overt decision to produce undergraduates who are strong generalists, recognising that specialisation is likely to occur through employment and/or postgraduate qualifications. Some institutions have added new agriculture double degree offerings.

The explicit move towards viewing agriculture degrees at undergraduate levels as generalist reflects that students generally do not know what they are most interested in or suited to prior to enrolment. Therefore, it makes sense to give them exposure to all subject areas so they can decide for themselves. This also has advantages from an organisational and administrative perspective. However, as the rebranding of degrees intervention described above suggests, not all institutions have adopted this approach. Adding more degrees without significantly increasing overall enrolment levels represents a more specialist-based approach (e.g. specialising in animal science or genetics).

Specialisation

Course or study specialisation focuses on prospective higher education students who have already identified agriculture as their preferred area of study or those who are currently working in the sector and are looking to develop their skillset and knowledge. These courses or study specialisations focus on a niche market or working in environments with specific skills sets. A necessary part of this strategy is the involvement of industry in identifying knowledge and skills gaps. This strategy relies heavily on industry involvement in course review, strategic planning and identification of future skills needs.

Logic

Reorienting course content and structure is undertaken to ensure that degrees are responsive and relevant to the needs of the market. This involves consideration of student preferences and the expectations of graduate employers.

Examples

During the period 2008/2009, CSU conducted a comprehensive review of its agriculture and horticulture programs (Guisard and Kent 2010, Southwell 2011). The review received two clear messages about what local industry seeks from agriculture graduates:

- increased work placements during the course; and
- curriculum to focus on developing agricultural science generalists who can be trained into specific industry roles once employed.

The agriculture and horticulture course are now generalised for the first three years and incorporate electives at the fourth year. For example, the horticulture program which previously ran two separate degrees is now provided as a single degree that allows later specialisation into production horticulture and environmental and amenity horticulture (Guisard and Kent 2010). Fourth year assessment is based on an industry-based project that is described further in the intervention strategy related to industry placement.

The University of Adelaide has merged its bachelor of agriculture and bachelor of agricultural science degrees, now only offering the Bachelor of Agricultural Sciences.

Observations

Among the providers of higher education level agriculture programs, there are currently both moves towards generalised degree structures and those which are more specialised. It is possible for both to exist in the one institution (meaning there is a bachelor of agriculture / agricultural science along with other degree offerings in specific areas), provided that overall enrolment levels are sufficient to maintain the viability of each degree.

While it is too early to gauge the success of the CSU remodelling, in principle, it makes intuitive sense that a fundamental redesign of aspects of traditional agriculture degrees is needed. In particular, the pathway from secondary school to first year, the composition of first year and the inclusion and timing of industry placement opportunities.

Other redesign options, such as the addition of double degree programs and the inclusion of work placements are likely to be attractive to some students but it is questionable whether measures of this type would be effective in changing overall enrolment trends.

5.3 Flexible delivery

Strategy

Some universities offer a high level of flexibility through distance learning. The universities who do this tend to have a longstanding distance education offering. This has advantages for employed students based in locations that are a long distance from the campus. It allows them to combine studies with employment which is particularly helpful if they are working in the agriculture sector. The face-to-face component of their degree is undertaken through intensive sessions run over consecutive days, with a focus on practical learning.

Flexible course delivery recognises that students attending agricultural science courses are more likely to come from remote and regional areas and require support to access higher education through off-campus study, online study or intensive block teaching. This is particularly the case where students study part time while working in the agricultural sector.

Another form of flexible delivery is the mixed campus model offered by some institutions. This usually involves the first year of a degree being at one campus (i.e. a campus in a regional location) and the remaining years being at another campus (i.e. in an urban location). This may be attractive for regionally based students, as it allows them to adjust to university life in a regional setting before moving to the city.

Logic

The logic of flexible delivery is to allow students who cannot access a campus to undertake their studies based on distance learning using internet based technologies. Recognising that agriculture related qualifications have a significant practical component, this is dealt with by intensive residential teaching at the campus. Well designed flexible course offerings may enhance student engagement.

Examples

The main examples of distance based learning in agriculture are UNE and CSU programs. Most UNE and CSU programs are offered by distance, as this is a major feature of the business model of each university. For instance, the bachelor of agriculture at each university is offered by distance (from Armidale and Wagga Wagga respectively), with each including intensive residential schools on the practical aspects of the course. The CSU residential schools are generally three to five days duration per subject.

La Trobe has a mixed campus model for the Bachelor of Agricultural Science. The first year of the course is undertaken at Albury-Wodonga, with the remainder in Melbourne (Bundoora).

Observations

Flexible delivery has become a feature of higher education provision in Australia, particularly at regional universities such as UNE and CSU. Flexible delivery was not conceived as an intervention to increase enrolments in agriculture qualifications but as a necessity of the regional university business model. Notwithstanding this, UNE and CSU have identified that flexible delivery is an advantage in agriculture, given that a significant number of those in the target market are based in regional locations and are working which precludes them from attending a campus regularly. Further, residential sessions can provide as good or better a quality of practical sessions, because of their intensive nature.

Growth in distance education based on online delivery is both an opportunity and a threat for providers of agriculture education. It is an opportunity to expand the market of potential students able to undertake university study, particularly in light of the National Broadband Network. It is a threat if prospective students perceive agriculture as not being a viable or attractive option for distance education.

5.4 Fee discounts

Strategy

This strategy involves providing prospective students with an incentive to enrol in agriculture qualifications, through a fee discount that only applies to agriculture. The attraction of gaining more students through this approach needs to be balanced with the reduced level of revenue from each student. Hence, any university choosing this approach must be confident that the increase in enrolments will justify the reduced revenue from individual students. It is also important to hold onto as many of these students as possible after first year in order to ensure they do not use the first year of agriculture as a way of having a discounted first year, after which they transfer to another degree (such as a general science degree).

Logic

The logic of this intervention is that lowering the price of a degree will increase demand.

Examples

La Trobe University has reported that it offered a fee discount a few years ago. The result was a short term increase in first year enrolments in undergraduate degree programs. However, beyond this initial increase, most of the additional students who were attracted by the one year fee discount subsequently transferred to other degrees after first year (La Trobe submission to the Victorian Parliamentary inquiry).

The Going to Uni website explains that HECS discounts, known as the 'HECS-HELP Benefit' were offered to students undertaking undergraduate degree programs in 'natural and physical science' and mathematics, provided they go on to work in related identified professions but agricultural science has not been included in this offer. However, in the recent mid-year budget update, the Treasurer announced this measure would cease.

Observations

Where fee discounting has been attempted it does not appear to be a sustainable strategy, particularly in the light of the recent decision by the Australian Government to remove the HECS discount for science and maths students.

The recently completed Higher Education Base Funding Review (Lomax-Smith 2011) commented on the use of HECS-HELP concessions to stimulate demand for certain courses. It found that these policies have had a limited effect in stimulating demand and recommends that these types of national priority programs be phased out. In their place, the Review recommended in favour of improved wages and employment conditions and information about careers as a more effective means of addressing skills shortages. Industry engagement and secondary school attainment in areas such as science were also mentioned as necessary elements in response to industry-specific skills shortages.

5.5 Summary and conclusions

It is essential that having attracted the interest of prospective students to the idea of an agriculture related career, the degree or product offering is suited to their requirements. Traditional approaches, such as four year degrees or science heavy first year programs, may need to be challenged in a way that makes programs more attractive to the market, without unduly compromising quality. There is also potential for an increase in innovative program structures, such as two year diplomas for those with sufficient industry experience.

Chapter 6

Intervention strategies: industry focussed

6.1 Industry engagement

Strategy

In the context of seeking to increase enrolments, this intervention is directed at ensuring that graduates of agriculture related programs meet industry needs. This intervention would also be undertaken with a view to attracting more students who are supported by employers. It can have further benefits not directly related to enrolment levels, such as identifying opportunities for research collaboration.

This strategy closely involves industry in the development and delivery of degree programs. This can occur as part of a review of degrees offered, through the establishment of an industry advisory committee and through industry placements (the latter of these is discussed under industry experience and projects).

Logic

The logic behind this intervention is that if a degree is attuned to industry needs, it can be marketed as such by the institution which will be attractive to students who want to be assured they will get a job based on their qualification. It can also lead to more businesses enrolling employees in degree programs, because they recognise the degree as being industry focussed.

Examples

Rangelands Australia

Rangelands Australia (RA) was established with investment from the University of Queensland and Meat and Livestock Australia in 2001. It operates from the Gatton campus of the University of Queensland and identifies its target group as:

- land and asset managers;
- facilitators and groups e.g. Landcare, Bushcare, catchment and regional groups;
- government advisers;
- consultants e.g. agribusiness;
- · local government e.g. environmental officers, planners, etc; and
- training and service providers e.g. banks, pastoral houses, etc.

As a part of planning its range of courses, RA consulted with industry, community and government stakeholders to identify gaps in education and training. Additionally, it tailors course delivery according to the nature of the subject and student demand. The Rangelands Management course offered by the University of Queensland at its Gatton campus is a comprehensive response to student and industry demand. The program offers qualifications at graduate certificate, graduate diploma and master's level, as well as short courses. It was developed in response to an identified need for specific rangelands management education that replaced course offerings that were deemed by key stakeholders to be narrow, bear limited relevance and were 'out of touch' with industry education and training needs (Taylor 2011).

PICSE industry placement

PICSE has an industry placement component which operates in tandem with the school based part of the program. At the PICSE residential camp, students are engaged in activities involving university staff and students, visit research organisations and tour local primary industry facilities and research/demonstration farms. The industry placement occurs in January over the course of one week, during which students are involved with a scientific research or extension team. The placement emphasises active participation and students contribute to the work of the mentor who may be a scientist or industry professional. The report back session occurs after the industry placement and allows students to share their experiences and reflect on how the program has influenced their study and career choices (Meinke 2011).

Industry liaison

Each UNE degree has an industry liaison panel. While the university's focus is on education, it is important to have a good understanding of industry expectations of graduate attributes. CSU also undertook an extensive industry engagement process as part of the revamp of its agriculture degree program.

Observations

There may be a perceived tension between extensive industry engagement and the traditional role of universities which is based on the pursuit of knowledge. An industry focus can be seen as resulting in degrees that are too vocationally focused, although there are many professional qualifications offered by universities where course content and outcomes are heavily shaped by industry and professional requirements. Often, these qualifications have among the highest employment outcomes and also score strongly in graduate ratings of course relevance (as indicated in the analysis provided in Chapter 2).

6.2 Industry experience and projects

Strategy

This involves an industry related project or industry experience as part of a degree program. Specific activities include links to local agricultural industry through fieldwork, tours and demonstrations of scientific work within research or industry placements.

Logic

The logic of this intervention is that students will be attracted to a degree which offers an industry placement — particularly students who are not currently employed in the industry. Additionally, this placement will assist students in developing practical skills and being job ready upon graduation. It will also assist students in developing a specialisation.

Examples

The fourth year of the CSU program is a practicum which involves undertaking an industry based placement. This was developed based on industry feedback obtained during a review of the programs. As a result of this feedback, the agriculture and horticulture courses now offer the choice between a workplace learning stream or a research-focused honours stream. Students who are already in the agricultural workforce may exit with a degree at the end of the third year. Students who have elected the workplace learning stream are not precluded from returning for another year to participate in the honours stream and vice versa.

La Trobe University undertook a restructure of its course content and adopted a problem-based learning approach where students investigated real-life case studies from producers in different sectors of the Victorian agriculture industry. This usually involves on-site work and meetings with producers and industry specialists. La Trobe University also offers its fourth year students the opportunity to take an international study tour that focuses on agricultural practices in South East Asia (La Trobe submission to Victorian Parliamentary inquiry).

The University of Queensland makes available a semester length agricultural science internship workplace project. Students work on an agreed science or management based project under academic and workplace supervision. It is intended that the student will be primarily responsible for the planning, management and reporting of the project.

Observations

These programs offer considerable potential because they appear to respond to what students and industry want. They also provide significant marketing opportunities given the appeal of industry experience to prospective students.

6.3 Cadetships and mentoring

Strategy

Cadetships focus on providing work-based learning and provide the student with greater insight into the career opportunities within the agriculture industry.

Cadetships range from twelve week summer programs with multinational agribusiness firms to individual farms seeking seasonal labour in return for on-thejob training. In the case of large companies, applicants apply directly and may become aware of these opportunities through campus recruitment days. Brokerage services exist to facilitate internships at farms or other small agricultural business. Internships may be paid or unpaid. What is regarded as a cadetship in the Australian agriculture industry varies significantly. Where it involves larger companies, particularly those involved in agribusiness, then internships are more likely to link explicitly with courses of study, to manage internee learning and provide reporting or assessment back to the student. In small and medium businesses, including farms, internships are more informal arrangements which rely on students' knowledge and prior experience but do not necessarily provide a forward link to a career in agriculture.

ASA (2011) observed that new job roles across agrifood sectors at paraprofessional and technician levels are emerging in response to the need for deeper knowledge and higher skill levels. Yet employment based training pathways do not exist to support entry into these job roles. In ASA's view, this is partly because these roles are new but also because they sit at a higher skill level than an apprenticeship. Consequently, ASA has found there is strong support for the notion of agrifood cadetships as a means of giving people a career pathway.

Such cadetships hold significant potential as a pathway from school but they could also be combined with a university entry pathway. Their technology and science focus would make them ideally suited to articulation with undergraduate programs (ASA 2011). Connections with relevant Cooperative Research Centres and the Rural Industries Research and Development Corporation would further enable learners to achieve a rapid introduction to an agriculture based career.

Logic

The logic behind a cadetship strategy is that students learn to apply the knowledge gained through their study to the workplace in a managed and systemic manner, such as over the twelve week summer break. Cadetships are distinguished from industry experience and field work because they are usually offered and managed by industry members and participation may be at an earlier stage of their education, including school leavers.

The logic behind the related area of mentoring is to provide students with more intensive support and guidance through their studies. Mentoring can be particularly effective for students from diverse backgrounds, as discussed in Box 6.1.

Examples

The Professional Cadetships Australia website explains that for several years, it has provided year 12 students with the opportunity to apply for a cadetship with leading companies in the financial services industry, including UBS Investment Bank, BNP Paribas, Westpac, QBE and Zurich. In 2011, two global companies will be offering cadetships under the Business Cadetships Program: UBS Investment Bank and Bank of America Merrill Lynch.

The Australian Government has established a national trade cadetship advisory panel, reflecting a high level of interest in the cadetship model in government.

Box 6.1

EFFECTIVE STRATEGIES TO INCREASE DIVERSITY IN STEM IN THE USA

Effective strategies to increase diversity in STEM qualifications in the USA offer some potentially important insights for agriculture related qualifications in Australia.

In responding to the problem of declining enrolments in STEM qualifications, it is critical that more people are recruited from those groups who continue to be underrepresented in STEM qualifications: women and minorities, particularly African American, Latino and Native American students.

Ten intervention strategies have been identified and these may be applicable to attracting more enrolments from individuals from diverse backgrounds to agriculture education in Australia:

- summer bridge pre university bridging programs (held during summer);
- mentoring programs in which a mentor is assigned to individual students, as someone who provides encouragement and support throughout the degree;
- research experience provides a hands on research experience whether within an academic setting or off-campus position in industry;
- tutoring involves additional support to aid student learning over and above the regular schedule of classes;
- career counselling and awareness additional guidance reflects that those from minority backgrounds are less likely to have a family background in that profession and have often received less career guidance at school;
- *learning centre* a unit, program or facility specifically to assist students in strengthening the learning skills needed for academic achievement;
- workshops and seminars to provide hands on assistance with study skills, reading skills, test taking strategies, test anxiety, mathematics anxiety and time management;
- academic advising involves close contact with faculty and advisers, despite high student dissatisfaction with academic advising, especially among STEM students, yet this advice is critical to retention;
- *financial support* involving scholarships and other financial aid which improves access and increases student commitment; and
- *curriculum and instructional reform* reflecting that undergraduate STEM courses have been presented in too narrow a teaching mode and broadening the approach, to recognise other skills, can assist in student retention.

Source: Tsui, L 2007, Effective Strategies to Increase Diversity in STEM Fields: A review of the research literature, Journal of Negro Education 2007, (76) 4, 555 - 581

Observations

Cadetships have been underutilised in Australian agriculture education. They represent a significant opportunity to increase enrolment levels, as part of an integrated response to the challenges confronting the agriculture workforce.

On the whole, research evidence seems to support the importance of mentoring in undergraduate education (Jacobi 1991). Specifically, mentoring has delivered tangible benefits to minority students (Santos and Reigadas 2002).

6.4 Scholarships

Strategy

Scholarships provide an incentive for students to enrol, complete and work in the field of agriculture. Scholarships are primarily forms of financial assistance during a course, providing a student with a stipend and a tuition fee discount or waiver.

Logic

The logic behind scholarships is that students will be attracted to undertaking a degree at a reduced cost or no cost, while being recognised for academic achievement as the basis of their enrolment.

Examples

The FFA is a comprehensive program dedicated to agricultural education in the United States. Among its many initiatives, the FFA offers scholarships sponsored by businesses and individuals. They are offered for a wide variety of experiences, including higher education places.

The Australian Council of Agricultural Societies and Coca-Cola Amatil have offered Australian Agriculture Scholarships valued at \$2,000 for the last five years to up to 35 young people for university or VET study in agriculture.

Meat and Livestock Australia has a scientist training portfolio which includes postgraduate scholarships for higher degrees by research and postdoctoral fellowships.

Observations

While there are insufficient examples of the use of scholarships in agriculture education, they have met with success when used in other fields of education such as engineering. Given the difficulties rural and regional students may face in relocating to study or financially supporting themselves in full time study, scholarships may prove successful in attracting and retaining students.

Scholarships can be effective in lowering the barriers to participation in higher education. Scholarships are therefore a way of expanding and diversifying the traditional market from which university students of agriculture are drawn.

While scholarships can increase enrolments, they also result in less revenue per student. It may however be possible to structure scholarships so as to leverage more revenue. They may also be an effective component of a broader market diversification strategy.

The Rural Research and Development Council (2011) has called for better funded scholarships in a research context, as a means of boosting the supply of rural researchers.

6.5 Pathways to higher education

Strategy

Pathways to higher education enrolments are those programs which facilitate the movement of secondary school students into enrolment in higher education agricultural science. This can be done through guaranteed entry programs or the provision of selected university subjects to Year 12 students.

As well as secondary to higher education pathways, some universities are also involved in VET to higher education pathways. These pathways can include articulation arrangements, where VET students have the option of gaining credit for a later higher education degree.

Logic

The logic of this strategy for the purposes of increasing enrolment in agriculture qualifications, is to broaden the market of potential students who may be enroled in university qualifications.

Examples

CSU is also conducting a pilot at its Orange campus, designed to provide a pathway from year 12 into a degree qualification. Under the pilot, students can study a CSU degree subject. If successful, they obtain credit towards an agriculture qualification at CSU. This is offered from CSU Orange by distance learning and being piloted at several high schools in central New South Wales.

The University of Ballarat offers agriculture training across higher education and VET since it is a dual sector institution. Its programs are linked through course pathways, articulation between VET and higher education and work-ready exit points. The University also utilises the VET in Schools program to enable Year 10, 11 and 12 students to complete a Certificate II course through the University. Students then receive credit once enrolled in a relevant qualification at the University.

The University of Melbourne is developing a proposal in which a consortium of education providers — the University, the Goulburn Ovens Institute of TAFE and the Wodonga Institute of TAFE — will provide a Diploma of Integrated Studies across six locations, ranging from Benalla, Dookie, Seymour, Shepparton, Wangaratta and Wodonga. The Diploma would provide opportunities for further study in science, agriculture, commerce, resource management and other specialisations and is designed for school leavers, VET and mature age students. The delivery of the proposed Diploma has been designed to support rural school leavers study towards a higher education qualification while they work 30 hours per week over a minimum of 18 months in order to be eligible for Youth Allowance during later full time study for a bachelor degree.

La Trobe University is also developing articulation arrangements with several TAFE institutes. Should these arrangements succeed, diploma students in veterinary nursing from Box Hill Institute of TAFE will be able to articulate into the bachelor degree in animal and veterinary biosciences. Agronomy students from the Sunraysia Institute of TAFE would be offered significant credit in the agricultural science degree.

The Royal Agricultural College UK website explains that it provides a 'Land-based Careers Taster Course' which is a two-day residential short course aimed at 16-19 year olds. The course aims to provide an insight into the many career options that exist in the food and land based industries and to learn more about the courses offered at the college. The course includes lectures and outside visits and features college lecturers and former students.

Observations

Arrangements that open up pathways to agriculture higher education may increase new entrants into the agriculture sector as well as support the training needs of current workers in the industry. ASA has observed that a 'building blocks' or incremental approach to the development and acquisition of skills and qualifications meets industry needs (ASA 2011). Rural and regional school leavers may find articulation arrangements which allow them to begin their studies within their region more supportive of their learning preferences or their transition to metropolitan-based higher education.

6.6 Summary and conclusions

Industry engagement related interventions are best viewed as enabling many other strategies. While a deliberative approach to industry engagement can lead to specific initiatives, such as scholarships and cadetships, these measures also underpin the other types of intervention discussed. For example, industry engagement can support efforts to engage with the next generation of agriculture workers in schools and at careers fairs. Industry engagement would also be a feature of reviews of course content related to product development.

Chapter 7 Findings and possible direction

As the preceding chapter shows, there has been no shortage of efforts to draw more people towards agriculture qualifications and career. As the PICSE submission to the Senate inquiry states:

For at least the last four decades, the major strategies employed to improve public perceptions of agriculture and increasing enrolment in agriculture courses has been to provide isolated media stories of agriculture, provide stand alone teaching resources in agriculture and teach agriculture in some high schools. ... these strategies in themselves, patently have not been effective.

The results of the PIEF stocktake of current programs, which is confirmed by the identification of various interventions in this report, along with the many reports over the years, suggest that the current problems in higher education enrolments in agriculture are not due to a lack of effort through individual programs. It does however suggest that a more coordinated and strategic national approach is required, particularly given the urgency of the problem.

Many of the challenges facing agriculture reflect broader economic and social trends. A response that is limited to evaluating individual interventions to determine those which are most effective so that universities can be advised to deploy them, will not of itself be sufficient to address declining enrolments. Interventions, such as those described in Chapter 4, 5 and 6, have a part to play but they are not likely to change attitudes and behaviours. Interventions need to be part of a whole workforce and professional strategy, similar to what the NZ dairy industry has put in place and Canada is attempting through CAHRC.

A comprehensive strategic approach is required which is based on collaboration between industry, education providers and government. This will incorporate a significant rethink of the current agriculture education model together with a sustained commitment by industry to renew and reimage occupations and professions across the sector.

The adoption of a comprehensive strategic approach is similarly recommended in a number of submissions to the Senate inquiry, including an information paper resulting from a collaboration of the Council of RDCs and CRC Association prepared by QualDATA (2011). That collaboration recommended: 'The creation and implementation of an overall industry wide strategy and plan', as part of efforts to attract and retain key personnel to the agriculture sector.

If the broader problem of the agriculture workforce fails to compete for attention, it will not attract the level of interest and cooperation to address the fundamental issues. Nor will it gain the policy focus it needs. The urgency of the problem and its implications need to be more effectively communicated.

Strategy overview

As discussed in introducing this report in Chapter 1, the problem being responded to and the resultant objectives related to addressing that problem can be viewed at several levels:

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- the broader problem is that the agriculture workforce has a shortage of appropriately skilled workers and this shortage is expected to worsen;
- university educated graduates are among those who are needed to address the shortage;
- the pipeline of university graduates begins with choices that are made at school;
- the trend has been one of declining or stagnant enrolments in these programs at universities; and
- if this trend continues the viability of more of these programs will be threatened which will undermine the capacity of the system to respond to the worsening shortage.

In forming a strategy:

- The objective is to increase skilled graduates as part of the overall effort to address agriculture workforce skill shortages.
- The context is one of high competition for university students. Furthermore, the market from which agriculture programs have drawn students is shrinking.
- The obstacles to achieving the objective include the well established challenges facing agriculture. In summary, these include low attainment and poor understanding of agriculture career opportunities and education programs.
- The resources which can be deployed to respond to this problem have traditionally been viewed as those of individual universities. However, the resources available can be greatly increased if all of those parties with an interest in addressing the challenges described join forces. This would involve a collaborative effort between: universities; other providers of agriculture education; the agribusiness industry; and government.

7.1 Governance arrangements

The focussed delivery of such a strategy requires a dedicated group to carry it forward. For this reason the establishment of an Agriculture Education Council is recommended.

The council will have overarching responsibility for taking forward the recommendations of this report. Once the council is formed, this would require the development of a detailed plan, building on the formative strategy outlined here.

Related to this, it is recommended that the formation of the council be viewed as an opportunity to ensure that:

- the representative arrangements for the agriculture and agribusinesss sectors are optimally configured, and that the representative bodies have a work stream dedicated to workforce, skills and education; and
- the ongoing involvement of the Business/Higher Education Roundtable in contributing to the implementation of the agriculture workforce strategy is confirmed.

7.2 Agriculture Education Council

The council would comprise representatives of higher education, vocational education, school science education, industry and government.

The suggested inclusion of a school science representative reflects the need for the council to actively consider the pipeline of post school agriculture students.

The role of the council would be to finalise and implement an agriculture workforce strategy, based on the recommendations of this review. Specific actions of the council could include:

- embed agriculture in school curriculums through the Sustainability stream of the Australian Curriculum and through science subjects;
- lead implementation of the cadetship program;
- involve more agriculture businesses in attracting people into agriculture and in the continuous improvement of agriculture education products;
- generalising the interventions outlined in this report across the education sectors;
- contribute to new agriculture education products, including those based on sub degree degree structures; and
- progress the items listed below under 'priorities'.

The ongoing need for a council would be reviewed once the strategy was implemented. A permanent role may not be required, but the council would be required for at least three years. As an example of a similar initiative, the Minerals Tertiary Education Council has been in place since 1999, after initially being established in response to deficiencies in tertiary education in that sector (Box 7.1).

The council will also be well placed to take forward any complementary recommendations arising from current parliamentary inquiries into agricultural education, particularly the Senate inquiry, given that this is considering the issue at a national level.

The responses to challenges facing the agriculture workforce have previously been described as 'somewhat fragmented and uncoordinated' (IDC 2009) and a council would respond directly to this by offering a well coordinated approach. The need for a council to drive an agenda focussed on the agriculture workforce is recognised by stakeholders consulted for this project. For instance, the submission by La Trobe University to the Victorian Parliamentary Inquiry in agriculture education supported the formation of a council. It argued that the work of such a council would be effective in attracting students to higher education in agriculture and developing sustainable careers.

The role of industry

Industry needs to have a high level of ownership of the future of agriculture education. While government needs to be at the table, it would be a mistake to wait for government to fix the agriculture workforce problem. Industry are the main beneficiaries of an appropriately skilled workforce, so it should take responsibility for the future development of the workforce. Successful examples in other sectors invariably feature a leadership role by industry, with government providing a complementary supporting role. Often, government will be more inclined to contribute substantively once it is clear that industry has taken the initiative.

Effective engagement by industry in a body such as the Agriculture Education Council would rest on a number of factors. Industry representation itself would need to encompass both on-farm agriculture and agribusiness. This would support effective input into strategy development and implementing reforms that benefit the agriculture sector as a whole. Further, industry commitment needs to be sustained over the long term so that it can contribute strategic and timely information on workforce and skills development needs. Industry engagement in the council may also have a beneficial effect in raising expectations of and demand for education attainment within the sector.

Box 7.1

LESSONS FROM THE MINERALS SECTOR

In 1998 the minerals industry concluded that the delivery of education for the development of technical professionals in that sector 'had to change' (Minerals Council of Australia). That report led to the establishment of the Minerals Tertiary Education Council. MTEC fosters a partnership between industry, government and academia. Through its university partners, MTEC seeks to ensure the delivery of 'world class' education in the specialist disciplines of earth sciences, minerals energy and metallurgy. MTEC is attributed with the achievement of significant improvements in technical education in the minerals sector. Additionally, it has resulted in an ongoing focus on minerals education, which has influence among policy makers. The high level of profile directed at this area was again demonstrated recently through the establishment of a National Resources Sector Employment Taskforce, which examined the labour force implications of rapid growth in the Australian mineral resources sector. This taskforce, which was chaired by Gary Gray MP, is also illustrative for the agriculture sector.

Source: Minerals Council of Australia National Tertiary Education Taskforce 1998, Back from the Brink: Reshaping Minerals Tertiary Education Discussion Paper

The role of government

Both State and Commonwealth governments have a significant role to play in supporting the strategy and reforms that may be adopted by the Agriculture Education Council. With the development of the national curriculum in primary and secondary schools and the role of the Commonwealth in higher education, there is a clear need for the support and involvement of these levels of government to ensure effective implementation.

More broadly, the involvement of government in the council will support policy links between lower education participation and attainment in rural Australia and the demand for skills and qualifications in the agriculture sector. There is also scope for data on workforce development and skills shortages to be refined or clarified so that an accurate picture of the agriculture sector might be obtained. The example of the nursing profession (described at Box 7.2) demonstrates how the combined efforts of the sector, education bodies and the government can address situations of workforce shortage.

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Box 7.2
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NURSING

The National Review of Nursing in 2002 recommended that expert advice be sought to develop a national marketing profile or brand for nursing that reflected the diversity of the Australian population and which should be used by all involved in the recruitment and retention of student. This was in response to data showing that student commencement in undergraduate nursing (registered nursing training) had declined (DEST 2002). There was widespread concern about a shortage of registered nurses through the mid 2000s.

The decline in nursing enrolments has today been reversed. Data from the Australian Institute of Health and Welfare demonstrate that in 2003 the number of student commencements in registered nurse training had further declined to 7,926 before recovering to 12,526 in 2009 (AIHW 2010). Indeed, there are now concerns about the capacity of the system to accommodate nursing graduates (*The Australian*, 29 June 2011). The turnaround was achieved through nursing being identified as a priority area which resulted in a number of measures initiated by the Australian Government to make nursing an attractive degree option. Concurrently, state governments undertook concerted recruitment campaigns, featuring high levels of nursing graduate recruitment.

Source: DEST 2002, AIHW 2010

A champion for agriculture higher education

Agriculture workforce and education concerns do not have a high profile, despite the persistence of skill shortages and related problems being well established. This suggests there is a need for an influential champion of the agriculture workforce to lead implementation of the strategy. Such a person would presumably chair the Agriculture Education Council. As well as raising the profile of the problem, the presence of a 'can do' personality would ensure that reforms were pursued with required urgency, and barriers to reform were overcome. Some of the recommended actions represent quite significant change, and effective leadership is required to affect this.

Positioning the agricultural workforce in the context of rural policy

Industry interests related to agriculture could be well served by positioning the agriculture workforce more directly in the context of rural policy.

Agriculture is a significant employer in rural areas. The challenge confronting the agriculture workforce mirrors those confronting rural Australia in a number of respects.

The RRDC is among those calling for a more coherent and integrated approach to rural policy and representation of the rural sector. As stated previously, it has identified capacity in people — levels of knowledge and skill — as an enabling theme requiring priority attention to underpin industry development, sustainable production and research.
Placing the agriculture workforce firmly in the context of rural policy may be an effective strategy for gaining greater policy attention and for ensuring that the contextual factors impacting the problem of declining enrolments are addressed as part of an integrated strategy.

7.3 Priorities

Priority items in the agriculture workforce strategy to be taken forward by an Agriculture Education Council are:

- reconceptualise agricultural education as one diverse sector with shared challenges and interests;
- marketing campaign to change the image of agriculture;
- a national program of agriculture cadetships;
- expand the PICSE program; and
- resolve data issues.

Agriculture education sector

Agriculture related education takes place at the school level, through VET or through higher education. Regardless of the level of education and the age and capability of students, many of the same challenges apply. The need to expand understanding of what agriculture is, as a means of increasing interest in agriculture is common. Similarly, the crisis facing the agriculture workforce is not the making of any one of these systems. There are skill shortage problems for both high skill and low to mid skill employment. Many of the strategies to increase interest in agriculture require collaboration between systems and benefit each system.

For these reasons, it is timely to bring the different levels and forms of agriculture education together under a unified council and strategy. Viewing agriculture education as a sector, albeit with a broad range of subject areas and qualifications, will provide for a coherent approach to issues of mutual interest, such as addressing poor levels of understanding about career and study opportunities in agriculture.

To give this initiative practical effect, under the leadership of the Agriculture Education Council, it is recommended that the AgriFoods Skills Australia environment scan be expanded to include higher education level qualifications.

A further suggestion is for the council to consider the feasibility of establishing agricultural education farm sites in regional areas which concurrently provide practical education opportunities to school students, VET and higher education. An existing under-utilised site or sites could be allocated for this purpose. The idea would be to improve the viability of existing sites, and provide more students with access to agriculture education infrastructure throughout school and post school education.

Marketing campaign to change the image of agriculture

Social market research shows that social attitudes are very hard to change and agriculture is in a very crowded space with other industries and professions jockeying for talent including at an international level.

Research suggests that early exposure to jobs and post school learning can influence students' attitudes and choices but that must be supported by actual changes in the labour market and in professions.

As a practical starting point, a marketing campaign to change the image of agriculture is required. In isolation, this will not change social attitudes to agriculture but in concert with a broader strategy it can be effective. This will not only benefit universities but agriculture education as a whole.

The campaign would be about both changing perceptions of the industry and in turn, the careers available in the industry. This would take inspiration from the Certified Practising Accountants (CPA) campaign which emphasised the global career opportunities that can be accessed through an accounting qualification.

Box 7.3

CPA CAMPAIGN

The accounting profession has suffered from a perception that accounting jobs are limiting and not overly interesting. In response, CPA Australia developed a campaign designed to change perceptions of careers in accounting — specifically as a certified practising accountant. The approach taken by CPA has been to focus on these benefits:

- enjoy life long advantages;
- explore diverse career paths; and
- see doors open across the world.

The last of these was a central theme of a CPA marketing campaign featuring a number of CPAs in corporate roles depicted as being globally oriented, involved in working for desirable brands and inherently interesting. The campaign was clearly designed to change perceptions of accounting and show the interesting roles that are available.

Source: CPA Australia website: http://www.cpaaustralia.com.au/cps/rde/xchg/cpa-site/hs.xsl/become-where-cpa.html

The key messages of such a campaign would include:

- modern agriculture is high tech, diverse and interesting;
- in agriculture there are opportunities to help solve the big problems facing humanity: food security and global warming (see discussion in Box 7.4 regarding sustainability); and
- in agriculture there are many interesting jobs which would be demonstrated through case studies.

The campaign might choose not to feature the word 'agriculture' but that would be something for the experts in branding and campaign development to consider.

Issues related to starting salaries, career structures, incentives for people to work in rural and regional areas including health and education services are critical.

Box 7.4

AGRICULTURE EDUCATION AND SUSTAINABILITY

As discussed in the description of course rebranding and reorientation in Chapter 5 which looked at product development, several providers are marketing agriculture related qualifications through an emphasis on helping to solve problems, such as food security and global warming.

Halsey has recommended that 'rural education and its leaders embrace a new challenge, sustainability and use it to pursue new policy fronts. Failure to do so runs the very real risk of further marginalisation from national policy debates and developments that matter.'

Since this suggestion was made, the focus on sustainability policy has increased and the significance of this for rural communities and agriculture is obvious. Examples include the impact of the Clean Energy Future package and the process leading to finalisation of the Basin Plan by the Murray Darling Basin Authority.

In this context, there is an opportunity and perhaps an imperative, to take the marketing of sustainability in agriculture qualifications to a greater level of prominence. The aforementioned proposal for a marketing campaign to change the image of agriculture would be a vehicle for doing this but it would need to be backed up by a repositioning in some institutions of the marketing of agriculture programs.

While farmers and others who work in the agricultural sector emphasise that sustainability has been long ingrained in the way they approach and operate their business, this is not always well understood by the wider community, or prospective students who may be drawn from non agriculture backgrounds.

Source: Halsey 2009

Implement a national program of agriculture cadetships

Cadetships are a clear opportunity to reform the school – university pathway. As AgriFoods Skills Council has pointed out, agriculture is ideally suited to cadetships, in which a promising year 12 graduate with a demonstrated interest in agriculture is provided with an industry placement linked to a higher education place. There are no reasons why a relatively significant number of such placements could not be offered across Australia if all universities with agriculture programs agreed to participate. This could include the potential to expand the concept of a cadetship to encompass a full qualification.

Conceptually there is no reason why structured programs of work and learning should not receive government incentives and other forms of support such as those that apply in the apprenticeship system including the potential use of intermediary bodies who employ cadets and rotate them amongst participating employers along the Group Training model.

Mentoring would be a feature of cadetships. Mentoring is recognised as a successful strategy in providing student support and demonstrating career pathways that otherwise may not have been explored. The Young Agribusiness Professionals of the Victorian Farmers Federation (2011) have reported that mentoring was one of the key reasons for agricultural education institutions being rated highly by members.

Expand the PICSE program

While increasing agriculture based learning experiences in schools is critical, combined with related initiatives, it does not appear to be happening to a sufficient scale at present. PICSE is an established comprehensive program. While the cost barrier reported by some universities requires consideration, ideally, a strategy to address the workforce problems in agriculture and increase enrolments over time, would feature an expanded PICSE program.

As the PICSE submission to the Senate inquiry states, PICSE was established in 1998 and its focus is on 'creating a desire for bright young people to enter the agrifood and agri-fibre industries as well as informing key career influencers such as teachers about these opportunities'. Therefore, PICSE is an established program seeking to achieve the precise outcome which is the subject of this study. Although of itself PICSE has not reversed the problem of declining enrolments, it is a model of good practice. Not all universities have joined PICSE because they are concerned about the level of fees being charged. Also, some universities advised that they are undertaking similar activities through other programs. Despite this, if all providers of agriculture related qualifications were part of PICSE, it would be stronger for it.

Resolve data shortcomings and educate policy makers about agriculture education data

The inclusion of environmental studies in the agriculture broad field of education belies the decline in enrolments and completions in agriculture specific degrees. At a minimum, the council should work to encourage better understanding of the true seriousness of the decline in agriculture enrolments. It may also be possible to change the classification, so environmental studies is not included. However, although an important issue, this should not detract from the main focus of effort, which is to respond to the decline and increase enrolments. Data understanding is only urgent to the extent that it builds the case for change, which forms the basis for industry and government buy in.

7.4 What individual universities can do

There are a number of initiatives which individual universities can and should pursue of their own volition. These will contribute to increasing interest and should lead to more enrolments in agriculture qualifications, and as such, are consistent with the thrust of the overall strategy.

The preceding chapters described interventions attempted by universities in Australia, with some international examples. While this demonstrates that a considerable level of effort has been directed towards this problem, there are some areas which have not been addressed directly in a substantive way.

Advice to universities on the most effective response is limited by the lack of any meaningful evaluation of the various measures that have been tried on student enrolment in agricultural courses (Meinke 2011). There is similarly a lack of evaluative material internationally. Consequently, the interventions described as recommended measures are selected because they fit within the broader strategic approach described, they respond to particular barriers and/or they have not been done before on a large scale.

However, the measures provided have been informed by recent research, including a recent survey of first year science students at UQ (Miller et al 2011) that identified the following strategies as most likely to be effective in relation to agricultural careers promotion:

- focus on the vital contribution agriculture makes to society, the strong employment prospects and the diversity of jobs and conditions;
- engage from early secondary school;
- existing workers are influential;
- the internet is a key medium for communicating about careers;
- once recruited, university agriculture studies are satisfying and fulfilling for students; and
- broad collaborative approaches are needed for recruitment programs to be effective.

Expand the market from which agriculture students are drawn

The workforce is ageing but interventions are heavily focused on the traditional school leaver market and around traditional course structures and assumptions — a more targeted approach is required for different learner age cohorts. The school leaver market is a highly contested market, reflecting the large number of undergraduate offerings available.

Universities should look at different markets, including identifying 'new' segments in existing markets. For example, those in rural and regional areas who have a connection with agriculture, do not intend to move from their current location and who would be enthusiastic about increasing their agriculture knowledge through study. These individuals are not traditionally part of a university cohort but many of them could be if given appropriate support.

A further example is the inclusion of university at school level. Although the current CSU pilot program is an innovative example involving the reshaping of this pathway, overall, the secondary school – university pathway to the first year of an agriculture degree program has remained unchanged. This is despite the significant challenges to agriculture programs, including the now intensive competition from other degrees and qualifications which are also attempting to attract young people.

There are likely to be people in rural areas who have not considered higher education for one or more reasons. As discussed in Chapter 2, they may not have had access to an education provider and they may have had poor internet access. The implementation of the National Broadband Network should at least ensure that high quality internet access is available. Through flexible delivery, including online provision, there is an opportunity to attract more of these individuals.

However, some individuals would not have actively considered a university qualification as an option. They may have not done particularly well in year 12, or there was not a strong expectation of university entry in their community, or they may be a mature agricultural worker who has learnt on the job or through other non-university training.

There is an opportunity to introduce the possibility of a university qualification to such individuals. There are examples of programs which have sought to attract a more diverse range of individuals into higher education. For example, a number of initiatives of been attempted in the United States, to increase diversity in science, technology, engineering and mathematics (Tsui 2007). They include mentoring, financial support and more intensive forms of assistance to help in the transition to study.

Rethink the first year at university

Another area, related to pathways into university, is attrition after the first year of agriculture programs. Students who do select agriculture programs generally want to do hands on work as part of the program. They are generally predisposed to practical problem solving and they want to have a practical experience within their studies. Generally, it appears that the practical elements of agriculture degree programs feature more strongly after first year. First year is focussed on foundational science. Agriculture degrees reportedly have a high level of attrition after first year and universities consulted cited this as being the main reason why this occurs. Students are not well prepared for this science heavy first year, a situation made worse because a high proportion of students would not have undertaken chemistry at year 12 level, despite chemistry being particularly important in agriculture programs at university level.

This point relates to redesign and reorientation of degree programs. It is closely related to the observations of Tsui (2007) in reviewing interventions to increase diversity in STEM qualifications in the USA. Tsui noted that despite many individuals from such backgrounds having relatively strong academic credentials, attrition following first year is disproportionately high. While there has been a tendency to view this as a natural 'weeding out' process, in depth observation based studies of the reason for this phenomenon called for fundamental curriculum and instructional reform to make learning less sterile and involving more practice-based learning.

Encourage articulation with VET

Consistent with viewing agriculture education as a sector, there are opportunities to continue to build links between higher education and VET.

The tertiary education landscape is changing with the potential for new forms of qualifications particularly in the interface with VET and new thinking about provision in upper secondary education. It would be potentially beneficial to both VET and higher education providers to increase the formal links between the sectors and market this to students, as is occurring in some other sectors.

The project was advised of a number of initiatives to strengthen relationships between higher education and VET. Several of these have been encouraged by Australian Government grants to regional universities. One such example is provided by CSU, as described in Box 7.5.

Box 7.5

REGIONAL UNIVERSITY CENTRE IN WANGARATTA

Charles Sturt University has been allocated a \$22.3 million Regional University Centres project grant by the Australian Government.

The CSU project will see collaboration with North Coast Institute of TAFE in Port Macquarie and Goulburn-Ovens Institute of TAFE in Wangaratta.

Under each collaboration, the funding will enable a significant investment in capital infrastructure through the construction of Regional University Centres alongside existing TAFE facilities.

Students at the Wangaratta Regional University Centre will be able to access degree level programs in agricultural business management and agricultural science.

The initiative seeks to address local labour market shortfalls. The Wangaratta facility is specifically seeking to respond to agriculture workforce skill shortages.

It will involve CSU and GO-TAFE developing pathways that will see students progress from Certificate III through to degrees.

CSU reports that it has been working closely with industry, employers and TAFE to respond to agriculture skill shortages.

Through these and other Regional University Centres throughout Australia, the Australian Government is seeking to provide opportunities for people based in regional areas to study locally.

Source: Media Release Senator the Hon Chris Evans and Rob Oakeshott MP 'Charles Sturt University students to benefit from \$22.3 million Gillard Government grant', 7 December 2011 accessed www.ministers.deewr.gov.au and Media Release Professor Ian Goulter 'New University Centre in Wangaratta to tackle agricultural skills shortage', 7 December 2011 accessed www.news.csu.edu.au

The challenge of increased articulation is in ensuring the vocational students either have taken, or are capable of taking, the science subjects required for an agriculture degree. This is less of an issue in an agribusiness degree where there is not a science component.

The AgriFoods environmental scan stresses the need to provide incremental skills development in addition to full qualifications. It notes the importance of recognition of prior learning for entry to skills development and qualifications in an industry where hands-on learning or field experience is highly regarded (ASA 2011).

The rural industry working group report of 2001, observed the low educational attainment profile in the industry with approximately 20 per cent of the workforce possessing skilled vocational or higher level qualifications compared to nearly 40 per cent of the general workforce at the time. In order to overcome this, the Working Group recommended coordinated action to improve the image of the industry among young people and 'greater synergies' between VET providers, higher education providers and industry to address the range of training needs in rural industry (RIWG 2001).

Reconsider ATAR scores

There is an opportunity for universities to closely consider their university entry requirements as a means of increasing enrolments. While universities understandably do not want to compromise quality, some of the entry scores for agriculture related pathways are relatively high. For example, under the revised structure of University of Melbourne undergraduate degrees, entry to the Bachelor of Science requires a score of approximately 85 out of 100. UWA noted that it would be reluctant to reduce its entry score requirement, although if it did, it could double its annual intake. Although reconsidering entry scores may be an option in some cases, it may also require an increase in demand. DEEWR (2011) has reported that the offer rate for the agriculture, environmental and related studies field of education was 97 per cent in 2010, indicating that almost all undergraduate applicants are receiving an offer (although this would not pick up applicants by students intending to undertake an agriculture related major in a degree labelled bachelor of science).

Appendix A Modelling the agricultural workforce

This appendix addresses how supply and demand for skilled workers and education and training in the agriculture industry could be modelled in the future. Broadly, there are two options for modelling projected supply and demand:

- manual scenario testing using a spreadsheet model in Excel; and
- macroeconomic forecasting using a Computable General Equilibrium (CGE) model.

A.1 Drivers of the market for skills

Modelling the effects of implementing the recommended interventions will take into account differences in drivers of the market for skills at the national and State levels. Necessarily, any tool will need to take account of:

- the macro-economic drivers of skills demand and supply; and
- the higher education policy factors that influence the market.

The model would need to consider the issues listed below.

- Labour market participation.
- Wage rates.
- Industry composition and growth rates.
- Forward projections of population growth.
- Year 12 or equivalent completion rates.
- Domestic and international student enrolments.
- The diversity of the student cohort.
- Changes in course admission requirements or selection practices.
- Graduate destinations.

A.2 Spreadsheet model

A spreadsheet model of supply and demand of agriculture qualifications and skilled workers, that considers the impact of different interventions using manual scenario testing, could be built in Excel. It would be grounded in historical enrolment and employment data, taking account of the issues listed above. It would be based on assumptions about the future and options for different scenarios.

The spreadsheets would include a cover page where multiple variables could be adjusted to examine the impact on supply and demand. The impact of the different scenarios could be examined by looking at changes in:

the number achieving qualifications and estimated over-supply/shortfall;

- the number employed in agricultural occupations and estimated oversupply/shortfall; and
- employment characteristics by degree and field of study.

A.3 CGE model

The influence of an intervention can also be estimated using a CGE model of the Australian economy. Such a model can help illustrate how the economy has changed, providing an insight on how the demand for certain skills has changed as a result. Whilst this method does not have the ability to respond as flexibly to an end-user, it can take into account how the demand for skills has been affected by a larger number of macroeconomic factors.

Using the CGE model we can project into the future, assessing the impact of different scenarios on supply and demand as compared to a baseline. Specifically, the Monash Multi Region Forecasting (MMRF) model provides a high-level representation of the economy, facilitating measurement of the wider effects of changes in economic activity in key industries and regions. The MMRF is regularly used by State and Federal governments to analyse climate change and other structural change. Year-on year forecasts of the demand and supply of agricultural occupations with and without intervention could be produced to 2030. Box A.1 provides a more detailed description of the MMRF model.

Box A.1

THE MONASH MULTI REGION FORECASTING MODEL

The Monash Multi-Regional Forecasting model is a CGE model of Australia's regional economies developed by the Centre of Policy Studies (CoPS) at Monash University (CoPS, 2008). It is a model of the entire Australian economy and it captures the interactions between different regions and sectors. (A detailed description of the theoretical structure of the model can be found in Peter et. al., 1996.)

The MMRF model is used for a wide range of policy studies, including the analysis of state tax reforms and the potential benefits of the National Reform Agenda. More recently, the Department of the Treasury and the Garnaut Climate Change Review applied the MMRF model to the national climate change modelling to assess the impacts of the proposed CPRS on the Australian economy.

The MMRF is a multi-sector dynamic CGE model of the Australian economy, covering the six states and two territories. It models each region as an economy in its own right, with region-specific prices, region-specific consumers, region-specific industries and so on. Since MMRF is dynamic, it is able to produce sequences of annual solutions connected by dynamic relationships.

The MMRF contains 58 industrial sectors which produce 63 commodities. The sectoral details allow the benefits of higher BIM adoption rate to be allocated appropriately across the different sectors.

The MMRF model is a high-level representation of the Australian economy, facilitating measurement of the wider effects of changes in economic activity in key industries and regions. To the extent that economic activity is interlinked, the MMRF model captures any indirect effects that arise from direct measures. In this instance, the direct impacts of increase household connection to the internet would lead to more time available to the household in economic activities and cost savings from the businesses and the public sector in delivering goods and services. This implies an increase in effective labour supply and productivity. The MMRF would capture the flow-on impacts of a larger work force and higher productivity on the Australian economy.

Source: The Allen Consulting Group

Appendix B

Themes from submissions to Parliamentary inquiries considering agricultural education

Stakeholder group	Theme	Description	Stakeholder suggestions
Agribusiness	Skills shortages	Technological advances & workforce restructuring generates demand for new skills.	Review of capabilities of agriculture faculties to ensure they meet industry needs; provide HECS relief to agriculture students; industry bodies to engage directly to support agriculture science education in schools
	Downturn in labour supply	Competition from mining industry; lack of understanding of career opportunities; declining number of agriculture science students entering the sector; declining number of higher degree students entering the private sector.	Map existing agricultural professional skills in Australia and determine areas of future need; employer rebate for advertisement and marketing of job vacancies; employer rebates for traineeships; support for skilled immigration; more attractive remuneration and working conditions; work with career services providers to inform them of career opportunities
Higher education providers	Chronic shortage of professionals in agriculture	Lack of a career path (identify focus areas such as climate adaptability, food security)	Continued and increased support for programs that successfully encourage secondary school students' engagement with ag. science.
	Provision of quality agriculture courses	Rationalisation of provision due to course costs; re-orientation of curriculum towards industry needs	Curriculum development in collaboration with industry, course delivery options; provision of cadetships; expansion of PICSE program; expansion of careers promotion; collaboration with Regional Development Australia committees; articulation arrangements with VET
	Lack of secondary school student aspiration	Secondary school students, their teachers and families are unaware of or do not aspire to careers in agriculture	Increase funding and opportunities for regional schools to engage with education providers in specialised projects
Specialist agriculture education providers	Lack of sufficient or clear support from rural industry for education and training	Rural industry is either unwilling or unable to develop strong and effective partnerships with education & training providers	Dedicated funding to specialist agriculture education & training providers; coordinated support for thin markets at state and national level; continued support for PIEF
Agriculture workforce (farmers etc)	Access to education and training, declining workforce	Restricted opportunities to access education and training due to remoteness	Increased rates of student income support for rural and remote students; reinstatement of FarmBis; promotion of careers in the sector
	Promote agriculture in the school curriculum	Increase student awareness of the opportunities to pursue a career in agriculture	Exposure of agriculture in the national curriculum; continue PIEF
Source: Allen Consulting Gro	up 2011 submissions to Senate Inquiry	and to Victorian Parliamentary Inquiry 2011	

Appendix C Stakeholders consulted

Table C.1 STAKEHOLDERS

Name	Organisation	
Richard Roush	University of Melbourne	
Kate Grenot	Rural Research and Development Council	
lain Young	University of New England	
Jim Pratley	Charles Sturt University	
Amanda Able	University of Adelaide	
Kadambot Siddique	University of Western Australia	
Dale Miller	University of Queensland	
Sam Nelson and Brian Duggan	National Farmers Federation	
David Russel	University of Tasmania	

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