

# From adversity comes strength – repositioning education in agriculture

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## Abstract

Much has been written about the decline in agriculture graduate numbers over recent times and the shortages created in the market place. At the same time, there has been an increased urgency towards professionalising the industry – a focus on education and training, a desire to improve the image of the sector, a move towards social licence and greater engagement with future opportunities, challenges and needs. This paper takes a fresh approach to these issues; drawing together the less commonly reported data on student enrolments in agriculture, the distortions created by misunderstanding course classification data and the emerging focus on learning and teaching academic standards in tertiary education. Decline in enrolments from 2001 has resulted in massive loss of income to university departments with commensurate contraction of academic staff numbers and expertise. The decline has now been addressed although it remains work in progress. The development of a national Learning and Teaching Academic Standards Statement (LTAS) for university Agriculture (AgLTAS) represents a significant positive step that engaged academic, student and industry stakeholders in its development. We expect that the AgLTAS statement will facilitate the implementation of academic standards by the agriculture discipline community, inform curriculum design, assist in identifying marketing opportunities for degrees and contribute to the further professionalization of agriculture.

## Key words

Higher education, learning and teaching academic standards, enrolment, field of education

## Higher education in agriculture and related disciplines

Agriculture and related disciplines are offered in 14 Australian universities as a three- or four year specialist degree or as a major in a science degree.

In 2007, the then Australian Institute of Agricultural Science and Technology held a colloquium to consider the paucity of agricultural graduates entering the workforce. Universities received considerable blame from industry for the lack of graduate output but it was unclear what steps industry itself had taken to promote careers in the sector. One outcome of that meeting was the formation of the Australian Council of Deans of Agriculture (ACDA) in 2007. The Council is made up of those Universities in Australia that undertake education and research in agriculture or related agricultural areas. It represents issues of common interest as they affect agricultural activities in universities and cooperates on projects of mutual benefit. It links and works with relevant government agencies and industry organisations to improve the performance and sustainability of Australian agriculture and to raise the overall education level of the sector.

A first step by the ACDA was to approach the then Federal Minister for Primary Industries to inform him that the number of professionals in agriculture with tertiary qualifications was in decline. He responded that the official position of government was that there were ‘plenty of agriculture graduates and insufficient jobs’, a position diametrically opposed to the view being expressed by ACDA. The Deans resolved to collect their own statistics, which have since been published at various times (Pratley 2008; Pratley *et al.* 2008; Pratley 2012). These statistics were a collation of the graduate data of Universities.

At the same time, in conjunction with the agricultural graduate employment company Rimfire Resources Ltd, analysis of the job advertisements in newspapers and the internet was undertaken to gain a better understanding of the employment market. The McColl Report (1991) into agricultural and related disciplines demonstrated that there were insufficient graduates, despite a buoyant employment market, to meet the needs of the agricultural industries. Despite this finding, the numbers of students graduating from the higher education institutions in Australia continued to decline until at least 2012 (Figure 1). The data showed

that there were up to six jobs for every graduate each year for the previous seven years. Although this has softened in 2014 (Figure 2), the market suggests that there are still about four jobs for every graduate. These data do not account for direct targeting of prospective employees by the agricultural industries. The latter seems to be significant. The revelations brought forward by ACDA created a substantial response from politics in the form of reviews, from industry and from educators (Cowan 2010; Australian Government 2012; Parliament of Victoria 2012; Pratley 2013). The reviews highlighted the lack of a positive image for agriculture, the perception that agriculture related only to farming, the negativity towards agriculture in the schools and the complacency in the education system and the community about food security. Students were actively discouraged from choosing agriculture as a career by school career advisors who perceived there were no jobs (Pratley 2013).

There were diverse responses and outcomes from these reviews:

- The agricultural industries realised that the lack of graduates was real, generating concern about its capacity going forward and the impact on future opportunities. Issues such as social licence became important;
- A resurgence in interest in agriculture in the broader community came from highlighting the link between the sector and global food security and sustainability;
- The importance of educating children about food and agriculture was elevated. This highlighted the activities of organisations allied with the ACDA, such as the Primary Industries Education Foundation Australia (PIEFA);
- The collective view of the ACDA that the impact of lower enrolments on universities was of national concern was reinforced.

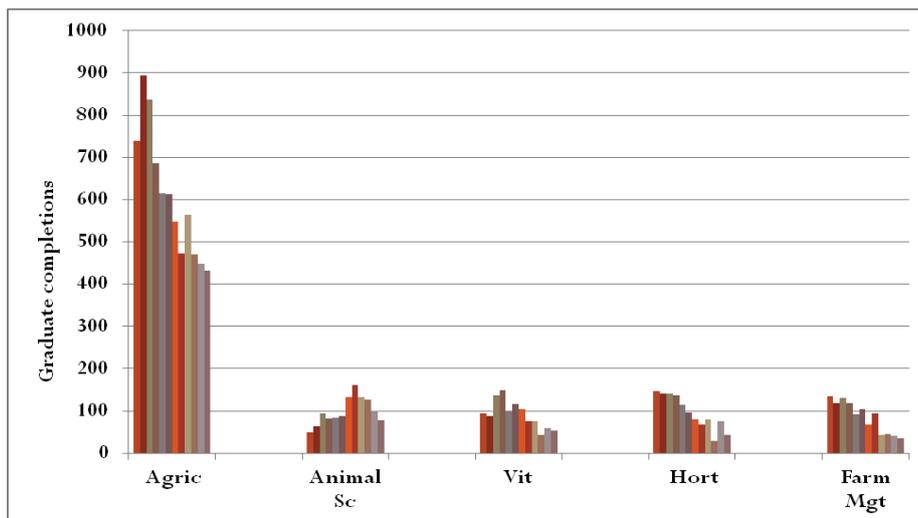


Figure 1. Annual graduate numbers (2002-2012) in agriculture and related areas (Pratley, 2012 updated)

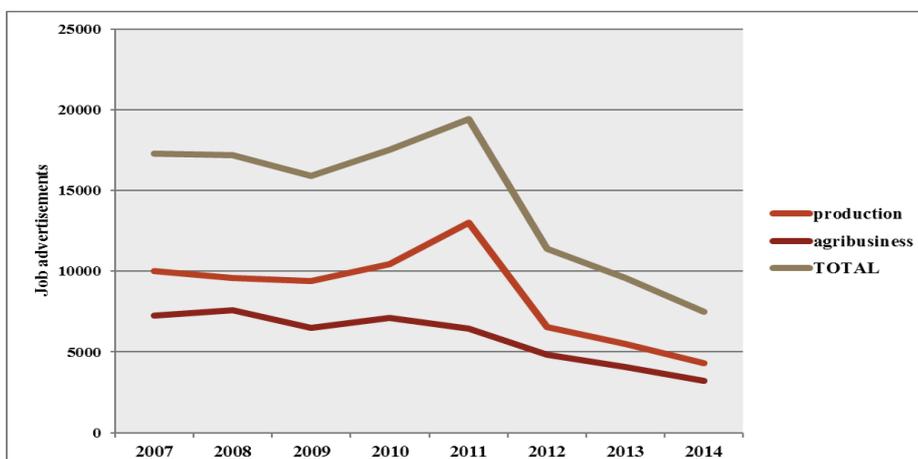


Figure 2. Job market trends for production and agribusiness based on advertisements in newspapers across Australia and on the internet for the period 2007-2014 (Pratley 2012, updated)

## Data misinterpretation

During the roll out of information on the demand and supply of agricultural graduates, two questions became important:

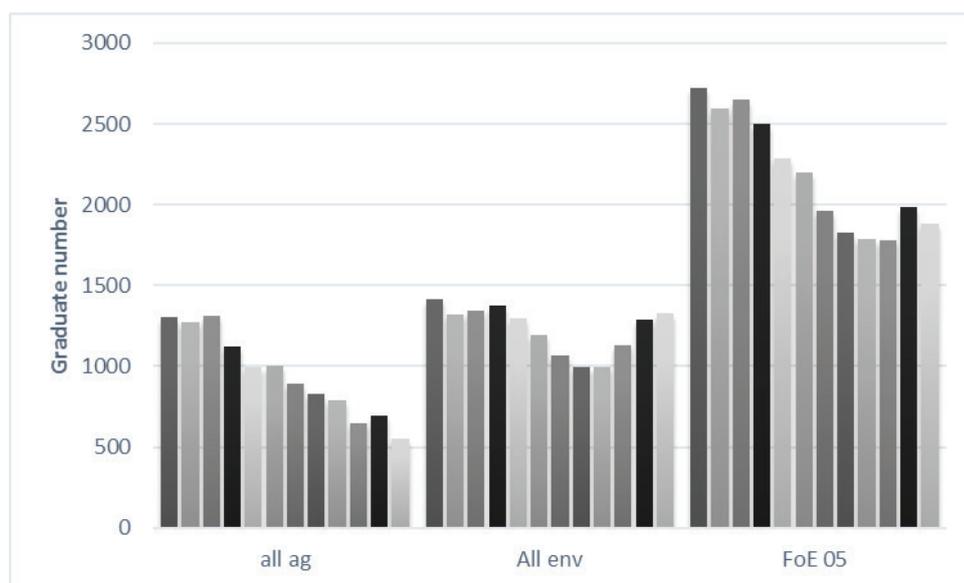
1. Why were graduate shortages in agriculture not identified using the annual census data (enrolments and completions) provided by universities?
2. Why were school career advisers under the impression that there were no jobs in agriculture and therefore advising students out of such careers?

Access to official data did provide the explanation. As part of their reporting responsibilities to government, universities provide student data according to categories called Fields of Education (FoE). There are 12 FoEs, agriculture being FoE 05. The range of FoEs is given in Table 1. The codes in column 1 of Table 1 represent the broad or 2 digit codes. Each FoE is further broken down into components and so fields like agriculture can be separated from horticulture and animal production.

FoE 05 represents both agriculture and environmental graduates. The latter vastly outnumber agriculture graduates and so the combined data are more representative of environmental graduates than of agricultural graduates. For example, in 2010 the number of graduate completions from agriculture and environment courses was about 600 and 1500, respectively (Figure 3). Thus, inquiries on graduate completions for FoE 05 can be very misleading with respect to the agriculture discipline. The ACDA now uses the narrow 4-digit code for reporting graduate completions in agriculture. More detailed analysis is given in (Pratley 2015a).

This scenario repeats itself in relation to salary and employment status. New graduates are surveyed several months after graduation by Graduate Careers Australia, an agency of government. Responses received are classified according to FoE at the 2-digit code. Figure 4 shows that agriculture has around full employment (>90%) whereas environment hovers between 60 and 70% employment in recent years. When combined the data show around 70% employment. FoE 05 is thus largely representative of environmental graduates and unrepresentative of agriculture graduates.

These analyses help explain why, on the basis of this ‘official’ information, careers advisers have formed opinions that there are limited employment opportunities in agriculture. Further analyses of these data are given in (Pratley 2015b).



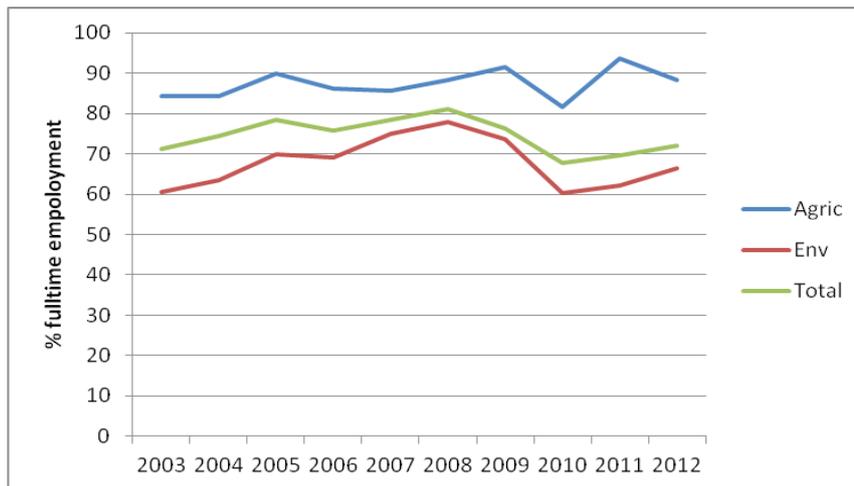
**Figure 3. Annual graduate completions (2001 to 2012) for agriculture and related courses, environmental courses and Field of Education 05 (Pratley 2015a).**

**Table 1. Agriculture and related sub-codes in the Field of Education (FoE) categorisation used in Australia.**

<i>Broad Code (2-digit)</i>	<i>Narrow (4-digit) and Detailed (6-digit) Code, where relevant</i>
01 Natural and Physical Sciences	0107 Earth Sciences 010709 Soil Science 0199 Other Natural and Physical Sciences 019905 Food Science and Biotechnology
02 Information Technology	-
03 Engineering and Related Technologies	0303 Process and Resources Engineering 030307 Food Processing Technology
04 Architecture and Building	-
<b>05 Agriculture, Environmental and related studies</b>	<b>0501 Agriculture</b> <b>050101 Agricultural Science</b> <b>050103 Wool Science</b> <b>050105 Animal Husbandry</b> <b>050199 Agriculture, n.e.c.</b> <b>0503 Horticulture and Viticulture</b> <b>050301 Horticulture</b> <b>050303 Viticulture</b> <b>0505 Forestry Studies</b> <b>050501 Forestry Studies</b> <b>0507 Fisheries Studies</b> <b>050701 Aquaculture</b> <b>050799 Fisheries Studies, n.e.c.</b> <b>0509 Environmental Studies</b> <b>050901 Land, Parks and Wildlife Management</b> <b>050999 Environmental Studies, n.e.c.</b> <b>0599 Other Agriculture, Environmental and related studies</b> <b>059901 Pest and Weed Control</b> <b>059999 Agriculture, Environmental and related studies, n.e.c.</b>
06 Health	0611 Veterinary Studies 061101 Veterinary Science 061103 Veterinary Assisting 061199 Veterinary Studies, n.e.c.
07 Education	-
08 Management and Commerce	0803 Business and Management 080321 Farm Management and Agribusiness
09 Society and Culture	-
10 Creative Arts	-
11 Food, Hospitality and Personal Services	-
12 Mixed Field programs	-

**Table 2. The percentage decline in graduate completions for Field of Education 05 and for agriculture from 2001 to 2010 (Pratley, 2015b)**

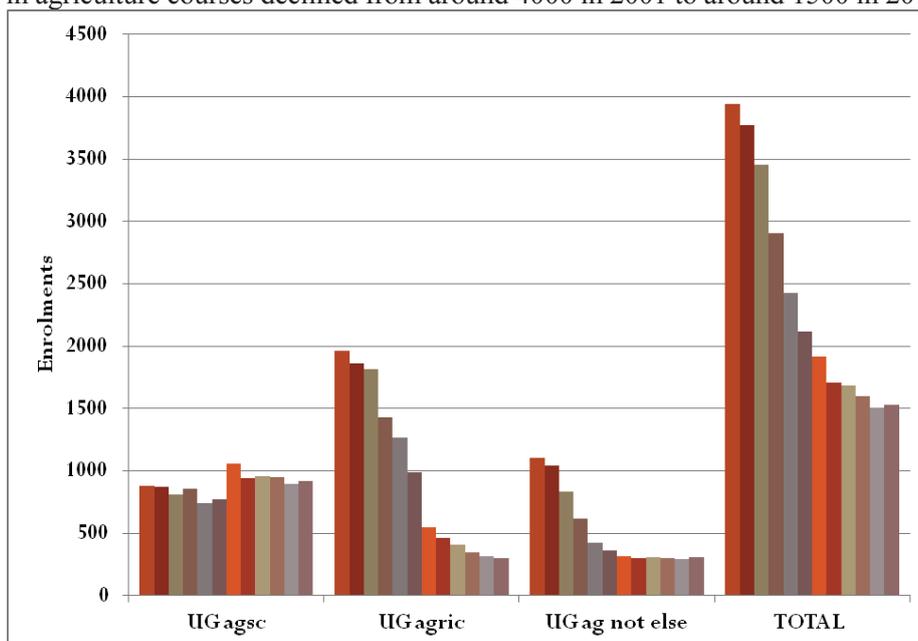
Source	2001	2010	% decline
Undergraduate (UG) completions (FoE 05) (2 digit code)	2991	2207	26
Undergraduate (UG) agriculture completions (6 digit code)	886	413	53



**Figure 4. Comparison of full time employment of agriculture and environmental graduates, separately and together, in the Graduate Careers Australian surveys 2003 to 2012 (Pratley, 2015b)**

### The impact of the downturn on universities

While much has been written about the decline in numbers of agriculture *graduates* over the past decades and the shortages created in the market place, little has been reported about the *enrolment* numbers in agriculture in the university system during that period. Enrolments are important because they determine the level of funds received from the government. The funds in turn determine the viability of the university departments that offer the courses. Analysis of official enrolment data shows that in the period 2001-2012, undergraduate enrolments in agriculture courses declined from around 4000 in 2001 to around 1500 in 2012, or a 60% decline (Figure 5).



**Figure 5. The annual decline (2001 to 2012) in undergraduate (UG) enrolments in agriculture courses in Australian universities (ACDA unpublished). Abbreviations: UG agsci, agricultural science; UG agric, agriculture; ag, agriculture courses not elsewhere reported.**

Such decline (Figure 5) results in massive loss of income to those departments, with commensurate contraction of academic staff numbers and expertise. In 2012, a university received around \$30,000 a year for a full-time student enrolled in agriculture. As a guide, the decline in enrolment numbers means that agricultural faculties received about \$75 million less in 2012 compared with the baseline year 2001. Most of the funds received go into general university administration with about one third going to the teaching departments. Consequently, departmental funding has declined from around \$40 million to \$15 million. As a rule of thumb, there is a ratio of about 20 students per staff member and the enrolment downturn therefore is the equivalent of the loss of about 125 academic staff.

The consequences of staff contraction are many. University departments no longer have the range of specialist staff. The capacity to supervise practical skills development has also diminished. As such training is constrained there is less call for the associated facilities, which then are not maintained to levels required for compliance with workplace health and safety and are forced to close.

Unofficial reports by ACDA members indicate that there have been increases in intakes nationally over the years 2013 to 2015, albeit from a low 2012 base. There is a lag in response to this as institutions take a cautious approach to re-building teaching capability as there is a need for departments to become financially stable. It remains to be seen whether there is sustained growth but there are signs of new optimism in the higher education sector.

### **Towards professionalism and Agriculture Learning and Teaching Academic Standards**

This episode in the evolution of the agriculture sector has been a wake-up call. There has been an increased urgency towards professionalising the industry – a focus on education and training, a desire to improve the image of the sector, a move towards social licence and greater engagement with future opportunities, challenges and needs. Universities have been an integral part of this increasingly professional approach and so the issue of quality in higher education is considered. Learning and Teaching Academic Standard (LTAS) Statements across several disciplines have been published, and are listed as reference points in the national standards framework developed by the Higher Education Standards Panel (Australian Government 2014). Graduates of agriculture and related sub-disciplines are employed in diverse roles, including but not limited to research, development and extension (R, D and E); primary production in the value chain; policy; finance and marketing; and media. As outlined above, recent inquiries by the ACDA and the state and federal Governments into higher education and skills training for agriculture and agribusiness has highlighted the importance of ongoing tertiary education in agriculture for Australia's economic prosperity. Universities must address the design, content and delivery of their agricultural curriculum to meet the needs of industry now and into the future.

The Agriculture Learning and Teaching Academic Standards (AgLTAS) were developed through a nationwide consultation with industry, graduates and academics and have been endorsed by the ACDA (Botwright Acuña *et al.* 2014a). The standards define the nature and extent of agriculture and also outline the key threshold learning outcomes (TLOs) for graduates. The standards include TLOs that closely reference those for the Science discipline (Jones *et al.* 2011): Knowledge, Understanding, Inquiry and Problem Solving, Communication and Personal and Professional Responsibility (Table 3). Together these represent what a pass-level graduate in agriculture should know, understand and be able to do upon graduation.

Although agriculture fits within Science, it also has technical, business, social and cultural aspects not captured in the Science TLOs. Agriculture is a multi-disciplinary area by its very nature and this is described in the standards. Industry input was vital in developing the national standards to ensure that agriculture graduates left university with the skills and knowledge needed by industry. The industry stakeholders who were consulted agreed that students needed to demonstrate highly developed problem solving and communication skills. Industry specific (vocational) knowledge was generally regarded as attainable during on-the-job training both during and after graduation. The issue of vocational training in agriculture at university is explored in more detail in Botwright Acuña *et al.* (2014b). The importance of undergraduates obtaining valuable on the job training through work-integrated learning or work experience is highlighted in the explanatory notes section of the standards statement. Furthermore, given the dynamic nature and

wide range of agricultural industries, the standards highlight that graduates need to be life-long learners and capable of undertaking continued professional development.

The new standards will inform the development and design of agriculture curricula delivered at Australian universities and will further promote agriculture as a career to encourage more young people into the growing industry. Greater engagement between universities and industry in curriculum design and cooperation between providers is necessary for curriculum rejuvenation (Dunne 2010; Bellotti 2012). For example, at the University of Tasmania, the standards have informed the proposed redevelopment of the three-year Bachelor of Agriculture degree program. The standards were mapped against the curriculum, which highlighted strengths in inquiry and problem solving that in some activities exceeded graduate level. Opportunities were identified to further strengthen some agribusiness-related topics to reinforce the commercial relevance of student learning outcomes. Higher education providers may choose to use these to demonstrate compliance with the proposed Higher Education Standards Framework in relation to learning outcomes and assessment.

Importantly, the standards will allow Universities to continue their delivery of unique content but enable students to have confidence that their degree is of a high standard. Higher education providers are encouraged to build on the standards as they design and deliver programs that reflect their particular strengths and priorities. They may do this by adding additional TLOs or by requiring the five TLOs to be met at a higher standard in their own organisation. If implemented as a reference point, the standards will support each higher education provider's autonomy, diversity and reputation.

**Table 3. Threshold learning outcomes for agriculture. Extracted from the Agriculture Learning and Teaching Academic Standards (Botwright Acuña *et al.* 2014a)**

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**Threshold Learning Outcomes for agriculture**

Upon completion of a bachelor-level degree in agriculture or a related sub-discipline, graduates will, as a minimum, be able to demonstrate their knowledge and skills in the following areas:

**Understanding agriculture**

1. Demonstrate an integrative understanding of agriculture by:
  - 1.1. Explaining the role and relevance of agriculture and its related sciences, and agribusiness in society.
  - 1.2. Understanding the major biophysical, economic, social and policy drivers that underpin agricultural practice and how they contribute to practice change.
  - 1.3. Understanding how information is adopted and the context within which producers, processors and consumers, make decisions.

**Knowledge of agriculture**

2. Exhibit depth and breadth of knowledge of agriculture by:
  - 2.1. Demonstrating knowledge of the core sciences in the context of agriculture.
  - 2.2. Demonstrating broad generalist knowledge of relevant agricultural production systems and their value chains, with specialist knowledge in at least one area.
  - 2.3. Understanding how knowledge from different sub-disciplines within agriculture is integrated and applied into practice.
  - 2.4. Demonstrating a basic knowledge of economics, business and social science as they apply to agriculture.

### **Inquiry and problem solving**

3. Critically analyse and address dynamic complex problems in agriculture by:
  - 3.1. Identifying contemporary issues and opportunities in agriculture.
  - 3.2. Gathering, critically evaluating and synthesising information from a range of relevant sources and disciplines.
  - 3.3. Selecting and applying appropriate and/or theoretical techniques or tools in order to conduct an investigation.
  - 3.4. Collecting, accurately recording, analysing, interpreting and reporting data.

### **Communication**

4. Be effective communicators by:
  - 4.1. Understanding methods of effective two-way written and verbal communication with different audiences.
  - 4.2. Communicating with a range of audiences in an agricultural context using a variety of modes.

### **Personal and professional responsibility**

5. Be accountable for their own learning and professional work by:
    - 5.1. Being independent and self-directed learners.
    - 5.2. Working effectively, responsibly and safely in an individual and team context.
    - 5.3. Demonstrating knowledge of the regulatory frameworks relevant to their specialist area in agriculture.
    - 5.4. Personally practising ethical conduct.
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### **Conclusion**

In 2007, higher education in agriculture was in a parlous state. Institutions were struggling to maintain agriculture programs. The industry sector faced a shortfall of graduates to take the sector forward into an era of opportunity. Through adversity comes strength and, with the combined efforts of many, the foundations of a firm future have been laid.

One particular outcome of these adverse circumstances was the formation of the ACDA. This brought the university sector together formally and enabled the study of graduate supply and demand through the compilation of data that hitherto had not been considered. The evidence clearly showed lack of supply of, and high demand for, agricultural graduates and helped provide the impetus for others to become involved in building interest in agriculture with schools and the community.

Data anomalies are now well understood but such discrepancies will continue to interfere with the data on enrolments and completions in agriculture and related disciplines unless the data are used appropriately. Categorisation of agriculture and environment into separate FoEs by government is highly desirable.

The decline in enrolments and associated contraction of funding for agricultural higher education has had a big impact to the extent that education delivery has been affected as staff numbers continue to decline, perhaps permanently. However the recovery phase, albeit slow and steady, is enabling newer and smarter approaches to courses. Agricultural industries have started to appreciate the need for more professionalism and universities are endeavouring to get their houses in order by addressing course standards nationally. With industry input, such standards will inform curriculum development and provide confidence that agricultural degrees are relevant and of high standard.

So, falling student enrolments and completions and the subsequent effect on teaching capacity over the last decade has driven a new dimension into agricultural education. There is greater ownership by all involved; there has been an image transition; awareness of career opportunities have been developed; and greater understanding has occurred of data and their interpretation. Taking advantage of the opportunities that lie ahead is in the hands of the agricultural sector, which we hope will be well supplied with new-age graduates. It is unclear where we would be, had there not been the thrust provided by the formation of the ACDA and its data focus.

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## References

- Australian Government (2012) Higher education and skills training to support agriculture and agribusiness in Australia. Senate Standing Committees on Education Employment and Workplace Relations, Canberra, Australia.
- Australian Government (2014) Higher Education Standards Framework: Advice to Minister. Higher Education Standards Panel Available at <http://www.hestandards.gov.au/final-proposed-framework>.
- Bellotti, W, 2012. Human capacity to meet the sustainable intensification challenge. In: Assessing the Opportunities for Achieving Future Productivity Growth in Australian Agriculture. Australian Farm Institute,
- Botwright Acuña, TL, Able, A, Kelder, J, Bobbi, P, Guisard, Y, Bellotti, W, McDonald, G, Doyle, R, Wormell, P, Meinke, H (2014a) 'Learning and Teaching Academic Standards Statement for Agriculture.' (Office for Learning and Teaching: Sydney, Australia)
- Botwright Acuña, TL, Kelder, J, Able, A, Guisard, Y, Bellotti, W, McDonald, G, Doyle, R, Wormell, P, Meinke, H (2014b) Academic, industry and student perspectives on the inclusion of "vocational knowledge" in a 'learning and teaching academic standards statement' for agriculture. *Journal of Learning Design* 7, 1-15.
- Cowan, H (2010) Review of post-secondary agricultural education in Western Australia. WA Government, Narembeen, WA. Available at [http://www.parliament.wa.gov.au/publications/tables/papers.nsf/displaypaper/3812579a453038438c668362482577a70001dba1/\\$file/tp2579.pdf](http://www.parliament.wa.gov.au/publications/tables/papers.nsf/displaypaper/3812579a453038438c668362482577a70001dba1/$file/tp2579.pdf).
- Dunne, A (2010) Contemporary issues in the provision of tertiary agriculture programs: a case study of The University of Queensland. Australian Agribusiness Perspective Available at <http://www.agrifood.info/perspectives/2010/Dunne.pdf>.
- Jones, S, Yates, B, Kelder, J (2011) Learning and Teaching Academic Standards Statement for Science. Australian Learning and Teaching Council Available at [altec\\_standards\\_SCIENCE\\_240811\\_v3%20\(5\).pdf](http://altec_standards_SCIENCE_240811_v3%20(5).pdf).
- McCull, J, Robson, A, Chudleigh, J (1991) Review of Agricultural and Related Education. Department of Employment, Education and Training and Department of Primary Industries and Energy AGPS, Canberra.
- Parliament of Victoria (2012) Inquiry into agricultural education and training in Victoria. Parliamentary paper No. 196 Session 2010 - 2012. Parliament of Victoria Education and Training Committee, Available at [http://www.parliament.vic.gov.au/file\\_uploads/ETC\\_Inquiry\\_into\\_Ag\\_Education\\_Final\\_Report\\_c3r44B0Q.pdf](http://www.parliament.vic.gov.au/file_uploads/ETC_Inquiry_into_Ag_Education_Final_Report_c3r44B0Q.pdf).
- Pratley, J (2008) Building Capacity in Agriculture. Submission to the 2020 Summit. Australian Council of Deans of Agriculture.
- Pratley, J (2012) Professional Agriculture - A Case of Supply and Demand. Wagga Wagga, NSW. Available at <http://www.csu.edu.au/special/acda/papers>.
- Pratley, J (2013) Review into Agricultural Education and Training in New South Wales. NSW Government.
- Pratley, J (2015a) Agricultural education and damn statistics. I. Graduate completions. *Agricultural Science* 27, 44-50.
- Pratley, J (2015b) Agricultural education and damn statistics. II. Graduate employment and salaries. *Agricultural Science* 27, 51-55.
- Pratley, J, Copeland, L, ACDA (2008) Graduate completions in Agriculture and related degrees from Australian universities, 2001-2006. *Farm Policy Journal* 5, 1-11.