1 February 2012

Chief Scientist

Committee Secretary
Senate Education, Employment and Workplace Relations
Committees
PO Box 6100
Parliament House
Canberra ACT 2600

Re: Enquiry into all aspects of higher education and skills training to support future demand in agriculture and agribusiness.

This submission is to inform the Senate Education, Employment and Workplace Relations References committee of a major project being undertaken by the Office of the Chief Scientist (OCS) that is relevant to the abovementioned enquiry.

The *Health of Australian Science* (*HAS*) project will be completed in late March 2012 and it is anticipated that the findings will be delivered to the Prime Minister's Science, Engineering and Innovation Council at its next meeting.

The *HAS* project is a comprehensive assessment of available data to profile the strengths and vulnerabilities of Australia's present science capability. This profile is being analysed in the contexts of emerging science areas and the increasing internationalisation of science.

Key questions that are being addressed include:

1. What is the breadth and quality of Australian science across all disciplines and sectors and how does it compare internationally?
2. What are the emerging science areas and does Australia have the necessary skills in those areas?
3. What does Australian science need to look like in 2020 to drive innovation across all sectors of the economy, deliver health and well-being outcomes for all citizens, underpin sufficient defence capability, and generate the breadth of evidence required for sound decision-making across government, business and community?

The project's scope incorporates the entire system from the supply side in the schools sector, through higher education and research sectors, to the demand side in government and private sectors. I expect that the project outcomes will be of considerable interest to the committee, particularly in relation to the enquiry's terms of reference 2 and 4.

Providing recommendations from the project to the enquiry at this point in time would be premature. Agricultural science is a discipline firmly in the national interest and is therefore under detailed investigation. To illustrate partially the breadth of information being considered a brief overview of the Agricultural Sciences component of the *HAS* project is included at Attachment A.

Yours sincerely

Professor Ian Chubb AC
Australia's Chief Scientist

ATTACHMENT A: BRIEF OVERVIEW OF THE AGRICULTURAL SCIENCES DISCIPLINE

Headlining this overview of the agricultural sciences discipline is:

1. 743 bachelor completions in agricultural sciences in 2010[1]
2. 581 full time equivalent teaching/research staff in 2009[2]
3. $1.2 billion total R&D spend on *Agricultural & Veterinary Sciences* in 2008-09[3]
4. 6 times as many agricultural sciences jobs advertised as there were bachelor completions in 2007-10[4]

1. University students enrolled in the agricultural sciences

The broad field of education representing the agricultural sciences is *Agriculture, Environmental and Related Studies (ASCED Code 05)*. Completions information for this field of education in 2010 is listed in Table 1. It is important to note that, with respect to understanding the agricultural sciences discipline, these figures are confounded by the inclusion of environmental and related studies. To accurately represent the situation for agricultural sciences alone the trend of student completions for agricultural sub-disciplines (i.e. agriculture, horticulture/viticulture, animal science, wine science) are shown in Figure 1. These data clearly demonstrate a declining trend in bachelor degree completions over the period 2002-10; the total agricultural science completions decreased from 931 in 2001 to 743 in 2010[5]. This represents a decline in agricultural science completions as a proportion of total bachelor completions across all fields of education from 0.87% to 0.51%. The sub-discipline of animal science is the only sub-discipline that does not show a decline.

Table 1: *Completions information for the broad field of education (FOE) Agriculture, Environmental and Related Studies (ASCED Code 05) for 2010[6].*

Course level	Completions for ASCED Code 05	% of completions across all FOE
Bachelors (inc. Honours)	2128	1.3
Postgraduate coursework	1156	1.1
Higher degree research	379	5.0
All course levels	3810	1.3

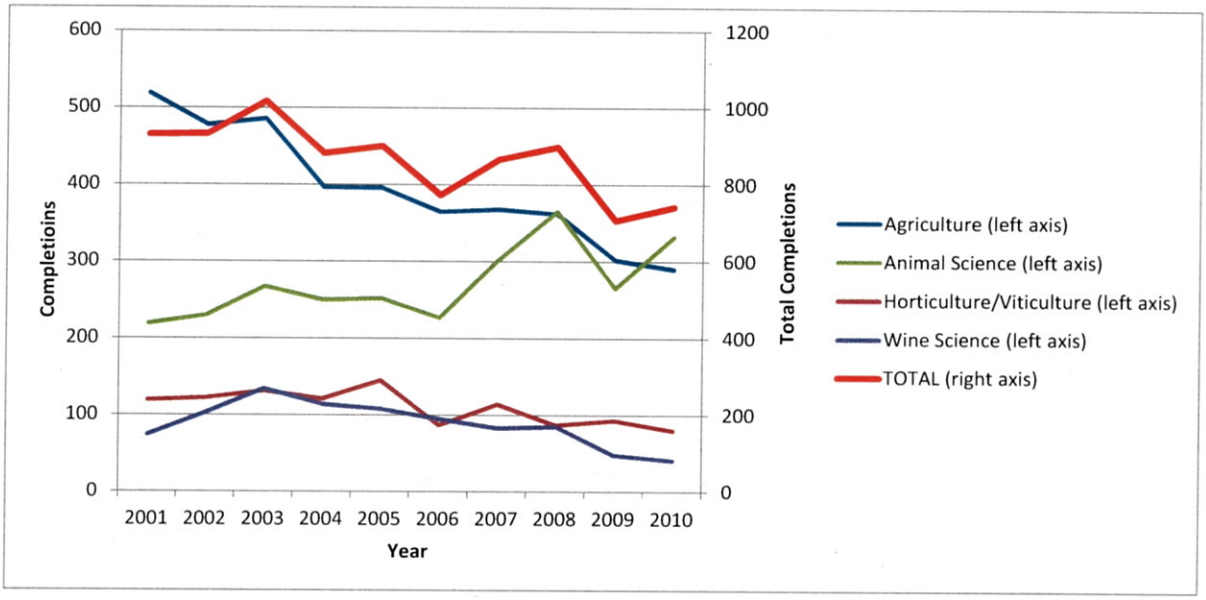

Figure 1: *Bachelor completions for the period 2002-10 for agricultural science sub-disciplines[7].*

2. University teaching and research in the agricultural sciences

The broad field of research representing the agricultural sciences is *Agricultural & Veterinary Sciences (ANZSRC Code 07)*. The full-time equivalent staffing profile of the total *Agricultural & Veterinary Sciences* discipline in 2009 was similar to the overall staffing profile with most staff at Level B (Figure 2). Staffing profiles for most of the agricultural science sub-disciplines have considerably less Levels A, B and C staff than the overall staffing profile (Figure 2).

Over the period 2001-10 there were a total of 1665 higher degree research completions in the agricultural sciences, with 30% of those completed by international students[8]. Over the same period annual domestic completions varied between 99 and 130, with the lower number of completions generally in the more recent years[9].

The total number of competitive ARC research grants awarded to the agricultural sciences in 2010 was 17, with a total funding value of $5.95 million[10]. This represents approximately 1.1% of the total number of grants and total funding value awarded. This figure was generally between 1.5 and 1.9 % in the first half of the period 2002-08 (Figure 3).

One measure of research excellence in agricultural sciences is the ERA rating; where an ERA rating of 3 or above indicates performance at world standard or above. For the reporting period 2006-08 all agricultural science sub-disciplines for which sufficient outputs were submitted were performing at or above world standard, with crop and pasture production and horticultural production performing significantly above world standard[11] (Table 2).

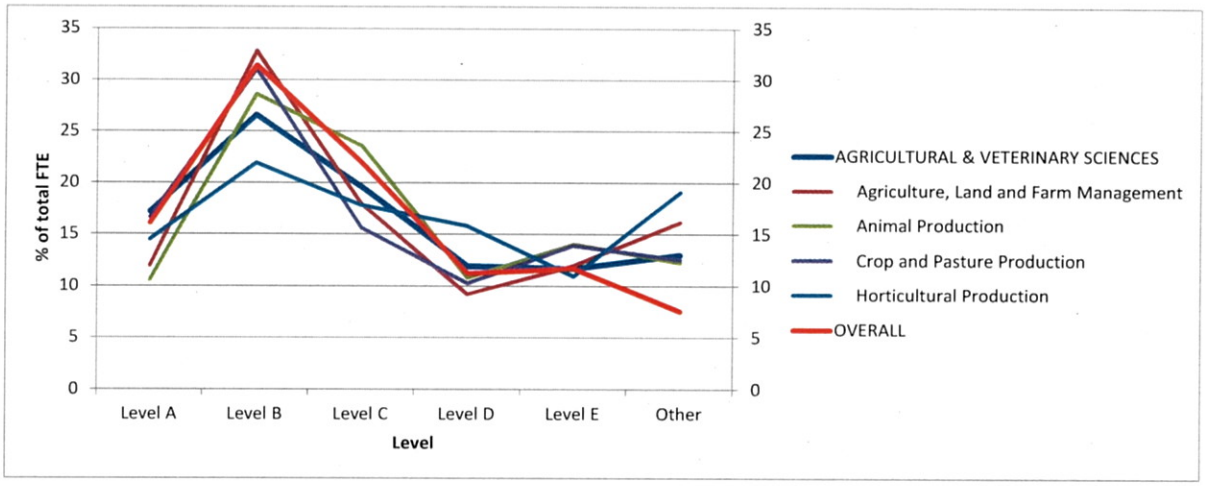

Figure 2: *Staffing profiles in 2009 for the broad field of research Agricultural & Veterinary Sciences (ANZSRC Code 07), agricultural science sub-disciplines, and the overall staffing profile across all academic disciplines[12].*

Table 2: *ERA ratings for the broad field of research Agricultural & Veterinary Sciences (ANZSRC Code 07) and the agricultural science sub-disciplines for 2006-08[13].*

Field of Research	ERA Rating
07 Agricultural & Veterinary Sciences	3.7
Agriculture, land & farm management	na
Animal production	3.7
Crop & pasture production	4.1
Horticultural production	4.7

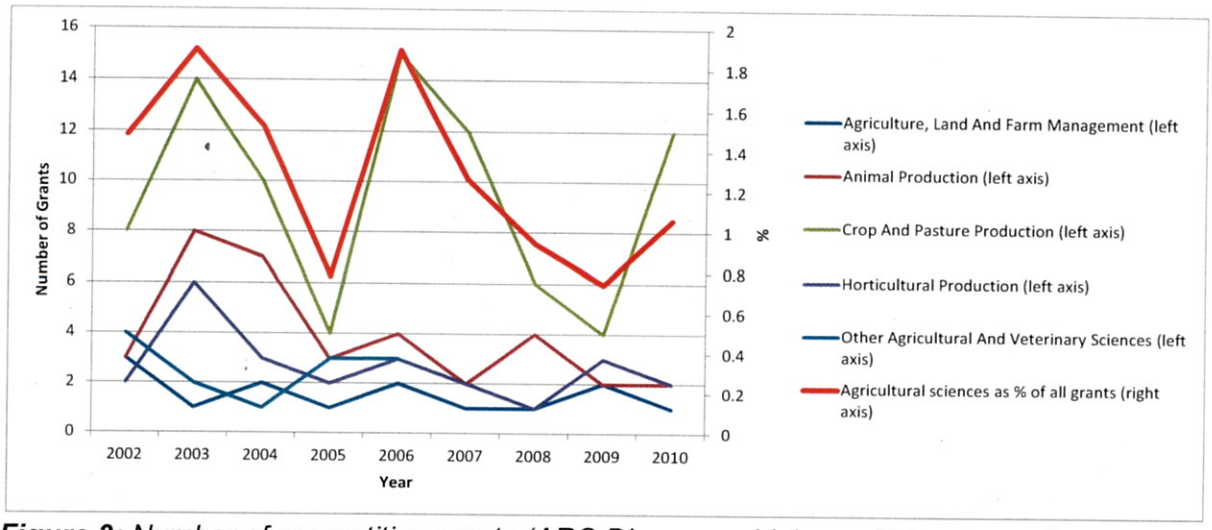

Figure 3: *Number of competitive grants (ARC Discovery, Linkage, Networks and Fellowships) for agricultural sciences sub-disciplines, and these as a proportion of all grants across all fields of research*[14].

3. R&D spend on the agricultural sciences

In 1998-99 the total gross expenditure on agricultural sciences R&D as a proportion of the total R&D across all research disciplines was 10.7%, a value roughly maintained throughout the 1990s[15]. Over the period 2000-09 this percentage had declined to 6.8%, despite a change in the accounting to include veterinary science and environmental sciences in the agricultural sciences research category[16]. The largest contributor to gross expenditure on R&D in the agricultural sciences, and the sector accounting for most of the recent decline, is the state and territory governments (Figure 4).

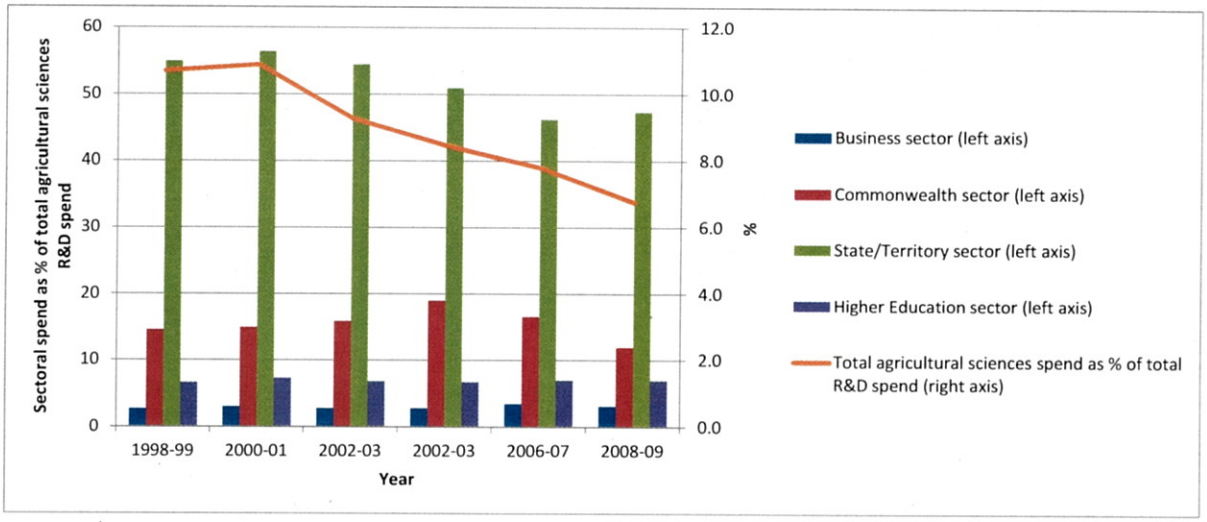

Figure 4: *Sectoral spend as a percentage of total spend on agricultural sciences R&D, and the total spend on agricultural sciences R&D as a percentage of total spend on all R&D*[17].

4. Demand for graduates in the agricultural sciences

One measure of the demand for graduates is the percentage of bachelor degree graduates seeking full-time employment that were in full-time employment within 4 months of

completing their degree. For the period 2002-10 the percentage uptake for agriculture graduates varied between 69% and 82%. The uptake was typically less than that for bachelor degree graduates generally (Figure 5).

A recent survey of advertisements for agricultural jobs has identified a job market of about 1600 per quarter, which arguably sets a demand for university graduates of around 4500 per year[18]. This is a factor 5 smaller than the current rate of bachelor completions (Figure 1).

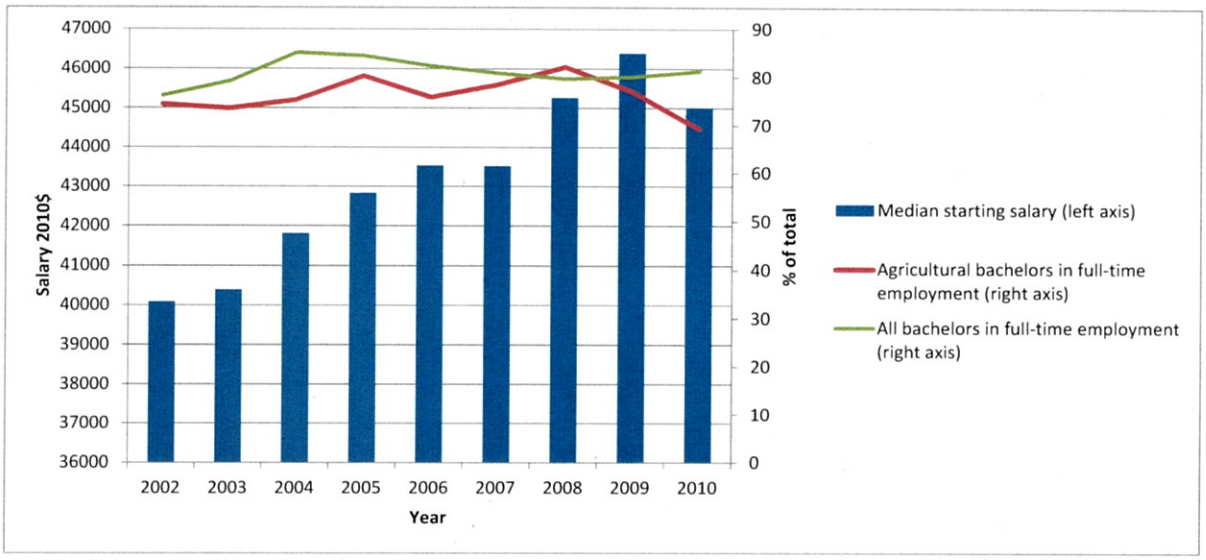

Figure 5: *Percentage of bachelor degree graduates in full-time employment in agriculture four months after completion, compared with the percentage of all bachelor degree graduates in full-time employment. The median starting salary for agricultural bachelor graduates is also shown[19].*

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[1] Source: Original data from Australian Council of Deans of Agriculture personal communication (2011). Note that analysis for this figure is limited to agricultural science disciplines, as defined by the Deans (i.e. agriculture, horticulture/viticulture, animal science, wine science).

[2] Source: Original data from Australian Research Council, 2010. *ERA 2010 National Report*, Australian Government. Note that this figure is restricted to the agricultural sciences within the broader *07 Agricultural & Veterinary Sciences* field of research (i.e. agriculture, land and farm management; animal production; crop and pasture production; horticultural production; other agricultural & veterinary sciences).

[3] Source: Australian Bureau of Statistics, Gross expenditure on R&D by sector-by field of research, 2008-09; including business, commonwealth, state and territory government, higher education and private non-profit sectors. Note that the Rural R&D Council recently estimated a figure of $2.9 billion, which includes agricultural, forestry and fisheries expanded along the value chain and related to rural components (Rural Research and Development Council, 2011. *National Strategic Rural Research and Development: Investment Plan*, Australian Government).

[4] Pratley, J. and Hay, M., 2010. *The job market in agriculture in Australia*. Occasional Paper 10-01, Australian Farm Institute, 1-14.

[5] See 1.

[6] Source: Original data from DEEWR Higher Education census.

[7] See 1.

[8] Source: Original data from DEEWR Higher Education census. Note that of the broad field of education *05 Agricultural, Environmental and Related Studies* only the agricultural science sub-disciplines are included in the analysis (i.e. agriculture, agricultural science, wool science, animal husbandry, horticulture/viticulture, pest/weed).

[9] Annual total completions were not calculated due to numerous cells with imprecise values for international students (i.e. <10).
[10] Source: Original data from the Australian Research Council national competitive grants data base. From the broad field of research *07 Agricultural and Veterinary Sciences* only the agricultural science sub-disciplines are included in the analysis (i.e. agriculture, land and farm management; animal production; crop and pasture production; horticultural production; other agricultural & veterinary sciences).
[11] Australian Research Council, 2010. *ERA 2010 National Report*, Australian Government.
[12] Source: Original data from Australian Research Council, 2010. *ERA 2010 National Report*, Australian Government.
[13] See 11.
[14] See 10.
[15] Source: Original data from Australian Bureau of Statistics, Gross expenditure on R&D by sector-by field of research, 1992-93 to 2008-09; including business, commonwealth, state and territory government, higher education and private non-profit sectors.
[16] Ibid. Note that there was a change in accounting in 2000-01 (and subsequent) so that the agricultural science category also included veterinary sciences.
[17] Ibid.
[18] See 4.
[19] Source: Original data from Graduates Careers Australia, accessed at http://start.graduatecareers.com.au/Resourcelibrary/GradStatsandGradFiles/index.htm on 30 January 2012. Salaries have been converted to 2010 dollars.