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An Evaluation of Secondary Agricultural Education Subject Offerings and Enrolments in Australia

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Abstract

Over recent decades in Australia, secondary and tertiary institution enrolments and completions in agriculture-related courses have been inadequate for the employment demand that exists. This demand, inter alia, includes the well-publicised global issues of climate change, food security and the need to feed a significantly larger population. This paper presents a study of the current secondary agricultural education system across states and territories in Australia and evaluates its performance as it endeavours to meet the workforce needs of the nation's agricultural industries. The data reveal a plateau in university agriculture graduate numbers, although variable between states. The need to increase intakes to expand graduate numbers represents a challenge because of the decline in numbers of secondary school agriculture course participants, an important component of the pipeline. The variability in offerings across states and territories in secondary agricultural education appears to be a blockage in the system such that students in some states, and regions within states, have little opportunity to follow that line of study. Increasing supply of students into university courses in agriculture is the major challenge in addressing the workforce shortfall. There needs to be improvements in secondary student exposure to agriculture and the buoyant employment opportunities both on-farm and off-farm, including in the cities. An increase in agricultural literacy of school student advisers, i.e. parents and teachers, would seem to be an important endeavour.

Keywords: *agriculture, education, agricultural literacy, Australia, secondary school students, agricultural workforce*

Introduction

The global population continues to increase, albeit at a decreasing rate. It is projected that there will be 9.7 billion people to feed by 2050, up from 8.2 billion in 2025, peaking at 10.3 billion people around 2083 (Worldometer, 2025). Table 1 provides a summary of world hunger and childhood nutritional insufficiencies as reported by The Food and Agriculture Organisation [FAO] et al. (2024) showing the extent of the challenge. The disruption in food supplies, due to the invasion of Ukraine and the Gaza conflict, has added to the global food insecurity problem, as has climate change.

Table 1. ***World Incidence in Hunger and Nutritional Insufficiencies in 2021 (FAO et al., 2024)***

Affliction	Number of people affected
People in hunger in 2021	733 million (9.2% of population)
Moderate or severely food insecure	2.33 billion (28.9% of population)
Children younger than 5 years with wasting	45 million
Children stunted growth and development	149 million

This food security challenge requires a productive and versatile global agriculture sector. Not only are the staple commodities (such as rice, wheat, maize) needed, but proper nutrition demands availability and affordability of fruits, vegetables and pulses as well as meat and milk. Australia is a significant agricultural producer that ensures food security for its own communities as well as contributing to world food supply. It currently feeds the equivalent of around 60 million people their whole diet, with potential to feed up to 120 million people globally with further investment (Bellotti, 2017). The Australian Government, in its *Delivering Ag2030* report, detailed the vision to assist the agriculture sector to reach AUD100 billion in Gross Value of Production by 2030 (Department of Agriculture, Water and the Environment, 2022). According to this report, such prediction would require a near doubling of the then current production growth rate of 3% to 5.4%. Australia's contribution could add to the availability of staples and to the nutritional components mentioned, thereby reducing the global challenge, even despite issues of climate change and land degradation. Its biggest challenge, however, is ensuring an adequate and well-trained workforce for the national agricultural sector, the focus of this paper.

The terms 'agriculture' and 'food and fibre' are used interchangeably as different parts of the value system use different terms. Agriculture is the study of food and fibre production, processing and marketing.

The 'McColl Review' (McColl et al., 1991) was a national study of agricultural education. Amongst its recommendations was that the Australian agriculture sector needed to increase the number of agricultural graduates to meet the likely increase in employment demand. Rather than increase graduate numbers though, data show that there was a substantial decline over the succeeding decade (Pratley, 2012). Graduate completions from 1988 to 2010 declined for agriculture (800 to 300), horticulture (150 to 80) and agribusiness (250 to 90). These circumstances led to reviews into 'agricultural education and training' by The Western Australian Government (Cowan, 2010), The [Australia] Senate (2012), The Parliament of Victoria (2012) and the New South Wales Government (Pratley, 2012). Concurrently, Pratley and Hay (2010) showed that there were at least 6 jobs per graduate and the shortfall was a threat to the sustainability of the agricultural and horticultural industries. Pratley et al. (2022) showed similar outcomes a decade later. The supply of graduates in agriculture from universities changed only slightly during that period, suggesting the need for some form of disruption to generate greater interest from prospective students.

Workforce shortages in agriculture have been occurring internationally, most notably in the United States, United Kingdom, Canada and New Zealand. As with Australia, there has been high dependence on Itinerant migrant workers with, in many cases, worker exploitation. This dependence has been shown to be high risk (e.g. Covid-19 in Australia, Brexit in the United Kingdom, immigrant policy changes in the United States, exploitation in Canada) and has resulted in a greater focus on technology to reduce routine labour tasks. The outcome has been an increase in demand for technically qualified personnel, both university graduates and vocationally trained paraprofessionals. This has been reaffirmed by later publications (e.g. Pratley, 2017; Pratley & Kirkegaard, 2019; Azarias et al., 2020). Although each of the afore-mentioned

Agricultural Education Reviews identified this need to varying extents, such reviews have not resulted in the requisite increases in university undergraduate students to undertake these education pathways towards agricultural careers.

Concern occurred in the United States as early as 1974 around the inadequacy of agricultural education in secondary schools, as it was being taught only to a small percentage of students. Mayer and Mayer (1974, as cited by Frick, 1991) expressed dismay that most secondary students were not taught even the rudimentary aspects of agriculture, leading to a large percentage of the population being ignorant about an area basic to their existence. Similar issues have arisen in the United Kingdom (Dyer & Osborne, 1994: Dillon et al., 2003). The [United States] National Research Council (1988) coined the term 'agricultural literacy', defined loosely as possessing knowledge and understanding to be able to synthesise, analyse and communicate basic information about agriculture. It is recognised that such knowledge and understanding needs to evolve with sector changes resulting from technological and other influences. Research into secondary school agricultural literacy in the United States has been evaluated by Kovar and Ball (2013), and in Australia by Cosby et al. (2022) but is largely confined to those students enrolled in agriculture subjects. Australian research into agricultural literacy is summarised in Table 2.

Table 2. ***Chronology of Agricultural Research into Agricultural Literacy in Australia***

Issues	**References**
'Agriculture' as a *de facto* subject for disengaged and less academically capable students, which in turn generates a negative attitude amongst teachers	Pratley (2013, 2017)
Lack of agricultural understanding amongst adults, requiring more education at secondary level	Worsley et al. (2015)
Adoption of agricultural technologies by teachers in classrooms, partly as a method of engaging students	Cosby et al. (2019), Manning et al. (2022)
Lack of knowledge and understanding about agriculture by both primary and secondary students	Peltzer (2020), Primary Industries Education Foundation Australia (2020), Hancock et al., (2024), Manning et al. (2024)
Lack of awareness of career opportunities in agriculture amongst secondary students	Cosby et al. (2022)
Lack of awareness of career opportunities in agriculture amongst university students	Smith (2022)
Secondary school technology teachers' outdated perceptions of agriculture and careers, linked to their childhood upbringing	Cosby et al. (2024)

Pratley (2013) in the New South Wales Review considered the agricultural education continuum from primary through secondary to vocational and higher education, to the business of agriculture and the image of the sector. The Review noted the historically low enrolments in agriculture courses at all levels and expressed concern at the inability of education providers to attract young people into agriculture. It recorded that

> *the perceptions of agriculture, the educational experience about food and fibre, the career advice to students, and the workforce issues in the industry as a whole are not conducive to enticing people into agriculture, even though there are many and varied employment opportunities at competitive salaries* (p.6).

Given that secondary students represent a pipeline of potential university students of agriculture, it becomes important to understand the size and trends of this pipeline in satisfying university graduate demand. Sustainability of agriculture subjects at secondary level has become of paramount importance. Student surveys (e.g. Bell & Biddulph, 2009; Barber & Pratley, 2016; Smith, 2022) indicate consistently that most students choosing a career in agriculture do so because of connection to agriculture through family or school influences. That connection to agriculture is in decline through demographic changes; 85% of Australians now live within 50km of the coast and are isolated from the main agricultural industries. That contrasts with demographic distribution in 1944 and earlier when most of the population lived in rural areas. The only connection to agriculture for most current students is the exposure in schools, particularly in agriculture subjects.

When student numbers decrease, schools find it harder to justify resourcing the subject properly (Dodd, 2011; Parliament of Victoria, 2012) thereby leading to a downward spiral of even fewer total enrolments. A complication is the severe shortage of agriculture teachers, who are themselves agriculture graduates. The inability of schools to recruit these teachers increases the risk of agriculture being culled in favour of some other discipline where teacher recruitment is easier. Any decline in agriculture enrolments at a secondary school level is likely, in turn, to contribute to decreased uptake of agriculture-related degrees at university level.

The size and trends of this pipeline in satisfying demand for university agriculture graduates need to be understood so that remedial options are explored and implemented. There has been no detailed study of the performance of secondary school agriculture courses in the decade following the Reviews. It is recognised that agricultural studies provision differs between jurisdictions and so this paper compares the offerings and their student completions over the period 2012 to 2022. The questions to be explored include:

1. What are the trends in course contents and respective career pathways?
2. Have the course offerings in agriculture and horticulture across each state/territory of Australia helped increase the supply of students to university study and then to industry as qualified personnel?
3. Do those states with reduced availability of agriculture courses in the early years of high school show lower enrolments in senior years due to the lack of continuity and later engagement with the subject?

Methodology

Aim

This paper uses a quantitative approach, employing a descriptive research method through secondary analysis of existing public data (Clark et al., 2021). The aim is to provide a 'stocktake' of secondary agricultural enrolments across Australia over the recent decade 2012-2022. Such analysis has not previously been undertaken on a state-by-state basis in a single study. Given the differing population sizes and agricultural production levels in each state across Australia, comparisons with both state population and state value of agricultural production in AUD billion are evaluated as part of the analysis for this paper.

Data sources

Data were obtained from state education authorities specifically responsible for school curriculum and assessment. Authorities include:

- New South Wales Education Standards Authority (NESA),
- Victorian Curriculum and Assessment Authority (VCAA),
- Queensland Curriculum and Assessment Authority (QCAA),

- South Australian Certificate of Education Board (SACE),
- Western Australian School Curriculum and Standards Authority (SCSA),
- Tasmanian Assessment, Standards and Certification (TASC),
- Australian Capital Territory Board of Senior Secondary Studies (ACT BSSS)
- Northern Territory Board of Studies (NTBOS)

Due to low or no enrolments, Tasmanian, Australian Capital Territory and Northern Territory numbers are not included in graphs, although courses offered in those jurisdictions are included in Table 3 and enrolment numbers are included in national totals where applicable.

Schools' data were obtained from publicly accessible websites and archives of these curriculum authorities and were biennial for the period 2012-2022 (inclusive). All agriculture and horticulture-related courses, both academic and vocational in nature, were included.

State population data and total value of agricultural commodities produced by each state, for the period 2012-2022 (inclusive), were obtained from publicly accessible website and archive of the Australian Bureau of Statistics. For population comparisons, Year 12 student completions were compared with population data from the December quarter of that same year (i.e. Year 12 2022 completions corresponded with December 2022 population data for that state). Comparisons between Year 12 student completions and agricultural commodity value for each state corresponded with the subsequent financial year data, given school data were for a calendar year, and commodity value is reported by the Australian Bureau of Statistics in financial years, July to June (i.e. Year 12 student completions from 2022 were compared with agricultural commodity values of each state from 2022/23 financial year). For both population and production value comparisons, Year 12 student completions were a combined total of all agriculture/horticulture courses offered in that state.

Data Analysis

Both descriptive analysis and trend analysis were performed using Microsoft Excel (version 16.91, MacOS). For descriptive analysis, total enrolments in each course in each state are graphed to offer comparison between states and biennial changes over the period 2012-2022 (inclusive). A national total is presented as the sum of all enrolments in all courses offered to Year 12 students in all states and territories of Australia. Importantly, it is noted that in states offering two or more courses in agriculture/horticulture, students can enrol in more than one of these courses. Hence total numbers are not indicative of unique individuals but rather the number of completions of that course.

Given the differing populations of states, the comparison of Year 12 completions to population of each state evaluates the relative strength, or weakness, of enrolments in different jurisdictions of Australia.

Trend analysis was also performed by means of linear regression and on some graphs the equation of the trendline ($y = mx+b$) is displayed, providing an estimate of slope (m) and the coefficient of determination (R^2) which explains the proportion of the variance of the dependent variable y that is explained by the independent variable x, b being the intercept. R^2 values range from 0 to 1 and are commonly expressed as a percentage, although in these graphs appear as a 0 to 1 figure. An R^2 closer to 1 suggests the trendline is a strong fit with the annual data, whilst a R^2 closer to 0 suggests a weaker fit with the annual data. Therefore, those trendlines with an R^2 value closer to 1 show clearer and more predictable enrolment patterns, whether it be increasing or decreasing. It is noted that a large range of variables impact enrolments in secondary subjects, such as gender, socio-economic status, educational and career aspirations, influence of peers and value placed on a subject (Jeffries, 2019). Whereas year to year differences may be difficult to interpret, longer term trends appear clearer and likely reflect the relative strengths or

weaknesses of each state's individual approach to offering agricultural education in secondary school.

Data used are limited to the most recently published biennial data up to and including 2022. Given the data are public, anonymised and published by curriculum authorities in each state, no ethical considerations occur.

Results

National Perspective on Student Completion Rates

Secondary education in Australia is primarily the responsibility of each State and Territory Government which regulates the public and private (including faith-based) schools within its jurisdiction; and oversees course accreditation, student assessment and awards for all schools (Australian Government, 2022).

State governments, and their relevant curriculum authorities, determine which subjects their students study and the associated curriculum to follow. What then have been the trends and impacts in the school systems?

In 2008, state, territory and federal governments in Australia agreed to the concept of a national Australian Curriculum in schools. The curriculum, initially released in 2010, aimed to create common outcomes for all students across the nation. Initially, this focused on core subjects such as English, Mathematics, Science and History in younger year groups, *i.e.* from Foundation (Kindergarten) to Year 10 (Australian Curriculum, Assessment and Reporting Authority, 2015). This was extended to include those four subject areas to Years 11 and 12 level and included Geography from 2013. This national curriculum initiative has led to numerous 'food and fibre' related outcomes appearing across the Science, Technology and Geography syllabi from Foundation to Year 10 and within diverse teaching subjects in any given state or territory. Despite these outcomes, there is flexibility as to what examples are used to deliver the curriculum and, as most non-agriculture teachers have little or no experience and interest in agriculture, other examples are used. The Primary Industries Education Foundation Australia continues to provide educational materials for teachers (teachers' guides and lesson plans) across the range of subjects offered in schools from Foundation to Year 12. It also has professional development programs for all teachers (www.piefa.edu.au/education-resources and www.primezoneacademy.edu.au).

Despite this move towards a national curriculum, 'Agriculture', or specific 'food and fibre' subjects, vary widely throughout Australia reflecting state and territory autonomy in education (Table 3). Only one state, New South Wales, offers an agriculture-specific subject prior to Year 11, while options in the subject area for students in Years 11 and 12 have fluctuated in availability and enrolments over time.

Given the vastly different course offerings available in each state, and even amongst different schools within some states / territories without a central year 7-10 curriculum, the question arises as to what effect this has on enrolments in senior secondary years.

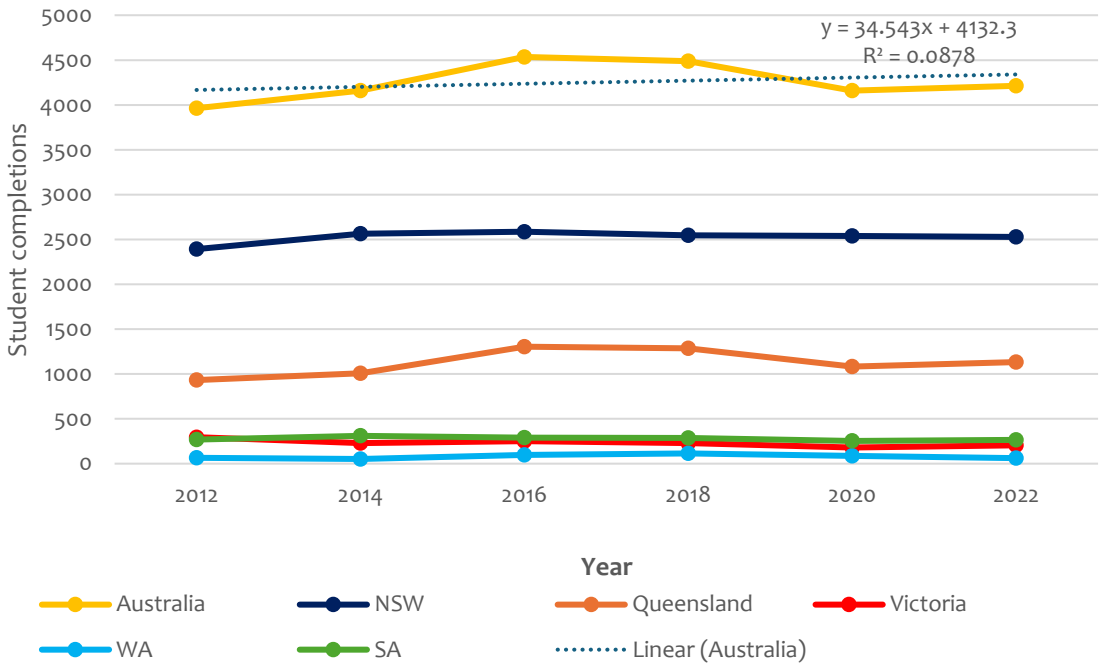
A study of total completions (Figure 1) in Year 12 Agriculture or Horticulture courses in Australia over the period 2012 to 2022 fails to show such progression. Numbers have flat-lined at an historical low, with no clear sign of improvement (nor significant decline) with the equation of the trendline ($y = 34.543x + 4132.3$) indicating an increase of only 34.5 students per two-year period. Nationally, the data vary from 3,963 to 4,535 annually over the period of study. Noticeable is the substantial influence of New South Wales which consistently supplies more than half and up to 61%, of those completions. Queensland is also a strong contributor with 1000 to 1300 student completions, whereas South Australia and Victoria deliver 100-300 and Western

Australia around 60-90. Tasmania, The Northern Territory and the Australian Capital Territory together contribute very few.

Table 3. ***Agriculture/Horticulture Subjects Offered From Years 7-12 in Each Australian State/Territory (NESA, 2022b; QCAA, 2022b; VCAA, 2022b; SCSA, 2022b; SACE, 2023; ACT BSSS, n.d.; TASC, 2022b)***

STATE	Years 7-10	Years 11-12
New South Wales	Agricultural Technology (Year 7-10) (optional) Technology Mandatory (Year 7-8) (compulsory subject which includes agriculture and food / fibre component) Food / fibre related content from Australian Curriculum incorporated in other subjects (*e.g.* Geography, Science)	Agriculture (optional) Primary Industries (optional)
Victoria	No state-wide standalone agriculture/ horticulture subjects	Agricultural and Horticultural Studies (optional)
Queensland	Schools can develop their own elective subjects to suit their context / community, and this can include agriculture Food / fibre related content from Australian Curriculum incorporated in other subjects (*e.g.* Geography, Technologies in food and fibre context)	Agricultural Science (optional) Agricultural Practices (optional)
Western Australia		Agribusiness (optional) Agricultural Science and Technology (optional)
South Australia		Agriculture (Year 11 optional) Agricultural Systems (Year 12 optional) Agricultural Production (Year 12 optional)
Tasmania		Agricultural Systems (optional) Agricultural Enterprises (optional)
Australian Capital Territory		Agriculture A/M (optional) and Agriculture A/T/M from 2023 Horticulture C (optional) and Horticulture A/M/V from 2023
Northern Territory		Agricultural Systems (optional) Agricultural Production (optional) NOTE: Northern Territory follows the South Australian curriculum

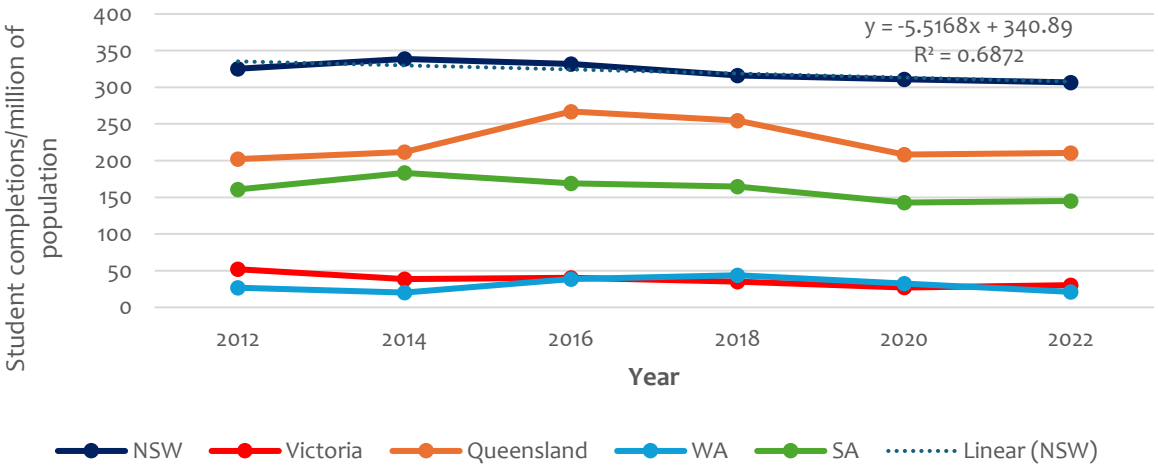
Figure 1. ***Total Completions by State and Nationally from Year 12 Agriculture/Horticulture Subjects, 2012-2022 (NESA, 2022a; QCAA, 2022a; VCAA, 2022a; SCSA, 2022a; SACE, 2022; ACT BSSS, 2022; TASC, 2022a).***



Note: Tasmania, Northern Territory and Australian Capital Territory numbers were negligible and are not included as individual states, but included in national total

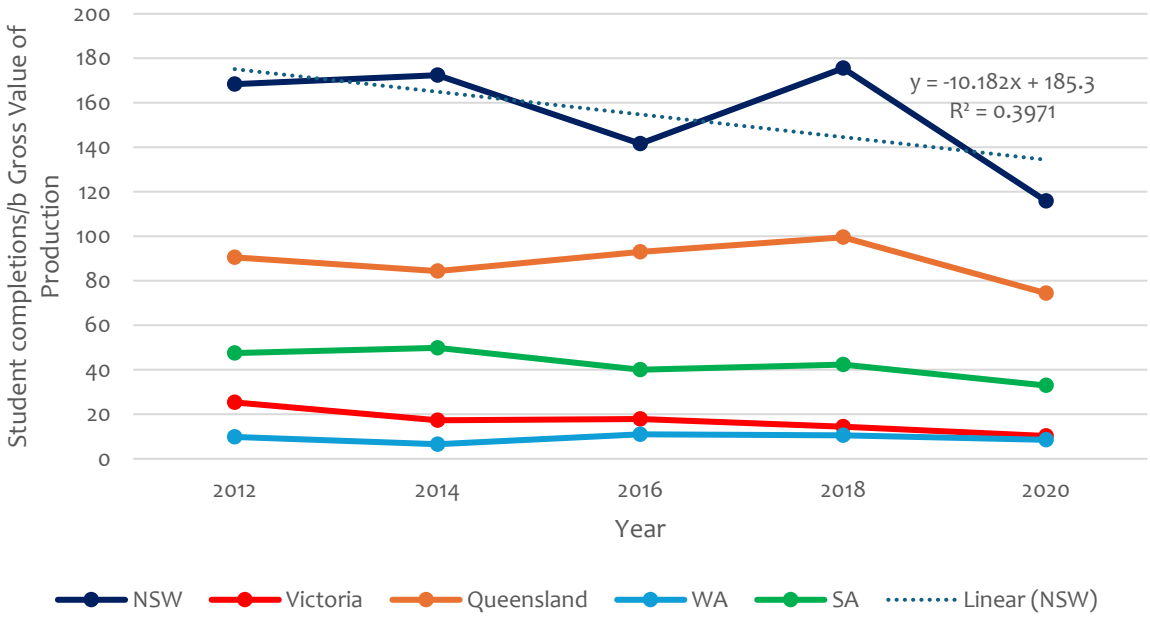
Student completions might be expected to relate to population of each state. Given that the population varies considerably between states, with New South Wales and Victoria being much larger in population than the other states, other metrics might be more insightful. Student completions per million of state population allows for that discrepancy (Figure 2) while completions per billion dollars of agricultural production (Figure 3) allows for variability in geography, including climate.

Figure 2. Total Year 12 Agriculture / Horticulture Completions by State per Million of Population, 2012-2022 (ABS, 2024; NESA, 2022a; QCAA, 2022a; VCAA, 2022a; SCSA, 2022a; SACE, 2022; ACT BSSS, 2022; TASC, 2022a).



Note: Tasmania, Northern Territory and Australian Capital Territory not included due to low numbers of completions.

Figure 3. ***Total Year 12 Agriculture / Horticulture Student Completions by State per AUD Billion Gross Value of Production of Agricultural Commodities Produced by State, 2012-2020 (ABS,2022; NESA,2022a; QCAA,2022a; VCAA,2022a; SCSA,2022a; SACE,2022)***



Note: Tasmania, Northern Territory and Australian Capital Territory not included in figure due to low completions. Production Value reported by the Australian Bureau of Statistics is for financial year whereas completion data are for calendar year i.e. comparisons are, for example, 2020 Completion Numbers Relative to 2020/21 Financial Year Production Value. The Australian Bureau of Statistics ceased publishing this data in 2022.

Relative to population, New South Wales remains the highest in completion rates at 307 to 339 per million of state population. Queensland, with a completion rate around 202 to 267, and South Australia, with 143 to 183, are strongly comparable whereas Victoria and Western Australia, both significant agricultural production states, have completion rates only around 20-50 graduates per million of population. Population data used are provided in Appendix 1. This shows there is a high variance amongst states in terms of Year 12 Agriculture/Horticulture completions produced relative to population. Overall, only Queensland had a higher ratio of students per capita completing Year 12 Agriculture courses in 2022 compared with 2012. All other states / territories (excluding Tasmania which had no senior syllabus or completions in 2012) generally trended downwards in completions per population over the period 2012-2022, finishing 2022 with fewer students per capita than in 2012. The slope of the trendline of New South Wales completions (y = -5.5168x + 340.89) indicates a decline of 5.5 students per million of population every two years.

Consideration of Year 12 student completions relative to the state Gross Value of Production in agriculture over the similar period 2012-2020 (Figure 3) produces the same rankings as those per population. New South Wales (116-180 completions), Queensland (74-100 completions) and South Australia (40-50 student completions) are substantially higher than those in the other states per AUD billion Gross Value of Production (i.e. Victoria 10-25; Western Australia 7-11: Tasmania 9-15 student completions). The Northern Territory and the Australian Capital Territory are not considered here due to negligible student completions in secondary agriculture. Gross Value of Production data used are provided in Appendix 2. By this measure, all states and territories trended downwards in Year 12 Agriculture course completions per AUD billion agricultural Gross Value of Production over the period 2012-2022, and all finished lower on this measure in 2022 than in the year 2012 (excluding Tasmania which had no completions in 2012). The slope of the

trendline of completions in the largest state, New South Wales (y = -10.182x + 185.3) indicates a decline of 10.2 students per AUD billion of Gross Value of Production every two years.

What are the Agriculture Course Provisions in Secondary Schools in Each State and Territory?

New South Wales. Agriculture/food and fibre-related content is included in several subjects in New South Wales schools. In addition to the Australian Curriculum content which is offered from Foundation (Kindergarten) to Year 10, *all* Year 7-8 students in New South Wales complete a mandatory context known as 'Agriculture and Food Technologies' in the Technology Mandatory course. This equates to approximately 50 hours of relevant content during those years (NSW Education Standards Authority, 2022b).

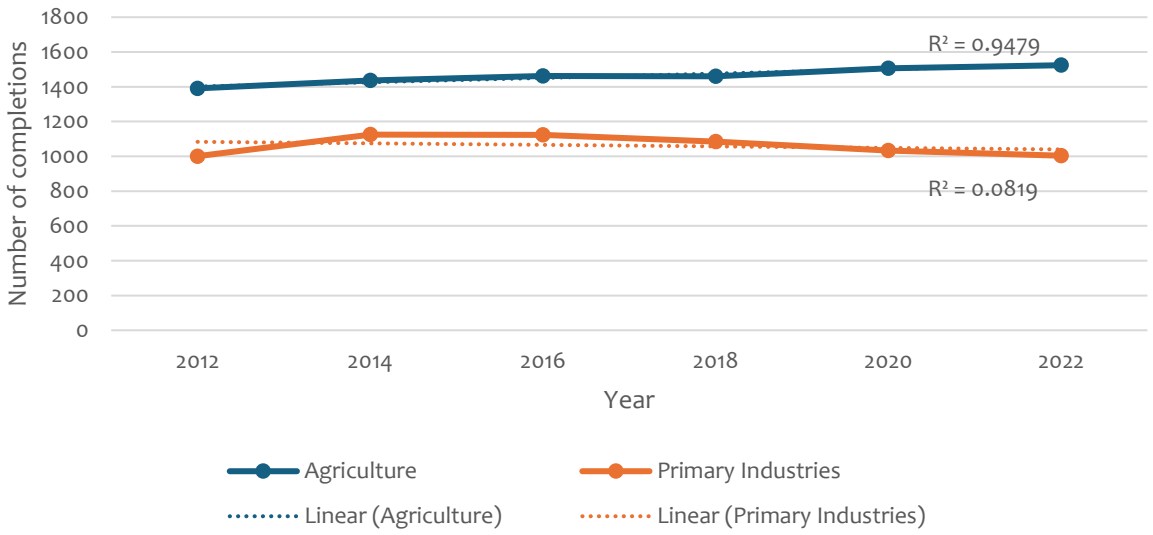
Additionally, New South Wales offers a stand-alone subject in Years 7-10 called 'Agricultural Technology' which students can choose, in addition to the 'Technology Mandatory' subject, in schools that offer it. This acts as an ideal springboard to encourage students to continue agricultural studies into Years 11 and 12.

In Years 11 and 12, two agriculture-related subjects are offered in New South Wales. 'Agriculture Stage 6' (henceforth referred to as 'Agriculture') is the larger subject by enrolment and is the more academically focused. It has a compulsory Higher School Certificate external examination and contributes towards an Australian Tertiary Admissions Rank (ATAR) if students opt to receive one. Students who aim to attend university are more likely to study 'Agriculture' than 'Primary Industries' for the Higher School Certificate.

Alternatively, 'Primary Industries' is a Vocational Education and Training (VET) subject that offers competency-based assessment throughout the subject. An optional HSC external examination can contribute towards an ATAR if students are receiving one. 'Primary Industries' is aimed at students who may take up 'on-farm' roles, given its practical basis and assessment by competency. Students later may go to Technical and Further Education colleges (TAFE) and/or directly into the workforce. In some schools, 'Primary Industries' can result in students attaining Certificate I, Certificate II or Certificate III qualifications. Students can choose to study both 'Agriculture' and 'Primary Industries' if they wish and if available. New South Wales also has a significant distance education program with more than five distance education schools offering secondary agriculture, such as Dubbo School of Distance Education and Sydney Distance Education High School. These allow students who cannot physically access school, or who attend a school in-person where Agriculture is not offered, to study Agriculture.

'Agriculture' consistently has had higher enrolments than 'Primary Industries' with approximately 1,391 to 1,524 students completing annually during the period 2012-2022 (Figure 5). This has remained steady, although at an historical low. 'Primary Industries', which was first offered in 2001, has also remained steady at approximately 1,000 completions per year over the period 2012-2022. This figure includes both those who choose to take the optional Higher School Certificate examination, and those who do not.

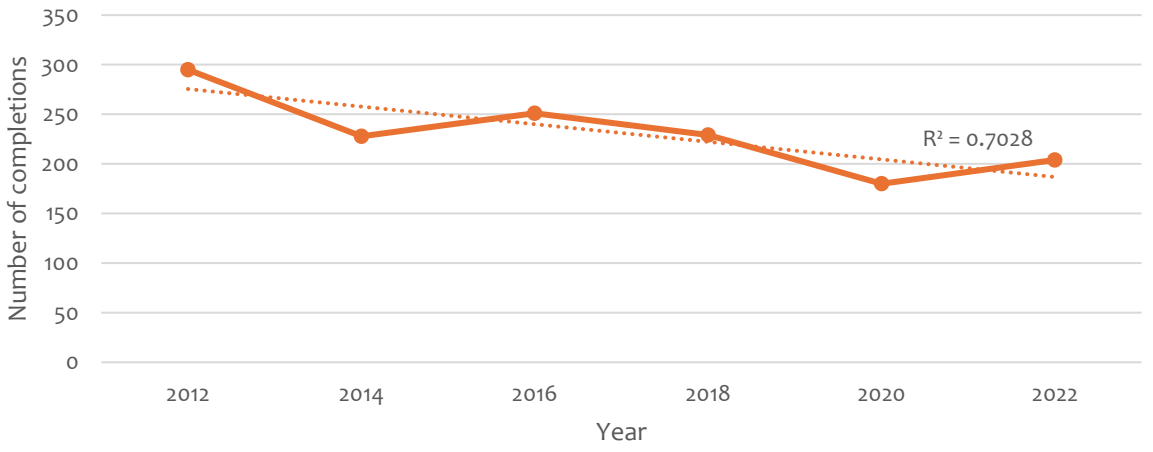
Figure 5. ***Total Subject Completions in New South Wales from Year 12 Agriculture and Primary Industries Subjects, 2012-2022 (NESA, 2022a)***



It appears that the significantly higher enrolments per capita and per AUD billion Gross Value of Production in New South Wales (Figure 3) relate to the additional educational opportunities offered in that state. Both the mandatory content in Years 7/8 and the state-wide agricultural curriculum in Years 7-10 are unique amongst the states. This is worthy of further investigation.

Victoria. The second largest state by population in Australia is at times the leading state for total annual value of agricultural commodities produced (Appendices 1 and 2). In public education, however, it offers no state-wide standalone food/fibre specific subject before Year 11 and only one food / fibre related subject in Years 11-12. This subject has had low enrolments and a declining number of student participants in the recent decade (Figure 6), from 295 in 2012 to a low of 180 in 2020 and 204 in 2022. Prior to Year 11, food/fibre content is taught within several subjects via Australian Curriculum content. Vocational qualifications such as Certificate II in Agriculture and in Horticulture can also be obtained via some schools in Victoria.

Figure 6. ***Total Completions from Year 12 Agricultural and Horticultural Studies Subject in Victoria, 2012-2022 (VCAA, 2022a)***



This situation continues to occur despite the Inquiry by The Parliament of Victoria (2012) into Agriculture Education and Training. The Inquiry noted a 31% decline in students over the prior

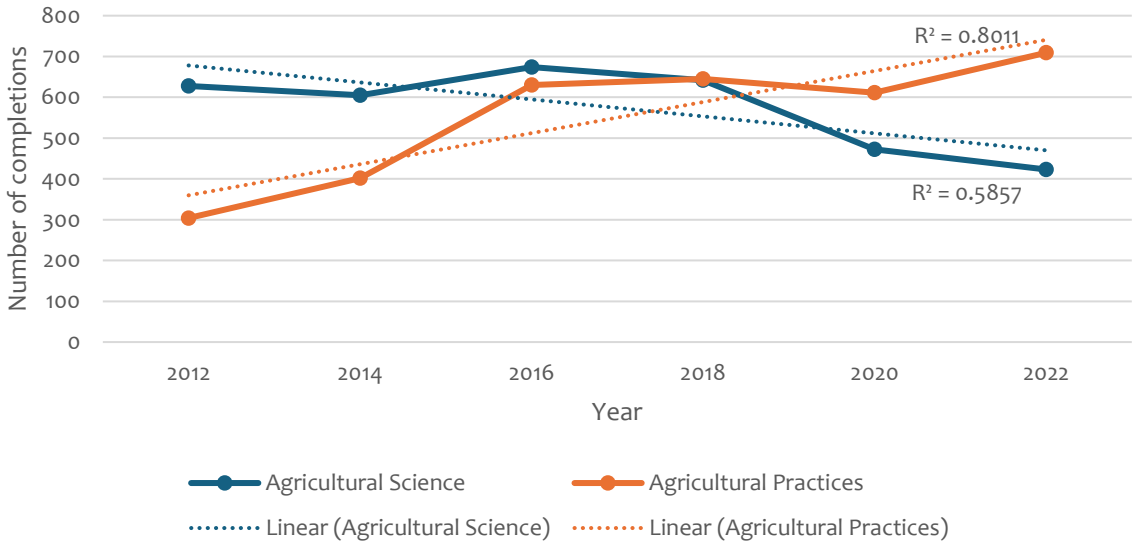
period, from 2002-2010 and considered this low enrolment as a likely cause for the low uptake of university-level agriculture-related courses.

Queensland. This state has the third largest population in Australia and regularly is second- or third-ranked in total annual value of agricultural commodities produced. Its output is significant (Appendices 1 and 2).

As with all other states in Australia excluding New South Wales, there is no state-wide stand-alone food/fibre specific subject before Year 11 in Queensland public schools. Related content at this stage is from the Australian Curriculum and infused through several subjects. In Years 11-12, two subjects are offered for senior students. 'Agricultural Science' is an academic-focused offering, categorised as a *General* subject, typically for those students with a post-school pathway that involves higher education. The second subject is known as 'Agricultural Practices' and is categorised as an *Applied* offering, a practical school-based program, typically targeted towards students who might attend TAFE and/or take up farm production work.

'Agricultural Science' has had annual enrolments previously around 500-600, although this has trended downward to 423 students in 2022 (Figure 7). Interestingly, and differently from New South Wales, the vocational production-focused subject, 'Agricultural Practices', in recent years has overtaken the academic subject of 'Agricultural Science' for total completions. In 2022, 709 students completed the vocational subject whereas only 423 completed the academic-focused subject, an apparent long-term shift. This occurrence raises interesting questions as it is opposite to the New South Wales experience, where the academic 'Agriculture' course dominates.

Figure 7. ***Total Completions from Year 12 Agricultural Science and Agricultural Practices Subjects in Queensland, 2012-2022 (QCAA, 2022)***

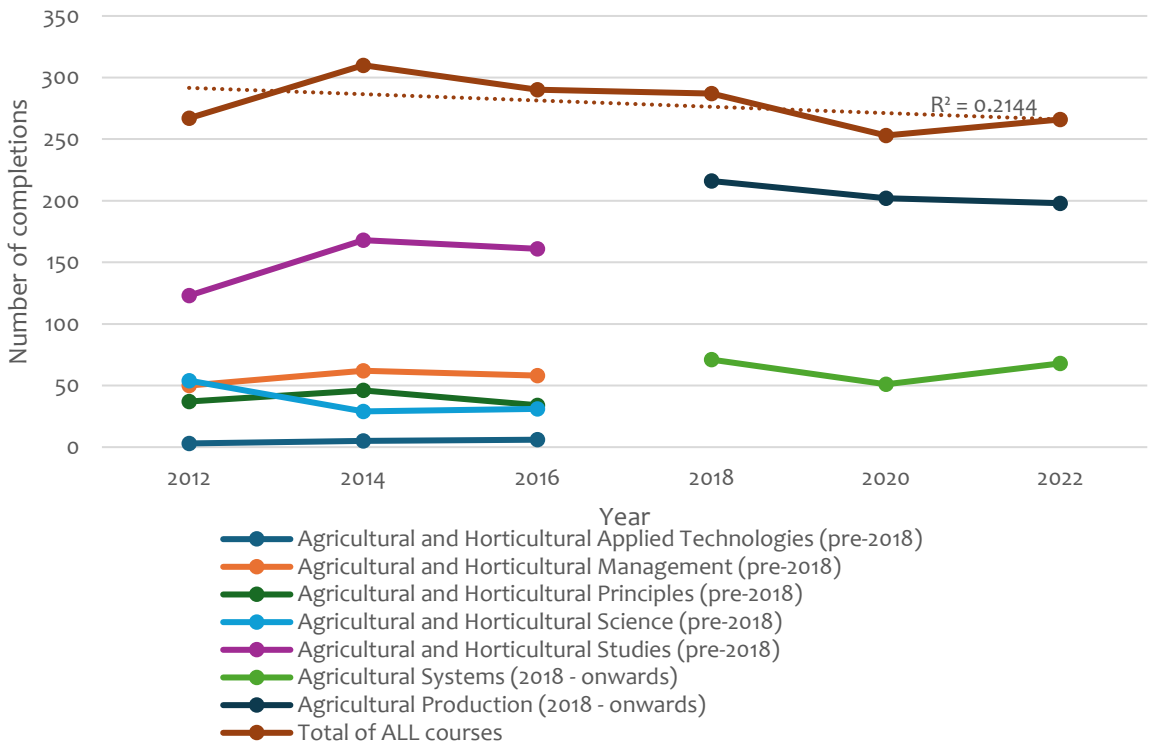


The state at times is equal highest with New South Wales in agriculture students per million population (Figure 2), and a clear second in terms of agriculture students per AUD billion production (Figure 3). Prior to 2019, Year 12 subjects were examined internally within schools in Queensland. External examinations were introduced from 2019 onward.

South Australia. Over the period 2012-2022, South Australia has had the highest agricultural commodity production in dollar value per capita of any state or territory in Australia (Appendices 1 and 2). In common with states other than New South Wales, there is no public state-wide specific food/fibre subject offered prior to Year 11 (Table 3). Approximately 65 schools offer agriculture as a standalone subject in Years 7-10 in the state, whereas others embed content within another subject such as Science. However, these Year 7-10 agriculture subjects are not

uniform state-wide, are created as bespoke subjects by individual schools to suit local contexts and communities and are based on a South Australian suggested scope and sequence, with sample food and fibre units of work also provided state-wide. Agriculture-specific subjects are offered in Years 11-12. In 2017, five previous subjects were transformed into two new subjects, 'Agricultural Systems' and 'Agricultural Production'. Total enrolments have remained reasonably steady across the period 2012-2022, peaking at 310 in 2014 and down to 266 in 2022 (Figure 8).

Figure 8. ***Total Completions From Year 12 Agriculture Subjects in South Australia, 2012-2022 (SACE Board, 2022)***



Note. Subject offerings changed from 2018 onwards, but totals of all available courses also shown for full period

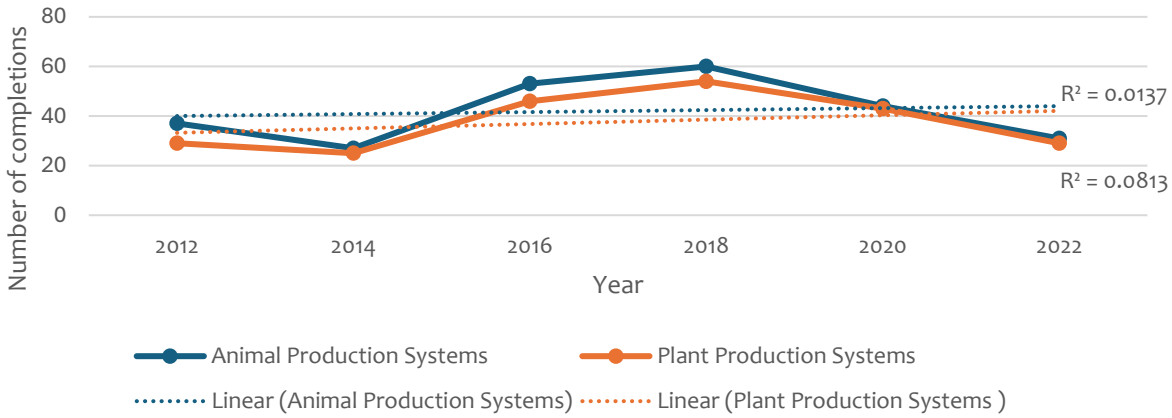
Students can also elect to complete certificates in vocational agriculture through Registered Training Organisations. These are mostly conducted externally to schools at the same time as students are completing their Leaving Certificate. Provision is made to have the subject count towards the Leaving Certificate.

Western Australia. As with most other states, there is no state-wide standalone specific food/fibre subject offering before Year 11 in Western Australia (Table 1). Some agriculture-related content is delivered within the food and fibre context of the 'Design and Technology' subject from Foundation to Year 10. Agricultural education in Western Australia is provided through its Western Australian College of Agriculture which comprises five residential school campuses at Cunderdin, Denmark, Harvey, Morawa, and Narrogin. Each campus is located on a commercial-sized farm. Such education is provided in Years 10, 11 and 12 where vocational qualifications can be obtained. In Years 11-12, two subjects, 'Animal Production Systems' and 'Plant Production Systems', are offered for senior students. Many, although not all, students undertake both subjects simultaneously and both can contribute to a student's ATAR.

Both metrics, *i.e.* Year 12 'Agriculture' completions per capita (Figure 2) and per AUD billion of production (Figure 3), place Western Australia towards the bottom of jurisdictions in Australia.

The completions from both subjects combined have fluctuated from a low of 52 in 2014 to 114 in 2018 (Figure 9) and then to 60 in 2022.

Figure 9. ***Total Completions of Year 12 ATAR-eligible Animal Production Systems and Plant Production Systems Subjects in Western Australia, 2012-2020 (SCSA, 2022)***



A curriculum review of the ATAR Animal and Plant Production subjects was undertaken in 2022 leading to the development of two new optional ATAR-eligible subjects, 'Agribusiness' and 'Agricultural Science and Technology' (SCSA, 2022b). These are offered in addition to the 'Animal Production' and 'Plant Production' subjects which have been retained as ATAR-ineligible *General* courses.

Tasmania. This state does not have a state-wide specific standalone food/fibre subject prior to Year 11 (Table 3). The state introduced 'Agricultural Systems' for senior students in Year 11-12 with the first leaving examination in Year 12 in 2017. Completions in the subject were 25 in 2018 and 20 in 2022 (TASC, 2022a). 'Agricultural Enterprise Level 2' is also offered "providing learners with an introduction to agriculture and developing enterprise skills and knowledge which position them to undertake entry-level positions or to undertake further study in the field" (TASC, 2022b). This subject does not include an external leaving examination with published enrolments and hence is not included in data provided.

Vocational education pathways are encouraged in schools to a greater extent than are external examination-based subjects such as 'Agricultural Systems'. As with other states, lack of suitably qualified agriculture teachers is a limiting factor as to where the subject can be offered.

These limited data place Tasmania among the lowest states/territories for Year 12 agricultural completions per capita (Figure 2) and per AUD billions of agricultural commodities produced (Figure 3).

Australian Capital Territory. With a small population, minimal land area and low total value of agricultural production relative to other states and territories (Appendices 1 and 2) it is not surprising that the Australian Capital Territory only has a small number of students studying secondary agriculture. One school in the Australian Capital Territory offers the New South Wales Higher School Certificate as their Leaving Certificate rather than the Australian Capital Territory's Senior Secondary Certificate, and as such, some students in Australian Capital Territory schools may be reflected in New South Wales figures for those studying agriculture subjects. Given the small number, there is significant fluctuation in student numbers completing the 'Agriculture A/M' and 'Horticulture C' courses each year in Year 12 in Australian Capital Territory schools. An 'A' course is a mainstream course for most students in Years 11-12, whilst an 'M' course is designed for those students who satisfy intellectual disability criteria. 'C' courses are accredited vocational education and training programs for Years 11-12 students and are assessed by Registered Training Organisations (ACT BSSS, n.d.). The 'Agriculture A/M' course has not offered

the opportunity for results in 'Agriculture' to contribute to the ATAR but has prepared students to access other pathways. In 2012, 11 students completed, with 5 in 2016 and none in 2014, 2018 or 2020. In 2022, 4 students complete the course (ACT BSSS, 2022). The agricultural offerings in the Australian Capital Territory were reviewed in 2022 followed by publication of a new curriculum, which now includes a T pathway to prepare students for higher education. This allows students to include the subject in the calculation of their ATARs.

Northern Territory. Agriculture in the Northern Territory follows the South Australian curriculum for the subject. The Year 12 leaving examination also follows that from South Australia. Whilst there was a small enrolment in the subject in 2020 in the Northern Territory, there were no known enrolments prior to this.

Discussion and Conclusion: Where to From Here?

Three substantial reviews into agricultural education and training (Australia - The Senate, 2012; Victoria - Parliament of Victoria, 2012; Pratley, 2013) coincided in their timing at a watershed moment in agricultural education due to historically low university enrolments in agriculture. However, data presented in this research have shown that student completions in agriculture-related courses at the end of secondary schooling in each state of Australia have flatlined. Key measures of completions, such as per capita (except for Queensland) or per AUD billion agricultural Gross Value of Production, have declined in all states of Australia.

There is, and has been for several decades, an urgent need to increase the number of graduates from agriculture-related university degrees to fill the jobs gap in the professional agriculture sector. It follows, given that secondary agriculture students potentially represent an important pipeline for the university courses, that more students are needed studying agriculture-related subjects at secondary school level. Smith (2022) found that 52% of students undertaking an agriculture-related degree at Charles Sturt University had studied agriculture in either Years 11 or 12, a significant proportion. Yet, the data on school intakes and completions infer that recommendations of the Reviews remain unactioned or have not worked their way through the system. The desired increase in the supply of students through secondary into tertiary courses and ultimately the trained workforce remains a challenge in a sector which struggles to attract enough skilled workers.

The questions raised from this scenario then include:

- Why have completion numbers not improved since these wide-ranging reviews? Have governments and industry done their parts to meet the recommendations?
- Given the slow-moving nature of government decision making and curriculum change, is more time than a decade needed to see effectual change?

The data clearly show that New South Wales has a substantially higher population of secondary agriculture students than any other state. It has proportionally higher enrolments and completions when based on population or state Gross Value of Production. It is also the only jurisdiction that has formal agricultural education prior to Years 11 and 12 and so secondary students have the opportunity of perhaps 2 to 6 years of developing agricultural literacy, including up to 4 years prior to their senior years, that enables them to evaluate career opportunities in agriculture. As such opportunity is not afforded students in other jurisdictions, or in schools that do not offer agricultural studies, the consideration of agriculture as a career is reduced or denied.

Kovar and Ball (2013) describe the United States rise in urbanisation over time as the basis for loss of agricultural literacy, leaving the future of its agriculture in smaller and smaller proportions of the population. This scenario is mirrored in Australia although to greater extent. Prior to 1944, around half the Australian population lived outside the capital cities in relatively close contact

with agricultural production. Agricultural literacy was likely much higher for the agriculture practised at that time than currently exists for contemporary agriculture. By 2011, 66% of the Australian population resided in the capital cities, rising to 68% in 2022. Importantly, 90% were in urban populations (ABS, 2024), with 85% living within 50km of the coastline, that is, away from the direct influence of agriculture.

In 2023, there were 257,000 people employed in agricultural production (Australian Bureau of Agricultural and Resource Economics and Sciences, 2024), of whom greater than 80% lived in regional areas. It is this population that is agriculturally literate. However, because of the disproportionate distribution of the population, most students (in New South Wales 67% - NESA, 2022a) live in the capital cities away from agriculture. Preliminary studies (Pratley, 2025) show that about two-thirds of university agriculture students are from private schools, around half of which are based in capital cities. Many of these students are boarders from regional areas of agriculture and so bring their agricultural literacy with them. However, metropolitan students in general are the largest group of students in Australia, but they appear to be the most untapped when it comes to their potential for the agriculture sector in this nation. The challenge then is to find ways to increase these students' interests in agriculture.

The issue is not just about students. Studies have shown that the most important influences on student subject selection and career choice are their schoolteachers and family members (Barber & Pratley, 2016; Primary Industries Education Foundation Australia, 2020). Inadequate agricultural literacy extends to the adults in these communities, including many teachers, and they will be advising students on their choices. The challenge for agriculture is to interest these communities located away from agricultural practice and help to improve their agricultural literacy. The issue of responsibility for building agricultural literacy remains confusing. There has been very little involvement by off-farm agribusiness where most professional employment opportunities exist. Consequently, most students equate agriculture with farming rather than agribusiness and, as they have no farm connections, they dismiss careers in agriculture as an option. It is incumbent on agribusiness to accept the responsibility of career promotion in its sector and invest time and funds into generating its future workforce. This has been explored by Pratley et al. (2022).

Emerging from this study are several challenges:

- The need to increase the number of schools who offer agricultural education. In states other than New South Wales, this means agricultural study opportunities in the earlier secondary school years, including a mandated 'Agriculture and food' component as occurs in New South Wales schools. It follows that there will need to be urgent attention to attract more teachers of agriculture to be trained.
- Principals need to ensure that Agriculture as a subject is elevated in status and expectation in schools and not be just a repository for low ability and disinterested students. There needs to be recognition in schools that the nature of agriculture has changed extensively and is now a very strong Science, Technology, Engineering, and Maths (STEM) subject highly dependent on science, technology, finance and engineering. Agricultural subjects need to explore the technology advances in the sector as a way of increasing interest but also changing perceptions towards a modern, technology-led industry sector.
- Agricultural teachers and industry need to engage with the community and colleagues to raise the level of interest and understanding of agriculture to the adult communities, particularly parents. It can be done as demonstrated by Graham (2021).
- Attention needs to be given to the perception or reality of the social inequity of the academic course for the Australian Tertiary Admissions Rank.

The current attitude is to promote agriculture to the agriculturally literate proportion of the community. While that is important to continue, it will deliver more of the same and university graduate numbers will remain inadequate. Change in the trajectory of agricultural enrolments

and completions at secondary school and at tertiary level necessarily will involve addressing these challenges, particularly in respect of the previously ignored metropolitan people.

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Appendices

Appendix 1. ***Total Value (AUD) of Agricultural Commodities Produced by Australian State per Financial Year (ABS 2022)***

Total value of agricultural commodities produced by state (nearest AUD million)					
	2012/2013	2014/15	2016/17	2018/19	2020/21
NSW	12,128	12,125	14,501	11,679	18,010
Victoria	11,631	13,144	14,016	15,886	17,542
Queensland	10,300	11,939	14,014	12,928	14,553
WA	6,690	7,922	8,991	10,750	10,201
SA	5,621	6,215	7,230	6,781	7,682
NT	479	835	610	759	746
ACT	9	8	11	9	9
Tasmania	1,190	1,438	1,470	1,637	2,113
TOTAL	48,048	53,625	60,842	60,430	70,856

Appendix 2. ***Estimated Resident Population by State in December Quarter of Each Year*** **(ABS 2024)**

Estimated resident population of each state in December quarter						
	2012	2014	2016	2018	2020	2022
NSW	7,353,189	7,562,171	7,793,277	7,992,853	8,084,192	8,238,800
Victoria	5,709,586	5,957,512	6,233,980	6,473,672	6,563,465	6,704,300
Queensland	4,611,304	4,747,263	4,884,196	5,051,610	5,191,354	5,378,300
WA	2,457,489	2,528,619	2,570,426	2,640,114	2,731,729	2,825,200
SA	1,663,082	1,693,107	1,720,224	1,758,014	1,796,955	1,834,300
NT	238,728	242,753	246,502	247,437	249,163	250,100
ACT	379,812	391,981	409,886	435,538	451,431	460,900
Tasmania	511,813	514,040	522,783	546,583	565,557	571,600
TOTAL	22,928,023	23,640,331	24,385,879	25,150,532	25,638,652	26,268,400