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Jim became Foundation Dean of the Faculty of Science and Agriculture at Charles Sturt University in 1990 and held that position for 16 years. Upon retiring from the deanship he was accorded the title of Emeritus Professor. He was subsequently appointed as Research Professor of Agriculture at Charles Sturt University, a role he currently holds part-time.

Positions held include President of the Australian Society of Agronomy and Vice-President of the International Allelopathy Society and he has served on the Boards of four Cooperative Research Centres. He currently holds appointments on the New South Wales Primary Industries Ministerial Advisory Council, the Expert Panel on Extension and Outreach for the Carbon Farming Futures in the Federal Department of Agriculture, Fisheries and Forestry (DAFF) and the Research Advisory Committee of the Australian Farm Institute. He is Secretary of the Australian Council of Deans of Agriculture.

He has published more than 70 research papers and more than 70 conference papers on aspects of agronomy including conservation farming, allelopathy, herbicide resistance and weed biology. He has also edited three books and written ten book chapters. He is the recipient of the international Molisch Award for research excellence in allelopathy and the Council of Australian Weed Societies (CAWS) Medal for Leadership.
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EXECUTIVE SUMMARY

This Review was initiated because of concern about the shortage of young people choosing careers in agriculture. It follows parliamentary enquiries federally and in Victoria, and looks specifically at the situation in New South Wales. However, it can be expected that at least some of the matters raised have application nationally.

There needed to be a context for the Report and so a vision statement was drafted that assumed that the agriculture sector was ambitious and wanted to capitalise on the opportunities created by global food security and developments in Asia. The Review was then able to focus on improvements across the scope of the investigation.

The particular issue was concern about the inability of the agricultural sector to attract new people, particularly young people. This required the Review to look more closely at the community perceptions of agriculture, the career advice to school students and the workforce agenda across all aspects of the sector.

Several factors became key components of the Review:

- The lack of awareness by students about food and fibre
- The perceptions about agriculture and the opportunities therein
- The importance of early engagement with students about key issues
- Concerns about the teaching of science and therefore agriculture in the primary schools
- The need for provision of quality teaching and learning materials to schools
• The roles to be played by the Primary Industries Education Foundation and the Royal Agricultural Society of New South Wales in education and development
• The lack of agriculture in about two thirds of secondary schools
• The emerging importance of primary industries in senior high schools
• The importance of agriculture as an underpinning discipline study for top students
• The key role to be played by agricultural high schools and the need for Lighthouse schools in agriculture
• The importance of teachers fully qualified in agriculture
• The quality of advice about agricultural careers provided by schools
• The importance in that advice of distinguishing between on-farm and off-farm employment opportunities, and using the career website, Career Harvest, to assist that process
• The re-establishment of Murrumbidgee College of Agriculture at Yanco
• The inadequate training and early employment arrangements for research students
• The lack of a workforce strategy in agriculture
• The need for industry support in ensuring quality education and training occurs
• Accreditation of people and processes.

The initial concern about the inability to attract young people into agriculture is well founded. 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. This Review considers these issues and suggests where improvements might be made to change the perceptions and increase the attractiveness to new players. There is no ‘silver bullet’ but there are many useful changes that could be made. They are each incremental but together they can deliver transformational change. The recommendations follow.

Many are directed to the New South Wales Government Departments but the Government cannot be held responsible for all. There are many things that industry can and should do and they are provided as industry recommendations.

Australian agriculture can re-establish itself as a leading influence and performer in Australian society. That will not be achieved by accepting the status quo nor will it be achieved by working individually. Progress will be made by agreeing on a vision, a way forward, and all working towards delivering on that platform. Using the structures already in place (Primary Industries Education Foundation, Career Harvest, Royal Agricultural Society), instead of creating more, is the way to progress.
GOVERNMENT RECOMMENDATIONS:

GOVERNMENT RECOMMENDATION 1
A review into careers advice provision in New South Wales schools be undertaken to ensure students are provided with well-informed advice on possible careers and pathways.

GOVERNMENT RECOMMENDATION 2
New South Wales school systems, schools and TAFE NSW Institutes establish an “Agriculture and Food Week” within the annual school year to celebrate and appreciate the role that agriculture and food make to the health, wealth and wellbeing of society.

GOVERNMENT RECOMMENDATION 3
The Board of Studies NSW develops a ‘Statement on teaching about agriculture in primary school’, including guidance and advice for teachers about Key Learning Area opportunities and availability of resources.

GOVERNMENT RECOMMENDATION 4
The NSW Institute of Teachers, New South Wales universities and school authorities initiate a review of the training and ongoing professional development of primary teachers in science, including agriculture and food, to ensure that primary teachers have the confidence, sufficient expertise and up-to-date knowledge to deliver quality science education in schools.

GOVERNMENT RECOMMENDATION 5
In the teaching of Technology in each of Years 7 and 8 of secondary school, at least one content area be based on agriculture, food and fibre.

GOVERNMENT RECOMMENDATION 6
In the context of the implementation of the Australian curriculum in the senior years of schooling, the Board of Studies NSW considers the potential for students with a clear interest in agriculture to package a set of study options that better target vocational and professional career opportunities in the field.

GOVERNMENT RECOMMENDATION 7
The NSW Institute of Teachers undertakes a review of the qualifications of teachers in agriculture and primary industries to determine future directions in recruitment to ensure strong depth of expertise in these areas.

GOVERNMENT RECOMMENDATION 8
The agricultural high schools in New South Wales be considered ‘specialist schools’ for education and training in agriculture and primary industries for secondary students. These schools should:

a. Encourage all students to study agriculture and/or primary industries in senior secondary school
b. Review their mission statements to ensure that agricultural education is strongly identified as a designated educational outcome for their students; and
c. Utilise the flexibility provided for staff appointments to appoint directly specialist agriculture teaching staff because of their pivotal role in the reputation and leadership responsibilities of the school.

GOVERNMENT RECOMMENDATION 9
An Agricultural High Schools Forum (AHSF) be established, comprising the Principals of the agricultural high schools and officers of the NSW Department of Education and Communities.

Issues for consideration should include:

a. Professional development needs
b. Management of agricultural equipment
c. Residential accommodation policies, management and staffing arrangements.

GOVERNMENT RECOMMENDATION 10
Agricultural high schools give consideration to establishing and maintaining, where they do not exist, an email-based alumni network for school promotion and reconnection with potential supporters.
GOVERNMENT RECOMMENDATION 11
Head teachers of agriculture from the agricultural high schools and vocational education and training providers form a network to develop a program of actions that contributes to leadership in agricultural education and training.

GOVERNMENT RECOMMENDATION 12
The NSW Department of Education and Communities considers Registered Training Organisation (RTO) status for the combined agricultural high schools.

GOVERNMENT RECOMMENDATION 13
The NSW Department of Education and Communities explores options for the designation of an agricultural high school in central New South Wales, such as Dubbo. Such school would need to be near to TAFE training facilities and would need adjacent accommodation facilities for females and males.

GOVERNMENT RECOMMENDATION 14
The NSW Department of Education and Communities identifies a range of Lighthouse schools statewide that support good practice in curriculum delivery, student engagement and career promotion in agriculture and primary industries.

GOVERNMENT RECOMMENDATION 15
The NSW Department of Education and Communities undertakes further consultation to develop partnerships that encourage more Aboriginal students to access agricultural courses, further training and related employment opportunities, including through Opportunity Hubs.

GOVERNMENT RECOMMENDATION 16
The NSW Department of Primary Industries’ Research Centres establish an annual forum with regional agriculture teachers to explore and plan activities to enrich the teaching of agriculture and primary industries in regional schools and vocational education and training settings.

GOVERNMENT RECOMMENDATION 17
Where opportunities exist, schools move over time to offer Certificate III in Primary Industries for those students seeking employment in agriculture.

GOVERNMENT RECOMMENDATION 18
State and federal funding authorities recognise the benefits for disengaged Aboriginal youth of BackTrack and similar schemes in New South Wales and create flexibility of funding to ensure the schemes are able to operate with maximum benefit to participants.

GOVERNMENT RECOMMENDATION 19
TAFE NSW reviews the offerings in primary industries in vocational education and training in the metropolitan area to ensure students have appropriate access to such training.

GOVERNMENT RECOMMENDATION 20
TAFE NSW works with the AgriFood NSW Industry Training Advisory Body (ITAB) to encourage:

a. Establishment of aquaculture training packages and opportunities in oyster farming and

b. Review of training packages in fish farming to ensure business principles and environmental management are appropriately represented.

GOVERNMENT RECOMMENDATION 21
In Smart and Skilled, agricultural and seafood courses be considered for thin market Community Service Obligation payments to guarantee training in rural and remote areas.

GOVERNMENT RECOMMENDATION 22
The NSW Department of Primary Industries, in conjunction with the C B Alexander Foundation and other stakeholders, establishes a set of guidelines on what constitutes a ‘Centre of Excellence in Agricultural Education and Training’ and ensure the guidelines are implemented.

GOVERNMENT RECOMMENDATION 23
The Tocal College farms be managed as a business unit under the auspices of the C B Alexander Foundation.
GOVERNMENT RECOMMENDATION 24
The NSW Department of Primary Industries re-establishes the Murrumbidgee College of Agriculture under the following principles to provide the opportunity to build on the reputation of the past, yet with flexibility to provide an expanded range of services. These principles are:

a. That Murrumbidgee College of Agriculture has a defined location and that the boundaries of the entity are drawn up along the lines indicated in Chapter 7 of the Report to enable the College to operate independently of Yanco Agricultural Institute

b. That the facilities are operated under a not-for-profit trust and continued investment in the operation of the facilities be undertaken

c. That an education and training subcommittee of the trust be appointed, comprising NSW Department of Primary Industries (NSW DPI), TAFE NSW, Yanco Agricultural High School and Charles Sturt University to advise on programs, farms, training facilities and inter-educational relations

d. That training and other programs deliver to the needs of southern New South Wales and operate independently of Tocal College but that the Colleges collaborate on issues such as a single ‘NSW DPI Colleges RTO’ (which should not align in name with either college), publications, training package development, and other Departmental training initiatives

e. That a College Director be appointed with skills in training, finance and enterprise management. Such appointment should be funded by the NSW Department of Primary Industries, have the independent authority to run the business and operate as the Executive Officer to the trust board

f. That the trust invites regional industries to commit to the College through investment, support for training of their staff and involvement in the trust.

GOVERNMENT RECOMMENDATION 25
The NSW Government, through the Standing Council on Primary Industries, raises the following matters with the Federal Government:

a. Greater provision of top-up scholarships by Research and Development Corporations, to the maximum allowable under the taxation rules

b. An increase in the maximum allowance for top-ups under the tax-free provisions for research scholarships and

c. The need to restore competitive and respectable stipends for postgraduate scholars under the Australian Postgraduate Award and Australian Research Council schemes, including annual increments and superannuation entitlements.

GOVERNMENT RECOMMENDATION 26
The NSW Department of Primary Industries, in conjunction with key industries and universities, explores the merit of developing a professional development program focused on leadership, management and policy development in the agricultural sector through an alliance modelled on the Australian and New Zealand School of Government approach.

GOVERNMENT RECOMMENDATION 27
The NSW Department of Primary Industries undertakes to complete the renewal of the Memorandum of Understanding on collaboration between the Department, the Royal Agricultural Society of NSW and NSW Farmers Association, with the purpose of increasing the range of activities year round to support the education needs in agriculture. Opportunity should be taken to engage commercial, industry and other government parties.
INDUSTRY RECOMMENDATIONS:

INDUSTRY RECOMMENDATION 1
A representative committee of the agricultural sector undertakes, or has undertaken, the development of a vision for the sector, and the associated mission statements, in order that the sector can move forward with common purpose to position it well for the opportunities and the challenges ahead.

INDUSTRY RECOMMENDATION 2
A representative committee of the agricultural sector undertakes, or has undertaken, a strategic analysis of the internal and external drivers that influence the delivery of the vision.

INDUSTRY RECOMMENDATION 3
The Cooperative Research Centre for Plant Biosecurity commissions the writing of “Cactoblastis saves the farm”.

This is the story of the introduction of the weed, prickly pear, originally as a garden plant. Its spread resulted in massive loss of agricultural production in eastern Australia. The introduction of the Cactoblastis moth enabled the control of the weed and represents a world class example of biological control. It is a story not unlike that of “The Very Hungry Caterpillar” but has the moral of biosecurity and the value of scientific endeavour.

INDUSTRY RECOMMENDATION 4
Primary Industries Education Foundation undertakes to retain liaison with PrimaryConnections with a view to the generation of teaching resources in agriculture and food for primary schools.

INDUSTRY RECOMMENDATION 5
Primary Industries Education Foundation (PIEF) be recognised as the portal for agricultural education resources by the industry sector and by the generators of educational resources in agriculture and food. All resources so generated should be deposited or registered with PIEF and necessary links identified.

INDUSTRY RECOMMENDATION 6
Primary Industries Education Foundation undertakes the responsibility for ensuring that Scootle is adequately resourced with relevant teaching resources on agriculture and food.

INDUSTRY RECOMMENDATION 7
NSW Farmers Association works with New South Wales schools to establish a network of cooperating producers to link particularly with metropolitan schools through smart technologies.

INDUSTRY RECOMMENDATION 8
Leeton and Griffith Councils, together with other local government organisations and key industries, give consideration to the establishment of an employment company similar to that operated by Narrabri Council.

INDUSTRY RECOMMENDATION 9
The horticultural sector reviews its needs for courses in universities to ensure continued availability of higher education in horticulture.

INDUSTRY RECOMMENDATION 10
The forest industry comes together to review its needs for courses in universities to ensure continued availability of higher education in forestry.

INDUSTRY RECOMMENDATION 11
The University of Wollongong gives consideration to the inclusion of a major study of aquaculture production and management in its Marine Biology degree.

INDUSTRY RECOMMENDATION 12
Rural Research and Development Corporations and other research funders commit to a minimum of 5 years funding for post-doctoral scholars with an obligatory 3-year review to establish prospects.

INDUSTRY RECOMMENDATION 13
The Australian Council of Deans of Agriculture explores the options for creating an alumni association of agricultural professionals across the university sector.
INDUSTRY RECOMMENDATION 14
The Royal Agricultural Society establishes a close working relationship with Primary Industries Education Foundation to facilitate quality industry educational resources being made available within the educational resource bases of the NSW Department of Education and Communities Teaching and Learning Exchange, Scootle and the Board of Studies NSW Program Builder.

INDUSTRY RECOMMENDATION 15
The agriculture sector commits to the implementation of Operation 1-AG as described below:

Operation 1-AG
The primary industries are well known for their fragmented approach to matters of policy and action. This is understandable to a degree because of the range of industries involved, although the fragmentation remains a source of frustration in political and departmental circles and limits the extent to which the decision makers can satisfy industry needs. Yet there are many aspects of the operation of these industries which could be common, at least in principle if not in application. In the context of this Review there have been identified numerous issues which apply universally to the industries described by agriculture. These are:

• Having a clear direction for the future
• Attracting new people into the agricultural workforce
• Addressing the issue of image and its consequences for the social licence to operate
• The importance of education and training in redressing the balance.

To promote discussion, encourage engagement and identify matters of common purpose, the slogan or catch-word chosen for the concept is Operation 1-AG. The ‘1’ signifies that there is both unity of purpose and an intention to move the sector to the top of the ladders of performance and respect. The focus is on what could be done in New South Wales but there is scope for this approach to be used in other jurisdictions. This Review suggests that there are four phases emanating from the considerations undertaken.

Phase 1: The Vision
This Review has created a draft vision in order to have direction for the findings of this investigation. It tries to identify those aspects for which there might be agreement between industries. Sector declaration on such matters of agreement provides the basis for the way forward to addressing the other matters. It is recommended that key industry organisations such as NSW Farmers Association drive this agenda.

Phase 2: The Education and Careers Imperative
This Review has shown that there is a clear need for investment at all levels of the education process. The school system needs to be enriched with quality teaching resources linked directly to the curricula through accepted protocol arrangements. Students need to be provided with clear career advice along the agriculture value chain. The action required here is:

a. Endorsing Primary Industries Education Foundation (PIEF) as the portal for educational materials into the education system through:

° Ensuring, before new materials are developed, that PIEF is consulted about key criteria that need to be met
° Modifying existing materials so that they meet the criteria
° Providing financial support to PIEF, particularly in the critical next 3 years.
b. Endorsing Career Harvest as the key professional portal for agriculture by:

- Providing testimonials from people employed in particular jobs
- Providing scholarship information on site
- Establishing an internship information service on site
- Contributing comment on current affairs related to careers and
- Providing financial support to Career Harvest as it endeavours to create the modern image of agriculture.

c. Providing support to the Royal Agricultural Society of NSW for:

- Its education program for schools, particularly in the metropolitan area, so the positivity of agriculture can be translated to metropolitan Australia
- Development of its rural youth network and the associated competition and related activities.

Phase 4: The Accreditation Imperative
There is a strong case for the industry sector to undertake an evaluation of accreditation offerings and needs at all levels. It is a recommendation of this Review that the sector:

- Conduct a ‘whole of sector’ audit of accreditation programs to evaluate opportunities for consolidation, gaps in provision and education and training requirements
- Develop a strategy for industry accreditation which minimises the openings for charlatans, improves market advantages and delivers the social licence to operate.

Phase 3: The Workforce Imperative
Impetus for this Review was the struggle along the value chain of attracting new workforce into the sector, and particularly young people to replace the high proportion of near retirees. It has not been clear that a strategy exists. Dependency on the fickle 457 Visa and the reluctance of the sector to embrace apprenticeships suggest that the sector needs to develop or reform its workforce strategy. This is a key component of the education and training needs for the future. The imperative therefore is for the primary industries sector to establish its workforce strategy so that there is clear direction in respect of its workforce in the 21st century.
CHAPTER 1
INTRODUCTION

Said Hanrahan

“We’ll all be rooned,” said Hanrahan in accents most forlorn, Outside the church, ere Mass began one frosty Sunday morn, The congregation stood about coat-collars to the ears, And talked of stock, and crops, and drought as it had done for years, “It’s looking crook,” said Daniel Croke; “Bedad, it’s cruke, me lad, For never since the banks went broke has seasons been so bad.”

“It’s dry, all right,” said young O’Neil, with which astute remark He squatted down upon his heel and chewed a piece of bark. And so around the chorus ran, “It’s keepin’ dry, no doubt.” “We’ll all be rooned,” said Hanrahan, “Before the year is out.” “The crops are done; ye’ll have your work to save one bag of grain; From here way out to Back-o’-Bourke they’re singin’ out for rain.

“They’re singin’ out for rain,” he said, “And all the tanks are dry.” The congregation scratched its head, and gazed around the sky. “There won’t be grass, in any case, enough to feed an ass; There’s not a blade on Casey’s place as I came down to Mass.” “If rain don’t come this month,” said Dan, and cleared his throat to speak – “We’ll all be rooned,” said Hanrahan, “If rain don’t come this week.”

A heavy silence seemed to steal on all at this remark; And each man squatted on his heel, and chewed a piece of bark. “We want an inch of rain, we do,” O’Neil observed at last; But Croke “maintained” we wanted two, to put the danger past. “If we don’t get three inches, man, or four to break this drought, We’ll all be rooned,” said Hanrahan, “Before the year is out.”

In God’s good time down came the rain; and all the afternoon On iron roof and window-pane it drummed a homely tune. And through the night it pattered still, and lightsome, gladsome elves On dripping spout and window-sill kept talking to themselves. It pelted, pelted all day long, a-singing at its work, Till every heart took up the song way out to Back-o’-Bourke. And every creek a banker ran, and dams filled overtop; “We’ll all be rooned,” said Hanrahan, “If this rain doesn’t stop.” And stop it did, in God’s good time; and spring came in to fold A mantle o’er the hills sublime of green and pink and gold. And days went by on dancing feet, with harvest-hopes immense, And laughing eyes beheld the wheat nid-nodding o’er the fence. And, oh, the smiles on every face, as happy lad and lass Through grass knee-deep on Casey’s place went riding down to Mass. While round the church in clothes genteel discoursed the men of mark, And each man squatted on his heel, and chewed his piece of bark. “There’ll be bush-fires for sure, me man, there will, without a doubt; We’ll all be rooned,” said Hanrahan, “Before the year is out.”

John O’Brien
Source: Around the Boree Log: And Other Verses, 1921, pp.77-81
BACKGROUND

In July 2012, the NSW Minister for Education, the Hon Adrian Piccoli MP, and the NSW Minister for Primary Industries, the Hon Katrina Hodgkinson MP, commissioned a Review into Agricultural Education and Training in New South Wales. This is likely the first time that a comprehensive evaluation of all aspects of agricultural education and training has been undertaken, that is, from primary schools to PhD. The education system also needs to be considered in respect of its relationships with the industry sector and its acceptance or otherwise by the community at large. With such broad parameters it is not possible to cover the entire value chain to the extent desired, and available time and resources have limited the extent to which coverage could be achieved. It is emphasised that this Review is focused on education and training and is not a review of the sector itself. However, in order to put together a meaningful report, it has been important to look at certain aspects of the industry and the community in so far as they impact on the education system or are impacted upon by the education and training regimes.

The Terms of Reference (see Appendix 1.1) for the Review sought recommendations to ensure that:

- Agricultural education and training in the New South Wales school and tertiary sectors is appropriate to meet future industry needs
- Agriculture is promoted to current and future students as an attractive career
- The sector is supported by an appropriately educated and trained workforce and
- The NSW Government-owned education and training institutions, research stations and other facilities are appropriately utilised in their education and training endeavours.

“The direction in which education starts a man will determine his future in life.”

Plato

This Review follows other enquiries such as the 2012 Federal Senate Enquiry, Higher Education and Skills Training to Support Agriculture and Agribusiness in Australia, and two Victorian Parliamentary inquiries in 2012, namely, Inquiry into Agricultural Education and Training in Victoria, and Inquiry into the Capacity of the Farming Sector to Attract and Retain Young Farmers and Respond to an Ageing Workforce. The work by the Australian Council of Deans of Agriculture (further explored in Chapter 8) in informing the industry sector and others of the inadequate supply of graduates has been influential in giving prominence to the emerging issue of workforce capacity in agribusiness. Others such as the National Farmers Federation and AgriFood Skills Australia have canvassed the workforce shortage on farms.

The issue of workforce has been investigated by the cotton industry in respect of its needs to 2016 (Box 1.1). The findings raise the question as to whether its requirements can be met based on current projections, reinforcing the focus that has been placed on agricultural education and training by governments and industries. Other industries within the agriculture sector would do well to follow the lead of cotton in mapping out their workforce needs. This issue is further considered in Chapter 9.
More recently the community has been apprised of the dearth of knowledge in children as to the source of their food. There have been several surveys undertaken but the issue is summed up by the findings of an Australian Council for Educational Research (ACER) survey *Food, Farming and the Future*, commissioned by the Primary Industries Education Foundation, which are summarised in Box 1.2. Clearly, such findings suggest that a more concerted effort in educating students about food and fibre and its production is needed. This matter is further addressed in Chapters 5 and 6.

**BOX 1.1 COTTON INDUSTRY WORKFORCE ESTIMATES TO 2016**

- Agronomists – 87
- Researchers – 44
- Professional water engineers – 2
- Technicians – 8
- Science graduates – 4
- Sales (agronomist) – 26
- Plant pathology – 2
- Plant breeder – 2
- Other – 4

Projections are based on assumption of continued industry expansion and make no allowances for a range of other occupations including: senior/strategic professional management, farm managers, business advisors, finance including CFOs, IT and electronics, company directors; nor retiring or departing personnel.

Workforce issues are exacerbated in specific areas by local factors. The local industry is operating with a third of the desired level of staff at Emerald and half the desired level in the Gwydir Valley.

*Cotton Australia submission*
THE REVIEW PROCESS

At the outset, an Issues Paper was prepared outlining a range of aspects relating to the topic. This Paper was widely disseminated. It asked many questions as a way of provoking discussion and requested submissions from all stakeholders. Overall, more than eighty submissions were received and considered for the report. A list of submissions is provided in Appendix 1.2.

A series of roundtable discussions was held around New South Wales. Locations included Tamworth, Armidale, Dubbo, Wagga Wagga, Yanco and several in Sydney. Invitees were representatives of the industries in the region, agribusinesses, education providers and government. Visits were made to schools, TAFE NSW centres, universities and organisations considered to be key stakeholders. Where possible, discussions were held with students to ensure their views and experiences were considered. Meetings with key officers of the NSW Departments of Education and Communities and Primary Industries were arranged so that current operations and procedures could be understood or challenged. Particular attention was given to the views of the emerging generation of agriculturalists. They have grown up with current technologies, have experienced better educational opportunities and in general have positive attitudes for the future. The list of consultations is provided in Appendix 1.3.

To assist the Review process, a Reference Group was established representing key education stakeholders. Three meetings with this Group were held to seek advice and test ideas, and the inputs of the Members are gratefully acknowledged. The composition of the Reference Group is shown in Appendix 1.4.

Where fitting, aspects of the Report were provided to key people to test the appropriateness or otherwise of the recommendations. Their advice is also gratefully acknowledged.

As the Review evolved it became apparent that, for progress to be made, there needed to be commitment from governments, in this case the NSW Government, and from the industry sector.

BOX 1.2 SOURCE OF FOOD – SURVEY OF SCHOOL STUDENTS

- 75% of Year 6 students thought cotton socks are an animal product
- 27% of Year 10 students thought yoghurt is a plant product
- Only 55% of students identified that bread, cheese and bananas all originate from farmed products
- Over two-thirds of students mistakenly believe most logs harvested come from native forests
- 40% of Year 10 students believe farming damages the environment
- 46% of students saw no link between use of pesticides/fertilisers and increased food production
- 28% of Year 10 students thought natural fibres only came from plants
- Only 57% of students linked scientific research to farming
- Only 45% of students linked innovation to farming
in order to address the shortcomings in agricultural education and training and achieve satisfactory outcomes for the identified Terms of Reference. Consequently there are recommendations for both the NSW Government and for industry to address.

WHAT DEFINES AGRICULTURE?

Whereas people equate agriculture with farming, in reality it refers to the whole food and fibre value chain often referred to as the farm-dependent economy. It takes into account the pre-farm gate supply sector, on-farm production, the post-farm gate processing and marketing as well as the associated advisory and finance sectors. It also includes the humanitarian work undertaken as part of the international aid effort (Figure 1.1). Consistent with the NSW Primary Industries portfolio, agriculture in this context includes horticulture, aquaculture and forestry. These components are variously considered in this Report.

Figure 1.1 Agriculture as considered in this Review

In order to give the Report context, it has been necessary to posit where the agriculture sector might want to position itself in the foreseeable future. To that end a vision has been created such that a direction is given to the Review.

Vision

From early European settlement, agriculture has been the backbone of the national economy. Whereas, for the first 150 to 200 years, its importance was not in dispute, the maturing of other sectors of the economy, together with political and demographic changes, has reduced its prominence and the community perception of its importance. Australians are used to agriculture just being there but its role has largely been taken for granted. Although agricultural education is offered at schools and universities, and there is a well-developed Primary Industries Curriculum Framework provided in the school and non-school vocational education and training network, the industry sector has done little to promote its case with the community. Consequently, the emerging generation does not consider that there might be quality careers in agriculture.

The question must therefore be asked about the future of agriculture in Australia. There are the alternatives of self-sufficiency (the current position), dependency on imports or a mix of these. If the assumption is made that food security in Australia is a high priority then the industry sector needs to decide whether it is happy with the status quo or whether it has ambitions to advance the sector. Determination of the vision will thus direct the needs for education and training.

Whilst various industries or companies within the agriculture sector may have developed vision statements for their operations there is no clear statement for the sector as a whole. This Review sought input from several people about what might comprise a vision statement for agriculture and the following such statement has been constructed (Figure 1.2) and used as the basis for this Review. It is hoped as a result of this Review that the vision generates lively discussion leading to much more commonality of purpose in the sector, which is currently well known for its fragmentation.

Efforts and courage are not enough without purpose and direction.
John F. Kennedy
Having created the vision, it then becomes important to evaluate the position of the industry as it looks to the future and its capability and capacity to put such a vision into effect. In this Review two tools of analysis have been used:

- The Political, Economic, Social and Technological (PEST) analysis enables consideration of the drivers which are external to the industry but which nevertheless impact heavily on its capability to operate; Table 1.1 is an attempt to highlight through PEST analysis some of the external drivers which shape the future for agriculture.

- The Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is more about the internal drivers and their interaction with the external drivers in the PEST analysis. Table 1.2 is an attempt to draw attention through SWOT analysis some of the external drivers which shape the future for agriculture.

It is not the purpose of this Review to undertake a comprehensive discussion on the vision of agriculture and its readiness to fulfil the vision described here. That would be a worthwhile task for the industry sector players to undertake so as to provide unity of purpose in its very fragmented sector (Industry Recommendation 2). Such analyses form an integral part of strategic planning for a sustainable future. It is recognised that the National Farmers Federation has developed a ‘National Blueprint for Agriculture’ over the last year and that is a useful starting point for a detailed strategy analysis.

The major purpose for undertaking this rudimentary attempt at a vision and the preliminary analysis of the sector’s readiness in this Review has been to provide a context and direction for the need for education and training in agriculture. Clearly, if the sector is ‘unambitious’ there is little need for an emphasis on education and training; however if there is clear ambition for agriculture to be well positioned to capture the opportunities, manage the challenges and be an attractive sector.

**The vision for Australian agriculture is an industry sector which:**

- Is profitable along the value chain and financially resilient
- Is environmentally responsible and sustainable
- Delivers high quality, ethically grown, affordable and safe produce
- Is export-competitive
- Has established industry-driven standards and accreditation which are at world best practice
- Has a highly trained, professional workforce which is valued
- Provides an attractive work environment which is safe, socially inclusive and culturally diverse
- Has a high level of self-esteem and
- Has the respect of the community and the social licence to operate.

**Figure 1.2 A suggested vision for agriculture**

- Is profitable along the value chain and financially resilient
- Is environmentally responsible and sustainable
- Delivers high quality, ethically grown, affordable and safe produce
- Is export-competitive
- Has established industry-driven standards and accreditation which are at world best practice
- Has a highly trained, professional workforce which is valued
- Provides an attractive work environment which is safe, socially inclusive and culturally diverse
- Has a high level of self-esteem and
- Has the respect of the community and the social licence to operate.
in which young people can establish careers, then agricultural education and training becomes an imperative. In this Review therefore, the assumption has been made that agriculture does want to move forward strongly and so the analysis of education and training has been carried out in this context. There are substantial opportunities to chase and many challenges to manage. The ability to do so will need a workforce educated and trained to a much higher level than has hitherto been the case. What is also clear is that not only are business and production skills needed on farm and along the value chain but there is a need for the industry sector to promote itself as an exciting, high-tech, environmentally conscious industry sector in which there is a large range of worthwhile and rewarding careers. Public relations therefore become an imperative and cannot be ignored if the industry is to move forward.

This Review considers the role played by agriculture in the community and economy, evaluates its education credentials and then considers how the components of the education system deliver to its needs. The Review considers that there are three major recipients of this education: the students undertaking the education and training in preparation for a career; the industries who need and employ the graduates of these programs; and the community, which is a beneficiary of the industry outputs but which also has major influence on perceptions and political direction. It is important to note that the education system itself cannot deliver a quality product without strong ownership and assistance from industry.
Table 1.1 A Preliminary Pest Analysis Of The Agriculture Sector In Australia To Address The Vision

<table>
<thead>
<tr>
<th>Political</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food security delivers political stability</td>
<td>Government assistance ‘propping up’ inefficient businesses</td>
</tr>
<tr>
<td>Minimal government assistance</td>
<td>Capital investment to farm</td>
</tr>
<tr>
<td>Mining versus agriculture</td>
<td>Investment relative to some other industries</td>
</tr>
<tr>
<td>Free trade agreements</td>
<td>Scale dependence (‘get big or get out’)</td>
</tr>
<tr>
<td>Subsidised agriculture in other countries</td>
<td>Supermarket duopoly</td>
</tr>
<tr>
<td>Murray-Darling Basin plan</td>
<td>Consumer preference for cheaper imports</td>
</tr>
<tr>
<td>Investment in quarantine</td>
<td>High $A:</td>
</tr>
<tr>
<td>Snap policy decisions – eg live export, Tasmania fishing, 457 visas</td>
<td></td>
</tr>
<tr>
<td>International decisions affecting exports – eg sheep to Pakistan; wheat to Middle East</td>
<td></td>
</tr>
<tr>
<td>Limited research and development funding impacts</td>
<td>Floods and fires – impact on production, harvest, transport</td>
</tr>
<tr>
<td>Infrastructure investment</td>
<td>Labour costs relative to other countries</td>
</tr>
<tr>
<td>Consumer demands and regulation</td>
<td>Foreign investment; corporate farming</td>
</tr>
<tr>
<td>Compliance – eg Work Health and Safety</td>
<td>Capital cost versus assets value</td>
</tr>
<tr>
<td></td>
<td>Infrastructure and capacity</td>
</tr>
<tr>
<td></td>
<td>Quality assurance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social</th>
<th>Technological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry not valued – taken for granted</td>
<td>Social media power against/for agriculture</td>
</tr>
<tr>
<td>Social isolation from other farmers/people</td>
<td>Global communication instantaneous – eg markets</td>
</tr>
<tr>
<td>Industry leadership</td>
<td>Labour saving devices replace labour</td>
</tr>
<tr>
<td>Disconnect between city and country</td>
<td>Mechanisation is expensive</td>
</tr>
<tr>
<td>Activist campaign impacts</td>
<td>Increased skills and knowledge required for increasing technology</td>
</tr>
<tr>
<td>Changing diets in Asia creates opportunity</td>
<td>Farmer age a barrier to technological innovation</td>
</tr>
<tr>
<td>Fair trade/organic/free-range movements – opportunity for value added produce</td>
<td>International research and development outcomes</td>
</tr>
<tr>
<td>Master Chef phenomenon – changing perspectives on food</td>
<td>Multi-national technologies available</td>
</tr>
<tr>
<td>Strong intellectual capacity in research and development</td>
<td></td>
</tr>
<tr>
<td>Resilience</td>
<td></td>
</tr>
<tr>
<td>Career attractiveness</td>
<td></td>
</tr>
<tr>
<td>Education and training needs</td>
<td></td>
</tr>
</tbody>
</table>
**Table 1.2** A preliminary SWOT analysis of the agriculture sector in Australia to address the vision

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reputation for quality and consistency of product</td>
<td>Geographical global isolation, exports and inputs to travel long distances</td>
</tr>
<tr>
<td>Geographical isolation for quarantine</td>
<td>Highly variable climate</td>
</tr>
<tr>
<td>Relative proximity to major Asian markets</td>
<td>Tyranny of distance for internal distribution of product and delivery of services</td>
</tr>
<tr>
<td>Stable political system</td>
<td>Some industries slow to respond to agenda of social licence to operate</td>
</tr>
<tr>
<td>Seasons ensure supply into northern hemisphere markets</td>
<td>Media portrayal of sector often negative</td>
</tr>
<tr>
<td>Quality education system; well defined training sector responsive to industry needs</td>
<td>Low level of succession planning</td>
</tr>
<tr>
<td>Aridity reduces need for pesticides; clean and green</td>
<td>Research and development focused on ‘quick fixes’</td>
</tr>
<tr>
<td>Not dependant on subsidies</td>
<td>Cost and availability of labour</td>
</tr>
<tr>
<td>Manage climate variability</td>
<td>High standard of living and community expectations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social media – tell the story for consumers to share in the experience</td>
<td>Activist campaigns and their manipulation of consumer attitudes</td>
</tr>
<tr>
<td>The growing market in Asia</td>
<td>Competition for natural resources</td>
</tr>
<tr>
<td>Secure investment climate</td>
<td>Imports and visitors introducing disease/pests</td>
</tr>
<tr>
<td>Generational change to generate interest in professional agriculture</td>
<td>Foreign control of key agricultural assets</td>
</tr>
<tr>
<td>National Broadband Network to ‘open up’ Australia for business and social connection</td>
<td>China – able to produce food more efficiently</td>
</tr>
<tr>
<td>Relative impact of sustainability in comparison with other countries where corruption or exploitation is less controlled</td>
<td>Subsidies in competitor countries</td>
</tr>
<tr>
<td>Export capabilities in agricultural education, technologies, farming of variable climates and quality assurance</td>
<td>Government regulations increasing production costs</td>
</tr>
<tr>
<td></td>
<td>Lack of trained personnel from farm hands to managers and loss of capacity for research</td>
</tr>
<tr>
<td></td>
<td>Loss of biodiversity</td>
</tr>
<tr>
<td></td>
<td>Inability to adapt to climate change</td>
</tr>
</tbody>
</table>
INDUSTRY RECOMMENDATION 1
A representative committee of the agricultural sector undertakes, or has undertaken, the development of a vision for the sector, and the associated mission statements, in order that the sector can move forward with common purpose to position it well for the opportunities and the challenges ahead.

INDUSTRY RECOMMENDATION 2
A representative committee of the agricultural sector undertakes, or has undertaken, a strategic analysis of the internal and external drivers that influence the delivery of the vision.
CHAPTER 2
THE ROLE OF AGRICULTURE

My Country

The love of field and coppice,
Of green and shaded lanes.
Of ordered woods and gardens
Is running in your veins,
Strong love of grey-blue distance
Brown streams and soft dim skies
I know but cannot share it,
My love is otherwise.

I love a sunburnt country,
A land of sweeping plains,
Of ragged mountain ranges,
Of droughts and flooding rains.
I love her far horizons,
I love her jewel-sea,
Her beauty and her terror –
The wide brown land for me!

A stark white ring-barked forest
All tragic to the moon,
The sapphire-misted mountains,
The hot gold hush of noon.
Green tangle of the brushes,
Where lithe lianas coil,
And orchids deck the tree-tops
And ferns the warm dark soil.

Core of my heart, my country!
Her pitiless blue sky,
When sick at heart, around us,
We see the cattle die –
But then the grey clouds gather,
And we can bless again
The drumming of an army,
The steady, soaking rain.

Core of my heart, my country!
Land of the Rainbow Gold,
For flood and fire and famine,
She pays us back threefold –
Over the thirsty paddocks,
Watch, after many days,
The filmy veil of greenness
That thickens as we gaze.

An opal-hearted country,
A wilful, lavish land –
All you who have not loved her,
You will not understand –
Though earth holds many splendours,
Wherever I may die,
I know to what brown country
My homing thoughts will fly.

Source: By arrangement with the Licensor,
The Dorothea Mackellar Estate, c/- Curtis Brown
(Aust) Pty Ltd.
BACKGROUND

The importance of agriculture to individuals and society is obvious in its key aspects. It provides the community with food and clothing, first and foremost, though many urban Australians — the vast majority — are insulated from the realities of food and fibre production, and give the agriculture industry little thought in their daily lives.

The agriculture sector plays a vital role in what it means to be an Australian. It is a major contributor to the economic wellbeing of the nation through its productivity, employment generation and its role in earning export income as a major international trader. It provides the Australian community with high quality food consistently throughout the year at a price which is affordable and in so doing provides a quality of life which is the envy of the world. More than 90% of the fresh food consumed by Australians comes from local production.

Australians have the highest quality food supply in the world, it is plentiful, safe, clean and green by world standards. This strong nutritional base of Australian society contributes significantly to the health of the community and is evident in the life expectancy for those Australians born in 2013, of around 82 years, in the leading 2% of nations (United Nations, 2007). The world average life expectancy is around 68 years.

The industry provides one in six Australian jobs and is the lifeblood of many regional towns. The sector manages about 60% of the national landscape (Lubulwa et al, 2010) on behalf of the nation, without recompense. Although there have been some environmental challenges over time, research and management have enabled producers to revolutionise their use of natural resources towards sustainability and, in so doing, now comprise the largest group of environmentalists in Australia.

At the same time, agriculture provides humanitarian aid to many countries. This can take the form of food aid but arguably its greatest contribution is working with agriculturalists in developing countries to assist them with increasing their food production and attaining a better quality of life. Agriculture and health together represent a major contribution by Australia to international aid.

It also needs to be remembered that this country was built by agriculture. Its early development was largely dependent on the wealth creation from agriculture (‘Australia rides on the sheep’s back’) and those days provided a rich archive of poetry, literature, art and music representing the evolution of the Australian character. This Review pays tribute to some of that history in the Report. It is also important to acknowledge the connection to land of the Indigenous peoples and the wonderful richness in their art and music.

This chapter provides a brief overview of the contribution of agriculture to provide a foundation for the Review that follows. The contribution by Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) is acknowledged and is presented with minimal amendment.

IMPORTANCE OF AGRICULTURAL INDUSTRIES TO AUSTRALIA

The agriculture industry has underpinned the economic development of Australia from first settlement. In early times it ensured food and fibre supply to the new nation, it created wealth and was the major part of its export earnings until other sectors of the economy, such as manufacturing and services, matured sufficiently to make a significant contribution. It follows that the proportions of gross domestic product (GDP) and export earnings coming from agriculture have declined over time but the absolute contribution continues to grow. This has been camouflaged by the mining and energy boom of recent times to the extent that its real value to the nation is no longer understood nor appropriately recognised.

Agricultural production contributes over $40 billion to the Australian economy, generates around 10% of export revenue and is the mainstay of many rural communities. Australia is a small, open economy with relatively abundant natural resources. In 2010–11, farm production accounted for 1.9% of Australia’s total output (GDP) and 2.7% of total employment; and the rural sector
(agriculture, commercial fishing, forestry and logging, support services) accounted for 2.3% and 3.1% of total output and employment respectively (ABARES, 2011).

Australia’s real gross value of farm production has increased over the past four decades, from A$35 billion in 1970–71 to A$49 billion in 2010–11 (in 2010–11 prices) (Figure 2.1) (ABARES, 2011). This represents an average annual growth rate of 1%, although there is considerable variation within the sector: trend growth in crop production (2.3% per year) has significantly exceeded that of livestock production (0.1% per year).

Farm production continues to represent a significant share of total exports. In 2010–11, farm exports accounted for 10% of the total value of Australia’s exports of goods and services (ABARES, 2011, ABARES, 2012). By international standards, Australia is a major exporter of several agricultural commodities. In recent years, Australia has been the leading exporter of barley, beef and raw wool (Table 2.1). Australia also ranks highly in world exports for other commodities, in particular, canola, sheep meat, sugar and wheat.

<table>
<thead>
<tr>
<th>Crops&lt;sup&gt;b&lt;/sup&gt;</th>
<th>World ranking no.</th>
<th>Share of world exports %&lt;sup&gt;*&lt;sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>3</td>
<td>14.8</td>
</tr>
<tr>
<td>Barley</td>
<td>1</td>
<td>35.0</td>
</tr>
<tr>
<td>Sugar</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>Raw cotton</td>
<td>4</td>
<td>6.4</td>
</tr>
<tr>
<td>Canola</td>
<td>2</td>
<td>14.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Livestock</th>
<th>World ranking no.</th>
<th>Share of world exports %&lt;sup&gt;*&lt;sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef and veal&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1</td>
<td>17.3</td>
</tr>
<tr>
<td>Sheep meat&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2</td>
<td>28.8</td>
</tr>
<tr>
<td>Raw wool</td>
<td>1</td>
<td>56.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dairy products</th>
<th>World ranking no.</th>
<th>Share of world exports %&lt;sup&gt;*&lt;sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Cheese</td>
<td>4</td>
<td>11.7</td>
</tr>
<tr>
<td>Skim milk powder</td>
<td>4</td>
<td>10.5</td>
</tr>
</tbody>
</table>

Notes:  
<sup>a</sup> Based on volume of exports.  
<sup>b</sup> Rankings and share of world exports for each crop are calculated for an aggregate of each country’s marketing year.  
<sup>c</sup> Statistics based on the 2011 calendar year.  
<sup>d</sup> Statistics based on the 2010 calendar year  
ABARES, 2012
To this analysis needs to be added the contribution of the farm input sector and then the farm output sector. Together with farm production this is referred to as the farm-dependent economy (FDE). An analysis by Econtech (2005) for the Australian Farm Institute showed that the ratio of ‘farm input’: ‘on-farm’: ‘farm output’ was of the order of 1:4:10. So any analysis of the contribution of the farm sector to the nation should include that made by the total FDE. Using the ratio as a multiplier, the contribution would be nearly three times that of the farm sector. In 2005, that amounted to 12%, of which the farm sector contributed 3.2%. This has declined since that time to 2.3% in 2010-11, largely due to drought and the high Australian dollar.

RURAL EMPLOYMENT

As in other developed countries, farm numbers in Australia have declined over the past four decades—at an average annual rate of around 1% (ABARES, 2011) but farm size has increased, with amalgamation of holdings resulting from expanding family operations or corporate investment. Rural employment has also declined over time: employment in farm and fisheries production in 2010-11 was around two-thirds of that in 2000-01. A major factor contributing to this decline was drought and its impact on food production (Department of Agriculture, Fisheries and Forestry (DAFF), 2012). Increased mechanisation and labour-saving devices have also contributed to the decline.

In respect of the labour, Econtech (2005) indicated that around 1 in 6 people in the Australian workforce were employed in the FDE. In regional areas that ratio was closer to 1 in 3, indicating the key importance of primary production to rural Australia.

IMPORTANCE OF AGRICULTURAL INDUSTRIES TO NEW SOUTH WALES

Agriculture occupies around 400 million hectares of New South Wales. In 2009-10, the gross value of production of primary industries excluding minerals was around $9 billion (Table 2.2) and export earnings from agriculture were over $5 billion. Employment in these industries and related services was approaching 80,000 people. For the FDE employment is estimated to be around 145,000.
Table 2.2: Gross value of production of New South Wales primary industries excluding minerals for 2009-10 (NSW Department of Primary Industries (DPI), 2013)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Gross value of production in New South Wales $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>8359.2</td>
</tr>
<tr>
<td>Fisheries</td>
<td>155.6</td>
</tr>
<tr>
<td>Forestry (sawn logs delivered)</td>
<td>381.0</td>
</tr>
</tbody>
</table>

Major industries within agriculture in terms of value were wheat, cattle and calves, wool, and horticulture. The contributions are provided in Table 2.3. It should be noted that this was a drought year and so are conservative relative to average data. Rice production, for example was largely absent due to the unavailability of water resources at that time.

Table 2.3: Gross value of production of agricultural product in New South Wales in 2009-10 (NSW DPI, 2013)

<table>
<thead>
<tr>
<th>Agricultural product</th>
<th>Gross value of production $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat for grain</td>
<td>1,155</td>
</tr>
<tr>
<td>Barley</td>
<td>230</td>
</tr>
<tr>
<td>Rice</td>
<td>89</td>
</tr>
<tr>
<td>Canola</td>
<td>123</td>
</tr>
<tr>
<td>Cotton</td>
<td>453</td>
</tr>
<tr>
<td>Fruit and nuts (incl grapes)</td>
<td>648</td>
</tr>
<tr>
<td>Cattle and calves</td>
<td>1,488</td>
</tr>
<tr>
<td>Sheep and lambs</td>
<td>584</td>
</tr>
<tr>
<td>Pork</td>
<td>215</td>
</tr>
<tr>
<td>Poultry</td>
<td>577</td>
</tr>
<tr>
<td>Wool</td>
<td>641</td>
</tr>
<tr>
<td>Milk</td>
<td>522</td>
</tr>
</tbody>
</table>

Two cropping industries have been singled out for special mention, cotton (Box 2.1) and rice (Box 2.2). Subject to adverse publicity in the past, these industries have evolved to world best practice in production, as well as addressing their environmental challenges. Together they are very important industries for their regional employment, economic underpinning of regions and for their export earnings for New South Wales.

AQUACULTURE

Aquaculture represents the farming of fish and related products and is distinguished from the wild harvest fisheries industry, which is not considered in this Review. Aquaculture is the fastest growing primary industry in Australia, with a growth of over 8% per year, albeit from a low base. This growth results from increasing community demand for high quality seafood. Aquaculture product accounts for over 40% of the gross value of Australian fisheries. Farmed fish are very efficient converters of feed to high quality protein.

New South Wales aquaculture is practised in fresh, estuarine and marine water, utilising two key production systems:

- **Intensive farming**, where the species being grown is given specially prepared feeds - eg silver perch and

- **Extensive farming**, where the natural ecosystem of the water provides feed for the species grown - eg oysters.

The challenge is to ensure that the industry develops in a sustainable manner - both environmentally and economically. NSW Department of Primary Industries has a key role in this process. The Department also conducts aquaculture research, pioneering farming of several species in New South Wales, including hatchery reared oysters, silver perch, yellowtail kingfish, mulloway and pearl oysters.

Aquaculture generates more than 1,500 full and part time jobs, predominantly in regional New South Wales, with approximately 3,000 further downstream jobs. Aquaculture can complement the supply of seafood from wild fisheries as consumer demand for seafood rises, both on the coast and inland.

Oysters are the most important aquaculture species in New South Wales, with 334 permit holders producing $40 million worth of oysters in 2009/10 on around 3,000 hectares of leases in a range of estuaries.
BOX 2.1 THE AUSTRALIAN COTTON INDUSTRY

The Australian cotton industry has grown from 17,000 hectares planted in 1966 to 600,000 hectares in 2011, an annual growth rate of 6.7%. A record crop was grown in 2011-2012, producing more than 5 million bales with forecast value of $3 billion.

Cotton is one of Australia’s largest rural export earners and helps underpin the viability of more than 50 rural communities, employing 15 times as many people as grazing and five times as many people as dryland cropping. In 2012, cotton provided employment for 8,000 people across northern New South Wales and southern Queensland alone.

Australia’s cotton growers produce yields two and a half times the global average and have produced the world’s highest cotton yields for 20 years running. In 2009-10 Australia recorded cotton lint yields of 1.857 tonnes per hectare (t/ha). The next highest yielding countries were Israel (1.667 t/ha), Brazil (1.439 t/ha) and Turkey (1.333t/ha). Plant breeding has been responsible for at least 50% of the yield increases seen in Australia, with 50% attributed to better water management. The Australian cotton industry has increased average production from 7.3 bales per hectare (bales/ha) to 8.7 bales/ha in the past five years – growing more cotton with the same amount of land. The top 20% of growers achieved yields of 11.2 bales/ha in 2011.

There are about 1,500 cotton farms in Australia, around half in New South Wales and half in Queensland. The average Australian cotton farm is family owned and operated, provides jobs for eight people, grows 656 hectares of cotton, is run by farmers with an average age of 39, grows other crops and often grazes sheep and cattle. Around 40% of farm area is dedicated to native vegetation.

The major production area in New South Wales stretches south from the Macintyre River on the Queensland border and covers the Gwydir, Namoi and Macquarie Valleys. In New South Wales cotton is also grown along the Barwon and Darling Rivers in the west and the Lachlan and Murrumbidgee rivers in the south. Cotton is a major contributor to agriculture’s share of gross regional product in all cotton regions – 75% in Narrabri, 50% in Warren. Australia uses 100% local seed.

Australia is a relatively minor producer on the world scale, but is the world’s fourth largest cotton exporter. In an average year, Australia has an enviable reputation on the world market as a reliable supplier of very high quality cotton, and can command a premium price for this reason. A recent study found new varieties from the Commonwealth Scientific and industrial Research Organisation (CSIRO) cotton plant breeding program had improved yield, high volume instrument quality and are showing superior textile performance attributes.

In an average year, Australia’s growers produce enough cotton to clothe 500 million people.

Adapted from Cotton Australia
BOX 2.2 THE AUSTRALIAN RICE INDUSTRY

The Australian rice industry is the most efficient in the world, operating without any production or export subsidies — unlike most of its major competitors. While small by world standards, the industry has become a competitive supplier of quality packed and branded rice products into world markets, achieved through vertically integrated marketing arrangements. SunRice, the grower owned company, has a turnover of approximately $800 million per annum in a normal year. Value-added exports contribute about $400 million to these earnings with 70% of Australia’s rice production exported to over 60 premium markets overseas, including the Middle East, Japan and Hong Kong. Rice is Australia’s third largest cereal grain export, and the ninth largest agricultural export.

The rice industry supports the direct employment of over 8,000 people across Australia and indirectly the employment of a further 33,000 people, mostly in regional Australia. The growing, harvesting, transporting, storage, processing, value adding and marketing of rice is a major contributor to the economic and social well being of the south western irrigation areas and districts of New South Wales. The major towns include Griffith, Leeton, Deniliquin, Jerilderie, Finley, Coleambally and Hay.

Rice growing is concentrated in this area due to irrigation infrastructure, availability of water, large areas of flat land, suitable clay-based soils and the development of storage and milling infrastructure in or near the regional towns. There are about 1600 farm businesses growing rice in the Murrumbidgee Valley of New South Wales and the Murray Valley of New South Wales and Victoria. The average size of an Australian rice farm is around 400 hectares.

The Australian rice industry is one of the world’s most efficient users of water. During the 1990s, the Australian rice industry improved its water efficiency by 60% and by 44% in the last 10 years, a remarkable achievement during the worst drought on record. Australian rice growers use 50% less water to grow one kilo of rice than the world average. This provides a strong argument as to why Australia must retain its rice industry.

The rice industry was the first Australian agricultural industry to initiate a regional biodiversity plan and a greenhouse reduction strategy. It runs an ‘Environmental Champions’ program which is a five level achievement program that guides rice growers through a series of activities. The program design connects environmental performance with better farm business performance. The Environmental Champions program sets the bar for industry standards in environmental performance and was developed in cooperation with rice growers, various government agencies and organisations.

More than half the people in the world eat rice at least once a day. Only 25 million of the 600 million tonnes of world annual rice production is traded outside the country of origin. Therefore, although Australian rice only represents around 0.2% of world rice production, our exports represent over 4% of world trade.

Australia produces enough rice to feed almost 40 million people one meal a day, every day.

Adapted from Ricegrowers’ Association of Australia
Oysters require a healthy estuarine environment and food safety is key to ensuring a supply of quality, healthy product to consumers. In order to retain its environmental credentials a range of strategies for environmental management, water quality protection and risk management are in place or under review for improvement. Production practices are also under continuous improvement with a focus on selective breeding of oysters for faster growth, condition and disease resistance. Other initiatives include increased support for commercial hatcheries and nurseries, the formation of a national oyster representative group (Oyster Australia) and consideration of a national marketing levy.

Non-oyster aquaculture production includes marine, estuarine and land-based farms. The species may be grown in cages, ponds, raceways, tanks or a combination these. The facility may be small or occupy many hectares in size. Prawn production was worth $2.43 million in 2009–10, followed by silver perch at $2.34 million, trout at $1.6 million and barramundi at $1.05 million.

Land-based farms can be found across the state and are generally divided into pond-based or recirculating aquaculture systems. Pond-based aquaculture may include both intensive and extensive forms of aquaculture.

The location of aquaculture farms is dictated primarily by the environmental constraints of the species being grown. Some species such as silver perch and yabbies are grown widely across the state, while prawns are grown on the far north coast, mussels near Eden and trout on the southern and northern slopes. Hatcheries that produce fingerlings for aquaculture farms, stocking of farm dams and aquarium fish are also located throughout New South Wales.

MARINE AQUACULTURE

New South Wales continues to support the development of other marine aquaculture and has approved a ‘State Significant Infrastructure’ application for a marine finfish research lease off Port Stephens, with others under consideration.

FORESTRY

Australia has 149 million hectares of forests comprising 147 million hectares of native forests and 2 million hectares of plantations. Around 26 million hectares are in New South Wales. These forests cover about 19% of the continent and 33% of New South Wales. This represents about 6.6 hectares of forest for each Australian, among the highest areas of forest per person in the world, which averages less than 0.6 hectares per person. Australia has about 3.75% of the world’s forest. Australia’s total imports of wood products in 2010 were valued at $4.2 billion, considerably in excess of total exports of wood products at $2.3 billion (ABARES, 2011).

<table>
<thead>
<tr>
<th>Australia</th>
<th>NSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total land area ('000 hectares)</td>
<td>770</td>
</tr>
<tr>
<td>Total forest area ('000 hectares)</td>
<td>149</td>
</tr>
<tr>
<td>Forest area available for timber harvest ('000 hectares)</td>
<td>113</td>
</tr>
</tbody>
</table>

Table 2.4 Forestry statistics for NSW and Australia (Forests NSW 2008-09 Facts and Figures 2008-09, NSW Government)

Australia’s native forests comprise mainly eucalypts (78%), acacias (7%) and melaleucas (5%). Plantation forestry is half exotic softwood (predominantly Pinus radiata) and half hardwood (predominantly eucalypt).

Arid and semi-arid lands occupy about 70% of inland Australia (average annual rainfall less than 350mm) and are too dry for forest production. Except for mallee, most native forests are located in areas where annual rainfall is greater than 500mm and most commercial plantations occur in greater than 700 mm annual rainfall regions.

Forestry, logging and wood manufacturing in 2010 employed 75,800 (ABARES, 2011) Australia-wide. The industry has helped to sustain many regional economies. Today,
however, its position has waned through market pressures, environmental concerns, government policies, and compliance requirements. The industry is in urgent need of renewal and promotion.

Until the early 1990s, state governments were the major plantation owners. Since then, there has been increasing private sector investment in plantations. As such, private ownership of plantations increased from about 30% in 1990 to more than 74% in 2010-11. At the beginning of 2013, the NSW Government established the Forestry Corporation, a state owned corporation. The new Forestry Corporation of NSW remains publicly owned and the nature of the business and business relationships will remain largely the same. The governance structures, however, have changed to improve the commercial performance. This has resulted in the movement to a leaner organisation and there will be a settling in period before clarity is provided about ongoing workforce needs.

MANUFACTURING

The product of the farm sector is exported, is consumed by Australians or undergoes some form of processing. Food manufacturing is the largest component of the manufacturing sector and its value was around $82 billion nationally in 2009-10 (DAFF, 2009). Whilst it is important to note this contribution, it is also important to note that the Federal Government’s Australian Workforce and Productivity Agency is undertaking a study of the food and beverage workforce in relation to the National Food Plan concurrently with this Review. Because of the wide scope of this Review, the manufacturing sector was not considered here. This outcome in no way detracts from the importance of the food manufacturing sector but time and budget constraints necessitated that the boundary of the Review was drawn at this juncture.

CONTRIBUTION TO INTERNATIONAL AID

Australia’s overseas aid activities began before World War II but came to the fore in 1950 with the Colombo Plan, which was concerned primarily with South and South-East Asia. Under the Plan, Australia provided a diverse range of activities such as education scholarships, technical cooperation, training and staffing assistance to countries of the region.

Education and agriculture are key components of Australia’s international aid strategy. Australia’s international aid utilises the nation’s agricultural expertise to close development gaps in our region. By 2016, AusAID will have supported sustainable economic development for 750,000 farmers through provision of access to new agricultural technologies that will result in increased crop value of over half a billion dollars (Australian Government, 2012).

Similarly, Australia continues to contribute to international efforts around agricultural research through the AusAID co-funded Australian Centre for International Agricultural Research (ACIAR). ACIAR builds capacity for agricultural research institutes in partner countries, including increased investments in agricultural research and development and support for postgraduate awards in agriculture (ACIAR, 2012).

Contributions of the agriculture industry and the agricultural expertise offered by Australia through the international aid program continue to build Australia’s role as one of the leading nations in agriculture. It is important that Australia is able to continue to promote opportunities to share and develop agricultural capabilities more broadly.

CHALLENGES AND OPPORTUNITIES

The world will need to produce, in the first half of this century, double the food produced in all of the last century (i.e. a fourfold increase) (FAOSTAT and UN). The world population is projected to be around 9.3 billion in 2050, up from the current 7 billion. At present an estimated one billion people in the world suffer from chronic starvation and this is set to rise as the population grows. The context of this challenge is that there is little prospect of extra land being available – in reality it is likely to decline as a result of expanded biofuel production, mining, urbanisation, desertification and pollution. Increased food production will thus be achieved by
BOX 2.3 NATIONAL FOOD PLAN – GOALS TO 2025

1. Value of Australia’s agriculture and food-related exports increased by 45%, contributing to increase in gross domestic product.

2. Stronger food trade and investment relationships with regional countries and capabilities to promote Australian interests.

3. Globally recognised Australian food brand synonymous with high-quality, innovative, safe and sustainable food, services and technology.

4. Australia’s agricultural productivity increased by 30%, helping farmers grow more food using fewer inputs.

5. Innovation in Australia’s food manufacturing industry increased, building scale and capability through collaborations to take advantage of emerging opportunities in Asia.

6. Agriculture and fisheries workforce with increased skills base; higher proportion with post-school qualifications.

7. Infrastructure and biosecurity systems support a growing food industry, moving food cost-effectively and efficiently to markets and supporting new export opportunities.

8. Increased participation by food businesses in digital economy; driving productivity gains and innovation and creating connections with global markets.

9. Australia among the world top five most efficiently regulated countries; reducing business costs.

10. Australia builds on its high level of food security by continuing to improve access to safe and nutritious food for remote communities or those struggling with disadvantage.

11. Australia in the top three countries for food safety, increasing the reputation of Australia’s exports.

12. Australians have information needed to help them make decisions about food.

13. Australian children with better understanding of how food is produced.

14. Australia to contribute to global food security by helping farmers in developing countries gain access to new agricultural technologies.

15. Australia to produce food sustainably and adopt innovative practices to improve productive and environmental outcomes.

16. Australia to reduce per capita food waste.

National Food Plan, Australian Government
consistent productivity gains, producing much higher yields than ever before, but all in the context of sustaining the natural resource base. Productivity gains will be dependent on research and development, new technologies, better trained practitioners and advisers, and better management of risk and markets.

Including Australia’s population of 23 million people, Australian farmers and fishers produce enough food for around 60 million people (National Food Plan, 2013). However, the world is changing, with climate change, population growth, increasing affluence and diet change in developing countries and related changes, presenting both challenges and opportunities. The prospect of the ‘Asian century’ is expected to present openings for Australia’s food industry provided it has the capacity and capability in a highly competitive international marketplace. Having a workforce with the requisite technical, practical and managerial expertise becomes an imperative. The details are presented in the National Food Plan (Australian Government, 2013) and it is important to reflect on the goals of that Plan (Box 2.3). It is clearly evident that the quality of the workforce is a necessary part of the goals if the nation is to capitalise on the opportunities presented. The lack of an appropriately skilled workforce presents a medium to long-term risk to our agricultural productivity and global competitiveness.
CHAPTER 3
THE EDUCATION PARADIGM

“In rural production we are passing, if we have not already passed, out of the era in which only certain staple lines of production needed to be engaged in, for which there was a reasonable assurance of a world market. The period has been described by some experts as the period of exploitation.

We are passing out of that. We are entering the period when there will be much more difficulty in obtaining markets. I am now taking the long view. We are passing into the period when we must direct ourselves to much more intensive use of our soil, with much more scientific knowledge of its treatment and possibilities and with much greater variety of production. If our rural industries are not to enjoy a brief period of high prosperity, while the world is going through the reconstruction period, followed by a shrinkage in the period of fierce competition that will then probably ensue, it seems clear that we must increase our efficiency and get our costs down.

That will involve, I believe, at least two things. It will involve a large development of scientific research in its relation to the agricultural and pastoral industries. It will involve serious attention to the problem of, not theoretical training, but scientific training for the actual work of the farmer. In regard to scientific training for the man on the land, it has seemed to me for a long time an anomaly that in a country so largely dependent for its true prosperity upon production from the soil, such meagre facilities should exist in relation to agricultural colleges, and that most of the existing colleges –and I have had a close look at a few – should be so obviously starved of plant, equipment, staff and buildings. If our attitude is to be that rural production is a mere matter of practical experience sharply limited to the locality in which it is acquired, and that a sound preliminary mental training is not needed, we shall fall very rapidly behind the other competitor countries.

On these matters, I should like to mention without discussing it further the position of agricultural and other technical experts in this country, often underpaid and overworked, who are the advisers of the man on the land. They have given and are giving notable service.”

R.G. Menzies
1945, Future of Australian Education
EDUCATION AND PRODUCTIVITY

There has been a long term trend in the decline in agricultural education and training participation and completions (eg Pratley 2012b). The agriculture sector in Australia is now notable for its low levels of post-secondary qualified workers and, in particular, for a shortage in the supply of appropriately qualified university graduates.

Evidence overwhelmingly indicates that levels of education are directly linked to increased levels of productivity. A 2010 Organisation for Economic Co-operation and Development (OECD) report on the benefits of improving outcomes of the ‘Programme for International Student Assessment’ (PISA) emphasises this point: “... economies with more human capital (measured by cognitive skills) innovate at a higher rate than those with less human capital, implying that nations with larger human capital in their workers keep seeing more productivity gains” (OECD, 2010, page 11). The report notes that schooling drives gross domestic product growth as long as it drives attainment. Economic modelling in the report suggests that if Australia were to achieve a 25 point increase in PISA scores by 2030 and maintain this to 2090, it would provide a projected benefit of more than US$2.5 billion to the Australian economy (OECD, 2010, pages 22-23).

What is true for the school sector also holds true in respect of vocational education and training (VET) and higher education: increasing levels of attainment are directly linked to increased levels of overall economic productivity. Research has found that higher-level skills increase earnings and productivity: those with a bachelor degree earn almost two and a half times more than people whose highest level of educational attainment is Year 11 (ABS, 2010), and firms with more qualified managers are better managed and more productive (Green, 2009).

Governments of all persuasions in Australia have identified that increased levels of skills and qualifications and higher levels of participation in the economy are seen as key to strengthening Australia’s productivity. The shortfall in a skilled workforce in the agriculture sector coincides with a wider national recognition that skills reform is central to driving economic growth. With skills reform a key component of the national agenda for economic growth, there is a clear opportunity to increase participation levels in education and training.

EDUCATION TARGETS

Commonwealth and State Governments have set ambitious targets to lift access, participation and completions in senior schooling and tertiary education for all Australians, including those from low socio-economic status backgrounds and Aboriginal students. The 2009 Commonwealth response to the Bradley Review of Australian Higher Education, Transforming Australia’s Higher Education System, has seen the adoption of targets to increase the percentage of young people who hold a bachelor degree and to increase the undergraduate enrolment of people from low socio-economic backgrounds. These are detailed in Box 3.1.

The NSW Government in its publication, NSW 2021, A Plan to make NSW Number One, has set targets which complement these national targets and build on the already above average levels of participation in higher education in this State. Consistent with the Council of Australian Governments’ (COAG) goals, New South Wales has also set targets for attainment of school and vocational education and training qualifications. These targets are detailed in Box 3.1. Such targets rely on more students finishing high school or equivalent.

In the context of this concerted policy drive to address skills needs and increase qualification levels for all Australians, there is a clear opportunity for developing strategies to increase participation and completions in agriculture qualifications. Given that the agriculture industries lag well behind those in other sectors in education and training qualifications, this represents a much greater challenge for the agriculture sector.
BOX 3.1 AUSTRALIA’S EDUCATION TARGETS

- 40% of 25 to 34 year olds will hold a bachelor-level qualification or above by 2025
- 20% of undergraduate enrolments will be students from low socio-economic status backgrounds by 2020.

Bradley Review of Australian Higher Education, Transforming Australia’s Higher Education System

BOX 3.2 EDUCATION TARGETS IN NEW SOUTH WALES

- 44% of 25 to 34 year olds holding a bachelor degree or higher qualification by 2025
- 20% of undergraduate enrolments from students with low socio-economic backgrounds by 2020
- 50% increase in the proportion of 20 to 64 year olds with qualifications at Certificate III level and above by 2020
- 100% increase in number of higher qualification completions at Diploma and Advanced Diploma level by 2020
- 20% increase in VET completions at Certificate III level and above by women, Aboriginal students, and students from rural and regional New South Wales by 2020
- 10% increase in apprenticeship and traineeship completions by 2016, including in rural and regional New South Wales
- 90% of school leavers participating in education and training or employment by 2020
- 90% of 20 to 24 year olds holding a Year 12 or Australian Qualifications Framework (AQF) qualification at Certificate II level and above by 2015, with this increasing to AQF Certificate III level by 2020
- Halve the gap in Year 12 or equivalent attainment for Aboriginal students aged 20 to 24 by 2020, and for reading and numeracy by 2018.

NSW 2021, A Plan to make NSW Number One
RURAL AND REGIONAL EDUCATION AND TRAINING

There is a growing recognition of the significant gap in educational attainment and aspiration that exists between metropolitan and non-metropolitan based students. The 2009 PISA assessment of students’ reading, mathematical and scientific literacy showed that 15 year old Australians in rural schools were one and a half years behind their peers in metropolitan schools in all areas. For example: “in reading literacy, the average score of students attending remote schools was about 30 score points lower than that of students attending schools in provincial areas, and about 50 score points lower than those of students attending schools in metropolitan areas” (ACER, 2009).

Similarly, in Australia, a disproportionately high percentage of applicants for undergraduate university places are students from metropolitan areas. Data for 2011 from the Department of Education, Employment and Workplace Relations (DEEWR) show that 76.6% of applicants were from metropolitan areas, an over-representation given their population share of 71.4%. In New South Wales and the Australian Capital Territory only 16.4% of applications came from non-metropolitan areas (DEEWR, 2011).

Conversely, participation in VET is relatively strong in regional and remote areas of New South Wales, with students in rural and regional areas representing 34% of NSW VET students in 2006, growing to 41% by 2011 (NSW Department of Education and Communities, NCVER). Overall there has been a 48% increase in VET student numbers in rural and regional areas (studying Certificate III and above) since 2006 compared with a 34% growth in metropolitan areas. A disproportionately high 42% of apprentices in New South Wales are from rural and regional areas.

In respect of Aboriginal students, and on a State-wide basis, a much higher proportion continues to be below the national minimum standards for reading and numeracy compared with non-Aboriginal students. Similarly, just over one third of Aboriginal students continue to Year 12 compared with over two-thirds of all students. This translates to a much lower participation rate at university for Aboriginal students, though participation in VET is generally strong, with significant increases in both participation and completions over the past four years (TAFE NSW).

A NSW Ministerial Taskforce on Aboriginal Affairs in 2012 outlined for comment a range of proposals that would radically boost opportunities for Aboriginal people.

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**Figure 3.1** Trends in degree attainment in agriculture relative to the Australian workforce

[Australian Bureau of Statistics Catalogue No. 6227.0 and previous iterations]
These include: better support of language and culture in communities and in schools to improve engagement with families and to motivate Aboriginal students to remain at school; and, importantly from the perspective of this Review, facilitating student pathways to real jobs by engaging local employers in career planning. Such initiatives provide opportunities for increasing Aboriginal student participation in agricultural education and training as long as careers are presented as real options at the local level.

Education and training needs to be available equally to all Australians, regardless of background and location. The data suggest that there are particular challenges for rural and regional people as the levels of participation are well below those of metropolitan communities.

**AGRICULTURAL EDUCATION**

Given the importance of agriculture to the New South Wales economy, improving the skills and knowledge base of the agriculture industry workforce is fundamental to assisting overall growth in productivity for New South Wales. Workers in the agricultural sector are 21st century citizens and are entitled to, and have expectations of, the same education opportunities as the rest of the community. Although the sector has been gradually increasing its levels of education (Figure 3.1), higher education qualifications (around 11% in agriculture) continue to lag substantially behind those of the community as a whole (28%).

It is also significant that the agriculture sector has a much higher proportion of its workforce (>53%) without post-school qualifications than occurs in the national workforce (35%). Such data perhaps reflect the sector’s preference for ‘on the job’ skills development instead of formal education and training. One submission to the Senate Committee Inquiry, *Higher education and skills training to support agriculture and agribusiness in Australia* (June 2012), noted that “for a long time human capital has been regarded by industry as a non-strategic cost rather than an asset and that, overall, education and training are misunderstood and undervalued” (Senate Committee 2012, page 4).

This is exemplified by the lack of apprentice positions offered in the agriculture, production horticulture, and fishing industries. With few exceptions, agricultural industries have not readily embraced education and training due to the link between qualifications and higher wages. The concept of professional development has not generally been part of workforce management in this sector.
Using data from its farm surveys, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES, submission 2012) has analysed the change over time in the education level of farm operators in broadacre and dairy production. Figure 3.3 shows a larger percentage of farm operators achieving a higher level of education in each consecutive decade. In particular, the proportion of broadacre and dairy farmers with post secondary school qualifications has increased markedly for VET (8.0 to 14.9%) and higher education (6.2 to 15.5%).

It is clear that the agricultural industries are progressing in the right direction, albeit slowly, in terms of qualifications attainment but there is an immense challenge if these industries are to raise their education levels commensurate with those of the broader workforce.

The question is whether education and training per se are the only factors at play. The age profile of producers explains some of the discrepancy. Agricultural production is dominated by older participants. Figure 3.4 shows the average age of farmers increasing to around 56 years in 2011. This suggests that the industry is still heavily reliant on those who learnt their business ‘on the job’ according to the common practice in previous times. That system served agriculture well in the 20th century but it is unlikely to be adequate for successful business operations for newcomers in the 21st century.

Further analysis of the age structure confirms that the profile of Australian farmers is substantially different from that of the rest of the Australian workforce. This is shown starkly in Figure 3.5 where the proportion of operators on farms over 55 years of age is about two and a half times that of the national workforce. Accentuating this mismatch is that the proportion under 35 years of age is less than one third of that in the national workforce. The Australian Census data of 2006 suggest that those in agriculture under 40 years of age have educational qualification levels not dissimilar from those of the rest of the workforce. The issue then would seem to be one of attracting younger people into the sector and this would increase the education level of the sector as a whole. Attracting young people into agriculture was the focus of the Weller Report (Victorian Parliament, 2012) and the data presented here support that initiative.

At present, there is a significant undersupply of people with post-secondary qualifications in agriculture that, if not addressed, will limit the sector’s capacity for continued growth. Modern agriculture needs well educated and highly...
skilled people to capture the opportunities represented by the food security crisis and the Asian markets. The need to manage the complexities of production, marketing, environment and the various compliance frameworks make education and training an imperative in the 21st century.

**Figure 3.4** Trend in average age of Australian farmers from 1971 to 2011
(NFF 2012 and ABS)

**Figure 3.5** The age profile of farmers and farm managers in Australia relative to the national workforce
(Australian Bureau of Statistics 2010 Labour Force Survey S8.2)

**EDUCATION AND AGRICULTURAL PRODUCTIVITY**

As part of this Review, ABARES was asked to provide from its sources any advice that related to the link between agricultural productivity and educational attainment. The ABARES submission is largely reported here without amendment. This contribution is important in the context of the Review and is gratefully acknowledged.
Farmer educational attainment recurs as a factor that has a positive and significant impact on productivity growth (Kokic et al., 2006; Nossal and Lim, 2011; Zhao et al., 2009). As well as being directly related to productivity growth, education broadly influences farmers’ innovative capacity, that is, their propensity to adapt and implement new practices or technologies (Prokopy et al., 2008).

Education increases knowledge, decision-making skills and the ability to apply information in new situations (Abadi Ghadin et al., 2005). For farm decision-makers, it can influence both capacity and willingness to innovate, leading to greater innovative effort and consequently higher productivity.

ABARES has recently undertaken two major studies on innovation and productivity that evaluated agricultural education:

- Farm innovation in the broadacre and dairy industries, 2006-07 to 2007-08 (Liao and Martin, 2009)
- Innovation and productivity in the Australian grains industry (Nossal and Lim, 2011).

Liao and Martin (2009) found a correlation between higher educational attainment and uptake of farm innovative activities by broadacre and dairy farmers. Using ABARES farm survey data, the study found that a higher proportion of farm owner-operators with post-secondary schooling made innovative changes than did farm owner-operators with secondary schooling or below. These results are consistent with prior research on the effect of education and training on farm management practices. For example, Kilpatrick (2000) found that education and training had an effect on:

- Managers’ awareness of a greater number of possible innovations
- Improved decision-making and allocation of resources
- Positive attitudes towards change.

Nossal and Lim (2011) used the same data to find that education had a significant impact on both the innovative effort and productivity of grain growers (Table 3.2). When growers were split into high, moderate and low innovators and their characteristics compared, it was found that university-educated farmers were 29% more likely to be high innovators.
Table 3.1 Innovative change by level of farmer education, broadacre and dairy farms, 2006-07 and 2007-08 (% of farms) (Liao and Martin, 2009)

<table>
<thead>
<tr>
<th>Innovative activity</th>
<th>Secondary school or below (%)</th>
<th>Post secondary school (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Marketing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New approaches to marketing farm’s production</td>
<td>23 (6)</td>
<td>35 (9)</td>
</tr>
<tr>
<td><strong>Management/labour use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New approaches to labour use</td>
<td>20 (7)</td>
<td>23 (10)</td>
</tr>
<tr>
<td>New members to farm’s management</td>
<td>9 (10)</td>
<td>9 (16)</td>
</tr>
<tr>
<td><strong>Natural resource management practices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed-related natural resource management</td>
<td>23 (7)</td>
<td>26 (12)</td>
</tr>
<tr>
<td>Pest-related natural resource management</td>
<td>15 (9)</td>
<td>19 (15)</td>
</tr>
<tr>
<td>Soil-related natural resource management</td>
<td>22 (7)</td>
<td>30 (10)</td>
</tr>
<tr>
<td><strong>Product changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New crop types</td>
<td>25 (8)</td>
<td>28 (10)</td>
</tr>
<tr>
<td>New crop cultivars</td>
<td>26 (8)</td>
<td>35 (9)</td>
</tr>
<tr>
<td>New livestock types</td>
<td>9 (11)</td>
<td>11 (18)</td>
</tr>
<tr>
<td>New livestock breeds</td>
<td>16 (9)</td>
<td>24 (12)</td>
</tr>
<tr>
<td><strong>Production practice changes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertiliser practices</td>
<td>34 (6)</td>
<td>35 (9)</td>
</tr>
<tr>
<td>Soil management practices</td>
<td>30 (8)</td>
<td>35 (9)</td>
</tr>
<tr>
<td>Weed, pest and disease management practices</td>
<td>26 (8)</td>
<td>29 (10)</td>
</tr>
<tr>
<td>Grazing management practices</td>
<td>16 (9)</td>
<td>26 (13)</td>
</tr>
<tr>
<td>Livestock feeding practices</td>
<td>19 (8)</td>
<td>24 (10)</td>
</tr>
<tr>
<td>Fodder conservation and use practices</td>
<td>14 (9)</td>
<td>14 (15)</td>
</tr>
<tr>
<td>Livestock handling practices</td>
<td>13 (11)</td>
<td>15 (12)</td>
</tr>
<tr>
<td>Livestock health practices</td>
<td>15 (10)</td>
<td>19 (14)</td>
</tr>
<tr>
<td>Pasture types</td>
<td>21 (8)</td>
<td>22 (12)</td>
</tr>
<tr>
<td><strong>Cropping equipment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment for cultivation, planting, fertilisation,</td>
<td>36 (6)</td>
<td>43 (8)</td>
</tr>
<tr>
<td>spraying and harvesting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Irrigation practices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation and water management practices</td>
<td>26 (15)</td>
<td>33 (15)</td>
</tr>
</tbody>
</table>

**Note:** Figures in parenthesis are standard errors expressed as a percentage of the estimate provided.
and 34% less likely to be low innovators, relative to farmers with primary school or no education. This implies that education has a strong influence on grain growers’ capacity to select and integrate new technologies and management practices into farming systems.

Table 3.2 Change in the probability of high, moderate and low innovative effort (%) (Nossal and Lim, 2011)

<table>
<thead>
<tr>
<th>Education</th>
<th>High innovator</th>
<th>Moderate innovator</th>
<th>Low innovator</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>16.2</td>
<td>11.8</td>
<td>-28.0</td>
</tr>
<tr>
<td>TAFE</td>
<td>20.4</td>
<td>5.1</td>
<td>-25.6</td>
</tr>
<tr>
<td>University</td>
<td>28.7</td>
<td>5.1</td>
<td>-33.8</td>
</tr>
</tbody>
</table>

The study also found that education was strongly associated with higher productivity. Grain growers with a university education demonstrated an average productivity level that was 36.6% higher than those with no formal education or primary schooling only, all other things being equal. TAFE and high school educational attainment was also associated with higher productivity. This suggests that education, along with other aspects of human capital, develop essential knowledge and skills needed for effective innovation.

This analysis by ABARES clearly indicates the positive link between educational attainment and productivity and is consistent with experiences in other industries. To this must be added the influence of age. Younger operators are usually more comfortable with new technologies and are keener to adopt new ideas. Where they have some influence they tend to be keener to push the frontiers relative to the more conservative older generation. As the younger generation usually has more formal education through better opportunities, there is the potential synergy of age and education to deliver greater productivity gains in the future.

CONCLUSIONS

The link between education and training is well established and agriculture is no exception. Whilst the younger generation are comparable in educational attainment with their peers, the issue for agriculture is that there are insufficient young people to make sufficient difference. The remainder of the Review endeavours to address the many issues involved, including industry vision, industry image, school experiences and teaching quality, workforce strategies and a general increase in the professionalism of the industry. Unless the emerging generation is well informed about the opportunities in agriculture and can identify clear career paths, then the ability of the sector to attract and retain a qualified workforce in order to remain competitive is in doubt.
CHAPTER 4
AGRICULTURAL EDUCATION AND TRAINING

Optimum Input

I’m standing by a boundary fence not far from Ararat,
Looking at some pastures which will quickly make sheep fat,
On one side feed is succulent, with clover and with grass,
The other side has onion weed, the feed is poor and sparse.

On one side of the boundary fence the sheep are in good nick,
The other side the sheep are poor, they barely get a pick,
The good feed side the sheep are well, the stocking rate is high,
The other side the sheep are poor, the owner wonders why.

And what is it about the land, which changes with a fence? Do soil type and rainfall change, does that make any sense? What magic mystery is there which causes such a line? It’s management, fertility and doing things on time.

Times of lambing, stocking rate and fertiliser spread, All combined to do things well, no lame excuse instead, The contrast in the management, from best to worst is stark, Some people have the lights full on, while some are in the dark.

The fence line that I’m looking at tells the tale so well, High input farming is the go, it gives you more to sell, Low input, poor stock, onion grass – no profit, farm decline, Contrasts with those with inputs high – they’re really doing fine.

Michelago Mick (aka Mike Stephens), 1996
Source: Poem and permission provided directly from author
Although components of agricultural education in New South Wales are specifically evaluated in subsequent chapters, a brief overview is warranted to provide a context to that evaluation. Considered here are some of the issues relating to articulation between ‘phases’ of the education system. Curriculum and management issues are considered in separate chapters.

The Review is being undertaken as the Australian curriculum agenda is being developed and implemented. It is important to note that agriculture per se is not being considered as a subject for development under the Australian curriculum and remains largely as an elective option in schools. Nevertheless there are substantial opportunities for agriculture to enrich the Australian curriculum with its best chance being in the formative stages of resource development and implementation. Background on the Australian curriculum is provided in Appendix 4.1. New South Wales is part of the Australian curriculum rollout and will adapt and build on the framework developed by the Australian Curriculum, Assessment and Reporting Authority (ACARA).

It is important to note the opportunities that exist to enrich the teaching of the curricula through the provision of quality teaching and learning materials that integrate agriculture and food content. This Review has identified the process to develop and successfully implement such curriculum resources for use at the school level. The process is described in Box 4.1.

PRIMARY EDUCATION

Formal education begins in primary schools although there is no consideration of agriculture per se. That said, there is opportunity for students to gain an understanding of plants and animals, their growth and care. An understanding of the source of food and its role in quality of life in Australia seems a reasonable proposition yet surveys of the knowledge of students in this respect suggest that there is an awareness gap, particularly in students from metropolitan regions (ACER, 2011).

SECONDARY EDUCATION

At this stage, students proceed to secondary schools where they are confronted with clearly separated instruction between disciplines, and specialised teachers. The exposure of these students to a range of individual teachers in the early secondary years is highly influential in determining the likes and dislikes for a discipline and thus a potential career (Health of Australian Science, 2012).

In schools where agriculture is offered, agricultural options are taught as part of Technology in Year 7 or Year 8 with an agricultural elective available in Year 9 and Year 10. Details of these subjects is provided in Chapter 6. In Year 11 and Year 12, students in schools where the discipline is taught are likely to have the option to choose Agriculture or Primary Industries or both. Subject detail is also provided in Chapter 6. Both Agriculture and Primary Industries can be studied for the Higher School Certificate (HSC).

Recent changes to education curriculum structures and course offerings led to more vocational education and training (VET) options within the school system. VET courses provide students with choice and flexibility as they make decisions on what they want to study and possible careers they may wish to take up following school. Primary Industries is the agricultural offering in VET and there are several options within ‘agriculture’ depending on locality and availability of instructional expertise. Students who take...
BOX 4.1 ENRICHING THE CURRICULUM BY PROVIDING ACCESSIBLE EDUCATIONAL MATERIALS

Many organisations and individuals have produced ‘educational materials’ for use by education systems but find that they are not utilised. They tend to be located on the home website in the expectation that they will be found by a search engine and then readily adopted. Most organisations do it this way so that they maintain control over the material.

From the education system viewpoint it is difficult to know what are authentic and appropriate learning support materials, given the range available. This is particularly so when non-agriculture teachers are considering the use of learning resources for their particular discipline. Providing resources through a recognised and trusted curriculum resource bank which ensures that materials are quality assessed and easily accessed is a solution.

Scootle (managed by Education Services Australia) and E-syllabus Program Manager recently established by the Board of Studies NSW are the two main resource banks for teachers. These are described below.

Scootle: this provides a portal for access to digital resources for teachers. Such resources are housed on the proponent’s website for their maintenance but there are requirements in terms of format, quality, technical features and searchability in order to be in Scootle. Two particular criteria apply – complete copyright clearance and relevance to the curriculum.

E-syllabus program builder: This is an internal ‘cloud’ for teachers to develop their own teaching units. There is provision for teachers to share with others and this represents an opportunity for those within the system, such as agricultural high schools, to upload programs and provide links to resources for others to use. Most resources associated with teaching programs however will be accessed through Scootle. Access is available to teacher training institutions but not to the general public.

Trusted providers are a critical element. For science, PrimaryConnections is well known and that organisation is prepared to work with agricultural science materials associated with the curriculum such that there are appropriate instructions on how to teach the unit. PrimaryConnections is further discussed in Chapter 5.

For the majority of agricultural materials, the trusted provider is the Primary Industries Education Foundation (PIEF), a not-for-profit organisation established for the prime purpose of ensuring quality curriculum materials in primary industries are available within the education system. PIEF is a ‘trusted provider’ and all resource providers should work through PIEF.


Other resources available include information through AgriFood Skills Australia which is available on their website: http://agrifoodskills.net.au.
Primary Industries can leave school with a VET qualification, usually Certificate II.

POST-SCHOOL

At the end of secondary school, students have the option of furthering their education through the VET system or university study. Otherwise they enter the employment market where they may also improve their educational qualifications with support and encouragement of the employer. Whilst there is no entry requirement to undertake VET studies, performance in the HSC determines whether the student qualifies for a place in university studies. Individual performance is measured by the level or 'Band' attained in an individual subject and the Australian Tertiary Admission Rank (ATAR) is used for a student’s overall performance relative to peers. Much conjecture exists in the education system about the allocation of Band 6s, the top level, in Agriculture and whether the scaling process for ATAR calculation disadvantages those students who choose to study Agriculture as an HSC subject. These two issues, Band 6 allocation and the ATAR calculation, are considered below.

BAND 6

Standards in a course are described in terms of relevant content, skills, concepts and principles and represent the range of achievement expected of students completing the course. Performance descriptors, which describe typical achievement at different standards (bands), have been developed for each course. There are six bands for 2-unit courses. The percentage of students in any band depends only on how students in that course perform at the standard specified by the band descriptor. There are no predetermined percentages of students to be placed in the bands.

Although the standards described by the bands in a course are the same from year to year, standards between courses will differ as they are based on different criteria. It is likely that the percentage of students in each band will vary across courses, and may vary from year to year. The range of reported marks for the bands in 2-unit courses is provided in Table 4.1.

<table>
<thead>
<tr>
<th>Band</th>
<th>Mark range</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>50-59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>60-69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>70-79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>80-89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>90-100</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The number of Band 6s is often used to judge performance of a school or course and there is often criticism about the number of Band 6s allocated to subjects. This is a common criticism in Stage 6 Agriculture. It is important to explain the process to dispel the myth.

The number of students in Band 6 depends on how the students have performed in that course and the way the standards in that course have been defined. There can be large differences between courses: some have relatively large numbers of students in Band 6, others only a small number. The number is a function of the number of students who have attained the prescribed standard for the Band.

This is immaterial in respect of ATAR calculations. If a student is in Band 6 for a course where there are relatively few students in that band, ranking is actually higher than for a student in Band 6 in a course with many students in Band 6. ATAR is based on marks gained in examinations and school assessments moderated against the actual examination marks.

AUSTRALIAN TERTIARY ADMISSION RANK (ATAR)

The ATAR is a measure of how well a student performs academically in relation to other students on the basis of their overall academic achievement in the HSC. It is about position or rank.

Each year about 50,000 students are eligible to receive an ATAR. English is compulsory, but students then choose from 100 or more courses on offer to make up the ten units required for their HSC.

For most courses a student receives two marks: one from the school, based on assessment tasks completed during the HSC year, and the second based on
performance in the HSC examination. All HSC examinations include a written examination but they also may include projects and oral/aural/performance components, all of which are externally marked.

Because schools report student marks in different ways, the Board of Studies NSW first moderates the marks provided by individual schools to place them on a common scale. These moderated marks are then comparable and are used by the Board of Studies NSW to determine the standards achieved by students in their courses. For each course, students receive an HSC mark that indicates the standard they have reached in that subject and a Record of Achievement, which is a profile of their achievements in the courses they have completed. There are six performance bands: for example, students who demonstrate that they have reached the highest standard receive a mark between 90 and 100. The Board does not provide an overall measure of achievement.

The Universities Admissions Centre (UAC) takes the average of the actual HSC examination marks and the moderated school assessments and determines the ranking of a student in the courses they have completed. Because a student’s ranking in a course depends on his/her ability in that course and the ability of other students in that course, the UAC first scales the marks to determine what the mark, and hence rank, would be if all HSC students undertook that course.

A student’s overall achievement is calculated by adding the scaled marks in their best ten units, including at least two units of English, to yield a mark out of 500. Students are then ranked on the basis of their aggregates of scaled marks, giving their ranking in relation to Year 12 students who were eligible for an ATAR. The final step is to determine what a student’s rank would be if there were no early school leavers, i.e. that all students completed Year 12 and were eligible for an ATAR. The ATAR, as calculated, is a number between 0 and 99.95 that indicates a student’s ranking in relation to their age cohort. Students whose overall academic performance is better that 80% of their age cohort receive an ATAR of 80.00. The middle student in the ATAR eligible cohort receives an ATAR of approximately 70, which varies slightly according to the participation rate.

The decisions students make in relation to future careers is influenced by a range of experiences, by mentors and not uncommonly by serendipity. What is important is that students have access to the best advice and resources so that they can make an informed decision.

The ATAR is then used to determine the offer the student will receive from a university, provided the student has nominated preferences for courses. There are no quotas on university course places imposed by government and the availability of places in a course is at the discretion of the individual university. Students will receive an offer based on the highest preference for which they are eligible and for which there are vacancies. All courses have a minimum ATAR for entry which varies across institutions and between courses in some institutions.

Much has been written and spoken about choice of courses by students for the best chance of attaining a high ATAR. The Review sought advice from key people about this issue, including officers from UAC. Advice received was that the best strategy is to disregard scaling, how good the class is or how good the school is. Students should choose those courses in which they have interest, perform well and which are likely to be useful for future pursuits. If they do this, they are likely to achieve higher marks and this will contribute to a better ATAR.
BOX 4.2 2012 HSC AGRICULTURE – AN EVALUATION

Agriculture is scaled as for other HSC courses. In 2012, Agriculture was taken by 1,298 students, of whom 71% were eligible to receive an ATAR. The best ATAR by a student studying Agriculture was 99.95. Of the Agriculture students who undertook more than ten units, 79% had their result in Agriculture included in their aggregate. The mean mark in the HSC was 68.8 and Band proportions were:

- 8% in Band 6
- 16% in Band 5
- 23% Band 4
- 28% in Band 3
- 17% in Band 2

The median mark was slightly lower than that of other courses (most are in the 70s) and the percentage in Band 4 was slightly lower than the corresponding percentage in other courses (most have 30%-40% in Band 4). These differences are unrelated to scaling, being determined by the panel of Agriculture judges.

The scaled mean for Agriculture in 2012 was 40.4 (out of 100). This appears low compared with mean HSC marks, but the scales differ. An HSC mark of 50 is the boundary between Band 1 and Band 2, and few students are placed in Band 1. Because scaled marks indicate ranking rather than level of achievement, the full range of marks (0 to 100) is used to maximise discrimination between students. The average scaled mark for the total candidature is 50 out of 100. A course in which more students are above average over all courses they undertake will have scaled means above 50. The converse applies.

The scaled mean of Agriculture indicates more students in Agriculture are below average across courses they undertake. Other courses with similar scaled means include General Mathematics, Community and Family Studies, Design and Technology, English as a Second Language, Information Processes and Technology, Music 1, Senior Science, Textiles and Design and Visual Arts

A low scaled mean does not imply that all students in Agriculture receive low marks or low ATARs. Key indicators are shown below:

- maximum scaled mark was 97
- 1% received marks above 92
- 10% received scaled marks above 75
- 25% received scaled marks above 56

Students who averaged 92 over all HSC courses in 2012 would have gained an ATAR above 99.5. Those who averaged 75 across all HSC courses would have gained an ATAR above 92 and those who averaged 56 would have gained an ATAR of approximately 72.
CAREER ADVICE

There has been much development internationally on career advisory services and the Australian Government has been active in considering this issue over an extended period (e.g., DEEWR, 2012; Prime Minister’s Youth Pathways Action Plan Taskforce, 2001). The Taskforce, over a decade ago, recommended that this career and transition support be “delivered by professionally trained and committed staff with good links both in the school and the community”. To date there has been little action on any implementation.

Students are provided with advice on careers and study options from a range of sources. These include parents, friends, industry people, teachers, career expos and career advisors in the school. The extent to which these sources are influential is highly variable. In respect of the current cohort of new agriculture students, the agriculture teacher was nominated as a major influence.

There is a large range of resources available to students. The Australian Job Guide is disseminated by the Federal Government to Year 10 students and the My Future website provides students with a process to explore where their interests lie. In agriculture the scope is well covered with AgriFood Skills Australia and Rural Skills Australia websites providing much advice at the VET level. More recently, website Career Harvest has been established to provide advice on professional opportunities for university graduates in agriculture and related areas. Box 4.3 provides more information on Career Harvest, developed by the Australian Council of Deans of Agriculture to fill the gap in career advice at the professional level.

ENTRENCtED ATTITUDES REGARDING AGRICULTURE

During the course of the Review, opportunity was taken to visit schools, TAFE NSW institutes and universities. Wherever possible, discussions were held with students. In the case of universities, the 2013 intakes at three institutions were engaged to relate their school experiences. Such views were critical to informing the Review, as the students had been the recipients of the system and had no obligations other than to tell it as it exists. The information provided was surprisingly consistent and raised concerns about student and teacher attitudes towards agriculture. There were at least four strong messages to emanate from the discussions:

• Students undertaking agricultural subjects were subjected to the views from their non-agricultural student peers as being ‘second class’. In some cases
they were given derogatory nicknames which reflected the lack of respect from others for their choice of study. Students also felt that some staff members were of the same attitude.

- In non-agriculture subjects where agriculture was used as an example (e.g., environmental studies), the context was negative towards agriculture and did not reflect the progress that agriculture had made over the last thirty years to address its environmental challenges.

- Some career advisors discouraged students away from a career in agriculture. In the discussions with new students at the University of New England and Charles Sturt University (some 250 students) fewer than 5 students in total indicated encouragement towards agriculture from careers advisors. A large majority in both cases indicated the negative message. At the University of Sydney, new students did not associate as strongly with the negative message but only a very small minority received supporting advice from advisors.

- Students were largely unaware of the specialist website “Career Harvest” which has been developed to provide a comprehensive account of professional employment in the primary industries.

Together, this scenario explains in large part the reluctance of high school graduates to consider a career in agriculture. To some extent the school communities are a reflection of the greater community and so the attitudes within the schools can be somewhat excused if the image of agriculture is coloured by media portrayal, incident publicity, activist propaganda and lack of promotion by industry. It emphasises the need for the agriculture sector to be proactive in recreating a positive image, promoting industry careers and regaining the social licence to operate (see Chapter 9 for a consideration of the social licence issue). At the same time action needs to be taken within the school system to change negative perceptions about agriculture as a career choice.

In discussions it became clear that some career advisors do not send positive messages to students about agriculture as a career choice. Some of these messages may stem from broader issues such as the urban/rural divide and from many urban trained career advisors being unaware of the range of agriculture careers available. In further evaluating the role that such personnel play, it became clear that there was little support for the current role from teachers, students and administrators who were consulted during the Review. Whilst career advisors receive some training and support in their roles, more emphasis needs to be placed on the significance of agriculture as a career choice in their ongoing professional learning.

Students need the advice of career professionals. The professionalising of the career advice in schools could be achieved by outsourcing the career advice to specialists in this field or by appointing internal career advisors who are appropriately trained and accredited. In taking this step it is recognised that some of the smaller centres in rural New South Wales may find difficulty in accessing specialist external career advisors and so the solution there might be intensive professional development for a limited number of selected staff from within the system. It is clear that the current system is not working and there needs to be a review of this agenda to ensure students are provided with the best advice. Career guidance must be enhanced to facilitate students being able to choose learning and career pathways related to their unique interests, talents, and aspirations. However, they need to be aware of current labour market and workforce needs.

The NSW Government and the Federal Government have clear intentions to improve the quality of education. This Review notes that career advice is now a defined profession with a nationally networked association (Career Industry Council of Australia) with clear requirements of qualifications and a code of ethics. In terms of the quality imperative the current system of career advisors is outdated and should be replaced with a program that meets these professional standards.
TOWARDS ATTITUDE CHANGE

It is unrealistic to expect schools to pander to the requests from an individual industry sector for greater exposure in the education system. However, for agriculture and food, this can be achieved within a greater context through the provision of quality teaching resources for use in the teaching program overall and this is explored in some detail in subsequent chapters. There are also some important life skills, perceptions and attitudes that are important in generating knowledgeable, sensitive, appreciative and health-conscious citizens over and above any discipline study. The context therefore is the role of food in our society, its value in Australia and elsewhere, and its role in providing good health outcomes for the community. Celebrating our quality of life, the role that quality food supply delivers, an appreciation for its production and its importance to the economic wellbeing of the country will help to amend the attitude in the secondary school system. Primary industries generate the products associated with food and associated fibre production, including aquaculture, horticulture, forest products as well as mainstream foods, wool and cotton.

In the school system there is a celebration of education in Education Week. There are numerous other special events such as the Schools Spectacular and other music and art events. This Review recommends that the NSW Department of Education and Communities institute an ‘Agriculture and Food Week’ that addresses the big picture aspects of food and fibre production, food security and food as an essential component of life. It is important for the leaders of tomorrow to appreciate that food has a value and that complacency over its continued availability is not a position to be encouraged. The components of the special week that, \textit{inter alia}, should be included are:

- Celebration of the multicultural foods available in Australia; traditional ‘aussie’ tucker; bush tucker; ethnic foods
- Appreciation of health aspects of food; importance of good diet and links with daily performance, health, obesity and food safety
- Understanding of food value and security; comparison with other lands; developing humanitarian values by sponsoring a child from hunger
- Appreciation of where food and fibre are produced; linking foods to origin, consideration of processing, food labels
- Understanding of importance of agriculture to the building of the nation, and to the national economy in current times
- Appreciation of the culture in agriculture including poetry, literature and music; ‘putting the culture back into agriculture’
- Showcasing of careers in agriculture to students
- Incorporation of special programs such as Art4Agriculture and Cows Create Careers as part of the celebration.

In consultations with teachers and others within the education system, it was advised that Terms 3 and 4 are not favoured because of the already busy schedule. Most favourable was Term 2.

The outcomes from the celebrations are numerous but include: students’ appreciation of Australia as a lucky country for quality, abundant food at reasonable cost relative to other places where food is scarce; that sensible food habits contribute to higher daily performance and better health and life expectancy; that people work hard to provide the range and quality on offer but nothing should be taken for granted; that agriculture provides us with some rich culture as well as contributing significantly to national wealth; and that agriculture pervades all areas of learning and in so doing provides a range of careers of immense diversity.

The establishment of Agriculture and Food Week establishes a conduit for the industry and the community to engage strongly with the education program. At the school, there is the opportunity for restaurants or ethnic communities to demonstrate their foods and cuisine, for Aboriginal communities to educate on their tucker and for local producers to provide samples of local produce. There is the opportunity for people who work in the industries to
share what their career activities are and for agribusinesses to show equipment or facilities. It is an opportunity for the NSW Department of Primary Industries Research Centres to show off their experiments or to prepare exercises for visiting students to undertake. It is an opportunity for agricultural high schools and other schools with extra facilities, TAFE NSW centres and the Royal Agricultural Society to share expertise, provide experience and host exhibitions for the benefit of the less well-endowed schools.

To promote the involvement of all New South Wales schools, the Week could be co-sponsored by the NSW Department of Primary Industries. This would encourage non-government schools to also become involved.

At the community level there is also opportunity to add value. For example, the New South Wales universities could be involved in a public lecture series around the state on critical issues affecting agriculture and food. Engagement of the media is critical as it provides them with good copy but more importantly allows the journalists to see what is good about food and fibre, that it is a modern industry contributing substantially to Australian quality of life and that the image they often portray of it is inconsistent with reality.

**TERTIARY EDUCATION**

Terminology is used to enable clear communications but, in the case of education, distinguishing between the sectors can be confusing. The term tertiary education is used to refer to the post-secondary options, namely the vocational education and training sector (VET) and the university sector, the latter referred to as higher education. In practice there is overlap and in the case of VET, secondary schools now offer Certificate training in many areas or outsource the delivery to TAFE NSW or other registered training organisations (RTOs).

There is ongoing pressure by segments of the community for RTOs to move towards universities and for universities to become closer to VET. This Review does not support these contentions as it is clear that both sectors have a defined role, a demarcation that should be defended. The Review is thus consistent with the Bradley Report (2008) which stated that

“...diversity in tertiary education provision remains necessary to ensure that the full range of learner, industry and social needs can be met. The broader tertiary education and training system must support development of generic and specific skills, knowledge and understandings for new workforce entrants and for those seeking skills deepening or broadening. It must also cater to young people experiencing difficulty in making successful transitions and to existing unqualified or low-skilled workers. In regional areas there are particular requirements to meet local skill and innovation needs. Given this variety of needs, it is critical that higher education and VET remain distinct in their educational offerings and roles.”

It is recognised that university education has changed over time from generic degrees to those more closely aligned with professions but compromising on the philosophy of what a university education should be is not supported in this Review. Similarly, VET has a clear role and should not be diverted from its core purpose. It needs to be said that VET *per se* is not simply a feeder to higher education as that is not its main function. However, such progression pathways need to be facilitated for those who wish to take that option. There is scope for the two sectors to work more closely together such that there are pathways from VET to university, and that university students and graduates can access skills training from VET providers where necessary.

**VOCATIONAL EDUCATION AND TRAINING (VET)**

Vocational education and training provides a wide range of skills training for particular trades and industry sector occupations. In Australia vocational education and training is mostly post-secondary although there is an increasing component within the secondary schools to prepare students for employment. The main post-secondary provision is through the public TAFE system although there are private providers. All provision has to
be through an RTO. The courses on offer are part of the national training framework consisting of the Australian Qualifications Framework (AQF, shown in Table 4.1) and Industry Training Packages which define the assessment standards for the different vocational qualifications. This framework allows a student to progress through increasingly higher qualifications as need and interest allow. In general, VET qualifications are delivered from Levels 1 to 6. There is a limited number of Level 7 qualifications through the TAFE system in Australia although none exists currently in New South Wales. The AQF awards are recognised both nationally and internationally. Summary descriptions of the levels are given in Appendix 4.2.

HIGHER EDUCATION – THE UNIVERSITY SECTOR

Whereas vocational education and training is strongly focused on skills training for specific jobs, university education is about an understanding of the theoretical base of knowledge, its implementation, the development of capability in integration and in problem solving, training in research capability and an appreciation of the discipline in the national and global context. Building good networks together with developing communication and interpersonal skills are important outcomes. Universities train people for employment rather than specific jobs.

PATHWAYS FROM VET TO UNIVERSITY

Most universities have pathways from VET to higher education. Pathways range from recognising qualifications for entry to giving credit where studies completed are relevant to the content of the degree. Generally a Certificate IV provides the entry requirement. One of the challenges is the pathway from VET in agriculture to Agricultural Science. In this degree, there is a strong underpinning of the enabling sciences like chemistry and microbiology. It thus makes it difficult to grant credit where those subjects have not been studied and students find the change challenging. The different mode of study is also challenging as there is a change from course directed training to self-directed learning. This issue has recently been investigated and is reported in the NSW Government Review of Tertiary Pathways, 2012.

Table 4.2 The Australian Qualifications Framework (AQF) as it applies to different education sectors (after Bradley et al. 2008)

<table>
<thead>
<tr>
<th>AQF level</th>
<th>School sector accreditation</th>
<th>VET sector accreditation</th>
<th>Higher education sector accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Doctoral degree</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Masters degree</td>
</tr>
<tr>
<td>8</td>
<td>Vocational Graduate Diploma</td>
<td>Bachelor Honours Diploma</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vocational Graduate Certificate</td>
<td>Graduate Diploma</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graduate Certificate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bachelors degree (TAFE NSW only)</td>
<td>Bachelors degree</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Associate degree (TAFE NSW only)</td>
<td>Associate degree</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced Diploma</td>
<td>Advanced Diploma</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Diploma</td>
<td>Diploma</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Certificate IV</td>
<td>Certificate IV</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Certificate III</td>
<td>Certificate III</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Certificate II</td>
<td>Certificate II</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Certificate I</td>
<td>Certificate I</td>
<td></td>
</tr>
</tbody>
</table>
Some options are emerging. TAFE NSW is developing transitional science subjects that aim to address the challenges for VET students to make the transition from the competence-based VET system to the criterion referenced system of the university. Such subjects are expected to be available for the 2014 academic year.

In addition, TAFE NSW is developing a course in maths and science skills for further study which is designed for individuals who require discipline specific skills and knowledge in science to undertake a pathway to further study at Certificate IV level or above.

There are no such challenges in subject matter for students entering agribusiness degrees. The combination of high level practical skills from VET training with the strong business skills provided by the university seems a combination that would deliver a well-rounded graduate to the primary industries.

**BOX 4.4 WHAT IS A UNIVERSITY?**

“If we seek guidance from the past, it is better to see the ‘idea of the university’ not as a fixed set of characteristics, but as a set of tensions, permanently present, but resolved differently according to time and place. Tensions exist between teaching and research, and between autonomy and accountability, most obviously. But also between universities’ membership of an international scholarly community, and their role in shaping national cultures and forming national identity; between the transmission of established knowledge, and the search for original truth; between the inevitable connection of universities with the state and the centres of economic and social power, and the need to maintain critical distance; between reproducing the existing occupational structure, and renewing it from below by promoting social mobility; between serving the economy, and providing a space free from immediate utilitarian pressures; between teaching as the encouragement of open and critical attitudes, and society’s expectation that universities will impart qualifications and skills. To come down too heavily on one side of these balances will usually mean that the aims of the university are being simplified and distorted.”

R. Anderson, 2012

**GOVERNMENT RECOMMENDATION 1**
A review into careers advice provision in New South Wales schools be undertaken to ensure students are provided with well-informed advice on possible careers and pathways.

**GOVERNMENT RECOMMENDATION 2**
New South Wales school systems, schools and TAFE NSW Institutes establish an ‘Agriculture and Food Week’ within the annual school year to celebrate and appreciate the role that agriculture and food make to the health, wealth and wellbeing of society.
CHAPTER 5
AGRICULTURE IN PRIMARY EDUCATION

South of My Days

South of my days’ circle, part of my blood’s country, rises that tableland, high delicate outline of bony slopes wincing under the winter, low trees, blue-leaved and olive, outcropping granite-clean, lean, hungry country. The creek’s leaf-silenced, willow choked, the slope a tangle of medlar and crabapple branching over and under, blotched with a green lichen; and the old cottage lurches in for shelter.

O cold the black-frost night. The walls draw in to the warmth and the old roof cracks its joints; the slung kettle hisses a leak on the fire. Hardly to be believed that summer will turn up again some day in a wave of rambler-roses, thrust it’s hot face in here to tell another yarn—a story old Dan can spin into a blanket against the winter. Seventy years of stories he clutches round his bones. Seventy years are hived in him like old honey.

Droving that year, Charleville to the Hunter, nineteen-one it was, and the drought beginning; sixty head left at the McIntyre, the mud round them hardened like iron; and the yellow boy died in the sulky ahead with the gear, but the horse went on, stopped at Sandy Camp and waited in the evening. It was the flies we seen first, swarming like bees. Came to the Hunter, three hundred head of a thousand-cruel to keep them alive—and the river was dust.

Or mustering up in the Bogongs in the autumn when the blizzards came early. Brought them down; we brought them down, what aren’t there yet. Or driving for Cobb’s on the run up from Tamworth-Thunderbolt at the top of Hungry Hill, and I give him a wink. I wouldn’t wait long, Fred, not if I was you. The troopers are just behind, coming for that job at the Hillgrove. He went like a luny, him on his big black horse.

Oh, they slide and they vanish as he shuffles the years like a pack of conjuror’s cards. True or not, it’s all the same; and the frost on the roof cracks like a whip, and the back-log break into ash. Wake, old man. This is winter, and the yarns are over. No-one is listening South of my days’ circle I know it dark against the stars, the high lean country full of old stories that still go walking in my sleep.

Judith Wright
Source: A Human Pattern: Selected Poems (ETT Imprint, Sydney 2010)
EARLY EDUCATION IMPERATIVE

Whilst this Review considers agricultural education and the need for food and fibre in the curricula at all stages, some reflection at a more general level is warranted. The work of Nobel Laureate and economist, Professor James Heckman, University of Chicago, is pertinent as a starting point. In summary, his research shows that an investment in early childhood education with maintained investment through schooling is more effective than a sole investment during adolescence. The rate of return on the human capital investment in a young person is higher than that of the same investment at an older age. In the first place, an early investment is capitalised over a longer period. Secondly, early investments raise the productivity (lower the costs) of later investments as skills, knowledge and understandings acquired early facilitate later learning. Heckman provided a diagram on how the rates of return in learning declined as age of the recipient increased (Figure 5.1).

This work provides a background for the discussion to follow on the need to focus on the importance of food and fibre education in the primary curriculum and to ensure that student engagement is encouraged and is a positive experience.

“Every kid starts out as a natural-born scientist and then we beat it out of them. A few trickle through the system with their wonder and enthusiasm intact”
Carl Sagan

TEACHING AND LEARNING ABOUT AGRICULTURE IN THE PRIMARY CURRICULUM

Primary education in NSW schools deals with the formative education of children aged 5 to 12 years. A first step in the evaluation of the primary education process for agriculture opportunities in this Review was to ask for the overall student outcomes for each stage of the system. Key Learning Areas in the primary curriculum have defined outcomes and Foundation Statements that set out expectations of student achievement at each curriculum stage. It is noted that there is government to government agreement on The National Goals for Schooling for the 21st Century (Box 5.1).

Figure 5.1 Rates of return on human capital investment at different ages
[Heckman, 2000]
which presents broad expectations of student learning for the system as a whole. These national goals provide the basis for development of the Australian curriculum and are a reference point more generally for the expectations of schooling in Australia.

However, there do not appear to be overall whole-of-curriculum statements which are student-centric for any stage. The Australian Primary Principals Association (Angus et al, 2007) has previously indicated that there is no firm agreement amongst stakeholders about the core purpose of primary schools or the various stages within. From the viewpoint of this Review, difficulty is created in identifying a way forward for agriculture and food studies without the opportunity for guidance for teachers in the form of statements that highlight the acquisition of agriculture-related knowledge as a core component of primary school learning.

There is a way forward to address this significant gap. A clear and authoritative statement on the importance of teaching about agriculture in the primary school years should be developed and made available to all primary school teachers. This should be accompanied by guidance and advice for teachers about opportunities to incorporate agriculture-related knowledge and understanding as part of the primary curriculum and the resources available to support teaching of agriculture.

Such a statement should be developed by the Board of Studies NSW in the form of a document to support the implementation of the primary school curriculum, with a focus on the potential within the existing curriculum to utilise agricultural content.

This Review acknowledges that it is unrealistic to expect that more and more information can be added to an already overcrowded curriculum or that there will be a special subject or stream provided for agriculture. In any case, it is an important principle that food and fibre become part of mainstream education rather than an adjunct to it. Figure 5.2 shows some of the more obvious opportunities that exist for agriculture to enrich the learning experience. Further detail is provided in Appendix 5.1.

In the Australian Council for Education Research (ACER) survey of teachers (2011) ‘Food, Fibre and the Future’ teachers indicated that most teachers wanted to teach about the primary industries but did not know where to start. All primary teachers and 91% of secondary teachers rated students learning about primary industries as very important or somewhat important. This provides a clear direction for the agricultural industries to ensure that teaching and learning materials are provided for the teaching fraternity.

Figure 5.2 Aspects of the K-6 curricula where agriculture can enrich the educational experience

A ROLE FOR AGRICULTURAL INDUSTRIES

The challenge for the agricultural industries therefore is to ensure that the education system has at its disposal rich teaching materials that address the existing curricula and to provide opportunities for schools to gain real world agriculture experiences for its students.

There is no simple formula for this. There is a need for a range of approaches from reading books in early primary to class exercises to use of smart technology. This Review suggests some ways in which this might occur.

One suggestion made here is to start the process in kindergarten where children
might learn through their reading, for example, the lesson of not introducing new organisms into Australia and also appreciate that science has played a key role in transforming a weed-degraded landscape to its former productive state. There are potentially many stories that could be written about agricultural experiences provided they tell a positive story and appeal to the students so that they gain the feeling that they can help.

The key issue however would seem to be a more fundamental one. There is a long term and persisting impediment in the teaching of science both in the amount of time allocated to its teaching and in the way it is taught. Whilst agriculture can fit into other curriculum areas to varying extents, its opportunity will largely rise or fall according to the strength of science instruction. The teaching of science in primary schools needs attention and its evaluation follows.

**BOX 5.1 THE NATIONAL GOALS FOR SCHOOLING FOR THE 21ST CENTURY**

Ten national goals for schooling provide a framework for cooperation between schools, States, Territories and the Commonwealth. The goals are intended to assist schools and school systems to develop specific objectives and strategies, particularly in the areas of curriculum and assessment:

1. Provide an excellent education for all young people, being one which develops their talents and capacities to full potential, and is relevant to the social, cultural and economic needs of the nation.

2. Enable all students to achieve high standards of learning and to develop self-confidence, optimism, high self-esteem, respect for others and achievement of personal excellence.

3. Promote equality of education opportunities, and to provide for groups with special learning requirements.

4. Respond to the current and emerging economic and social needs of the nation, and to provide those skills which will allow students maximum flexibility and adaptability in their future employment and other aspects of life.

5. Provide a foundation for further education and training, in terms of knowledge and skills, respect for learning and positive attitudes for life-long education.

6. Develop in students:
   - skills of English literacy, including skills in listening, speaking, reading and writing
   - skills of numeracy, and other mathematical skills
   - skills of analysis and problem solving
   - skills of information processing and computing
TEACHING OF SCIENCE

“Agriculture is the science you eat”
Anon

Agriculture is a particular application of science. Its learning therefore is informed by the learning of science, yet the learning of science can be enriched by the use of agricultural examples. In the course of the Review many mixed messages were evident in terms of the science instruction in primary schools. The 2002 Commonwealth Committee for the Review of Teaching and Teacher Education reported that science was often not taught or not taught systematically in primary schools. A major issue for the Review was the uncertainty among primary teachers about what to teach and how to teach science. A further Review in 2008 (Tytler et al., 2008) reiterated that “the major problem for improving effective engagement with science in the primary school is the lack of science taught, and the lack of confidence and competence of teachers”. In places where the passion for science existed, good things were achieved.

- understanding of the role of science and technology in society, together with scientific and technological skills
- knowledge and appreciation of Australia’s historical and geographic context
- knowledge of languages other than English
- appreciation and understanding of, and confidence to participate in, the creative arts
- understanding of, and concern for, balanced development and the global environment
- capacity to exercise judgement in matters of morality, ethics and social justice.

7. Develop knowledge, skills, attitudes and values that will enable students to participate as active and informed citizens in our democratic Australian society within an international context.

8. Provide students with an understanding and respect for our cultural heritage including the particular cultural background of Aboriginal and ethnic groups.

9. Provide for the physical development and personal health and fitness of students, and for the creative use of leisure time.

10. Provide appropriate career education and knowledge of the world of work, including an understanding of the nature and place of work in our society.

Ministerial Council for Education, Early Childhood Development and Youth Affairs
However it was a common view that primary teachers are not comfortable in the science space and that the teacher training provided in universities did little to prepare new teachers in how to engage students in the excitement of science. Interestingly, Australia’s Chief Scientist, Professor Ian Chubb has been highly critical of the way science is taught in the secondary school system - the prevalence of didactic rather than interactive modes of instruction. In the publication *Health of Australian Science* (Office of the Chief Scientist, 2012) it is reported that the “traditional chalk and talk teaching, copying notes and cookbook practical lessons” have largely removed the challenge and excitement that should be inherent in the study of the sciences. At this secondary level, the teachers are science-trained whereas in the primary system teacher training in the sciences is ‘hit and miss’ to the extent that science education (and hence agricultural education) is highly compromised.

In consideration of the Australian curricula being introduced nationally from 2013, notional times for each subject area per week are provided by ACARA in its Curriculum Design Paper. That paper suggests around one to one and a half hours per week through primary school should be devoted to science education (Table 5.1). By comparison, some two hours per week is suggested for Health and Physical Education in each primary school year. These guidelines presumably relate to current curricula as well.

Interestingly, the paper by Angus *et al.* (2007), prepared for the Australian Primary Principals Association (APPA), reported that the time actually spent on science averaged 43 minutes for Kindergarten to Year 2, 42 minutes for Year 3 and Year 4 and 51 minutes for Year 5 and Year 6, overall less than half the notional time. When the times used for school assemblies (56 minutes per week) and religious education (53 minutes per week) are considered it is clear that there is a need to address the gross inadequacy of science education in primary school and hence the likelihood of agriculture being considered. The Commonwealth Review (2002) recommended that there needed to be a higher level of scientific competence among primary teachers and improved infrastructure for science teaching.

Several issues emerge here. An important one is that primary teachers in general are uncomfortable teaching science, because they feel they do not have the requisite knowledge or the training in how to teach the science. Primary teachers are generally not steeped in a discipline, but achieve a high degree of expertise in general pedagogical practice. Their problem in relation to science, particularly physical science, is one of knowledge and confidence (Goodrum *et al.*, 2001). This lack of confidence feeds into an attitude of low enthusiasm, interest and passion, all of which help to turn the students away from science. There are at least three actions that would help redress this situation:

Firstly, there needs to be an examination of the teacher training process such that future teachers have education in science content knowledge as well as pedagogical content knowledge in order to have confidence in teaching science. It is justified given that science is a national priority in the education system. This provides opportunity for agriculture to be included in that education.

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**Table 5.1** Australian curriculum guidelines for weekly time allocation for English, Mathematics and Science (based on APPA average weekly teaching time of 1486 minutes.)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Years K-2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>27% (6.7hrs/wk)</td>
<td>22% (5.5hrs/wk)</td>
<td>22% (5.5hrs/wk)</td>
<td>20% (5hrs/wk)</td>
<td>20% (5hrs/wk)</td>
</tr>
<tr>
<td>Maths</td>
<td>18% (4.5 hr/wk)</td>
<td>18% (4.5 hr/wk)</td>
<td>18% (4.5 hr/wk)</td>
<td>16% (4 hr/wk)</td>
<td>16% (4 hr/wk)</td>
</tr>
<tr>
<td>Science</td>
<td>4% (1 hr/wk)</td>
<td>7% (100 min/wk)</td>
<td>7% (100 min/wk)</td>
<td>7% (100 min/wk)</td>
<td>7% (100 min/wk)</td>
</tr>
</tbody>
</table>
Secondly, *current* teachers need to be provided with professional development on science content and the teaching thereof. Agriculture needs to be a part of that professional development.

Thirdly, primary teachers need to be provided with quality teaching resources and it is here that the various agricultural players such as the Primary Education Foundation, NSW Farmers, Horticulture Australia Ltd and the various industry bodies and agribusinesses play a vital role. It is crucial that the agricultural sector ensures that such rich teaching materials exist so that incorporation into teaching and teacher training can occur.

“When you make the finding yourself – even if you’re the last person to see the light – you’ll never forget it”
Carl Sagan

The second issue is that of student engagement in science. There is a plethora of literature (*e.g.* Institution of Mechanical Engineers, 2010; Archer *et al.*, 2010; Murphy and Beggs, 2005; Tai *et al.*, 2006; Tytler *et al.*, 2007; Osborne *et al.*, 1998; Maltese and Rae, 2010) that enunciates the importance of forming positive attitudes and ensuring engagement with science before the age of 10 or 11. Where the interest in science is strong at this age the interest is likely to persist into secondary school. Otherwise, there is a rapid decline in interest from around 11 years of age into the early secondary school period and it becomes very difficult with age to reverse that decline. The lack of science engagement in primary education represents a lost opportunity to improve science literacy in the community over time and to increase the talent pool for a future in science, including agriculture. The lesson for agriculture is to ensure that engagement occurs in a positive way in primary school and is maintained into the early secondary school years.

The follow-up issue therefore is how to engage primary school students in science. Student interest in science from an early age needs to be fostered by life examples of science and agriculture, and the professions associated with them. Classroom teaching needs to be transformed from transmissive pedagogies to those that involve students in enquiry, discussion and engagement, i.e. the ‘science by doing’ (Australian Academy of Science) approach. This principle is not new as the literature has been littered by recommendations along these lines for a long time. Adoption of this approach, however, has been inhibited by the curriculum, considered by some teachers to be overcrowded by content. Perhaps a better balance between content and engagement is needed. There is an argument however that it is better to do a few things well than a lot of things badly – in this case for students to have understanding through doing rather than be fact-rich and unengaged. Agriculture and food provide ideal topics whereby students can strongly engage through personal experience and appreciate the scientific aspects involved. Links with practice in real time can provide an enriching experience for students.

One approach taken by some schools is to engage a science specialist to work with teachers in science education and to conduct special science lessons. Table 5.2 shows the proportion of schools which employ specialists based on an Australian survey reported in Angus *et al.* (2007) for the APPA. What is noticeable is the very low percentage of science specialists relative to other curriculum areas and this needs to be addressed. With the introduction of *Local Schools, Local Decisions*, together with the Gonski reforms if implemented, there is opportunity for schools to address the science education shortfall in a positive way, provided such specialists are science-trained and have a good understanding of the pedagogical imperatives. The opportunity for adjacent schools to share such specialists would enable progress to be made under cost sharing arrangements if necessary. Greater interschool cooperation is also needed where the final stage of primary and the first stage of secondary schools link through secondary science and agriculture teachers working with primary students to engage them in science and agriculture.
BUILDING THE RESOURCES

There is other help at hand in this ‘new’ approach. The project PrimaryConnections, spawned by the Australian Academy of Science but now an independent organisation, provides a rich portfolio of learning resources that focuses on the teaching of primary science through student enquiry. These resources and approach now have widespread acceptance in the national school system, there being over 30 units now available related to the Australian curriculum in science. Teachers in the NSW system consulted in this Review speak highly of the products and their existence should be widely disseminated.

Currently, however, there are no agriculture and food units in the PrimaryConnections collection and this provides a challenge and an opportunity. It is important to note that the agriculture sector has established a not-for-profit organisation, the Primary Industries Education Foundation (PIEF) to coordinate agricultural education activities and arrange the development of quality teaching resources. That mandate is largely about quality content and links with PrimaryConnections would provide the appropriate pedagogical support. The main question therefore becomes the provision of funds from the industry and others to enable this process to occur.

It is also important to note that many other participants in this space have developed or are developing resources. It is a positive sign that many want to help address the current education malaise in agriculture and food. At the same time there have been many calls for a single portal for such materials, in many cases being a call by a participant to run it while at the same time retaining tight ownership of the resources it has developed. This Review makes the point that PIEF (Box 5.2) has been set up as the industry sector’s resource provider and, in effect, the portal. As such it should receive the widespread support of the industry sector in this role both financially and in the provision of industry teaching and promotional resources, particularly at the school level. It is recognised that the generators of such materials may want to retain ownership and control but it makes sense that such resources are on a register with PIEF and that there are clear links from PIEF to any site. For educational material to enter the education resource bases, however, there are key protocols to be followed including use of material free of copyright. These issues are described in detail in Appendix 9.1. The fragmented approach of the past has not worked and is less likely to work in the future. Much more can be achieved if all parties work together in the interests of the agriculture and food sector.

PrimaryConnections and PIEF thus provide real opportunity to redress the paucity of resources in the teaching and learning of agriculture and food in primary schools and need to be part of the resource building agenda.

At the same time, it would be folly not to take advantage of other resource bases and to ensure that they also are rich in agricultural teaching resources. Two in particular deserve mention. The website Scootle (www.scootle.edu.au), operating under the auspices of Education Services Australia, provides digital teaching resources supporting the Australian curriculum and is widely used by teachers. External evaluation of the repository of agricultural education material shows that there is a dearth of modern agriculture materials and this is a golden opportunity
to enrich the site with such resources. This would seem a valuable responsibility of PIEF.

Recently launched by the Board of Studies NSW is E-syllabus, a website that enables teachers to build programs for teaching the Australian curriculum using resources on the site or through links to outside sites. This can be personal space for individual teachers to develop programs or such programs can be shared with others. This is an excellent opportunity for those leading the way in agriculture and food education. It is particularly relevant for leadership in agriculture curriculum by agricultural high schools (see Chapter 6). Whilst this is an internal site for teachers, there needs to be links established to PIEF and to Scootle when the latter is appropriately resourced with agricultural and food resources.

THE AGRICULTURAL EXPERIENCE

 Whilst the prior information has been about teaching resources and their development and dissemination, there still needs to be the opportunity for students to ‘do’ or to ‘see’ first hand. For agricultural

BOX 5.2 PRIMARY INDUSTRIES EDUCATION FOUNDATION

The Primary Industries Education Foundation (PIEF) is a private, not-for-profit company limited by guarantee with tripartite membership covering the primary industries (including agriculture, forestry and fisheries), government and education sectors nationally. Its objectives are to:

- Provide national leadership and coordination of initiatives to encourage primary industries education in schools through a partnership between industry, government and educators
- Commission, coordinate, facilitate and manage national projects to encourage primary industries education in schools
- Provide a source of credible, objective and educational resources for schools to maintain and improve community confidence in Australia’s primary industries and
- Communicate primary industries research and development in a format accessible for schools and encourage interest from schools in primary industries related careers.

The Foundation develops and maintains a web portal of resources and initiatives (www.primezone.edu.au) which allows sharing of existing resources and provides a central, authoritative information source. PIEF manages nationally focused primary industries educational projects for members and approved organisations. It provides savings by removing the need to run separate education projects for each state and territory.

PIEF guides the quality of educational resources delivered by the Foundation for credibility and objectivity. It provides advice on teacher professional development to assist in the uptake and use of primary industries educational resources.

PIEF monitors the adoption of education resources and information and reports to all stakeholders. The Foundation assists members by developing education resources from the outcomes of members’ key research projects.
BOX 5.3 CORINELLA DREAMING

- Is a program run successfully since 2010 by Corinella Public School, an isolated 10 student school located 60km south west of Forbes, New South Wales.

- Is a collaboration between Corinella Public School and Parents and Citizens Association, Lachlan Catchment Management Authority (LCMA), Landcare, Forbes High School, Forbes North Public School, Lake Cowal Foundation, West Wyalong High School and a local farmer co-operator.

- Was developed to provide a strong appreciation of agriculture and how it functions within the broader climatic and geophysical surrounds, as well as encouraging a keen interest in the environment by investigating soils, native plants, weeds, fertilisers and sustainable farming practices.

- Educates students from diverse backgrounds to understand how and where their food is sourced.

- Endeavours to break down the barriers between city and country as metropolitan schools engage.

- Students from local high schools visit Corinella trial site on a weekly basis together with representatives from partner organisations (eg LCMA).

- Students are provided with a Corinella Dreaming uniform which is not only appropriate for outside activities, but also changes the mindset of students from typical learning styles to a hands-on approach.

- Corinella student activities have included:
  - engaging with geologists to study soils and geological history of the area, topography and rock formation
  - soil sampling and testing to learn about soil pH and texture; results are compared with other farms.
  - evaluating crop varieties – eg variety comparison of wheat germination in varying light conditions
  - seed collecting for the Corinella Dreaming site and propagation in the school green house
  - collecting weeds for compilation into a herbarium by the students. These are labelled with correct scientific and common names, date collected and location.
  - developing skills for identifying insects, weeds, seeds, frogs and tree species, using internet and microscopes.
  - school excursions to compare different farming landscapes (Broken Hill to Enngonia), including cattle farms, cotton gin, gypsum mine and irrigation systems, funded by Grains Research and Development Corporation (GRDC). Soil samples were collected and trees identified along the way, utilising the knowledge learnt at Corinella.
issues there are plenty of opportunities for rural schools to have visits to farms, research stations and other agricultural settings. Many schools already have networks organised for that purpose and there are interesting and exciting models for others to follow. One is the Corinella Dreaming project (described in Box 5.3). This shows what is possible where the school, the community, the industry and the researchers combine to give students a highly value-added experience. It also shows that schools (both primary and secondary, rural and city) can work together for a mutually enriched outcome.

It is a greater challenge in the metropolitan schools where the availability of ‘places to visit’ in the context of agriculture and food is limited. The Stephanie Alexander Kitchen Garden concept (Box 5.4) therefore does provide the opportunity for students to experience the growing of produce and its association with food on the plate. This is about students doing the work, not watching the teacher doing it. The agricultural high schools also should be a source of real experiences for other schools. This is especially so in the metropolitan areas where such resources are scarce. This is further developed as a theme in Chapter 6.

Metropolitan schools need to be informed that there are valuable excursion offerings.

The Royal Agricultural Society at Olympic Park is developing a year round school education experience which should be better utilised by schools. Its offerings are described more fully in Chapter 9. Calmsley Hill City Farm at Fairfield also provides a positive farm experience for children and Wollondilly Shire is also developing sites for real rural experiences. In addition, TAFE NSW specialist Rural Skills Centres could provide students with practical experiences in agriculture. Discussions during the Review indicated that these and other resources are not well known within the school circles and there would be value in having information available within the departmental website. The Statement on ‘Teaching about agriculture in primary schools’ by the Board of Studies NSW should provide for the listing of excursion options available to schools on the Board’s website.

The availability of smart technologies also represents an opportunity. Classrooms today have smart boards and most have computers. It thus becomes possible for a classroom to link through Skype or similar technology to farms in real time and engage in discussion with real farmers. For example it is possible to home in on a shearing shed in full action, see the sheep being shorn and the wool being classed. With prior arrangement a small sample of the wool could be posted to the school so

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**BOX 5.4 STEPHANIE ALEXANDER KITCHEN GARDEN FOUNDATION**

In 2001, renowned cook and food writer Stephanie Alexander OAM established the Kitchen Garden Program at Collingwood College in inner Melbourne. Through the support of Federal and State governments nearly 300 schools around Australia are learning how to grow, harvest, prepare and share fresh, seasonal food.

The philosophy of the program is that by setting good examples and engaging the curiosity of children, as well as their energy and their taste buds, the positive food experiences form the basis of positive lifelong eating habits.

As participants in the Kitchen Garden Program, eight to twelve year-old children spend structured time in a productive veggie garden and home-style kitchen as part of their everyday school experience. There they learn life skills and discover the fun of growing and cooking their own seasonal vegetables and fruits.
that the students could feel, smell and see the product first hand. Likewise they could witness a crop being grown and watch it being harvested and then receive a small sample to have the real experience of the grain or the cotton fibre. For metropolitan schools, making the link with cooperating producers is the hardest aspect and so it would be a valuable contribution for farmer organisations to establish such links.

CONCLUSIONS

Agriculture and food offer much to enrich the education of primary students. It is clear that there is opportunity to populate the curriculum almost anywhere with real examples and challenges. It is also clear that any entry will be determined by the confidence, interest and competence of the teachers involved. Agriculture's best chance is to ensure that quality teaching materials are available in all education resource bases used to develop programs in schools and that there are well developed approaches to teach that material. Engagement with real agriculture is important and it is incumbent on the industry itself to be a contributor, either on farms or via smart technology.
GOVERNMENT RECOMMENDATION 3
The Board of Studies NSW develops a ‘Statement on teaching about agriculture in primary school’, including guidance and advice for teachers about Key Learning Area opportunities and availability of resources.

GOVERNMENT RECOMMENDATION 4
The NSW Institute of Teachers, New South Wales universities and school authorities initiate a review of the training and ongoing professional development of primary teachers in science, including agriculture and food, to ensure that primary teachers have the confidence, sufficient expertise and up-to-date knowledge to deliver quality science education in schools.

INDUSTRY RECOMMENDATION 3
The Cooperative Research Centre for Plant Biosecurity commissions the writing of “Cactoblastis saves the farm”.

This is the story of the introduction of the weed, prickly pear, originally as a garden plant. Its spread resulted in massive loss of agricultural production in eastern Australia. The introduction of the Cactoblastis moth enabled the control of the weed and represents a world class example of biological control. It is a story not unlike that of “The Very Hungry Caterpillar” but has the moral of biosecurity and the value of scientific endeavour.

INDUSTRY RECOMMENDATION 4
Primary Industries Education Foundation undertakes to retain liaison with PrimaryConnections with a view to the generation of teaching resources in agriculture and food for primary schools.

INDUSTRY RECOMMENDATION 5
Primary Industries Education Foundation (PIEF) be recognised as the portal for agricultural education resources by the industry sector and by the generators of educational resources in agriculture and food. All resources so generated should be deposited or registered with PIEF and necessary links identified.

INDUSTRY RECOMMENDATION 6
Primary Industries Education Foundation undertakes the responsibility for ensuring that Scootle is adequately resourced with relevant teaching resources on agriculture and food.

INDUSTRY RECOMMENDATION 7
NSW Farmers Association works with New South Wales schools to establish a network of cooperating producers to link particularly with metropolitan schools through smart technologies.
CHAPTER 6
AGRICULTURE IN SECONDARY EDUCATION

Andy’s Gone with Cattle

Our Andy’s gone with cattle now –
Our hearts are out of order
With drought he’s gone to battle now
Across the Queensland border

He’s left us in dejection now
Our thoughts with him are roving
It’s dull on this selection now
Since Andy went a-droving

Who now shall wear the cheerful face
In times when things are blackest
And who shall whistle round the place
When Fortune frowns her blackest
Oh, who shall cheek the squatter now
When he comes round us snarling
His tongue is growing hotter now
Since Andy crossed the Darling

The gates are out of order now
In storms the ‘riders’ rattle
For far across the border now
Our Andy’s gone with cattle

Poor Aunty’s looking thin and white
And Uncle’s cross with worry
And poor old Blucher howls all night
Since Andy left Macquarie

Oh may the showers in torrents fall
And all the tanks run over
And may the grass grow green and tall
In pathways of the drover

And may good angels send the rain
On desert stretches sandy
And when the summer comes again
God grant ‘twill bring us Andy.

Henry Lawson
BACKGROUND

Agriculture is taught in about one third of public secondary schools and in many independent and Catholic secondary schools. To that extent there is reasonable health in agricultural education and certainly a base on which to build. It does raise the question, though, about the two thirds of schools which do not have such education options and the extent to which students are exposed to food production, the role of agriculture in the environment and an appreciation of agriculture and food in the national economy and in underpinning the quality of life of Australians.

In schools where agriculture is taught, the program usually comprises an 8-week block within the mandatory Technology curriculum and this is programmed in either Year 7 or Year 8. In Years 9 and 10 there is an elective in Agriculture available to students. In the senior years students can study Agriculture, Primary Industries or both, depending on the offerings available at the individual school. Both Agriculture and Primary Industries can be taken for the Higher School Certificate.

Primary Industries was introduced into the school system in 2001 to provide a vocational training option in agriculture. Students can finish school with a Certificate II qualification and in some cases a Certificate III qualification. There is a range of ‘primary industry’ options that are studied depending on the location of the school and associated industries in the region.

Figure 6.1 shows the number of schools offering Agriculture and Primary Industries over the past 15 years. Consistently over this period over 300 schools or around a third of NSW schools have offered Agriculture. The number of schools offering senior Agriculture reduces by around half. There was no Primary Industries offering in 1997 but that is now well established in around 150 schools in New South Wales. The trend for that subject is a positive one.

The number of schools described above translates into around 6,500 students per year studying Agriculture at Year 10, declining to around 2,000 in Year 11 and 1,000 in Year 12 (Figure 6.2). There has been a decline in Year 12 numbers over the period of the data but the numbers elsewhere are stable. The provision of Primary Industries from 2001 has delivered around 1,000 more students into this discipline.
Where Agriculture is not offered the option exists for students to enrol and study by distance education through TAFE NSW’s Open Training and Education Network (OTEN). This equates to about 180 students per year across the three years, presumably from the range of distance education schools mainly located in the western part of New South Wales (Figure 6.3).

The demise of horticulture in the NSW school system is important to note. Figure 6.4 shows that in 1997 more than 30 schools taught horticulture in senior schools. By 2002 this had declined to fewer than 10 schools and in 2012 no schools provided that option. Student numbers over that period have declined from over 250 in 1997 to zero in 2012 (Figure 6.5). This is a poor reflection on the horticulture sector which needs to review quickly its commitment to education and its relationship with the community.
The trends in horticulture contrast with those in aquaculture. Over the course of the recent decade interest has been growing in aquaculture, with around 80 schools providing elective options in Year 10 (Figure 6.6). There is a small number of schools providing senior school instruction but that development is in its infancy. Over 2,000 students had been enrolled in aquaculture in Year 10 in 2012 (Figure 6.7).

The Review also considered forestry education in the school system but there was very little evidence that the subject area was active.

This chapter considers the opportunities for improvement. It also considers the role of the agricultural high schools and their management.
In schools with a capacity to offer Agriculture, the Technology curriculum offers a range of 8-week block options. Although Technology is a mandatory subject in Years 7 and 8, the teaching of agriculture as part of this subject is optional. A school chooses six out of fifteen content areas (Table 6.1) to teach. Five of the fifteen content areas have agricultural specific content material. Under these areas of study, content from a minimum of six technologies must be addressed by the end of the course. Technology aims to “develop student’s ability to design, produce and evaluate quality solutions that respond to identified opportunities and needs. It enables the student to justify solutions and to responsibly, safely and creatively use and select materials, tools and techniques.”
Table 6.1 Optional content areas within the mandatory Technology subject in Year 7 and Year 8. Agriculture, food and fibre options are bolded (Board of Studies NSW).

<table>
<thead>
<tr>
<th>Animal production technologies</th>
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<tbody>
<tr>
<td>Control technologies</td>
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<tr>
<td>Electronics technologies</td>
</tr>
<tr>
<td>Food technologies</td>
</tr>
<tr>
<td>Graphics technologies</td>
</tr>
<tr>
<td>Information technologies</td>
</tr>
<tr>
<td>Media technologies</td>
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<tr>
<td>Metals technologies</td>
</tr>
<tr>
<td>Mixed material technologies</td>
</tr>
<tr>
<td>Model-making technologies</td>
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<tr>
<td>Plant production technologies</td>
</tr>
<tr>
<td>Polymer technologies</td>
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<tr>
<td>Textile technologies</td>
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<tr>
<td>Timber technologies</td>
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<tr>
<td>School-developed technologies</td>
</tr>
</tbody>
</table>

For each Technology content area listed in Table 6.1, there are three prescribed ‘areas of study’ (see Appendix 6.1):

- Built environments
- Products
- Information and communications.

These prescribed areas lend themselves to examples relating to agriculture and food, as do content areas not specifically in primary industries.

The experience students receive here is vital to their retaining interest and engagement with agriculture as a career option or their forming of positive views about the industries producing and processing food and fibre. In Chapter 5 the importance of engagement and enquiry in primary schools was described as pivotal to sustaining ongoing interest in science and, by association, agriculture. By around 11 years of age attitudes to and engagement with science, and by association agriculture, are formed and then may decline significantly unless sustained. By age 14 attitude and interest in the study of science is largely formed (Archer et al., 2010) and broad choices in career paths are commonly determined (Institution of Mechanical Engineers, 2010). The experience the students gain in Years 7 and 8 is thus extremely important and their future in agriculture or their attitudes towards agriculture may well be determined at this time.

It is also worth noting that Year 7 is the first time that students are exposed to specialist teachers and their influence is substantial. In the Health of Australian Science (2012) report by the Office of the Chief Scientist, the findings of a survey by Goodrum et al. (2012) indicate the importance of the early secondary experience (Figure 6.8). The largest triggers were school-based lessons or activities, including specific teachers, enrichment programs and subject information sessions. A Universities Australia survey of first year university students undertaking Science, Technology, Engineering and Mathematics (STEM) courses emphasised the encouragement by school teachers as a major influence. An unpublished survey of first year agriculture students at NSW universities in 2013 for this Review reinforced that the agriculture teacher was highly influential in their choice to study agricultural science at university.

This scenario suggests at least four actions that need to be put in place in Years 7 and 8. In the first instance it is important there is no hiatus in the offerings – an option should be provided in both Year 7 and Year 8. Secondly, those schools that do not currently teach primary industries content areas be encouraged to provide such options for their students. The third aspect is that the teachers chosen to deliver the subjects do so with passion, commitment and expertise. Fourthly, the way options are taught needs to be engaging, include enquiry and have a tangible outcome. Having a positive context to the classes is important, and enrichment through excursion or focused event adds value.
Although there are units in Technology that include agriculture, it is not mandatory for schools to choose these particular units. The Board of Studies NSW advises that the Technology syllabus for the Australian Curriculum is still being finalised and opportunities exist to include compulsory teaching of agriculture under this subject. This would seem to be an opportunity not to be missed. However, there would need to be quality teaching materials developed for these agriculture units, including insights into what the teaching would entail. It is unlikely that there would be a teacher trained in agriculture in every school and so such teaching materials become an imperative. The opportunity to value-add exists by integrating the agricultural unit with another ‘technology’ such as food.

Geography and History are also mandatory subjects at this level. An analysis of the content suggests that agriculture can enrich the teaching of these subjects. Appendix 6.1 provides an outline of content of these subjects. There is also opportunity in cross curricula areas. This is detailed in Appendix 6.3 – agricultural data for example could be used in Mathematics or for spreadsheet skills in ICT and agricultural information used as the basis for literacy activity.

AGRICULTURE IN THE JUNIOR SECONDARY SCHOOL – YEARS 9 AND 10

In Years 9 and 10, several elective subjects focus on the primary industries specifically. The specific elective subjects comprise Agricultural Technology, Food Technology, Industrial Technology and Marine and Aquaculture Technology. A particular concern is that where students are not provided the option of agricultural topics within Technology in Years 7 and 8 they will not consider choosing any of the primary industries electives in Years 9 and/or 10. Addressing Government Recommendation 5 will help alleviate those concerns.

The mandatory subjects that have agricultural related content in Years 9 and 10 are Science (how the values and needs of contemporary society influence the focus of scientific research) and Geography (the patterns, functions and issues associated with primary production).

In subjects like Geography, History and Commerce, there is much scope for the inclusion of agricultural examples and as a base for the study program. The question is raised as to whether the current treatment of agriculture in these subjects is constructive or destructive of the sector’s image. The anecdotal
account from students in the system or having recently left the system is that the agriculture focus is invariably negative rather than objective. Similar comments relate also to earth and environmental science. There does need to be a review of the details of the curricula and there should be representatives with agricultural expertise on the Review panel. It is clear that there need to be teaching resources that accurately reflect the role agriculture has played and is currently playing.

**AGRICULTURE IN THE SENIOR SECONDARY SCHOOL – YEARS 11 AND 12**

There is reasonable coverage across the State in the offering of Year 12 tuition in Agriculture although the density is not strong. Locations for 2012 are provided in Figure 6.9 state-wide and for the Sydney/Newcastle/Wollongong corridor in Figure 6.10. There are limited offerings in the central metropolitan and coastal suburbs of the latter corridor.

In those schools that have capacity in agricultural education, the major offerings are Agriculture and the VET option, Primary Industries. Technology Life Skills and Marine Studies (a VET Board of Studies NSW endorsed course) also relate to Primary Industries. A summary of those subjects appears in Table 6.2.
There are other subjects where agriculture can be used in the teaching program. These are listed in Appendix 6.4. This brief overview clearly indicates that whilst there are specific subjects in the primary industries area, there is significant scope to enrich the other teaching areas in the senior curricula. This is particularly important in those schools which do not have agricultural expertise as students in those places will not be exposed to important issues of food and the role of agriculture in the national economy. The opportunities available to a student to learn about agriculture in these subjects are dependent on the choice of the individual school and teacher. The challenge therefore is the production of high quality teaching materials on the various topics that have been identified. The question remains as to who should produce said materials.

During the Review advice was sought from the NSW Department of Education and Communities and the Board of Studies NSW about how agriculture might be incorporated more deeply within the curricula. The constructive responses are summarised here:

- Encourage teaching staff to utilise Scootle and TaLe resources for ways agriculture can be linked into current curricula; this emphasises the need for the development of quality teaching resources on these sites.

(TaLe: Teaching and Learning Exchange: NSW gateway to Primary, Secondary and TAFE NSW teaching and learning resources. The resource can be accessed by all NSW government school teachers and TAFE NSW teachers. It serves a similar function to Scootle and the Board of Studies NSW Program Builder)
• Make available fact sheets for teachers, with additional information on how to integrate agriculture in the curriculum. In many subjects, aspects of agriculture are optional and teachers are likely to avoid including such modules if uncomfortable teaching that subject matter. This is particularly important for Years 7 and 8 Technology teachers who need to choose six technologies from 15 available in the current syllabus document. Teaching agricultural technology as part of the six should be encouraged but non-agriculture expert teachers require this support to enable them to deliver the principles.

• Work with professional bodies (e.g. the Australian Teacher Education Association, the Geography Teachers Association of NSW, and other relevant bodies) to communicate the importance of teaching modern agriculture in school and to encourage teachers’ use of external resources such as Scootle to find innovative ways to integrate agriculture into the existing curriculum. The need for quality teaching resources is again emphasised.

• Develop high quality resource materials, using primary industry concepts as the vehicle, for use in improving literacy and numeracy skills.

• Work with the Board of Studies NSW in revising the NSW syllabuses for the Australian curriculum. Opportunities exist for the following subjects, although some syllabuses would not be rolled out until 2015:
  ° Technology (mandatory) in Years 7 and 8 (potential to be rolled out 2014; consultations taking place in 2013)
  ° Science and Technology in Years K-6; syllabus has already been developed but may require adjustment based on the development of Technologies curriculum from ACARA for Years K-6
  ° Technology electives for Years 9 and 10 (including textiles, industrial, food)
  ° Geography (mandatory) K-12; consultation for Geography is ongoing. It is likely there will be opportunity for NSW to integrate agriculture more formally into this syllabus during the second half of 2013, to be finalised in 2014. The final New South Wales syllabus is likely to be implemented in 2015-16

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Table 6.2 Syllabus summary for agriculturally related subjects in Years 11 and 12.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Students develop knowledge and understanding about the production and marketing of both animal and plant products as well as the associated skills and responsible attitudes necessary to manage and market these products in a sustainable manner.</td>
</tr>
<tr>
<td>Primary Industries</td>
<td>Students develop a range of technical, vocational and interpersonal competencies valued both within and beyond the workplace, based on agriculture, horticulture and conservation and land management. Students also acquire underpinning knowledge and skills related to work and further education.</td>
</tr>
<tr>
<td>Technology Life Skills</td>
<td>Students engage with a range of technologies and acquire knowledge, understanding and skills which are transferable and facilitate lifelong learning. Content includes Agriculture, Design and Technology, Food Technology, Industrial Technology and Textiles and Design Life Skills.</td>
</tr>
<tr>
<td>Marine Studies (a VET course)</td>
<td>Students study the marine environment and marine and maritime employment. The focus is on aquaculture.</td>
</tr>
</tbody>
</table>

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Table 6.2 Syllabus summary for agriculturally related subjects in Years 11 and 12.
Science Although the NSW syllabus for the Australian curriculum has already been finalised, there is opportunity for fact sheets for teachers about integrating agriculture into science (e.g. environmental issues and agriculture) in time for the roll out of the new curriculum in 2014.

LOCATION OF AGRICULTURE

Traditionally the agriculture discipline was collocated with the science faculty. The emergence of Technology resulted in agriculture being located in the Technology faculty in schools. The debate was ongoing as the Review progressed and there was no clear resolution. The subject ‘Agriculture’ has more in common with science. Its presence in the Technology subject in Years 7 and 8 compromises the science relationship to some extent. The introduction of Primary Industries in the VET program in schools reinforces its location with Technology. Perhaps the more important issue is the location of staff, particularly where their expertise relates more closely with science as a second teaching area. In the end it

BOX 6.1 AQUACULTURE AT NEWMAN SENIOR TECHNICAL COLLEGE, PORT MACQUARIE

Newman Senior Technical College, a co-educational Years 11-12 High School, has invested significantly in aquaculture in response to industry growth and community interest in fish-farming on the New South Wales Mid-North Coast.

The College’s indoor intensive aquaculture enterprise is a NSW Fisheries approved hatchery and grow-out facility. Its permit includes freshwater species such as Silver Perch and Australian Bass, several saltwater species including Mulloway and a large number of ornamentals, mostly marine, including invertebrates and soft and hard corals.

In 2013, 185 students enrolled in the Marine Studies course offered at the College as part of their NSW Higher School Certificate. Aquaculture is a key module in the Board of Studies NSW Marine Studies syllabus. Students gain first-hand experience and knowledge by studying in the College’s aquaculture facility.

Some students elect to complement their studies by enrolling in national qualifications such as Certificate II in Aquaculture which they complete through Natfish at Grafton TAFE.

Students learn important on-the-job skills working in the College’s aquaculture facility. The hatchery hosts students from other schools who attend for work experience blocks, including from as far away as Mildura. Students from local schools are regularly on site learning about the industry.

The present focus is the production of several species of clownfish, Banggai cardinal fish, dottybacks and soft and hard corals. The enterprise packs and airfreights weekly to wholesalers in Sydney and Brisbane. An experimental aquaponics system provides an insight into growing vegetables over the freshwater fish.

Students who visit the facility for one day, for a one week block or for a 12 month course gain valuable skills in the aquaculture Industry.

Adapted from information provided for the Review by Warren Bridge, Newman Senior Technical College, Port Macquarie
BOX 6.2 RURAL YOUTH CATTLE ENRICHMENT (RYCE) PROGRAM, TUMUT HIGH SCHOOL

A community partnership was developed in 1995 to engage local cattle producers, societies, parents, schools and students, industry representatives and local businesses. The aim is to impart industry knowledge, skills and experiences in the cattle industry and to address the current shortage of industry skills within the agriculture sector. The Rural Youth Cattle Enrichment (RYCE) program was established in 2012 to take the program and students to a new level within the cattle industry.

Tumut High School (THS) is a comprehensive secondary school and caters for 560 students from Years 7 to 12. The Tumut region has experienced a decline in skilled rural labour, professional agricultural expertise and agriscience. THS identified the need for students to develop an interest in an agriculture career and wanted to open up possibilities for students in part-time rural work, to improve and develop the practical skills and knowledge of students in the rural sector and to promote industry confidence through the demonstration of skills to prospective employers.

The school formed partnerships with local organisations, Rising Sun Rural and Weemaru Murray Grey Stud, to create the RYCE program. RYCE addresses the current shortage of industry skills within the agriculture sector. The partners are involved at all stages and share resources and expertise. The Principal of Rising Sun Rural has worked in the cattle industry for 25 years, specialising in cattle selection, marketing, breeding, conditioning, extensive showing and judging at national levels. This partner brings skills and knowledge in rural consultancy and all aspects of cattle husbandry, as well as industry level training skills. Weemaru Murray Grey Stud provides resources in the form of stock and equipment to the program, as well as expertise in cattle husbandry. Both partners provide transport, stock, feed, land and business advice.

Students participate at local and metropolitan shows and are thoroughly engaged in rural work such as cattle management, hay carting, collection and storage of stock feed, preparation of stock for shows and the ‘breaking in’ of cattle. There is a weekly cattle management program and the students are given the chance to be involved in public speaking. Participants have competed in: cattle parading; cattle junior judging; national sales; and breed society workshops.

Many awards have been won by the school but success is also measured by the increasing number of students inspired by the program. The increased responsibility for students develops team work and increases self-esteem and self-discipline. The program has enriched lives of disadvantaged students, and motivated students previously disengaged. The school’s profile has been raised and broadened in local and wider communities. Media attention on the school and the cattle program has created an awareness of the importance of the agriculture curriculum.

The partners have gained greater recognition. Their contribution has included: development of the Charolais stud; involvement in the Community Festival Day; running cattle workshops for students on artificial insemination of cattle and cattle disease testing procedures; and purchasing livestock for the program.
is an issue for the school as to the best arrangements in respect of the individual school.

From the perspective of this Review the important aspect is the timetable arrangement such that those students who choose Agriculture also have the opportunity to study one or two science subjects for the HSC if their intention is to go into agricultural science at university.

TEACHER TRAINING IN AGRICULTURE AND PRIMARY INDUSTRIES

An issue for this Review has been the quality of teaching in Agriculture and Primary Industries. The question of expansion of the number of schools that might teach agriculture is both a matter of cost of the operation and the availability of expertise. In the course of the Review advice was provided as to the difficulty of being able to attract staff suitably qualified in agriculture. The decline in the number of students undertaking university agriculture studies (see Chapter 8) has made recruitment of agriculture teachers more difficult. In addition, the change in emphasis under the banner of technology is considered to have resulted in the appointment of graduates in Technical and Applied Studies (TAS). In some cases these teachers have been excellent but in others the lack of sufficient agriculture training has been a deficiency in their ability to deliver a high quality program for students. Other anecdotal input indicates that environmental science graduates have been appointed to teach Agriculture. This is of concern as such graduates have not been provided with any primary production training. This then raises the issue as to the renewal of agriculture staff in the education system in New South Wales given the likely retirement pattern of the near future (Figure 6.11).

There has been significant recruitment of teachers in the public system in the agriculture discipline. This is surprising given the shortage of agriculture graduates and the competing strong job market for such graduates. It is recognised that they may not be fresh graduates and some may have been teaching on a casual basis prior to permanent appointment. The pattern of recruitment is shown in Figure 6.12. The current Review was unable to determine the relationship between current appointment and qualification and this is an important set of data to understand the capabilities of agricultural education in the schools.

THE AGRICULTURAL HIGH SCHOOLS

A unique aspect of the agricultural education in secondary schools in New South Wales is the existence of specially designated agricultural high schools. These schools were reportedly established in response to public pressure and have had a long period of contributing to agricultural education in NSW. The view of the Minister in 1939 provides cause for reflection (Letter 6.1).
These specialist schools complement other designations such as sports high schools, technology high schools and performing arts high schools. Some characteristics of the four schools are provided in Table 6.1. The question must be asked as to what the expectations ought to be of these specially designated schools. The designation implies that all students who attend these schools will receive a strong grounding in agricultural production to an advanced level. The quality of the agricultural education should equate to best practice where students are exposed to modern agricultural methods and have access to contemporary equipment and machinery.
The expectations regarding the teaching staff in Agriculture include the need for them to be well trained and regularly undergo professional development in order to maintain their currency with industry practice. These schools are, or should be, centres of excellence in agricultural education and training. Given this Review and others, it seems appropriate that there be reaffirmation of the specialist role of agricultural high schools in the education system of New South Wales in order to give effect to other issues.

The four agricultural high schools, whilst having commonality of purpose, offer different styles of education and this diversity needs to be fostered. Table 6.3 shows the characteristics of each. Three have residential facilities, two of which also have day students. Entry to the two city schools is more competitive than for the two country schools. James Ruse Agricultural High School is the most competitive in terms of entry and it is important that its role is retained such that the leaders of other industries and services have an empathy with our agricultural industries. Its uniqueness warrants some consideration of the role of agriculture in the education of these high achieving students and is articulated in Box 6.3.

Given the specialist nature of these schools it is not unreasonable for students who wish to attend them to be expecting to have an agricultural education. The study of agriculture is compulsory from Year 7 to Year 10 in all agricultural high schools. It is also compulsory for students entering the school in Year 11 to study Agriculture at Hurlstone and Yanco Agricultural High Schools. Whilst it is not possible to mandate senior subjects, apart from English, the study of Agriculture in the senior years of schooling should be strongly encouraged.

An exception might be a student from an isolated area with high ambitions outside agriculture and HSC performance needs might dictate subject choices other than Agriculture to attain a target ATAR. The choice of the final 10 units to attain a higher ATAR for entrance to higher education is recognised. As the options for residential schooling for isolated students at reasonable cost are limited, such needs should be addressed. Such exceptions would be uncommon and require special exemption from the Principal. It is appropriate that this Review re-asserts that specialist agricultural high schools were established for agricultural education and training, and that all students knowingly enrol in the school under that premise. It is also noted that James Ruse Agricultural High School accelerates its agricultural programs so that Stage 5 is completed in Year 9 and Stage 6 in Year 11, at which time the students sit the HSC examination in that subject.

The existence of these particular schools also suggests that many of the other schools teaching Agriculture and Primary Industries are likely to be less well off in terms of land, equipment, resources and expertise. It is therefore not unreasonable for the agricultural high schools to provide access and assistance to other schools teaching in this discipline where that can be feasibly provided and where it adds value. Issues such as timetabling of classes ought not be used as a barrier to achieving this outcome as there is precedent across NSW in other subject areas in sharing subjects. In Primary Industries, for example,
The establishment of the Farrer Memorial Agricultural High School at Tamworth will give to the State a third residential Agricultural High School geographically so placed as to provide effective training for students who wish to qualify for a degree either in Veterinary or Agricultural Science. It appears to me that with the establishment of this third school the time has arrived for the Department to seriously review the existing policy with a view to determining what is best in the interests of this branch of education and of the State in the future. Agricultural High Schools, by reason of the fact that they provide residential accommodation for students who enrol, plus provision for practical husbandry, etc., are in the nature of things fairly costly to establish and maintain. It is essential, therefore, that the cost so incurred by the State should be compensated by the maximum advantage in the way of educational results of the highest possible order.

I am of the opinion that for many years to come the Department should not commit itself further to the building of such schools, but should concentrate on completion of schools which are now established, assuring that they shall have the best possible equipment and accommodation for the maximum number of lads who can be efficiently accommodated there. Further, I am of the opinion that having regard to the fact that these schools are so designed and equipped as to prepare boys for a University Degree, it is not in the interests of the State that boys should be admitted to these schools whose I.Q. is so low as to render it extremely doubtful as to whether they will succeed in satisfactorily completing a matriculation course. Boys whose I.Q. falls below this standard should not be admitted to Agricultural High Schools unless there is a surplus of accommodation which cannot be otherwise used.

It will be noted that the real purpose of an Agricultural High School is not to provide a training farm course. Such facilities are only for the better training of the student in the application of science and a better apprehension of its teachings. For those lads of lower standard of intelligence, the obvious place is an Agricultural Farm where courses are designed to meet the requirements of a training school for lads who wish to become practical farmers. The training there is mainly along the lines of practical work, systematic routine and a thorough knowledge of the work and implements of agriculture. This section of the work in an Agricultural High School is largely incidental, though necessary.

To place an Agricultural High School upon the level of a training farm is to incur an expenditure which cannot be justified in the final analysis. There is continuous complaint of the overcrowding of our Agricultural High Schools, and it is probable that even with the establishment of the Farrer Memorial High School at Tamworth, this overcrowding will continue unless a rigid standard of entrance is applied along lines which will ensure, as I have already indicated, that those who commence the course will be capable of carrying it through successfully.

I desire that this policy be noted for action in the forthcoming and succeeding years.

D. H. Leurford
MINISTER,
3.1.39.
Armidale independent schools New England Girls’ School and The Armidale School arrange timetables so that joint classes can occur. The agricultural high schools need to take a leadership role in this space and this will be facilitated by the emergence of smart technologies. Further it is not unreasonable, because of their facilities, that the agricultural high schools take a lead role in career expos and contribute to the image building that needs to occur with students, teachers and parents.

**BOX 6.3 AGRICULTURE AT JAMES RUSE AGRICULTURAL HIGH SCHOOL – A PHILOSOPHY**

Gifted and talented (GAT) students are used to seeing immediate results for their efforts. Students can swot and revise and produce results very quickly. They can control the pace and timing and the results. However, the elements of agriculture have their own pace and timelines. The life cycle of a plant in the field cannot be hurried. There are seasons and each has its own timeframe. Agriculture is thus different from every other subject. The study of Agriculture teaches the students that they are not always in control. They can create the conditions, but sometimes nature has other ideas. It teaches the students to delay gratification – not so long ago this was the mark of a mature adult. In an instant gratification society, no other subject forces them to slow down, to work with the earth’s natural rhythms, to take joy in the unhurried process.

Taking care of animals and plants teaches students to care about our planet. If students do not experience the wonder and contentment from agricultural pursuits, how then can they be expected to care about sustainability and ecological issues? Because GAT students are more likely to end up as leaders in their various professions – anecdotal evidence certainly supports this – then it is even more important for the future of our planet that GAT students study agriculture.

Most GAT students become significant decision-makers in all spheres of life. In Agriculture at James Ruse Agricultural High School (JRAHS), students are exposed to the political dimensions of the curriculum as well as the scientific and husbandry aspects. For example, in the study of corn, students learn to evaluate the decision made by US Congress making it compulsory for corn syrup to be included in all US canned goods, at a time when US citizens are among the most obese in the world. A health issue for the nation was deemed less important than an economic one to support the corn farmers. Gifted students are exposed to all the tensions and ambiguities in making decisions to do with the economics of food supply, water quality and public health. What students learn in Agriculture gives them the edge in making wise decisions economically, as well as politically and socially.

Because of the very high expectations GAT students place on themselves, there is a need to support students experiencing anxiety or depression – a school priority. Agriculture offers support in this area on many levels. It is a practical subject and mentally is a valuable change from the more theoretical parts of

**MANAGEMENT OF AGRICULTURAL HIGH SCHOOLS**

Each of the agricultural high schools was visited during the Review. In the process the mission statements were consulted to evaluate the relationship between school designation and operation. Only one school (Farrer) specifically referred to agriculture in its mission statement. Clearly, in these specially designated schools, the principals of agricultural high schools should ensure the primacy and
importance of agriculture is reflected in the school’s educational programs and mission statements.

Field equipment in several cases was totally inadequate. Much related to old world agriculture rather than modern agriculture, some needed constant repair which incurred high cost, if indeed parts could be procured, and some was unsafe for use. There needs to be an ongoing consolidated replacement list of machinery and equipment, including large equipment and off-contract equipment and services, to address this inadequacy. Each agricultural high school, in conjunction with the NSW Department of Education and Communities, needs to undertake a regular audit of assets and establish a depreciation and maintenance register for all equipment, machinery and facilities needed for the delivery of, inter alia, agricultural education in its school.

The funding of farm operations and the appointment and duties of farm staff were constant themes of frustration. Concerns were expressed that profits might be made in some years and losses in others and that costs were incurred in respect of the teaching program that would not otherwise be incurred in a business. These issues were raised with the NSW Department of Education and Communities and assurances were given that Local Schools, Local Decisions would allow most of these issues to be addressed.

During the Review, there was a consistent theme of a ‘disconnect’ between the needs of agricultural education and training and empathy of departmental decision makers. There seems little to be gained in reflecting on the past, particularly given the move to Local Schools, Local Decisions. What is important is to embrace the opportunities this change will make to the operations of the agricultural high schools. This Review has investigated how best this might be achieved. In that process there will be the opportunity to dispel or correct long-held beliefs by the schools about apparent departmental barriers and, on the other hand, an opportunity for the Department to be much more cognisant of

Adapted from submission by L Treskin, Former Principal JRAHS, 2012
It was also evident during the Review that the agricultural high schools themselves do not mutually engage – this was surprising given that they have a common agenda in many areas and working together is always more effective than working in isolation. Their engagement with the Department was mainly in isolation from the other agricultural high schools. Clearly the schools are not in competition with each other as their clientele is different, as are their geographies. There is then the opportunity to operate collegially and, together, work with the Department to deliver the mandate of best practice agricultural education. This arrangement needs to be formalised to ensure the engagement occurs. This Review recommends the establishment of an Agricultural High Schools Forum (AHSF) comprising Principals and Departmental staff. Rotation of such meetings around the campuses would enable the build-up of ownership and understanding of the challenges by all parties.

Establishment of the AHSF provides the mechanism to address critical issues. Several urgent agenda items have been identified during this Review and are identified here so that they do not ‘fall off the agenda’. The list includes:

- the need for professional development for the Executive of the schools on the operation of Local Schools, Local Decisions and particularly its operation in respect of the operation of the agricultural high schools. This would include relations with local suppliers and opportunities for receiving donations of machinery and equipment
- the need to review the priority list of equipment and machinery
- the need to undertake a review of the operations of the residential accommodation policies and management, including teaching staff after hours duty and live-on campus requirements
- the identification of the support provided to Principals as managers of small to medium sized businesses.

It is recognised that agricultural education and training is an expensive process and so opportunities should be taken to reduce the impact on school and departmental budgets. At times there might be market or community advantages for businesses to donate or lease equipment to schools. The agricultural high schools should develop networks with business, communities, the industry sector and their alumni as well as their parents and citizens associations. In this way opportunities are created for supporters, participants, benefactors and donors to emerge. As ‘centres of excellence’, there is a compelling reason to establish a strong alumni link and so, where it does not function, attempts need to be made to establish an email contact list for regular (once or twice a year) newsletters about activities – these schools have much to promote and they should be proud to do so and, in the process, use their contacts for promotion.

There is also real opportunity for the agricultural high schools to build social and cultural relationships within the agricultural high schools network. It is noted that James Ruse and Yanco agricultural high schools have already established some links and this is to be applauded. Building these relationships is to be encouraged.

**OBLIGATIONS OF AGRICULTURAL HIGH SCHOOLS**

The designation as agricultural high schools and the notion that they are ‘centres of excellence’ means that there are associated obligations. On the one hand the NSW Department of Education and Communities by virtue of having these specialist schools has an obligation to ensure that they have the necessary freedoms to operate, that they can run ‘enterprises’ such as farms and residences as businesses using, as far as possible, best management practices, and that they have the appropriate and up to date machinery and equipment to deliver quality agricultural education and training.

The agricultural high schools on the other hand have obligations by virtue of their status and capability to play a strong leadership role in agricultural education and training. The quality and passion of...
their agriculture teachers is critical to this agenda and they play an important role in the credibility and reputation of the school. Under current employment agreements schools can directly appoint one in two staff. The important role that agriculture teachers should play in an Agricultural High School provides a compelling case for the right agriculture teachers to be appointed. To that end, therefore, the schools must exercise their discretion within the flexibility provided to appoint directly all specialist agricultural staff.

How then might the leadership play out for the agricultural high schools? Several examples follow.

- There is a need for quality teaching materials and associated teaching programs and lessons for access by other teachers around the state. This is facilitated by the availability of the newly created Program Builder on the Board of Studies NSW website. Here teachers can build their own lessons which can remain private or they can share these with others in the system, the latter being the way forward for the agricultural high schools.

- Provision of resource materials to be uploaded into the Scootle resource portal under the auspices of Education Services Australia Ltd.

- Farm activities can be recorded on a website for other schools to use – this would be particularly valuable for livestock herds or flocks in terms of production parameters through the use of electronic tags and other smart technologies.

- Because of their reasonable geographic distribution, the formation of regional networks of agriculture teachers linking to an Agricultural High School would be valuable, particularly for the mentoring of new agriculture teachers, for teacher training days and for visits by other schools for particular practical experiences and activities associated with the Royal Agricultural Society (see Chapter 9).

- Use of facilities for school vacation agriculture camps, including strong participation by industry and other relevant players.

- In particular, there is strong value in the agricultural high schools together having RTO status for agriculture and related relevant areas. This provides an alternative option for other schools to operate under in the Primary Industries certificate studies, particularly where VET opportunities are limited, including Certificate III attainment by students.

**AVAILABILITY OF AGRICULTURAL HIGH SCHOOLS**

The opportunity of agricultural high schools to work with a network of schools depends on their accessibility around the state. These agricultural high schools are located in the northern and south-western suburbs of Sydney, in the Murrumbidgee Irrigation Area (MIA) and on the northern slopes. This is a reasonable spread. However in the state’s north, Farrer is an all male school and so there is no state boarding option for girls in the central and northern parts of the state. There is a large gap in central New South Wales for boys as well. There is a case therefore for an Agricultural High School in the central area that caters for girls as well as boys and this strongly suggests Dubbo as a suitable site. In terms of facilities, the TAFE NSW Institute already has excellent training facilities and Dubbo Senior College already has strong relationships with the TAFE Institute. The arrangement for residential accommodation becomes the key point and it is suggested that the NSW Department of Education and Communities, together with Dubbo City Council and TAFE NSW – Western Institute (Orana Campus), explore the feasibility of establishing a hostel that would service the residential needs of such an arrangement. There is the potential of a strong feeder network including at least in part the Isolated Children’s Parents’ Association (ICPA).
OTHER ISSUES

It is not the purpose of this Review to comment on all the needs of individual schools. However some commentary is warranted on aspects of particular schools because of their important role in agricultural education in New South Wales.

Yanco Agricultural High School: This school offers real prospect to deliver quality livestock, cropping and irrigation education in the southern part of the State. That can be achieved provided attention is paid to its immediate needs. It has been in existence for over 90 years and is in need of refurbishment. Its experience as a boarding only school is unique in the state system and its facilities are in use more constantly than in non-boarding schools. There needs to be improvement in staff housing and in some student accommodation. Science laboratories are in short supply and a case exists for expanding the farm and associated water licences to enable it to be more financially secure.

Hurlstone Agricultural High School: This school offers great prospect for addressing some of the needs for agricultural education in the southern/western suburbs of Sydney where resources are scarce. Its ability to deliver this depends on its refurbishment program. It has been several years since the Mal Peters’ Report into the future of Hurlstone Agricultural High was handed down in respect of the management and facilities at this school. The recommendations are progressively being implemented but the refurbishment of the school facilities is dependent on the sale of a small area of school land, which needs to be expedited.

James Ruse Agricultural High School: This school provides for future leaders to see and capture the opportunities likely to open up for agriculture. The nature of the students allows the school to accelerate the agricultural education of students but results in the school being funded at stage 5 levels for stage 6 instruction. This anomaly should be addressed.

THE ‘LIGHTHOUSE’ CONCEPT

It is also recognised that the agricultural high schools are few in number and their geographic spread is limited. Other schools also have substantial Agriculture and Primary Industries programs, facilities and expertise. These schools also need to be encouraged to develop, and to play a leadership role. Within the Australian education system the terminology of ‘lighthouse schools’ has been used, whereby the school is designated with the responsibility of improving an aspect of the teaching program, learning experiences or system change in a region or state. Special funding usually accompanies the designation of a lighthouse school in consideration of the extra workloads such designation imposes. The lighthouse school concept would appear to be highly relevant to the need to elevate the quality of the educational experience around the state in Agriculture and Primary Industries.

MANAGEMENT OF TIME AND MONEY IN SCHOOLS WITH AGRICULTURE AND PRIMARY INDUSTRIES

There was a range of comments from contributors to the Review regarding the role played by principals. The principals could be supportive or obstructive depending on attitudes to the discipline. Clearly Agriculture and related studies are expensive operations and this needs to be recognised particularly in the context of Local Schools, Local Decisions. Issues highlighted for attention included the following:

• In some cases principals reportedly facilitated collaborations between schools, or between school and TAFE NSW, through timetable arrangements, whereas others inhibited that exchange

• A common input to the Review was that the after-hours commitment of Agriculture and Primary Industries teachers to farms and animal management was not appropriately recognised in time allocations and
There was commonly little recognition of the seasonal vagaries of running farms. The high cost of running farms, particularly in drought years, was not able to be offset by the generation of funds in good years due to budgets being exclusively a year by year proposition. This practice needs to be made more flexible.

ABORIGINAL STUDENT PARTICIPATION IN AGRICULTURE

The issue of participation of Aboriginal students in agricultural education is canvassed in other places in this Report. While there was no data available about Aboriginal student participation, there is an ongoing need for action to encourage Aboriginal students into agriculture through education and training.

USE OF NSW DEPARTMENT OF PRIMARY INDUSTRIES AGRICULTURAL RESEARCH FACILITIES

In New South Wales there is a substantial network of agricultural research facilities under the auspices of the NSW Department of Primary Industries (Figure 6.13). Although they are well utilised for the research purposes intended, they also represent a valuable resource that could be utilised for education. It is important to note that some of the facilities already play a role in education but the role is likely to be dependent on the attitude of the managers and their willingness to participate in this process. It needs to be noted that the primary focus is always the research function and so any activity must be compatible with that primary function.

A theme running through this report is that all those involved in agriculture have a responsibility to contribute to the education of the community about agriculture and to encourage the younger generation to give consideration to future careers in the agriculture sector. In most cases schools are not well equipped to provide the defining experiences in agriculture to their students. This can be the role of the research centres. The point being made here is that education should be made a mainstream activity of the research centres rather than the ad hoc arrangements that occur from time to time. To put this into effect, formal arrangements need to be put in place such that the activities are planned well in advance so that they deliver to the schools and impact minimally on the research activities. This also allows schools to plan ahead and provides an indication to all schools in the region that this process is inclusive of their interests.

The Review proposes that there be a formal meeting each year, likely in School Term 4, between the agriculture teachers and the research centre staff to explore options and plan activities for the academic year ahead. The activities, for example, take the form of a field day, practical work, monitoring via smart technology or internet, special experiments, competitions, special lectures or some combination. The aim here is not to prescribe but to encourage the interaction.

FUTURE HSC OPTIONS AND REQUIREMENTS

The opportunities available for the study of Agriculture in the senior years of schooling have provided a useful grounding as preparation for further education and training in agriculture.

However, present HSC study options may not allow students with strong vocational and professional career interests to be as prepared as they otherwise might be for further study in their chosen vocational and professional areas.

It may be timely, in the context of the implementation of the Australian curriculum in the senior years of schooling, to consider ways of giving students greater choice in constructing their HSC study programs to connect better with their vocational and professional aspirations. This could also include any necessary updating of curriculum (in consultation with industry) to ensure that it meets future workforce needs across the range of industry areas that are key to the economic future of the nation.

In this context, curriculum options for the study of agriculture as a broad post-school career area could be updated and
repackaged to address emerging needs in the agriculture industries. An example could be the agricultural expertise needed to supply the growing Asian market.

This broad approach to support ongoing study in the agriculture field would ideally give students the opportunity to select relevant knowledge, skills and capacities to prepare them for:

- skills-based through to academic-based agriculture pathways; and
- on-farm careers through to off-farm careers in manufacturing, export, processing, business management, finance and investment.

Figure 6.13 Distribution of NSW Department of Primary Industries research facilities in NSW (NSW DPI)
GOVERNMENT RECOMMENDATION 5
In the teaching of Technology in each of Years 7 and 8 of secondary school, at least one content area be based on agriculture, food and fibre.

GOVERNMENT RECOMMENDATION 6
In the context of the implementation of the Australian curriculum in the senior years of schooling, the Board of Studies NSW consider the potential for students with a clear interest in agriculture to package a set of study options that better target vocational and professional career opportunities in the field.

GOVERNMENT RECOMMENDATION 7
The NSW Institute of Teachers undertakes a review of the qualifications of teachers in Agriculture and Primary Industries to determine future directions in recruitment to ensure strong depth in expertise in these areas.

GOVERNMENT RECOMMENDATION 8
The agricultural high schools in New South Wales be considered ‘specialist schools’ for education and training in Agriculture and Primary Industries for secondary students. These schools should:

a. Encourage all students to study Agriculture and/or Primary Industries in senior secondary school

b. Review their mission statements to ensure that agricultural education is strongly identified as a designated educational outcome for their students and

c. Utilise the flexibility provided for staff appointments to appoint directly specialist agriculture teaching staff because of their pivotal role in the reputation and leadership responsibilities of the school.

GOVERNMENT RECOMMENDATION 9
An Agricultural High Schools Forum (AHSF) be established comprising Principals of agricultural high schools and officers of the NSW Department of Education and Communities. Issues for consideration should include:

a. Professional development needs

b. Management of agricultural equipment

c. Residential accommodation policies, management and staffing arrangements.

GOVERNMENT RECOMMENDATION 10
Agricultural high schools give consideration to establish and maintain, where they do not exist, an email-based alumni network for school promotion and reconnection with potential supporters.

GOVERNMENT RECOMMENDATION 11
Head teachers of agriculture from the agricultural high schools and VET providers form a network to develop a program of actions that contributes to leadership in agricultural education and training.
GOVERNMENT RECOMMENDATION 12
The NSW Department of Education and Communities considers Registered Training Organisation status for the combined agricultural high schools.

GOVERNMENT RECOMMENDATION 13
The NSW Department of Education and Communities explores the options for the designation of an agricultural high school in central New South Wales, such as Dubbo. Such school would need to be near to TAFE training facilities and would need adjunct accommodation facilities for females and males.

GOVERNMENT RECOMMENDATION 14
The NSW Department of Education and Communities identifies a range of lighthouse schools state wide that support good practice in curriculum delivery, student engagement and career promotion in Agriculture and Primary Industries.

GOVERNMENT RECOMMENDATION 15
The NSW Department of Education and Communities undertakes further consultation to develop partnerships that encourage more Aboriginal students to access agricultural courses, further training and related employment opportunities, including through Opportunity Hubs.

GOVERNMENT RECOMMENDATION 16
The NSW Department of Primary Industries’ Research Centres establish an annual forum with regional agriculture teachers to explore and plan activities to enrich the teaching of Agriculture and Primary Industries in regional schools and VET settings.
CHAPTER 7

VOCATIONAL EDUCATION AND TRAINING IN AGRICULTURE

The Presser

The shearing was awful,
the weather was crook,
The team was half poisoned,
made ill by the cook.
The roads were all closed,
so the blokes got no mail,
And none of the wool
could be carted to rail.

The owner was bossy,
a military chap,
So smart in his breeches,
his tweeds and his cap.
He’d said to the shearers,
‘Before you begin,
Remember the wool’s mine,
the sheep need the skin’.

He lined up the classer,
the wool roller too,
He gave them instructions
on just what to do.
‘You must keep this floor spotless
without any mess.’
It was then he went round
to the bloke on the press.

‘It’s very important
believe me my man,
To press all the bales
to one weight if you can.
I want them all even,
so try not to fail
Three hundredweights neat,
is the weight for a bale.’

For daily inspection
he’d enter the shed,
The standard of shearing
was shocking he said.
The wool staff were useless,
the wool room a mess.
Then each day he’d go round
to the bloke on the press.

He’d go to the scales
and pick up the book,
And carefully then
at each entry he’d look
To check all the entries
for yesterday’s date,
To ensure that each entry
showed three hundredweight.

And there in the book
every morning he’d see,
The weights just as even
as even could be.
He’d smile at the presser
and go on his rounds.
As he saw all the weights
were three thirty six pounds.

Some bales of oddments
and bellies were light,
But all of the fleece wool
was even all right.
It really was pleasing
he had to confess,
To see such a job
with an old squatter press.

When shearing had finished
he paid off the team
With a blasphemous curse –
‘You’re the worst that I’ve seen’.
He paid of the wool staff
as if in duress,
And then he went round
to the bloke on the press.

He took off his tweed cap
and held out his hand,
And said, ‘Thank you my man,
for you’ve met my demand.
Here’s your cheque and a bonus,
you’ve earnt it I think’,
And the presser said ‘thanks’
and went off for a drink.

As soon as the presser
arrived at the bar,
He shouted for all
of the blokes near and far.
He had a fat bonus
to spend without fail,
Because three hundredweights
he had put in each bale.

Then later that night
as the grog took its toll,
And the presser got full
and lost all self control.
He was grateful he said
that a bonus was paid
It was then he confessed,
not a bale had been weighed.

Mike Stephens, 1994
Source: Poem and permission provided directly
from author
BACKGROUND

The NSW Vocational Education and Training (VET) System provides training to an extensive number of students across the state. Overall, there are approximately 500,000 publicly-funded students (NCVER, 2012) and, of those, about 150,000 are apprentices and trainees (IVETS). There are around 60,000 VET in schools students (NCVER, 2012), of whom about 3,000 are apprentices and trainees (IVETS).

In 2010, the NSW Government announced changes to the school leaving age. The rationale provided at the time was that students who stayed at school longer had improved employment prospects. Reported (http://www.schools.nsw.edu.au/leavingschool/schoolleaveage/index.php) were studies in Australia and elsewhere that teenagers who leave school early are two and a half times more likely to be unemployed, earn lower wages and have poorer health. A consequence of that decision is that many students who would have previously left school now remain until they turn 17 years of age. The guidelines now are:

• All students must complete Year 10
• All students who have completed Year 10 but are under 17 years of age, unless registered for home schooling, must be:
  ° in school
  ° in approved education and training (eg VET, traineeship, apprenticeship)
  ° in full-time paid employment (average 25 hours/week), or
  ° in a combination of work and education and training.
• The education and training must be relevant, meaningful and useful to the needs of these students.

This change builds on the initiative in 2001 to introduce VET into the school system to enable students to attain work skills with associated AQF qualifications (described in Chapter 4). A further change has been the introduction of ‘Trade Training’ in schools from 2008. All these innovations are positive for agriculture and will enmesh with Smart and Skilled from 2014.

For Agriculture and related areas, the vocational education and training provision in schools and post-school is through four avenues:
• Primary Industries Curriculum Framework in secondary schools;

• The Tertiary and Further Education (TAFE) NSW network;

• The agricultural colleges; and

• Private Registered Training Organisations (RTOs).

PRIMARY INDUSTRIES CURRICULUM FRAMEWORK IN SCHOOLS

For Years 11 and 12 students undertaking the HSC, the majority of enrolments in government schools in agriculture-related industry areas in 2012 were in Primary Industries Curriculum Framework. There have been steady enrolments in this Framework, with annual growth in the years 2008-2011 (Figure 7.1). The majority of Primary Industries courses are delivered in schools (SVET), with about 6% being provided by TAFE NSW (TVET) and a small number by private providers.

Table 7.1 Offerings of the Primary Industries Curriculum Framework across NSW in the government school sector in 2012 (NSW Vocational Education in Schools Directorate, submission, 2013)

<table>
<thead>
<tr>
<th>NSW Department of Education region</th>
<th>Year 11</th>
<th>Year 12</th>
<th>Total enrolments 2012</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunter/ Central Coast</td>
<td>254</td>
<td>162</td>
<td>416</td>
<td>17.1</td>
</tr>
<tr>
<td>Illawarra and South East</td>
<td>145</td>
<td>81</td>
<td>226</td>
<td>9.3</td>
</tr>
<tr>
<td>New England</td>
<td>185</td>
<td>108</td>
<td>293</td>
<td>12.1</td>
</tr>
<tr>
<td>North Coast</td>
<td>283</td>
<td>200</td>
<td>483</td>
<td>19.9</td>
</tr>
<tr>
<td>Northern Sydney</td>
<td>30</td>
<td>14</td>
<td>44</td>
<td>1.8</td>
</tr>
<tr>
<td>Riverina</td>
<td>166</td>
<td>132</td>
<td>298</td>
<td>12.3</td>
</tr>
<tr>
<td>South Western Sydney</td>
<td>80</td>
<td>41</td>
<td>121</td>
<td>5.0</td>
</tr>
<tr>
<td>Sydney</td>
<td>2</td>
<td>10</td>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>Western NSW</td>
<td>283</td>
<td>154</td>
<td>437</td>
<td>18.0</td>
</tr>
</tbody>
</table>

The provision of VET in schools is broadly supported across the state, especially in rural areas. This may reflect the limited availability of TAFE NSW centres with agricultural offerings in the metropolitan areas and the modest agricultural facilities in the city schools.

Of the courses available within the Framework, the majority of enrolments are for the 240 hour course, with minimal numbers also enrolling in the additional extension or specialisation study courses (Table 7.2). In 2012, the majority (65%) of enrolments were male students. Of the 2,429 enrolments in 2012, 49 were trainees. Enrolments by Aboriginal students made up 8% of the total.

Table 7.2 Student enrolments in the standard 240 hour course, the extension course and the specialisation study in NSW government schools in 2012 (NSW Vocational Education in Schools Directorate, submission, 2013)

<table>
<thead>
<tr>
<th>Framework course name</th>
<th>Year 11</th>
<th>Year 12</th>
<th>Total enrolments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Industries</td>
<td>1,472</td>
<td>921</td>
<td>2,393</td>
</tr>
<tr>
<td>Primary Industries Extension</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Primary Industries Specialisation Study</td>
<td>23</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>Grand total</td>
<td>1,495</td>
<td>934</td>
<td>2,429</td>
</tr>
</tbody>
</table>

As well as the Primary Industries Curriculum Framework course enrolments, there have been a smaller number of enrolments in non-Framework courses for Years 11 and 12 students in government schools, as shown in Table 7.3.
Table 7.3 Non-framework course enrolments in NSW government schools in 2012 (NSW Vocational Education in Schools Directorate, submission, 2013)

<table>
<thead>
<tr>
<th>Non-framework course</th>
<th>Enrolments</th>
<th>Non-framework course</th>
<th>Enrolments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture</td>
<td>6</td>
<td>Horse Industry</td>
<td>110</td>
</tr>
<tr>
<td>Recreational Fishing Industry</td>
<td>1</td>
<td>Horse Racing Industry</td>
<td>5</td>
</tr>
<tr>
<td>Seafood Industry</td>
<td>31</td>
<td>Equine Industry</td>
<td>26</td>
</tr>
<tr>
<td>Forest Industry</td>
<td>4</td>
<td>Beef Production</td>
<td>12</td>
</tr>
<tr>
<td>Horticulture</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

QUALIFICATIONS

In 2012, the most common qualification entered as part of the Primary Industries course enrolment was the Certificate II in Agriculture (AHC20110 for Year 11 students, RTE20103 for Year 12 students). Additional qualifications are shown in Table 7.4.

The majority of these qualifications are provided by the Department of Education and Communities (DEC) regional RTOs, with a small number offered by private provider RTOs.

In 2011, 909 Year 12 students from government schools undertaking Primary Industries Curriculum Framework were awarded qualifications or statements of attainment as a result of successful completion of the requirements (Table 7.5).

As the VET program evolves in the school system, every advantage should be taken to progress students to Certificate III. This particularly relates to those schools (e.g. agricultural high schools) with adequate facilities or those with appropriate access to such schools, agricultural colleges and TAFE NSW institutes.

TRADE TRAINING CENTRES IN SCHOOLS PROGRAM

This Program commenced as a national program in 2008. It is a Commonwealth-funded infrastructure program that provides funding to selected schools for facilities and equipment. The program sets out to give secondary school students access to greater training opportunities and help address skill shortages. In the first four rounds of the program, 83 NSW government schools in 26 clusters have been funded to support training in Agriculture and Primary Industries. Schools can apply for funding either individually or in clusters. A small number of clusters have included schools from all sectors and in...
In addition some NSW schools have been successful in Round 4 of the program and are seeking to provide vocational qualifications or training in agriculture, including:

- Henry Kendall High School, Gosford (government)
- Kempsey Adventist School, Kempsey (independent)
- Trinity Catholic College, Goulburn (Catholic)
- Woodenbong Central School, Woodenbong (government).

Greater detail of the Trade Training Centres in Schools Program is provided in Appendix 7.1.

VET TRAINEESHIPS AND APPRENTICESHIPS

Australia's apprenticeship system includes both traditional apprenticeships in traditional trades and 'traineeships' in broader areas including service-oriented occupations. Both involve a legal contract between the employer and the apprentice or trainee and provide a combination of institution-based and workplace training. Apprenticeships typically last three to four years whereas traineeships are only one to two years in duration. Apprentices and trainees receive a wage which increases as they progress.

Table 7.4 Qualification enrolments in Primary Industries in NSW government schools in 2012
(NSW Vocational Education in Schools Directorate, submission, 2013)

<table>
<thead>
<tr>
<th>Qualifications (data are for SVET course delivery only)</th>
<th>Year 11</th>
<th>Year 12</th>
<th>Total entries</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTE20103 /AHC20110 Certificate II in Agriculture</td>
<td>1,068</td>
<td>796</td>
<td>1,864</td>
<td>93</td>
</tr>
<tr>
<td>RTE20703 /AHC21210 Certificate II in Rural Operations</td>
<td>41</td>
<td>4</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td>RTF20103 / AHC20410 Certificate II in Horticulture</td>
<td>69</td>
<td>7</td>
<td>76</td>
<td>4</td>
</tr>
<tr>
<td>AHC21010 Certificate II in Conservation and Land Management</td>
<td>4</td>
<td>–</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>AHC30110 Certificate III in Agriculture</td>
<td>20</td>
<td>–</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,202</strong></td>
<td><strong>807</strong></td>
<td><strong>2,009</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
States and territories fund most delivery but regulation is now national. All states except for Victoria and Western Australia have referred their regulatory powers for training organisations to the Commonwealth, which has established the Australian Skills Quality Authority (ASQA). ASQA regulates all RTOs operating in NSW. There is national recognition whereby the assessments and awards of any one RTO must be recognised by all others. This allows national portability of qualifications and units of competency.

A crucial feature of the training package is that the content of the vocational qualifications is theoretically defined by industry and not by government or training providers. A training package is ‘owned’ by one of 11 Industry Skills Councils which are responsible for developing and reviewing the qualifications.

In Primary Industries there have been completions in apprenticeships in 11 courses, all of which are in the amenity and turf areas (Table 7.6). The forest industry also offers a range of apprenticeships.

What is noticeable is the absence of any agriculture or production horticulture programs under the apprenticeship scheme. This lack of opportunity must have some impact on today’s youth as they choose their careers, since this signifies that there is no career path. This issue is considered further in Chapter 9 where a workforce strategy is canvassed, including whether there ought to be trade qualifications for the agricultural industries, given their importance to the nation’s food supply, its quality of life and the dependence on export markets.

At the traineeship level (Appendix 7.2) there is a broader range of offerings including for agriculture. Production Horticulture is again a notable absentee from the list of traineeships being completed and this must be a concern for the future of the industry.

Table 7.6 Apprenticeship completions in Primary Industries in NSW 2008-2012 (NSW DEC)

<table>
<thead>
<tr>
<th>Course</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowling Greenkeeping – Horticulture (Turf) Certificate III</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Golf Greenkeeping – Horticulture (Turf Management) Certificate III</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Golf Greenkeeping – Horticulture (Turf) Certificate III</td>
<td>37</td>
<td>41</td>
<td>44</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>Greenkeeping – Horticulture (Turf Management) Certificate III</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Greenkeeping – Horticulture (Turf) Certificate III</td>
<td>55</td>
<td>66</td>
<td>63</td>
<td>54</td>
<td>55</td>
</tr>
<tr>
<td>Landscaping – Horticulture (Landscape) Certificate III</td>
<td>92</td>
<td>93</td>
<td>101</td>
<td>99</td>
<td>132</td>
</tr>
<tr>
<td>Landscaping Certificate III</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nursery – Horticulture (Retail Nursery) Certificate III</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Nursery – Horticulture (Wholesale Nursery) Certificate III</td>
<td>15</td>
<td>15</td>
<td>19</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Parks and Gardening – Horticulture (Parks and Gardens) Certificate III</td>
<td>58</td>
<td>96</td>
<td>86</td>
<td>67</td>
<td>86</td>
</tr>
<tr>
<td>Parks and Gardening Certificate III</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>270</strong></td>
<td><strong>321</strong></td>
<td><strong>325</strong></td>
<td><strong>275</strong></td>
<td><strong>334</strong></td>
</tr>
</tbody>
</table>
SCHOOL BASED APPRENTICESHIPS AND TRAINEESHIPS (SBATs)

School based traineeships (SBTs) were first trialled in 1998 and made available to all senior secondary students in NSW in 1999. Currently over 50 school based traineeship qualifications are available in NSW and these are reviewed regularly to ensure that qualifications offered reflect skill shortages and provide career pathways for young people to new and emerging industry areas.

In February 2006, the Council of Australian Governments (COAG) determined that school based apprenticeships (SBAs) would be available to senior secondary students in all states and, by early 2007, were available in NSW schools. Students can complete a traineeship or the equivalent of the first year of an apprenticeship as part of their Higher School Certificate. Students may begin as early as Year 10. School Based Apprenticeships and Traineeships (SBATs) combine paid part-time work, training and school. Qualifications are available across a range of rural industries and in many cases will contribute towards the student’s Australian Tertiary Admission Rank (ATAR). SBATs build skills and provide a practical component to the ‘formal’ vocational or trade training. Students have greater prospects when they leave school. In summary:

- Students receive credit towards the HSC and an industry based nationally recognised qualification
- Students undertake a minimum of 100 days of paid employment over the two years of the HSC
- SBTs complete a minimum Certificate II qualification, and
- SBAs complete Stage 1 of their trade qualification and continue in their apprenticeship post HSC.

Government incentives are available to assist and support businesses that employ a school based apprentice or trainee. In 2012 Agriculture made up around 2% of the school based trainees (Figure 7.2).

Information about Qualifications or Statements of Attainment (SOA) for Agriculture and related education are available through the School Based Apprenticeships and Traineeship program. Current Certificate II offerings for School Based Traineeships (SBT) qualifications are shown in Table 7.7.

![Figure 7.2 The composition by industry of the school based trainee training in 2012](image)

[NSW Vocational Education in Schools Directorate, submission, 2013]
Table 7.7 Current availability of School Based Apprenticeships and Traineeships in NSW (NSW Vocational Education in Schools Directorate, submission, 2013)

<table>
<thead>
<tr>
<th>Certificate II School Based Traineeships qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
</tr>
<tr>
<td>Agriculture – Irrigation</td>
</tr>
<tr>
<td>Conservation and Land Management</td>
</tr>
<tr>
<td>Horticulture – Floriculture</td>
</tr>
<tr>
<td>Horticulture – Horticulture</td>
</tr>
<tr>
<td>Horticulture – Parks and Gardens</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certificate III School Based Apprenticeships qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horticulture – Landscape Construction</td>
</tr>
<tr>
<td>Horticulture – Parks and Gardens</td>
</tr>
<tr>
<td>Horticulture – Production Nursery</td>
</tr>
</tbody>
</table>

THE TAFE NSW NETWORK

The Technical and Further Education (TAFE NSW) network is a well-established organisation for vocational education and training. It offers a multitude of programs and provides training for many thousands of students. In 1992, TAFE NSW reviewed their offerings in rural education and created a network of Rural Studies Centres throughout the state. Figure 7.3 shows the distribution of that network. Through these centres, TAFE NSW delivers a wide range of agricultural education and training, from Diplomas and Advanced Diplomas in Agriculture and Agribusiness through to Certificates I-IV, as well as skill sets customised to local enterprises and industries. TAFE NSW also provides training that addresses the workplace safety agenda, being the large vehicles, machinery, farm bikes, dangerous implements and the like. It is imperative that this training exists but other institutions such as schools and universities are increasingly risk-averse and such training at these places does not readily occur. In the case of forestry, training is carried out largely in the workplace using the commercial machinery. This capability works in favour of TAFE NSW for such training, although schools and universities (See Chapter 8) could make better use of TAFE NSW’s ability to complete the significant risk assessment paper work and carry out the training.

One of the issues raised during this Review in respect of TAFE NSW provision is the lack of agriculture training opportunities in the metropolitan area. Figure 7.4 shows the availability of agriculture training in the Newcastle/Sydney/Wollongong regions. Whereas amenity horticulture is well provided for through the Ryde and Padstow Colleges, agriculture in the Sydney region is provided only at TAFE NSW Western Sydney Institute (Richmond) which in 2012 substantially reduced its capacity. There remains the opportunity to study formally through Open Training and Education Network, the distance education arm but the practical skills component is compromised.

THE ROLE OF SKILL SETS IN AGRICULTURAL INDUSTRIES EDUCATION AND TRAINING

In TAFE NSW skill set delivery represents 20 per cent of all enrolments in the agrifood sector. Skill sets delivered to meet enterprise needs include nationally endorsed skill sets from training packages, and RTO developed skill sets using nationally endorsed units of competency. Skill sets are defined as “single units of competency, or combinations of units of competency, from endorsed Training Package(s), which link to a licence or regulatory, or defined industry need” (NSSC 2012). As no national data have been collected at this stage on the completion of skill sets there is potential for the under reporting of the uptake of VET education and training by the agrifood sector.
Most students have adapted to the new school age mandate but there is a minority for whom the system fails. Its rigidity does not allow for those students, from 14 to 17 years of age, who are poorly adapted to such rigidity within the school/TAFE provisions. They do not want to be at school and can be a disruptive influence on others. Some are on the margins of the law. Others have a family history without the background of an education or a working ethic.

The program BackTrack commenced in the Armidale district in 2006. It has successfully delivered agricultural and metals/engineering training and life skill development for nearly 300 disengaged, at risk, young people. Around 87% have transitioned into full time employment or further education and training. BackTrack’s success is directly attributable to its capacity and ability to deliver flexible training. This is achieved using creative delivery and learning processes that are industry driven and hold National Accreditation Status.

BackTrack exists to offer young people, who have lost their way, the opportunity to re-connect with education and training to become work ready, find jobs, lead happy and productive lives, and participate fully in the community. Small communities, such as Armidale, have unique strengths that enable community participation to find solutions. As young people engage in BackTrack they enter into traineeships and apprenticeships through the BackTrack team’s intensive attention to personal and life skill development. This helps to restore, and sometimes establish for the first time, relationships and recognition within the broader community, while building skills, gaining purposeful training and qualifications for life-long employment and successful community engagement.

BackTrack is aware that the young people they work with will stay close to their town of origin and family connections. These aspects are considered as opportunities not barriers in the strategic development of the program. The BackTrack model ensures the graduating participants are work ready with clear and real pathways to employment while also addressing other social, learning, personal or behavioural obstacles.

Successful models of delivery with BackTrack have occurred through a range of resourceful opportunities and partnerships including: week-long intensive residential programs at Tocal College where BackTrack staff provide additional learning and social support; contracting accredited Certificate IV trainers to assess young people in-situ (ie shearing shed or in the paddock); strong partnerships with small RTOs to deliver tailored on-site Certificate II Engineering at the BackTrack Shed.

BackTrack is enabling other communities to use its model successfully – far north Queensland, Quirindi, Tamworth, Gunnedah, Glen Innes and Tenterfield.
REGISTERED TRAINING ORGANISATIONS

In addition to the school-based training and that provided by TAFE NSW, opportunity exists for other organisations in the public and private sectors to provide education and training of industry training packages. This includes agriculture and related areas. Under the NSW Government’s *Smart and Skilled* purchase of training places will be contestable and RTOs will be in competition with the TAFE NSW network. Currently TAFE NSW undertakes more than 80% of training. One issue in respect of some RTOs has been the quality of delivery of training but there are increasingly stringent requirements in place to limit the risk of poor delivery.

The number of RTOs delivering agriculture, environmental and related courses across Australia is provided in Table 7.8 whilst the number operated by TAFE NSW are provided in Table 7.9. In both cases the number has remained relatively stable and it is unlikely that there will be a significant shift with *Smart and Skilled*. The notable exception is in the Aquaculture/Fisheries area which has experienced a decline in education provision as business opportunities have also declined and the regulatory environment has become more stringent. Student demand also declined as fishing-related accredited courses were replaced at the national level by training packages that did not have a focus on fishing.

Figure 7.3 Availability of courses in agriculture across NSW through the TAFE NSW network 2011
(NSW DEC)
Table 7.9 TAFE NSW RTOs delivering agricultural courses 1997-2012 (TAFE NSW)

<table>
<thead>
<tr>
<th>Course Group</th>
<th>1997</th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Livestock</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Aquaculture and Fishing</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Conservation and Land Management</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

* Includes Open Training and Education Network (OTEN)

PROVISION FOR AQUACULTURE

Advice received during consultations indicated that the main aquaculture provision in training was for fish farming. Issues of scale of operation limit rapid expansion of fish farming in NSW, which is also inhibited by environmental limitations imposed by local councils. Advice indicated that there was a particular need for business skills and environmental...
management understanding and training provisions should be adjusted in these directions.

The emphasis on fish farming ignores the reality that, in NSW, aquaculture is dominated by oyster production which is more than 80% of the industry. There do not appear to be any training programs for oyster farming in NSW, yet this seems to be the greatest need. Oyster production is significantly represented by family businesses handed down through generations - with limited interest in training and qualifications. Current industrial climates and issues of social licence suggest that the emphasis towards training and qualifications needs to happen.

PROVISION FOR FORESTRY

The current arrangements for forestry training appear to be adequate. There is a network of TAFE NSW trainers around the state to conduct the training on site where the commercial equipment resides. Other RTOs also work in this area although in the past the practices of some have been questioned. The process of registration under the new arrangements of Smart and Skilled should alleviate those concerns. Given the extensive changes in the industry over the recent past, it is somewhat unclear what the needs are likely to be for workers and their skills training. It is an aspect that needs to be monitored but there are no recommendations in this Report for changes to the current setup.

THIN MARKETS

In the provision of specialised training in primary industries the clientele are widely distributed in rural NSW and in numbers that make offerings of training financially unviable. Thin market industries include but are not limited to: production horticulture, aquaculture, floriculture, horse breeding, pork production, poultry production, commercial seed processing, commercial seed testing, pest management, irrigation and production nursery. There needs to be special consideration for the provision of training for these industries such that RTOs continue to service these industries and to ensure that individuals participate.

ABORIGINAL EDUCATION AND TRAINING

Aboriginal students, on a State-wide basis, have a much higher proportion below the national minimum standards for reading and numeracy compared with non-Aboriginal students. Similarly, just over one third of Aboriginal students continue to Year 12 compared with over two-thirds of all students. This translates to a much lower participation rate at university for Aboriginal students, though participation in vocational education and training is generally strong, with significant increases in both participation and completion rates over the past four years.

A NSW Ministerial Taskforce on Aboriginal Affairs (established in 2012) has outlined a range of proposals for comment that would radically boost opportunities for

<table>
<thead>
<tr>
<th>Course field of education</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>0501 - Agriculture</td>
<td>37</td>
<td>34</td>
<td>29</td>
<td>44</td>
<td>44</td>
<td>45</td>
<td>46</td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>0503 - Horticulture and viticulture</td>
<td>45</td>
<td>44</td>
<td>39</td>
<td>40</td>
<td>40</td>
<td>44</td>
<td>43</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>0505 - Forestry studies</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>0507 - Fisheries studies</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>0509 - Environmental studies</td>
<td>18</td>
<td>21</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td>0599 - Other agriculture, environmental and related studies</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>11</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>
Aboriginal people. These include: better supporting language and culture in communities and in schools to improve engagement with families and motivate Aboriginal students to stay in school; and, importantly from the perspective of this Review, giving students pathways to real jobs by getting local employers involved in career planning. These initiatives aim to provide opportunities for increasing Aboriginal students’ participation in education and training, provided careers are presented as real options at the local level.

One program already in existence and with similar ideals is the BackTrack program (Box 7.1) which addresses the needs of Aboriginal youth amongst others. A critical issue for the success of such programs is providing the flexibility needed to deliver the desired outcomes for Aboriginal students. Flexibility is needed to deliver desired long-term outcomes and schemes should reflect this reality.

Securing government funding, properly accounting for the expenditure of that funding and documenting achievements against milestones is challenging in itself. Doing this in the context of providing a flexible education pathway for previously disengaged Aboriginal (and other) students presents particular difficulties. It is important that funding authorities recognise this inherent tension and adjust processes and requirements where reasonably possible.

The Ministerial Taskforce on Aboriginal Affairs recommended that an Opportunity Hub model be developed, trialled and evaluated within selected locations in NSW to coordinate employment and training opportunities between schools, local businesses and the community. The Opportunity Hubs initiative has responded to feedback from Aboriginal communities emphasising the need for pathways to assist Aboriginal young people in the transition from school into tertiary education, training and/or employment. The initiative aims to improve coordination and utilisation of existing resources and to improve accessibility to appropriate services rather than create new programs.

The key to this initiative is to create the link between training and real employment so as to avoid the trap of training that does not lead to meaningful employment. Identifying such opportunities locally through private sector partnerships will provide for a more secure future for the participants. This Review supports the initiative. Such an initiative is highly relevant to agriculture. Aboriginal students are strongly under-represented in agricultural studies in Australian universities and there needs to be greater effort to address this anomaly. This Review makes a recommendation with respect to Opportunity Hubs in Chapter 6.

**THE AGRICULTURAL COLLEGES**

Agricultural colleges were a strong part of the education landscape for much of the 20th century. Two types evolved: those with formal courses leading to a diploma, evolving to a degree after their designation to College of Advanced Education (CAE) status, and others established to train young people in skills needed for employment on farms.

In NSW there were three agricultural colleges under the CAE system. They produced the technologists/paraprofessionals who were employed as extension officers or who went into agribusinesses as intermediaries between research and farmers. These colleges became part of the university system in 1989. Specifically, Hawkesbury Agricultural College became part of the University of Western Sydney, Wagga Wagga Agricultural College which had previously amalgamated with Riverina College of Advanced Education (later Riverina-Murray Institute of Higher Education) became part of Charles Sturt University and Orange Agricultural College became part of the University of New England, then the University of Sydney and currently Charles Sturt University (CSU).

In the 1960s, the need for more agricultural training for the farm workforce was identified by government and industry. Yanco Agricultural College, then Murrumbidgee College of Agriculture (MCA or Murrumbidgee College) and now Murrumbidgee Rural Studies Centre, was established in 1963 on the then Yanco
Experiment Farm. There was already extensive accommodation on the site which had been constructed for children in the 1930s by the then Child Welfare Department. The buildings had been used during the Second World War for internees and afterwards the facilities reverted to the NSW Department of Agriculture, having been first established by the NSW Department of Agriculture in 1908. The Department was able to establish a college at virtually no cost and staff it largely from within the ranks of the Department. This provided the solution for the south of the state.

Around the same time Tocal College was established as an agricultural college through the efforts of the late Edward Alan Hunt who saw the opportunity for the Tocal estate to become an agricultural college. The Presbyterian Church opened the College in 1965 and it had a strong focus on combining practical skills and farm management. Because of the extensive farm resources, practical skills could be accommodated on the farm. By the late 1960s it was clear this college was not viable as an independent entity and it was transferred to the NSW Department of Agriculture with the passing of the C B Alexander Foundation Incorporation Act 1969.

In this Review the conundrum of the relative success of Tocal College and the relative failure of Murrumbidgee College (and its various iterations) exercised much consideration. On the surface they are operated by the same department and have the same agenda. They are at opposite ends of the state and are complementary in that Tocal College has a strong focus on the livestock industries whereas Murrumbidgee College had a strong focus on the cropping and irrigation sectors. The demand for a qualified workforce across the agricultural sector remains strong.

The demise of Murrumbidgee College occurred in 2003. It was a political decision taken in opposition to recommendations of an Upper House Committee, at the time, to retain the College. The entity was changed to a rural training centre with strong constraints including closure of the residential facility. Whilst accommodation exists for more than 100 students, data show (Table 7.10) that full-time student numbers at the time had declined and the costs of full-time provision were increasing, with little flexibility in staff arrangements. The inflexibility within which it has operated has restricted prospects of success. During the last decade the prospects to shift the entity to organisations such as TAFE NSW and Charles Sturt University have been explored. Instructions for this Review included specific reference to finding a ‘solution to Murrumbidgee’. Table 7.10 shows the pattern of enrolments in various activities leading to 2003.

Why then was Tocal College able to avoid a similar outcome? There are some significant differences:

<table>
<thead>
<tr>
<th>Year</th>
<th>Murrumbidgee</th>
<th>Tocal</th>
<th>Murrumbidgee</th>
<th>Tocal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full-time</td>
<td>Part-time</td>
<td>Short course</td>
<td>Total</td>
</tr>
<tr>
<td>1997</td>
<td>60</td>
<td>95</td>
<td>189</td>
<td>344</td>
</tr>
<tr>
<td>1998</td>
<td>44</td>
<td>59</td>
<td>689</td>
<td>792</td>
</tr>
<tr>
<td>1999</td>
<td>59</td>
<td>88</td>
<td>4,929</td>
<td>5,076</td>
</tr>
<tr>
<td>2000</td>
<td>49</td>
<td>85</td>
<td>4,003</td>
<td>4,137</td>
</tr>
<tr>
<td>2001</td>
<td>32</td>
<td>152</td>
<td>3,303</td>
<td>3,487</td>
</tr>
<tr>
<td>2002</td>
<td>28</td>
<td>127</td>
<td>2,345</td>
<td>2,500</td>
</tr>
<tr>
<td>2003</td>
<td>39</td>
<td>80</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Figures for short courses in 2003 not provided.
• Tocal College is geographically independent of the research functions of the NSW Department of Primary Industries (DPI) and so its farm activities have operated on a commercial basis. Murrumbidgee College, however, has always been integrated with a major irrigation research centre, Yanco Agricultural Institute.

• Tocal College operates the farm and chicken enterprise, as well as the Homestead, under the C B Alexander Foundation. As a not-for-profit entity, Tocal has been able to obtain grants for conservation works on its farms and homestead. This provides some degree of independence from NSW Department of Primary Industries management. It enables the College to undertake non-departmental activities, the most obvious extreme example being weddings and receptions. Whilst this does not interfere with the main functions of the College it does utilise a particular set of facilities, attracts income and gives the College profile. There are other more relevant activities such as cattle sales, which also profile the institution. Murrumbidgee College on the other hand operates solely under the management of the Department and as such is subject to the policies and procedures of the bureaucracy and is limited in what it can and cannot do, including with staff arrangements. As with most bureaucracies, personnel change functions regularly and there has been little continuity of association with head office. The strength of the relationship between the College and head office has depended highly on the individual in the chair at the time. The Principal of Tocal was delegated authority for Murrumbidgee but the remoteness of the two campuses from each other created challenges of its own and is not a favoured solution.

• Tocal College has had the benefit of strong, focused and progressive leadership which is well-connected and politically savvy. Murrumbidgee College has never been in a position of strength to play a strong role and has been dependent on people remotely to push its case – the success of that process is highly dependent on the passion and commitment of the responsible individual in the Department to do the pushing.

• It could be argued that education and training per se is a lower priority function of the NSW Department of Primary Industries. Thus in situations where there are strong budget pressures, the lower priorities become sidelined and drains on the budget are blocked. This has clearly been the case at Murrumbidgee College, whereas the situation at Tocal with its greater flexibility of management and income generation is a lesser target for cutbacks. The trust arrangement at Tocal obligates the Department to fulfil its commitments. That said, it is important that the NSW Department of Primary Industries retains a strong interest in education and training as a skilled workforce provides a better outcome for its regulatory and research and development (R&D) functions. It is a valuable return on the Department’s investment.

The two entities are now evaluated separately as a way forward is explored.

TOCAL COLLEGE

Tocal started as a private and independent institution and that influence continued well past the hand over to the Department. It has often recruited teaching staff from the private sector and the commercial nature of its large farms has pervaded its operation in a positive way. Staff selection has been an important component of the success story at Tocal.

This College is certainly a showpiece for the NSW Department of Primary Industries. It is a large property for the district and runs primary enterprises (beef cattle, dairy cattle, chickens, horses) at commercial levels. In large part it practices what it preaches. It has good teaching and accommodation facilities and a very active program. Its buildings are attractive in that they have won architectural awards and the homestead adds a profile dimension. The College produces quality materials and operates at the leading edge of vocational training. The Department and the Minister should place great value on this asset and
ensure its sustainability. Its future however depends on continued support from the Department.

The College has been accorded ‘Centre of Excellence’ status within the NSW Department of Primary Industries. It is unclear whether this is just a ‘feel good’ self-proclamation. There do not appear to be any guidelines on what constitutes such a centre nor what functions or obligations such a conferment signifies. It certainly is an excellent centre for agricultural education and training and the agricultural industries need such centres to promote the positive side of its activities. However there needs to be a move beyond tokenism to a real commitment and real obligations in order that the designation of ‘Centre of Excellence’ is warranted and sustained. This includes ongoing commitments to best practice, current practices and equipment, national and international benchmarking on standards, leadership in education and training and the like. It obligates the NSW Department of Primary Industries to also make commitments to the task, since accepting the plaudits of the designation comes at a price.

Whilst Tocal College operates under the more flexible arrangements provided by the C B Alexander Foundation, some anomalies remain that compromise best practice for the functions it undertakes. Whereas the chicken and equine enterprises are managed locally by the College, the cattle enterprises are directed from head office. This makes no sense to the Reviewer as there are no other apparent justifications, such as preservation of a genetic line, that warrant such intervention.

What then are the risks in these changes? The risks would seem minimal relative to the benefits that would accrue. The College becomes more responsive to client needs and to opportunities that arise, often at short notice. The Department is an integral part of the C B Alexander Foundation Board, has audit arrangements at its disposal, yet is relieved of the impost of needing to micro-manage an activity which is to the side of its core business. Such changes in responsibilities are consistent with the Centre of Excellence concept and of best practice.

MURRUMBIDGEE COLLEGE

The NSW Department of Primary Industries holds extensive accommodation resources at Yanco Agricultural Institute (YAI) which have been underutilised since the decisions of 2003. They were partially reopened in 2005 and operated through Tocal College as a residential arm of ‘Murrumbidgee Rural Studies Centre’. While this arrangement has produced some outcomes and revenue, the long term possibilities of growing the business within the current business model are limited.

The key issue is that it is virtually impossible within the constraints of NSW Department of Primary Industries to operate the type of business which needs to be created to sustain this accommodation facility. The NSW Department of Primary Industries continues to attract criticism for not making the facility more readily available for public use and there appear to be many players calling for the facility to resume a strong role for the industry. Availability of VET courses in agriculture in the Murrumbidgee Irrigation Area is very limited and the attainment of qualifications in this region depends on the passion and drive of the individual to make the long journey to Wagga Wagga or Albury to fulfil the requirements.

The reality is that there is no future under current organisational arrangements. The options therefore are two-fold: close the facility permanently or find a different operational basis to enable it to have reasonable prospects for success. The external interest in the facilities suggests that effort be made to find a way forward. What options are there to regenerate the activity on a better business footing? In no particular order the options would seem to include:

- A residential TAFE NSW facility for agricultural education and training - it is acknowledged that TAFE NSW already runs facilities for agricultural education and training but does not have residential facilities in its network. This proposal, whilst addressing the dearth of opportunities for vocational qualifications in agriculture in the region,
would transfer the limitations from one bureaucracy to another and would be unlikely to be sustainable

• A vocational agricultural education high school – this option arises out of a proposal from the Isolated Children’s Parents’ Association (ICPA). In that proposal it was unclear whether there were a sufficient number of students to make the business case on its own. On that basis it is not supported here but their issues are canvassed elsewhere in the Review. It also has the potential to compromise the operations of Yanco Agricultural High School which is located in close proximity to the site in question

• A private sector agricultural training centre – the option of calling for tenders to run an agricultural education and training centre may attract interest from private RTOs. The issue for the NSW Department of Primary Industries is the need to minimise conflict with the ongoing R&D use of the Yanco Agricultural Institute site

• A not-for-profit agricultural college – this option involves the creation of a trust under which the operations of a college would occur. This would retain the strong association with NSW Department of Primary Industries but would provide the flexibility needed to grow the business. The advantages of such arrangements have been demonstrated through the C B Alexander Foundation at Tocal College and also under the Belgenny Farm Trust that operates at Camden. This is the preferred option and is explored further.

There is the question of the name of the entity as well. It is always a good idea to build on the strengths. The name Murrumbidgee College of Agriculture (MCA) is well known and former students associate with the name. The word ‘college’ denotes an institution for vocational, technical and professional instruction whereas a ‘centre’ is more ambiguous in its meaning. There has been a large amount of discussion in industry, in the community and in political circles and the term ‘college’ is common parlance. The Review is supportive of reverting to the name most commonly associated with the entity, being Murrumbidgee College of Agriculture. In so doing it does not imply that its only functions are those of previous times. The institution needs to move with the times and deliver training in all guises relevant to the times and industry needs, as well as be a valuable resource available to the community.

There are several principles that are identified in the re-establishment of ‘Murrumbidgee College’. These include:

• That MCA has a defined location that comprises the residences, dining facilities, teaching spaces and facilities, sporting facilities and appropriate office spaces and reception (see Appendix 7.3)

• That the facilities are operated under a not-for-profit trust. The MCA trust board should be chaired by an independent person from industry and comprise members with skills in education and training, finance, public relations, and industry as well as the NSW Department of Primary Industries at senior level. The Department should enter into contractual arrangements with the trust in respect of security of tenure, maintenance arrangements, general appropriation commitments and suitable access to land for training and related activities

• That there be appointed an Education and Training subcommittee of the trust comprising NSW Department of Primary Industries, TAFE NSW, Yanco Agricultural High School and Charles Sturt University to advise on programs, farms, training facilities and inter-educational relations

• That training and other programs deliver to the needs of southern New South Wales and operate independently of Tocal College but that the Colleges collaborate on issues such as a single ‘NSW DPI Colleges RTO’ (which should not align in name with either college), publications, training package development, and other Departmental training initiatives

• That a College Director be appointed with skills in training, finance, enterprise management. Such appointment should be funded by NSW Department of Primary Industries, have the independent
authority to run the business and operate as the Executive Officer to the trust board. The NSW Department of Primary Industries will need to fund a complement of core staff but the expectation is that the ‘business’ will be able to support other contract staff.

This outcome provides the opportunity to build on the reputation of the past but have the flexibility to provide an expanded range of services. It addresses the lack of training facilities for vocational agriculture in that region and in part provides for some of the Isolated Children’s Parents’ Association needs. This process also enables industry partners to have buy-in of the operation in order to provide for their needs and to sustain the operations. The vision should be a Centre of Excellence in Irrigation and Cropping under the provisos outlined above in respect of the similar designation of Tocal College. In so signifying the intention it opens the way for discussions with interested parties to engage with the College to locate their training programs physically and/or virtually with the institution. One such proposition has been articulated by the irrigation infrastructure industry (Box 7.2).

There is an extensive range of opportunities for training at Murrumbidgee College of Agriculture including:

- Certificates II, III and IV and Diploma studies in agriculture and related areas by full-time, part-time or block time

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**BOX 7.2 IRRIGATION AND WATER MANAGEMENT BUSINESSES – AN OPPORTUNITY**

**BACKGROUND**

More than 40 stores in Australia are involved in the design, supply, installation and maintenance of irrigation infrastructure for a wide range of agricultural and commercial applications. This includes sub-surface drip, centre pivot, pumping systems for stock water, horticulture, aquaculture and broadacre irrigation systems. In NSW there are more than 100 people employed by Think Water in this industry.

Supplying irrigation infrastructure projects requires technical know-how combined with practical knowledge of farming practices, engineering and project management. Typical on-farm irrigation projects can range from a few thousand dollars to well over $1 million.

The ability to attract and retain trained staff is a major limiting factor. Current training and training support is piecemeal and in some cases delivery through Recognition of Prior Learning (RPL) does not support strong workplace outcomes. Improved training will help develop standards and eventually licence requirements to ensure irrigation best practice and reduce end user costs in the longer term through good design practice. Currently in-house training is provided through a 10-day residential school covering Work Health and Safety, Irrigation Hydraulics, Pump Technology and Selection, Trouble-Shoot Irrigation, Drip and Agriculture Filtration, Basic Commercial and Domestic Irrigation Design, Retail Management, Pipe and Fittings Technology and Group Customer Quote and Presentation.

Several organisations offer Certificates III and IV and a Diploma in Irrigation, some based in NSW. Currently 35 students are undertaking the Federal Government’s Critical Skills Infrastructure Funding (CSIF) program. This is time consuming and cumbersome, although funding provides 90% of tuition costs. Federally funded, state administered traineeships for Certificates III and IV in Irrigation exist, but delivery standards vary between providers.
• Trade qualifications in the above mentioned activities
• Workplace assessments and RPL
• Training for Aboriginal students
• Access by regional schools for practical experience for Primary Industries studies and for school excursions
• Refugee and 457 Visa holder training in trade qualifications
• Industry short courses
• Courses and internships for international students and organisations

• Seminars and conferences
• School outback experiences
• Weddings and functions.

The list goes on.

Of importance in making the MCA concept work is the support of the regional councils who should use the facilities for their activities and staff training. It is in their interests to see the MCA succeed and be used as a community facility. Further, the concept of council(s) creating an employment company similar to that established by Narrabri Council (see Box 9.2) to provide a trained regional workforce is worthy of serious consideration.

A WAY FORWARD

Best practice irrigation comes from the best use and installation of technology combined with skilled application of the equipment by operators and farmers. With the right mix of practical application and system parameters, a best practice Irrigation School could be developed to service the whole industry through design, supply, installation, and operation. The ideal training solutions would cover broad aspects of irrigation, project management and business knowledge. This could be conducted in a single location that already has irrigation and student accommodation, such as the Murrumbidgee College of Agriculture.

While Yanco/Leeton is not easy to access, and this may be a major impediment, the location has advantages that make it ideal for an ‘Irrigation School’, which could service a wider market than NSW. There is a mix of irrigation systems, horticultural and broadacre irrigation farms close by and teaching infrastructure. There is a great opportunity to develop a Centre of Excellence, supported by industry, covering technical irrigation skills, farmer irrigation and agronomy based education, incorporating academic research and support of technology.

At the same time on-line training delivery allows for a much wider student reach, perhaps even other countries, where water infrastructure is vital for their long term survival.

While delivery and practical courses are important, so is the rigour of the course to ensure that employers are confident that the knowledge and skills outcomes are being delivered.

Based on submission by P. Best, Think Water, a network of independently owned water services businesses
consideration in conjunction with key industry bodies.

In order to make the Murrumbidgee College of Agriculture initiative work, there would need to be clear demarcation of space at Yanco Agricultural Institute so that responsibilities are clear and boundaries are known. Based on advice, the clearly defined area would comprise main quadrangle, the buildings to the south, Heath and Pearson blocks, Amaroo and the Recreational Hall. This would involve some expenditure up front but ‘getting it right’ at the start would be a good investment. Swimming pool and sports fields become part of the College.

The Director would have responsibility for negotiating access to Yanco Agricultural Institute land and maintaining records as appropriate in respect of future research use of the land. This was common practice in the past and so ought not to be a barrier to future activities. Commercial farms also need to be accessed for practical training. The citrus orchard offers a useful resource for training in horticulture.

Existing training staff based at Yanco Agricultural Institute will need to be considered early in the Director’s tenure. They ought to be offered the opportunity to operate with the new direction or stay outside it as NSW Department of Primary Industries sees fit.

What is important is that all staff within the revamped Murrumbidgee College of Agriculture need to embrace the new order and not hang on to the past. The success of the Murrumbidgee College of Agriculture depends on the commitment of all staff and their focus to make it work.

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**BOX 7.3 THE REGIONAL PASSPORT**

Proposed by the rice industry, the concept of the Regional Passport is to document industry-specific certification in a range of key skill areas, eg forklift driving, such that the holder can undertake seasonal work across several agricultural industries in the region in rotation. The benefit of the passport is to minimise repetitive training practices and maximise and retain skills within the region. Such training for the passport would be undertaken at Murrumbidgee College of Agriculture. The passport could link in with the Federal Government’s Harvest Trail initiative. In association, the regional councils need to work closely with industry and consider seriously the implementation of a “Make it Work” scheme as has been established in Narrabri (Box 9.2)

This proposal needs to be facilitated by the NSW Department of Trade and Investment, Regional Infrastructure and Services (NSW Trade and investment), if the option for a regional passport is to take place across NSW regions.

Much of the training that the passport would capture would not necessarily be AQF qualifications but would include short skills courses or Work Health and Safety (WHS) requirements.
GOVERNMENT RECOMMENDATION 17
Where opportunities exist, schools move over time to offer Certificate III in Primary Industries for those students seeking employment in agriculture.

GOVERNMENT RECOMMENDATION 18
State and federal funding authorities recognise the benefits, for disengaged Aboriginal youth, of BackTrack and similar schemes in New South Wales and create flexibility of funding to ensure the schemes are able to operate with maximum benefit to participants.

GOVERNMENT RECOMMENDATION 19
TAFE NSW reviews the offerings in Primary Industries in vocational education and training in the metropolitan area to ensure students have appropriate access to such training.

GOVERNMENT RECOMMENDATION 20
TAFE NSW works with the AgriFood NSW Industry Training Advisory Body (ITAB) to encourage:

- Establishment of aquaculture training packages and opportunities in oyster farming
- Review of training packages in fish farming to ensure business principles and environmental management are appropriately represented.

GOVERNMENT RECOMMENDATION 21
In Smart and Skilled, agricultural and seafood courses be considered for thin market Community Service Obligation payments to guarantee training in rural and remote areas.

GOVERNMENT RECOMMENDATION 22
The NSW Department of Primary Industries, in conjunction with the C B Alexander Foundation and other stakeholders, establishes a set of guidelines on what constitutes a ‘Centre of Excellence in Agricultural Education and Training’ and ensures the guidelines are implemented.

GOVERNMENT RECOMMENDATION 23
The Tocal College farms be managed as a business unit under the auspices of the C B Alexander Foundation.

GOVERNMENT RECOMMENDATION 24
The NSW Department of Primary Industries re-establishes the Murrumbidgee College of Agriculture under the following principles to provide the opportunity to build on the reputation of the past, yet with flexibility to provide an expanded range of services. These principles are:

a. That Murrumbidgee College of Agriculture has a defined location and that the boundaries of the entity are drawn up along the lines indicated to enable the College to operate independently of Yanco Agricultural Institute

b. That the facilities are operated under a not-for-profit trust and continued investment in the operation of the facilities be undertaken
c. That an education and training subcommittee of the trust be appointed, comprising NSW Department of Primary Industries (NSW DPI), TAFE NSW, Yanco Agricultural High School and Charles Sturt University to advise on programs, farms, training facilities and inter-educational relations

d. That training and other programs deliver to the needs of southern New South Wales and operate independently of Tocal College but that the Colleges collaborate on issues such as a single ‘NSW DPI Colleges RTO’ (which should not align in name with either college), publications, training package development, and other Departmental training initiatives

e. That a College Director be appointed with skills in training, finance and enterprise management. Such appointment should be funded by the NSW Department of Primary Industries, have the independent authority to run the business and operate as the Executive Officer to the trust board

f. That the trust invites regional industries to commit to the College through investment, support for training of their staff and involvement in the trust.

INDUSTRY RECOMMENDATION 8
Leeton and Griffith Councils, together with other local government organisations and key industries, give consideration to the establishment of an employment company similar to that operated by Narrabri Council.
CHAPTER 8
AGRICULTURE IN HIGHER EDUCATION

Wheat

“Sowin’ things an’ growin’ things, an’ watchin’ of ’em grow;
That’s the game,” my father said,
an’ father ought to know.
“Settin’ things an’ gettin’ things
to grow for folks to eat:
That’s the life,” my father said,
“that’s very hard to beat.”
For my father was a farmer,
as his father was before,
Just sowin’ things an’ growin’ things
in far-off days of yore,
In the far-off land of England,
till my father found his feet
in the new land, in the true land,
where he took to growin’ wheat.

Wheat, Wheat, Wheat!
Oh, the sound of it is sweet!
I’ve been praisin’ it an’ raisin’ it
in rain an’ wind an’ heat
Since the time I learned to toddle,
till it’s beatin’ in my noddle,
Is the little song I’m singin’ you
of Wheat, Wheat, Wheat.

Plantin’ things — an’ grantin’ things
is goin’ as they should,
An’ the weather altogether
is behavin’ pretty good —
Is a pleasure in a measure
for a man that likes the game,
An’ my father he would rather
raise a crop than make a name.
For my father was a farmer,
an’ “All fame,” he said, “ain’t reel;
An’ the same it isn’t fillin’
when you’re wantin’ for a meal.”
So I’m followin’ his footsteps,
an’ a-keepin’ of my feet,
While I cater for the nation
with my Wheat, Wheat, Wheat.

Wheat, Wheat, Wheat!
When the poets all are beat
By the reason that the season
for the verse crop is a cheat,
Then I comes up bright an’ grinnin’
with the knowledge that I’m winnin’,
With the rhythm of my harvester
an’ Wheat, Wheat, Wheat.

Readin’ things an’ heedin’ things
that clever fellers give,
An’ ponderin’ an’ wonderin’
why we was meant to live —
Muddlin’ through an’ fuddlin’
through philosophy an’ such
is a game I never took to,
an’ it doesn’t matter much.
For my father was a farmer,
as I might ‘a’ said before,
An’ the sum of his philosophy was,
“Grow a little more.
For growin’ things,” my father said,
“it makes life sort o’ sweet
An’ your conscience never swats you
if your game is growin’ wheat.”

Wheat, Wheat, Wheat!
Oh, the people have to eat!
An’ you’re servin’, an’ deservin’
of a velvet-cushion seat
In the cocky-farmers’ heaven
when you come to throw a seven;
An’ your password at the portal
will be, “Wheat, Wheat, Wheat.”

Now, the preacher an’ the teacher
have a callin’ that is high
While they’re spoutin’ to the doubtin’
of the happy by an’ by;
But I’m sayin’ that the prayin’
it is better for their souls
When they’ve plenty wheat inside ’em
in the shape of penny rolls.
For my father was a farmer,
an’ he used to sit an’ grieve
When he thought about the apple
that old Adam got from Eve.
It was foolin’ with an orchard
where the serpent got ’em beat,
An’ they might ‘a’ kept the homestead
if they’d simply stuck to wheat.

Wheat, Wheat, Wheat!
If you’re seekin’ to defeat
Care an’ worry in the hurry
of the crowded city street,
Leave the hustle all behind you;
come an’ let contentment find you
In a cosy little cabin
lyin’ snug among the wheat.
In the city, more's the pity,
thousands live an' thousands die
Never carin', never sparin' pains
that fruits may multiply:
Breathin', livin', never givin';
greedy but to have an' take,
Dyin' with no day behind 'em
lived for fellow-mortals' sake.
Now my father was a farmer,
an' he used to sit and laugh
At the "fools o' life," he called 'em,
livin' on the other half.
Dyin' lonely, missin' only
that one joy that makes life sweet —
Just the joy of useful labour,
such as comes of growin' wheat.

Wheat, Wheat, Wheat!
Let the foolish scheme an' cheat;
But I'd rather, like my father,
when viv span o' life's complete,
Feel I'd lived by helped others;
earned the right to call 'em brothers
Who had gained while I was gainin'
from God's earth His gift of wheat.

When the settin' sun is gettin' low
above the western hills,
When the creepin' shadows deepen,
and a peace the whole land fills,
Then I often sort o' soften
with a feelin' like content,
An' I feel like thankin' Heaven
for a day in labour spent.
For my father was a farmer,
an' he used to sit an' smile,
Realizin' he was wealthy
in what makes a life worth while.
Smilin', he has told me often,
"After all the toil an' heat,
Lad, he's paid in more than silver
who has grown one field of wheat."

Wheat, Wheat, Wheat!
When it comes my turn to meet
Death the Reaper, an' the Keeper
of the Judgment Book I greet,
Then I'll face 'em sort o' calmer
with the solace of the farmer
That he's fed a million brothers
with his Wheat, Wheat, Wheat.

C.J. Dennis
Source: The Weekly Times Annual,
4 November 1916, page 16

BACKGROUND

The universities involved in agricultural education in New South Wales have each been established under an Act of the NSW Parliament. However in modern day Australia, the vast majority of their funds is derived from the Federal Government and the policies for higher education are driven federally. Nevertheless New South Wales universities, by their actions and performance, influence substantially the opportunities available to prospective students, and the quality of their graduates impacts on the industries in which those graduates gain employment. As well, the university sector contributes significantly to the research and development effort and this has strong value for the New South Wales economy.

GRADUATE SUPPLY AND DEMAND IN AGRICULTURE

During the preceding four to five years, research by the Australian Council of Deans of Agriculture has drawn attention to the decline in, and low supply of, graduates in agriculture (Pratley 2012b) and related areas including horticulture (Pratley 2012a). This decline in the number of graduates has taken place over more than two decades. Figure 8.1 shows the number of graduating students from Australian universities over the last decade and Figure 8.2 shows the trends for New South Wales universities, including for aquaculture and forestry.

In respect of New South Wales, the trends are consistent with those nationally. In all cases relating to primary production, there has been a substantial decline in enrolments (Figure 8.2) and, unless there is a turnaround, some disciplines will disappear. Increases of around 15-20% reported in 2013 intakes nationally, including New South Wales, are the first indication that the declining trend may have reversed. Already, however, degrees in horticulture have disappeared from all but one Australian university and this is also the case for forestry production degree courses at undergraduate level. Both surviving institutions are in New South Wales, horticulture being offered at Charles Sturt University and forestry at Southern Cross University. Professional
studies in aquaculture are of limited availability across Australia and are only available in New South Wales as a major in an environmental science degree at Southern Cross University.

The number of completions from international students in undergraduate agriculture programs in New South Wales universities is very low (around 15 per year, Figure 8.3) and this may offer some prospects for expansion as food security becomes more pronounced in future years. The relatively strong Australian dollar, combined with the impacts of the global financial crisis, provide impediments to such expansion currently.

It is also important to note that graduate completions in food science (Figure 8.4) are at unsustainable levels and such courses exist probably only because of
enrolments by international students (Figure 8.5). It raises the question as to why prospective students do not see a career in the food production and processing industries as worthwhile, given their role in the sustainability of humanity and, in the case of Australians, underpinning their quality of life.

For the five years up to and including 2012 there have been at least five jobs per university graduate per year. In 2012, such demand had softened somewhat but not sufficiently to affect the message. Figure 8.6 shows the number of advertisements in Australia for agriculture for the period. In 2012 there were around 5,000 jobs advertised on the internet and in the papers. After allowing for some duplication, say 20%, the vacancies are still more than five-fold the number of graduates.
‘Agriculture’ is offered at four universities in New South Wales. Two regional universities, Charles Sturt University (Wagga Wagga and Orange) and the University of New England (Armidale) offer full-time and distance education programs. In the metropolitan area the University of Sydney at Camperdown/Camden and the University of Western Sydney at Richmond offer full-time programs although the University of Western Sydney suspended intake in 2012 as a result of lack of numbers and its offering is now a major in a degree in Natural Sciences. Forestry is offered at Southern Cross University which also offers a major study in aquaculture. Details of offerings are listed in Table 8.1.
A previous review of agricultural higher education (‘The McColl Report’, 1991) commented that there were too many institutions offering agricultural education across Australia at that time. The report proposed that there be a rationalisation in the number of these institutions in the expectation that there would be fewer, but stronger, institutions. Rationalisation has taken place across Australia with 23 campuses being reduced to twelve (Figure 8.8) and, of that, about nine rural campuses reduced to four. In the process however the consolidation has not led to stronger institutions because of the downturn in student demand. In that rationalisation, New South Wales went from six campuses to five with the loss of the University of New South Wales, with three being in rural locations (Armidale, Wagga Wagga and Orange). Whether that rationalisation is complete remains uncertain and will likely continue if student numbers do not improve markedly. Currently there is reasonable geographic coverage across the state. Each institution could receive a substantial increase (eg doubling) in intake and therefore there is no case for expansion of agriculture into new campuses in New South Wales.

A brief commentary on the University of Western Sydney in respect of its offerings in agriculture is warranted in this Review. Agricultural education was offered at Richmond from 1891 until 1989 under the auspices of Hawkesbury Agricultural College (HAC). Under that banner it was a single purpose institution and had a strong and proud heritage, providing professionals for the agricultural industries. Whereas it was a country institution for most of its existence as Hawkesbury Agricultural College, it has become the victim of progress and is now in the rapidly expanding metropolitan region and has thus lost its ‘country image’. As part of a large, multi-disciplinary university, in this expanding city area, agriculture has also lost its pre-eminent position. It has struggled to retain a significant presence within a very complex institution where there is a focus on professional courses that deliver to the western suburbs of Sydney.

The downturn in the demand for agriculture courses nationally over the last decade or two has impacted significantly on its ability to attract students into its agriculture and related courses. The decision to suspend intake in 2012 was an unfortunate one as it signalled to the client base that the commitment to agricultural education was under review. There are no longer dedicated degrees in agriculture, horticulture, animal production or food technology as these study areas are now only majors. This makes such study areas difficult to promote and have recognised

![Figure 8.7](image-url) The job market in agriculture and related areas based on advertisements in newspapers and on the internet for the period of 2007-2012 (Pratley 2012a). Figures are provided across Australia and for New South Wales.
<table>
<thead>
<tr>
<th>University</th>
<th>Undergraduate Courses</th>
<th>Postgraduate Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles Sturt University</td>
<td>Bachelor of Agricultural Business Management*</td>
<td>Graduate Certificate in Sustainable Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agriculture*</td>
<td>Graduate Diploma of Water Policy and Governance*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agricultural Science</td>
<td>Graduate Diploma of Sustainable Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Ecological Agriculture*</td>
<td>Master of Agricultural Business Management*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Horticulture*</td>
<td>Master of Applied Science*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Viticulture*</td>
<td>Master of Philosophy*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Wine Business*</td>
<td>Master of Sustainable Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Wine Science*</td>
<td>Master of Viticulture and Oenology*</td>
</tr>
<tr>
<td></td>
<td>*Available by external study</td>
<td>Doctor of Sustainable Agriculture*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PhD*</td>
</tr>
<tr>
<td>The University of New England</td>
<td>Bachelor of Agribusiness*</td>
<td>Graduate Certificate in Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agricultural and Resource Economics*</td>
<td>Graduate Certificate in Precision Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agriculture*</td>
<td>Master of Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agriculture/Bachelor of Business*</td>
<td>Master of Science in Agriculture*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Agriculture/Bachelor of Laws*</td>
<td>Master of Rural Science*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Animal Science*</td>
<td>PhD*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Rural Science</td>
<td></td>
</tr>
<tr>
<td>The University of Sydney</td>
<td>Bachelor of Agricultural Economics</td>
<td>Graduate Certificate in Agriculture</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Environmental Systems</td>
<td>Graduate Diploma in Agriculture</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Resource Economics</td>
<td>Master of Agriculture</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Science in Agriculture</td>
<td>Master of Philosophy (Agriculture)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Doctor of Philosophy (PhD)</td>
</tr>
<tr>
<td>University of Western Sydney</td>
<td>Bachelor of Natural Science (Sustainable agriculture and food security)</td>
<td>PhD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Cross University</td>
<td>Bachelor of Forestry Science and Management*</td>
<td>Graduate Diploma in Forestry Science and Management*</td>
</tr>
<tr>
<td></td>
<td>Bachelor of Environmental Science (major in Fisheries and Aquaculture Management)*</td>
<td>Master of Forestry Science and Management*</td>
</tr>
<tr>
<td></td>
<td>* Available by external study</td>
<td>PhD*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Master of Environmental Science and Management (Fisheries and Aquaculture Management)*</td>
</tr>
</tbody>
</table>
for full professional recognition and official data do not identify them other than under the generic degree nomenclature. It is difficult to see the current position turning around. What is clear is that rural students are choosing to attend either Charles Sturt University or the University of New England and do not seem to be considering the University of Western Sydney.

Students in western Sydney are not exposed strongly to agriculture at secondary school, particularly due to lack of exposure to real world agriculture through inadequate facilities and lack of encouragement from school careers advisors. Such students are also unlikely to be able to afford residential costs, and public transport to Richmond is not particularly convenient. Those who qualify are likely to choose the University of Sydney or another career that can be pursued at a campus closer to home.

Further, there is now a modest number of specialist agriculture staff at the University of Western Sydney and most are relatively close to retirement. The University therefore has the opportunity to let nature take its course. The alternative is to make a substantial investment in staff renewal in this discipline in order to be attractive to prospective students and to be able to deliver quality graduates to the industries involved. The business case for the latter is problematic. It is noted that the University of Western Sydney has undertaken a review through Professor Bawden who has identified several options for the University to contemplate. This Review does not make a recommendation in respect of agriculture and related areas at the University of Western Sydney as it remains a decision for university authorities whether the business case for agriculture warrants the investment needed.

Higher education provisions in horticulture, forestry and aquaculture remain a major challenge. In all cases student demand is weak and universities have responded accordingly. The need for professional education in horticulture has been argued by the Australian Council of Deans of Agriculture (Pratley 2012) and there had been widespread provision until recent times when degree courses were deleted from all but one university and it remains only as units of study in a limited number of others. Rates of pay for horticulture graduates are generally not competitive and the industry itself has largely been disengaged with the need for upgrading its levels of education commensurate with the rest of Australian society. In the 21st century, particularly in the production horticulture sector, the challenges of market access, legislative compliance, traceability, precision horticulture,
integrated pest management, business acumen and the like suggest the need for higher order knowledge and skills. This is an industry sector which has high future prospects but faces strong competition in the international market place from better educated practitioners.

The forest industry also faces a dilemma in that a strong higher education offering in the past has diminished to a single institution offering a forest production degree. The industry has undergone significant change in recent times (some might say upheaval) and there is a negative perception, perhaps misguided, in the community about commercial forestry. A study of the need for forestry professionals was undertaken in 2010 and it suggested that some 75 graduates per year in Australia are needed to maintain levels of professionals in the industry. However fewer than half that number graduate annually.

The aquaculture industry has a tradition of generations of family ownership in much of the industry and little formal engagement with education at any level. The job market for graduates in aquaculture is not well developed and it is difficult to predict an increase in university offerings particularly for a degree in its own right. As the only higher education offering in New South Wales is a major study at Southern Cross University, Lismore, there is a case for another university on the south coast, notably the University of Wollongong, offering at least a major in aquaculture within its Marine Science degree.

### QUALITY OF AGRICULTURAL EDUCATION PROVISION IN NEW SOUTH WALES UNIVERSITIES

The location, history and student backgrounds of the universities offering agriculture and related studies provide for diversity in graduate attributes. The institutions individually are known for providing particular kinds of graduates and that is a good thing. There is strength in diversity and any pressure for conformity should be resisted. Table 8.2 shows the indicative characteristics of the entering (ie 2013) cohorts of agricultural science students at New South Wales universities. The data show that there is gender balance at all institutions in agricultural science. However in the animal science offerings females were dominant at all universities and males were dominant in agricultural economics and resource economics at the University of Sydney. In the animal sciences, the intentions post-graduation were approximately evenly split between companion animals, wildlife and livestock.

The backgrounds of the students at Charles Sturt University and the University of New England were remarkably similar - about 80% or more were from rural backgrounds, mainly off farms. More than 70% had studied HSC Agriculture and about 20% had taken Primary Industries for the HSC, commonly in conjunction with Agriculture. A small proportion, around 10%, had not studied either Agriculture or Primary Industries. The vast majority had also studied a science, such as Biology or Chemistry. The cohort at the University of Sydney was notably different in

<table>
<thead>
<tr>
<th></th>
<th>Charles Sturt University</th>
<th>University of New England</th>
<th>University of Sydney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male : female</td>
<td>50:50</td>
<td>50:50</td>
<td>50:50</td>
</tr>
<tr>
<td>% farm/rural</td>
<td>&gt;80</td>
<td>&gt;80</td>
<td>&lt;10</td>
</tr>
<tr>
<td>% HSC Agriculture</td>
<td>-70</td>
<td>-70</td>
<td>-50</td>
</tr>
<tr>
<td>% HSC Agriculture and Primary Industries</td>
<td>-20</td>
<td>-20</td>
<td>&lt;5</td>
</tr>
<tr>
<td>% neither</td>
<td>-10</td>
<td>-10</td>
<td>-50</td>
</tr>
<tr>
<td>% HSC Science</td>
<td>-90</td>
<td>-90</td>
<td>&gt;95</td>
</tr>
</tbody>
</table>

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**Table 8.2** Indicative characteristics of the 2013 cohort of first year students undertaking full-time agricultural science programs at Charles Sturt University, University of New England and University of Sydney (statistics from consultations)
background. Less than 5% of that cohort had a rural/farm background and only around half had undertaken Agriculture for the HSC. Almost no-one had taken primary industries as an HSC subject, the reason being in several cases that it was not offered at their schools. Almost all students had studied at least one science subject for the HSC.

The case is made elsewhere in this Report for maintaining the standards and distinctiveness of degrees and the pressure to hybridise the ‘product’ should also be resisted. The common criticism of universities is that graduates in agriculture do not have the same level of practical skills as those of graduates of former times. Whilst that was also a criticism of graduates in those former times, there is a stronger message in current commentary. The questions are why this might be the case and what could be done to address the issue in agriculture.

PRACTICAL TRAINING IN UNIVERSITIES

It needs to be appreciated that the downturn in student numbers in agriculture and related areas over the past two decades has taken its toll. University departments no longer have the number of staff or the range of specialist staff they once enjoyed nor comparable levels of funding. The capacity to supervise practical skills has therefore also diminished and it is not uncommon for staff to have to teach outside their areas of expertise. The applied science staff numbers, such as those in agronomy and livestock husbandry, are less common and so those field skills once transferred to students are less likely to occur now. As such training is constrained, the need is reduced for training facilities and equipment to be maintained. To reverse this trend takes funds which do not exist, and the duty of care and workplace safety then ensure that such facilities and equipment are not used. Over time universities, like schools, have become risk averse to the extent that it is easier not to do an activity than to go through the approval processes.

What then might be the options for turning this around? Indeed, is it necessary to turn it around? It needs to be recognised that most university disciplines are facing a similar dilemma – for example, most students who study chemistry will never be practising chemists and so whether they need full training in chemistry laboratory skills is a moot point. Many graduates will not be practising farmers and so an appreciation rather than expertise may be all that is needed to fulfil their employment requirements. Does a soil scientist need to know how to swing a gate? Does a weeds specialist need to be able to mark lambs and calves? Further, the development of knowledge and technology requires new skill sets, which are likely to have higher priority, and there is only so much time available. That debate will endure but regardless, the system should provide the opportunity for skills development for the students who require it or wish to increase their employability. This needs to be facilitated by the university but not necessarily provided by the university. The following options are canvassed:

- Arrangements can be made with relevant TAFE NSW institutes or with agricultural colleges to undertake Certificate II or III qualifications concurrently with the degree studies. The important aspect here is that TAFE NSW institutes are geared up to do this training, including managing the risks associated with hazardous equipment. Such institutes exist near the two rural-based universities, University of New England and Charles Sturt University and training can be arranged in blocks or otherwise to fit in with university schedules. The challenge is greater in the metropolitan areas where there is a lack of appropriate facilities – the appropriate option would appear to be linking with the other universities or to undertake the training at the agricultural colleges where accommodation is available in addition to the facilities. The major consideration from the student’s perspective is the cost. Options include: direct payment by the student; funds from government; absorption of the cost by the university; or addition to the
student’s Higher Education Contribution Scheme (HECS-HELP) debt. The ability of the student to gain paid employment during university recesses will be enhanced and may offset the cost.

- The growth of Primary Industries in the secondary school system provides an opportunity for students to have the skills training prior to entry into university. Currently the system allows for Certificate II training and desirably Certificate III training where Primary Industries is offered. The detail of this has been discussed in Chapter 7. It is important, however, to reiterate that the opportunities in the school system need to be enhanced to facilitate the provision of strong, quality certificate training. The dearth of opportunity in the metropolitan areas in particular needs to be addressed, but it does impact more on the University of Sydney cohort who identified this issue during the Review discussions.

INDUSTRIAL EXPERIENCE

Students can obtain their skills training from VET either before or after degree studies. The pathway from VET has already been canvassed in Chapter 7 and issues of transition have been considered. It is noted that there is a significant cohort of university graduates seeking VET studies post-degree in order to increase their practical skills levels and this trend is to be encouraged.

The universities have ‘industrial experience’ requirements to be satisfied outside formal class time. This comprises time spent on farms, in agribusiness or in government organisations during university recesses to improve students’ mainstream knowledge of agriculture and gain relevant experience. The time requirement and the prescriptive details vary between institutions but it is noted that such requirements have been reduced over time. It is worth considering why these requirements have declined. The workplace learning or ‘prac training’ has long been part of the courses, often as a ‘satisfactory or unsatisfactory’ element. It did not necessarily count for unit value accumulation and was often voluntary and unpaid. Over time circumstances and policies have evolved.

The accumulation of a HECS-HELP debt and the need to earn income for living expenses is common in today’s student population. The imposition of the experience requirement compromises such employment. There is also pressure being exerted by the Australian Qualifications Framework (AQF) and elsewhere in respect of the definition of a degree in terms of workload and hours, to the extent that such practical experience needs to be counted in the degree workload through the allocation of a unit value. Such information is transparent to the student. This then requires priorities to be determined by the university in favour of the experience or away from that experience. The exceptions here are those degrees that prescribe industry experience as part of course accreditation with professional bodies eg Veterinary Science. None of the agricultural programs has such professional accreditation.

Universities have also had to take account of the requirements of the Fair Work Act 2009 in respect of the need to distinguish between work experience and employment. The Act recognises such vocational placements provided that they are a requirement of an Australian based educational or training course, are authorised by legislation and undertaken with an employer for which a person is not entitled to be paid any remuneration. The main benefit of a genuine work experience placement or internship should flow to the person doing the placement. If a business is gaining a significant benefit as a result of engaging the person this may indicate an employment relationship has been formed. These complications increase the burden on universities to ensure compliance and fairness. However, for reasons outlined above, unpaid work experience without clear learning outcomes has become unattractive to students unless its value is made readily apparent. Institutions have tried to accommodate all these factors by re-evaluating the requirement for industrial experience, leading to its reduction in some cases or allocating it unit value within a formal course structure.
“Universities do not provide job-ready graduates and never have. They do, however, supply employment-ready graduates”

Australia’s Chief Scientist, Ian Chubb

Universities are now responding to the issue that universities are not producing ‘job-ready graduates’. It should be noted here that the role of universities is not producing job-ready graduates (ie for a specific job) but rather employment-ready professionals (ie adaptable to a range of employment positions) with the requisite skills and know-how to take the business forward where there is opportunity to do so. In recent times some universities have included in their programs a period of internship in industry in the final year as a way of improving the readiness of students for the employment market after graduation. Some organisations have adjusted their businesses to enable them to accommodate students for internships. This provides a means of building a relationship with students with the prospect of securing their employment in a highly competitive labour market. The internship is usually highly structured with clear project requirements for both the student and the industry partner. However, as explained in Chapter 9, none of this obviates the employer from its responsibilities to provide suitable orientation and professional development programs for its recruits so that they are better prepared to do the particular job for which they have been hired.

INNOVATION WORKFORCE

Universities provide for graduates to undertake postgraduate research degrees that qualify them for a career in research. Research and development are critical components of the agricultural system whereby productivity gains and sustainable practices are generated particularly for the benefit of the primary producers but also others in the value chain. Postgraduate scholars are also an important contributor to the research performance of a university, on which funding and reputation depend. Universities, together with research funders, research providers including government agencies and the industries generally have a vested interest in
attracting the best minds into the research process. It might be assumed therefore that the research training pathway might be made attractive enough to entice those with the appropriate intellect to consider that direction. The reality could not be further from that ideal.

To be eligible for postgraduate research, a student is usually required to have a four year undergraduate qualification with Honours at first class level or upper second class. By this time an agricultural science graduate will have accumulated a HECS-HELP debt of around $30,000 (see Table 8.3 for HECS-HELP in 2013). That debt is payable through the taxation mechanism when salary reaches a threshold ($49,000 in 2013) and continues to accumulate interest based on CPI adjustment for the duration of the postgraduate study and until fully paid. There is no further HECS-HELP for an Australian scholar undertaking the higher degree.

Table 8.3 The annual student contribution fee for fulltime study in the range of disciplines available at Australian universities (DIICCSRTE 2013)

<table>
<thead>
<tr>
<th>Student Contribution Band</th>
<th>Annual Student Contribution from 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAND 3 Law, dentistry, medicine, veterinary science, accounting, administration, economics, commerce, including agricultural economics</td>
<td>$0 – $9,792</td>
</tr>
<tr>
<td>BAND 2 Computing, built environment, other health, allied health, engineering, surveying, agriculture, mathematics, statistics, science, including forestry</td>
<td>$0 – $8,363</td>
</tr>
<tr>
<td>BAND 1 Humanities, behavioural science, social studies, education, clinical psychology, foreign languages, visual and performing arts, nursing</td>
<td>$0 – $5,868</td>
</tr>
</tbody>
</table>

Scholarship arrangements for a postgraduate scholar are based on the ‘prestigious’ Australian Postgraduate Awards (APA) which are allocated to universities by formula. The stipend, which is tax free, is $24,653 per annum. This stipend is also that for Australian Research Council (ARC) doctoral scholarships under the Discovery Scheme but the stipend under the ARC Linkage Scheme is $29,844. It is unclear why this discrepancy exists. The poverty line in late 2012 was around $25,200 and so $24,653 is below the Australian poverty line and is a disincentive, particularly when agribusiness salaries are well over double that figure for new graduates. Comparison with average weekly earnings shows that the stipend continues to lose ground (Figure 8.9). The tax-free status, useful in past times, now makes little difference as tax scales have changed dramatically in the last decade or two with the tax-free threshold now being $18,000 (Table 8.3).

The minimum wage in Australia in 2013 sits at around $31,532, 28% above the scholarship stipend. These stipends have no associated increments and whereas the rest of the community now have superannuation benefits, these do not flow to postgraduate scholars. Some of those who have been through the system argue that there needs to be some personal sacrifice in order to make the grade as a scientist – that might have been the case in the past but such argument is nonsense in 21st century Australia. By any comparison, the remuneration is a disincentive for those whom we would wish to be attracted to the research pathway. It is a 20th century construct in the 21st century. The agricultural industries need to attract the best people and this is not the way.

The stipend can be adjusted upwards without affecting its tax-free status. Under basic student eligibility requirements for an Australian Postgraduate Award (APA), as stated in section 2.10.1(1)(g) of the Commonwealth Scholarships Guidelines (Research) 2012, it is a requirement that a student must not be receiving an equivalent award, scholarship or salary related to their course of study providing greater than 75% of their annual APA stipend rate. Based on the 2013 APA stipend rate of $24,653, full-time students must not be in receipt of a combined amount greater than $18,489 from additional sources (for example – top up scholarships), in 2013, to remain eligible for an APA. Under this basic eligibility
requirement, income received from sources unrelated to the course of study is not taken into account and therefore should not affect their eligibility for an APA under this section. Only the Grains Research & Development Corporation (GRDC) of the Research and Development Corporations (RDCs) provides maximum top-up.

The other aspect of this training pathway for scientists is at the career end of that study. Over the course of the last two decades there has been significant erosion in the career prospects for emerging scientists in agriculture. The Cooperative Research Centre (CRC) program has played a significant part in that change whereby much of the emerging research capacity was funded through the CRC funds. This represented a partial substitution effect which was fine at the time but which has not been redressed as the CRCs have come to an end. In the 1990s and early 2000s agriculture was well served by CRCs but currently there is very little activity and their disappearance has left an employment void for emerging scientists. State agencies in particular operate much smaller research workforces than occurred in the early 1990s. Increasingly, doctoral graduates are employed on research funds largely from the RDCs, usually on three year stints. This three year cycle is highly inefficient due to start up and wind down components, is demoralising for the postdoctoral scholars and eventually is wasteful of expertise as significant numbers leave the industry. Contracts take forever to renew and no account is taken of the impacts on families and esteem. This system needs to change. Greater security and improved personnel management are needed and it is proposed that 5 year minimum postdoctoral projects be funded to provide that better security. There needs to be a review at three years where prospects for renewal, change or termination are determined. This provides the time for alternative actions to be initiated if necessary and for contractual arrangements if any to be in place well

<table>
<thead>
<tr>
<th>Taxable Income</th>
<th>Tax Payable</th>
<th>Nett Income</th>
<th>Scholarship Equivalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20,000</td>
<td>$342</td>
<td>$19,658</td>
<td></td>
</tr>
<tr>
<td>$22,000</td>
<td>$722</td>
<td>$21,278</td>
<td></td>
</tr>
<tr>
<td>$24,000</td>
<td>$1,102</td>
<td>$22,898</td>
<td></td>
</tr>
<tr>
<td>$26,000</td>
<td>$1,482</td>
<td>$24,518</td>
<td>Australian Postgraduate Award and Australian Research Council Discovery scholarship</td>
</tr>
<tr>
<td>$28,000</td>
<td>$1,862</td>
<td>$26,138</td>
<td>Poverty line 2012</td>
</tr>
<tr>
<td>$30,000</td>
<td>$2,242</td>
<td>$27,758</td>
<td></td>
</tr>
<tr>
<td>$32,000</td>
<td>$2,622</td>
<td>$29,378</td>
<td>Minimum wage level</td>
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<tr>
<td>$34,000</td>
<td>$3,002</td>
<td>$30,998</td>
<td>Australian Research Council Linkage scholarship</td>
</tr>
<tr>
<td>$40,000</td>
<td>$4,547</td>
<td>$35,453</td>
<td></td>
</tr>
<tr>
<td>$45,000</td>
<td>$6,172</td>
<td>$38,828</td>
<td></td>
</tr>
<tr>
<td>$50,000</td>
<td>$7,797</td>
<td>$42,203</td>
<td>Grains Research &amp; Development Corporation top-up</td>
</tr>
</tbody>
</table>
before the original contract concludes. If it is deemed that the project is not suitable for such funding or that there is a lack of confidence in the candidate then the project should not be funded in the first place.

UNIVERSITY ALUMNI

Each university has an alumni association and it receives generic attention from the university. Newsletters, social functions and lectures by dignitaries form part of the agenda to maintain contact with its graduates and for inter-graduate contacts. In return the university hopes that the members of the alumni will generate funds and assist in the promotion and development of the institution. Alumni associations are well developed in the US whereas in Australia the activity is at a much lower level of operation. The point of raising it here is that there must be some opportunity for the network of university graduates in agriculture and related areas to contribute to the cause of building the image of and respect for the agricultural sector in the community. The way forward is to combine resources and work for a common purpose and present the unified voice that has been lacking for so long. This is not to restrict individual universities having their own chapters but it is about recognising that there can be more achieved together than can be done separately.

DEVELOPING LEADERSHIP

As the industry moves forward, strong leadership will be needed to address and manage the complexities involved in capturing the opportunities that will emerge. It is recognised that there is a highly successful Australian Rural Leadership Program for future leaders. There are also opportunities for Board Directors courses. Is this enough to guarantee high level leadership of industries and the public service in the tasks ahead?

Other sectors of the economy have taken the next step to strengthen the management and policy capacity of their respective public sectors through an association, such as the Australia and New Zealand School of Government (ANZSOG). This School has been created from governments across Australia and New Zealand and several universities. Its vision is to create “a world-leading educational institution that teaches strategic management and high-level policy to public sector leaders and acts as a trusted facilitator, helping governments to find solutions to real world public issues” (ANZSOG 2013) http://www.anzsog.edu.au/.

This Review presents the opportunity to consider how to develop further the leaders and key personnel working in the agricultural sector. Whereas the ANZSOG program is focused on government and the public sector, it should be possible to design a program focused on agriculture, which addresses issues such as policy development, leadership, human resource development, workforce management, and business management. Such areas would be of interest to industry associations, major corporate farmers and agribusiness groups as well as government.
GOVERNMENT RECOMMENDATION 25
The NSW Government, through the Standing Council on Primary Industries, raises the following matters with the Federal Government:

a. Greater provision of top-up scholarships by Research and Development Corporations, to the maximum allowable under the taxation rules

b. An increase in the maximum allowance for top-ups under the tax-free provisions for research scholarships and

c. The need to restore competitive and respectable stipends for postgraduate scholars under the Australian Postgraduate Award and Australian Research Council schemes including annual increments and superannuation entitlements.

GOVERNMENT RECOMMENDATION 26
The NSW Department of Primary Industries, in conjunction with key industries and universities, explores the merit of developing a professional development program focused on leadership, management and policy development in the agricultural sector through an alliance modelled on the Australian and New Zealand School of Government approach.

INDUSTRY RECOMMENDATION 9
The horticultural sector reviews its needs for courses in universities to ensure continued availability of higher education in horticulture.

INDUSTRY RECOMMENDATION 10
The forest industry comes together to review its needs for courses in universities to ensure continued availability of higher education in forestry.

INDUSTRY RECOMMENDATION 11
The University of Wollongong gives consideration to the inclusion of a major study of aquaculture production and management in its Marine Biology degree.

INDUSTRY RECOMMENDATION 12
Rural Research and Development Corporations and other research funders commit to a minimum of 5 years funding for post-doctoral scholars with an obligatory 3-year review to establish prospects.

INDUSTRY RECOMMENDATION 13
The Australian Council of Deans of Agriculture explores the options for creating an alumni association of agricultural professionals across the university sector.
CHAPTER 9
THE BUSINESS OF AGRICULTURE

The Weather Prophet

‘Ow can it rain,’ the old man said,
‘with things the way they are?
You’ve got to learn off ant and bee, and
jackaroo and galah;
And no man never saw it rain,
for fifty years at least,
Not when the blessed parakeets
are flyin’ to the east!’

The weeks went by, the squatter wrote
to tell his bank the news.
‘It’s still as dry as dust,’ he said,
‘I’m feeding all the ewes;
The overdraft would sink a ship,
but make your mind at rest,
It’s all right now, the parakeets
are flyin’ to the west!’

A B ‘Banjo’ Paterson
Source: The Animals Noah Forgot, 1933
BACKGROUND

During the 19th and most of the 20th centuries, agricultural industries were well served by the notion of ‘experience on the job’. Formal education and the attainment of qualifications were not priorities. A large proportion of the population resided in rural areas and these areas were well represented politically. The primary industries were major contributors to the economy and to export earnings. Most of the population was connected in some way to a farm and that relationship provided a respectful conduit between city and country. The social licence to farm was never in question due to these relationships.

The winds of change in the 1960s and 1970s transformed forever those entrenched positions. By then, there was much population movement from country to city, and this has been ongoing to the present time. The links between city and country have diminished to the extent that in 2013 the relationships are a generation removed. Whereas in previous times people understood farmers and farming, the emerging generation is more likely than not to have no link with farms and farmers.

The political environment had changed in the 1970s to remove gerrymandering, the practice of having uneven elector numbers between electorates. This had favoured country electorates. The change resulted in a substantial decline in the representation of rural people in parliaments and their loss of political influence. As other parts of the economy developed and matured, agriculture was no longer front and centre of the political agenda. Although its absolute contribution continued to increase, its proportional contribution to the economy and export earnings has declined as mining and the services sectors have grown.

Also, in 1973 higher education became free to everyone, opening up the opportunities to the majority of the population, particularly in the cities. Although successive governments have moved back somewhat from ‘free’ to a system of post-study taxation liability (subject to a threshold minimum salary) known as the higher education loan program (HECS-HELP), the system remains fair to all, leaving the biggest challenge as the cost of accommodation and living expenses where a student needs to relocate for institution access. This is more likely an issue for a rural-based student. Access to higher education was embraced by a wide cross-section of the population and qualification attainment (including those from vocational education and training) has risen steadily since that time. The agriculture sector was much slower in responding and its aspirations in this space have been much more conservative than the rest of the Australian population (Figure 3.1) or its competitors in other countries. The Australian community as a whole is thus operating at a much higher level of education than is the agriculture sector.

The environmental movement had established itself from the 1960s. This coincided with the massive erosion taking place on farmlands and its negative impacts on waterways. Massive dust storms were a regular occurrence and some made their way into urban areas (eg February 1983) reinforcing views that all was not well on Australian farms in respect of sustainable practices. The evolution of television and more recently the internet provided the platforms for environmentalists to enter living rooms visually and they were adept in forming community attitudes. Agriculture tended to ignore such challenges and so the image of agriculture, in the minds of the community, was being formed by people outside the industry. Agriculture was an easy target as it provided little resistance. Other issues such as mulesing, live animal trade, genetic modification, the Murray Darling Basin, logging of native forests, eutrophication in the Great Barrier Reef and decline in wild fish numbers have provided fodder to the negative image of Australia’s primary industries. Although agriculture has done more than most, if not all, industry sectors in mitigating its environmental shortcomings, its lack of community engagement on this progress ensures that the negative image remains. Whether the claims by the activist campaigners have validity is not the issue – perception is everything.

Together, these and other factors have conspired to establish the current
image; the loss of political influence, the increasing gap in education level, the disconnection between city and country, and the lack of a single voice to prosecute the case of reclamation of environmental damage and of animal welfare. In short, agriculture, horticulture, aquaculture and forestry have lost at least some of their social licences to farm. From the enquiry undertaken for this Review, the loss of social licence is evident in the attitudes of many teachers, the teachers of teachers, and of school career advisors. Such views are then transmitted to school students, particularly in secondary schools, to the extent that students have the perceptions reinforced and are turned away from considering careers in agriculture. There is a stigma attached to students studying agriculture, evident in the attitudes of students who do not.

It would be easy to blame the education system for this situation. However, it needs to be recognised that school represents a major formative phase in the life of a citizen and teachers are a critical influence in that process. Teachers, like any other member of the community, are products of their own education and life experiences. They are responsive to their own perception-forming influences. The majority of teachers have grown up in the midst of the active campaigns against agricultural practices and most are products of the city and continue to live there. Unless and until the perceptions that are ingrained are challenged and re-aligned with current practice in the field, the anti-agriculture flavour will perpetuate. This will only occur when agriculture, horticulture, forestry and aquaculture regain their full social licence to farm.

**BOX 9.1 AUSTRALIAN COTTON – LEADERS IN SOCIAL LICENCE TO OPERATE**

In the 1980s and early 1990s the cotton industry in Australia was under pressure from the community particularly about pesticide use and impact to the extent that the Federal Government was being urged to impose a regulatory framework for cotton operations (Roth, 2011). If imposed this may have made cotton production uneconomic and resulted in loss of major employment and social dislocation in the regional communities involved.

After extensive stakeholder consultations the cotton industry developed and implemented ‘best management practice’ policies firstly in pesticides management and subsequently for water, soil and other natural resources management. Other management practices on-farm and through processing and transport followed.

In 2008, the industry’s Land and Water Management Plan was formally recognised by the Queensland Government – then the only voluntary on-farm management system to be so recognised – as an alternative pathway to regulation.

A technologically advanced industry, cotton has been at the forefront of genetic modification. A high proportion of the Australian crop is genetically modified and this has enabled the reduction in pesticide use. Insecticide use has been reduced by more than 90% over the last decade or more, with consequent reduction in complaints about pesticide use (Figure 9.1).

The cotton industry clearly demonstrates that social licence issues can be turned around and provides an excellent example for other industries to follow.
WHAT IS THE SOCIAL LICENCE TO FARM?

A social licence is the privilege of operating with minimal formalised restrictions (e.g., legislation, regulation, market mandates) based on maintaining public trust by doing what is ‘right’. Every organisation, large and small, operates with a level of social licence. This occurs when a business or industry operates in a way consistent with the ethics, values and expectations of its stakeholders. Stakeholders include customers, employees, the local community, regulators, legislators and others with an interest in how the organisation, industry or business impacts on them. The concept is explored in detail for agriculture in Australia by Williams and Martin (2011).

A single event or incident can reduce stakeholder trust to the extent that the social licence is replaced with social control. Social control is regulation, legislation, litigation or market mandates designed to compel the organisation, industry or business to conduct its business to the expectations of its stakeholders. Operating with a social licence usually means greater flexibility and lower cost. As the degree of social control increases so usually do the costs and bureaucratic compliance, and operational flexibility declines.

Historically, when under pressure to change, the agricultural industry sector has usually responded by attacking the attacker, using science alone to justify current practices. Too frequently, the industry confuses ‘scientific verification’ with ‘ethical justification’. This approach is ineffective in building stakeholder trust and support, and it tends to increase suspicion and scepticism about the industry being worthy of public trust. Williams and Martin (2011) suggest that the normal practice of defending the ‘right to farm’ is not productive; instead the primary industries need to lead the community in establishing the terms of agriculture’s social licence to operate.

The process involves strong leadership, voluntary accountability and strong strategy. It involves accepting the criticism even though it might seem unfair or incorrect and it is likely to involve short term pain in search of the long term gain. It needs to recognise that community attitudes and standards evolve and the industries need to evolve too, preferably in advance of those attitudes. In general that has not been the case with agriculture.

It is fortunate that at least one of the primary industries, cotton, has taken a progressive and professional approach to this agenda and its journey is briefly featured in Box 9.1. A focus on consultation

Figure 9.1 Number of complaints received by NSW EPA regarding pesticide use in cotton production
(after Roth 2011)
both within and outside the industry and the development and implementation of ‘best management practice’ has generated rewards in its social licence and in production efficiencies and returns. The cotton industry thus successfully shifted from a costly defence of much-criticised practices to management innovations which have made defence largely unnecessary, and also greatly improved the industry’s bottom line. Its experience suggests that other industries should undertake a similar process to manage the social licence agenda.

The primary industries sector is fraught with contradiction. Some areas are pioneering in technology and marketing whilst other areas are dragging behind. There has been an environmental revolution but it is largely not understood by the community through a lack of public relations. Some operations do not meet community norms whilst others are in advance of community attitudes and are compromised by activist campaigns that remain largely unchallenged by the sector.

Perhaps the big challenges in addressing the social licence agenda are those where community attitudes and norms have moved beyond those of the primary industries and some of those are briefly discussed here in the hope that the sector might give greater consideration to them as movement is made towards the Vision (Chapter 1). These challenges are:

- The image of agriculture
- The labour force attitudes and value (incorporating education and training)
- Accreditation standards and professional accreditation.

“Think you can, think you can’t; either way, you’ll be right.”

Henry Ford

**IMAGE OF AGRICULTURE**

In previous chapters, much has been written about the perceptions of agriculture and its image. That detail will not be repeated here. The point to make is that industry, including agribusiness, needs to be proactive in turning the image around such that it is seen as having good prospects for employment and a promising career. The lack of promotion and engagement by industry in recent decades reinforces the notion that commitment to public relations is an imperative. Public relations can take numerous forms and this Review has highlighted where effort should be expended. Remaining silent on this agenda is not self-serving as it will become increasingly difficult to attract new members to the sector’s workforce. That has already been widely shown at the university graduate level. Given the age structure in the sector, new blood is urgently needed.

It is important to comment that the farm sector has been active in this space, undertaking the preparation of educational materials and other public activities but traction has been difficult. It is to be hoped that this Review provides some guidance on how this might be improved. Agribusiness, as distinct from the farm business sector, has been particularly absent from this space. This is surprising and disappointing since their businesses are highly dependent on a vibrant primary production sector and they are also the major beneficiaries of the higher education process as the employers of graduates. One of the difficulties is the lack of a peak body that represents them so that engagement can be made on issues such as this. Maybe this is the tactic so that they do not become engaged. Much is to be gained by a concerted effort of all players. Little can be gained by remaining fragmented and unengaged.

The way forward does not indicate a silver bullet. Rather it is an incremental process which has the following elements:

- **Strong engagement with the education system** using the appropriate protocols of engagement (see Appendix 9.1 for protocols for the Scootle digital resource base). In this way teachers gain access to high quality teaching materials.
linked to the curriculum; teachers and students gain a better and more positive appreciation of agriculture and its role in society; students understand that food has value; and parents’ attitudes are influenced by the positive experiences of their children. Agriculture is fortunate that it has an organisation, Primary Industries Education Foundation (PIEF), that provides the conduit into the education system and its efforts need widespread support. There is an excellent possibility for the Royal Agricultural Society to work closely with PIEF in progressing the availability of industry-prepared educational materials into the education system.

- **Strong involvement with career promotion**, particularly at the professional end. Agriculture is well served with vocational career websites such as Agrifood Careers and Rural Skills Australia. At the professional end, the new website Career Harvest is leading the way in transforming the impressions of agriculture from just a farm pursuit to a professional, high-tech, humanitarian, rewarding range of career opportunities. In this endeavour, agribusiness and farm business support is needed.

- **Strong community citizenship**, whereby there is involvement in school and community presentations and activities.

### Table 9.1 Capability for the Royal Agricultural Society (RAS) to provide educational experiences in agriculture for metropolitan students

<table>
<thead>
<tr>
<th>Pre-Primary School students 3 – 12 years</th>
<th>Secondary School students</th>
<th>Teachers/Careers Advisers</th>
<th>VET and Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junior Farm Hands (JFH)</td>
<td>RAS EDU</td>
<td>Junior Farm Hands and RAS EDU</td>
<td>RAS Youth In Agriculture</td>
</tr>
</tbody>
</table>

#### Key messages

- Where does our food and fibre come from? Australian farmers and their role in producing our food and fibre.
- Secondary messages about sustainable food production, natural resource management, innovation and technology in the industry.

#### Activities

- Education booklets
- Passport program and stamping stations (utilising the *Sunday Telegraph* Animal Walk).
- Agricultural displays/sessions (sheep shearing, milking barn, working dairy, pat a pig, pat a chick, little diggers).
- Food Farm pavilion “Paddock to Plate” story.
- Animal nursery (key Show attraction).
- Schools sessions.
- Careers Expo and Seminar program (1-4 days depending on year and number of school days).
- School sessions (cheese and chocolate appreciation, working dairy, District Exhibits).
- School competitions - livestock and agriculture competitions (cattle, poultry, sheep, horticulture). “Race around the Royal” video competition and Schools District Exhibits.
- Limited at this point to participation in student activities. (Have previously run Careers Seminar for teachers only but in holidays it is difficult to achieve high attendance).
- Youth in Agriculture Day.
- Young Farmer Challenge.
- Strong social media presence and campaign (Facebook and Twitter).
including the ‘agriculture and food week’ as proposed in this Review.

- **Support for the Royal Agricultural Society of New South Wales (RAS)** annual program of educational activities. The capability of RAS is significantly underutilised as it has the potential to service the needs of metropolitan students on food and fibre education from its central location. Table 9.1 shows the range currently in operation.

- **Opportunistic responses to media** and other public options to provide a positive message to the community at large.

**LABOUR AND EDUCATION**

Workforce issues are current for the agricultural industries on farm (ie behind the farm gate) and along the value chain (ie beyond the farm gate). Whilst the market has been responsive to the latter, there are more fundamental issues related to the on-farm workforce. Unless these are addressed it will be more and more difficult to attract suitably qualified people into the industry.

**BEHIND THE FARM GATE**

The issue of labour in the production workforce, ‘behind the farm gate’, is one of competing forces. On the one hand the employer wants to minimise the cost of labour in the interests of tight profits. In training there is a focus on skill sets rather than qualifications. On the other hand the employee needs to provide for his or her family and its future. The new players are working to a different paradigm from that of the 20th century. There is the need to explore the options and choose that which gives the most satisfying outcome for the individual. Qualifications have become more important as they are the currency for workers to move jobs or take advantage of education and training pathways for personal and professional advancement.

To some extent the two sides do not appear reconcilable but they need to be. The 21st century paradigm (Chapter 3) for employment in the Australian workforce is based on it being well educated and trained where pathways for progression are provided. Agriculture is well out of step with the rest of the nation’s workforce, and its international competitors, to the extent that it will find it increasingly difficult to attract the younger generation to join the agricultural industries. The cotton industry is a notable exception to this rule.

![Figure 9.2 Business by employment size for agriculture, forestry and fishing relative to that of all industries, New South Wales at 30 June, 2011](ABS, Cat. No. 8165.0, 2012)
The data, discussed in Chapter 7, show that the sector has embraced traineeships but the only apprenticeships are in the landscape and forestry industries. This Review sought an explanation for this situation from industry bodies but no explanation has been forthcoming. There does not appear to be a workforce strategy in place. Informal advice from others has indicated that apprenticeships have a longer commitment, by the employer, of time and there are then award requirements in terms of wages paid after completion. If that is the case there is a need for close attention being given to the issues of training so that the sector can be in line with other sectors that provide career pathways. In that process, the opportunity to be innovative needs to be taken.

Several factors need to be considered in this issue:

• The majority of farm businesses are small operations and have only a small workforce, perhaps one or two employees. The proportion of small businesses in agriculture is greater than in all industries in New South Wales (Figure 9.2).

• The number of farm businesses is in decline but the size of farm businesses is increasing as farms are amalgamated. Corporate farms are gradually increasing in number, suggesting that these larger operations will have a workforce larger than, and different from, that of their smaller counterparts. Prospects for career progression may become more common.

• Much of the work is seasonal, particularly in the horticulture industries, and there is widespread use of casual labour, often using 457 Visas (Figure 9.3). The proportion of casual labour in the primary industries is around 43% of all employees, almost double that of all industries.

• The age profile on farms is distributed towards the older categories relative to the Australian workforce (Figure 9.4).

There is participation in all aspects of the education framework but two statistics stand out: the low proportion of the workforce with degree qualifications relative to the population at large; and the much higher proportion of the primary industries workforce without any post-school qualifications (Figure 9.5). Between industries within the agriculture sector, however, the data vary substantially.

Farmer organisations have to embrace the need for positioning the industry comparatively with the rest of society in terms of education and training.
BOX 9.2 ‘MAKE IT WORK’ PROGRAM – SHARING WORKERS LOCALLY

The Narrabri region was faced with a chronic shortage of local skilled workers, with youth leaving town in search of fulltime employment or education. Much of the work was seasonal and fulltime employment was difficult to attain by workers or to afford by employers. Narrabri Shire Council established a working partnership with AgriFood Skills Australia, Dusseldorp Skills Forum, ‘Make it Work’ and Tocal College to pilot an innovative program aimed at retaining skilled workers in the region.

The key aspect is cross-industry training, which breeds flexibility and responsiveness in the local labour force, builds resilience into regional economies and retains skills and people in the region. ‘Sharing Workers Locally’ coordinates seasonal labour for host employers in a range of industries, including agriculture, mining, manufacturing, infrastructure management and retail, providing employers with the skilled workers they need, and workers in the region with continual employment throughout the year.

HOW IT WORKS
Narrabri Shire Council:
• employs workers to meet the seasonal employment needs of local businesses
• coordinates placement of workers by matching their skills to the needs of the business
• manages the recruitment, training and payroll administration.

The employer:
• is responsible for the safety of employees.

DEVELOPING SKILLS
During seasonal employment lows, workers participate in training and become part of Council’s workforce. To ensure the development of cross-industry skills, workers complete a Certificate III in Rural Operations through a combination of on - and off-the-job training. This certificate educates workers in:
• Chemical application, transport and storage
• Operation, transport and maintenance of tractors, equipment and specialised machinery including backhoe, loader, ride-on vehicles and forklifts
• Operation and recovery of four-wheel drive vehicles
• Cleaning machinery of plant, animal and soil material
• Welding using manual and gas metal arc welding processes
• Traffic control.

Workers are also trained in carrying out workplace health and safety procedures, responding to emergencies and providing basic first aid.
Employment post-training seems to be a particular blockage, particularly where the implications are higher salaries for a permanent job. The initiative taken by Narrabri Shire Council with its ‘Make it Work’ program is an innovative solution to the problems of fluctuating workloads on farm throughout the year (Box 9.2). Similar solutions are worth strong consideration in other places.

There is also a strong mindset in the sector that labour is a cost to the business, rather than an asset. If it is only a cost there must be a question mark over whether it is needed. Labour should be contributing to the profitability and sustainability of the business. The more skilled and qualified the employee, the greater should be that contribution to compensate for the higher stipend required for these better qualifications. Making the workplace family friendly, particularly for women, is another issue to be addressed.

**BEYOND THE FARM GATE**

The decline in graduate numbers from universities over past decades has culminated in a concerted publicity campaign led by the Australian Council of Deans of Agriculture. There has been significant response from employers and salary packages are now very competitive with those in other sectors of the professional workforce. There has been a response from students in 2013 in selecting agriculture and related courses at Australian universities, with responses nationally being around a 20% increase in new students.

Some employers have been critical of universities for not training such graduates in particular skills and not having them ‘job-ready’. This issue is considered in Chapter 8 in more detail. What has been a concerning trend in some companies has been the negative attitude towards the new employees in terms of early mentoring and in general professional development. The dearth of qualified graduates has resulted in the targeting of individuals between businesses to the extent that it has been difficult to retain staff. Salary packages have risen as a result, making the industry more competitive with other employment options.

This ‘churn’ in the employment market, however, has resulted in some employers deciding not to provide professional development for staff in the expectation that such staff will be enticed away and the investment will be wasted. Whilst on one hand the economics could be argued, on the other the practice is short-sighted and it is likely that the company will not become the employer of choice as word gets around. It is certainly not in...
the industry’s interests that the workforce is not developed in any business. If all businesses work positively with the staff they have then everyone benefits, even if staff move around. Regular anecdotes occur of relatively new employees leaving their job because there had been no mentoring and they could not see that the company valued them as employees. Some have been lost to agriculture altogether and it needs to be recognised that an agricultural education is attractive to other sectors because of the range of skills of graduates and their capability for discipline integration and problem solving.

It is also important to identify that in many businesses, even those with a sizeable workforce, there are poorly identified career paths for new employees. The new player enters the company to find that the long serving employees, although paid more, are not accorded senior status. Nor are there any guidelines as to how to move towards senior recognition.

The way forward is for agribusinesses to define a clear and attractive career path, monitor salaries in the market place, broaden the scope of the role through training and networking, provide modern technology and invest in professional development.

ACCREDITATION

PROFESSIONAL ACCREDITATION

Australian primary industries used to operate under a system whereby government advisory officers provided the guidance free to producers on research outcomes and aspects of best management practices. Over time such government extension services have been wound back to the point where private consultants, research and development corporations or retail organisations mainly provide the advice. The challenge in modern day farming is to ensure the conduit exists from research and development to the producer. In a period where limited numbers of professionals are entering the sector due to a decline in university enrolments, there is a proliferation of companies and individuals peddling products, management practices and services for which no evidence of their validity exists. Colloquially they are referred to as ‘snake oil salesmen’. A consequence is that producers are spending millions of dollars each year on products that do not work. The question arises as to how a producer might discern the reliable from the rogue. Clearly, the well-educated and trained producer is better placed to make a judgement and it might be expected that the adviser with strong credentials is likely

Figure 9.5 The highest qualification of people working in agriculture, forestry and fishing in Australia, relative to those of all industries

[ABS, Cat. No. 6227.0, 2012]
to be a responsible purveyor. However, under current arrangements there are no impediments to anyone claiming to have expertise. There is no clear market signal to a farmer, for example, or for a funding agency, that one consultant is better than another. This occurs largely by word-of-mouth or by other measures of reputation. Even then, the client has no benchmark by which he or she can judge that the consultant is abreast of current technology and best practice. There is no signal that there is adherence to a code of ethics nor an appreciation of the need to manage production and environmental interactions. There is no measure of the acceptance of the consultant/adviser by his or her peers or in terms of industry norms. There is therefore a strong case for a professional accreditation scheme to provide the assurance needed in the workplace.

A professional accreditation scheme for clients therefore provides the following benefits to producers:

- A benchmark on technical, business and professional performance
- Increased confidence of low risk of engagement
- Adherence to a code of ethics
- Continuous program of upgrading knowledge and standards
- Contextualising the need within a broad framework
- Peer recognition and acceptance
- Market acceptance, in time.

There are also benefits for the consultants and advisors:

- Professional image to clients and peers as part of market differentiation and professional satisfaction
- A process enabling the professional to maintain currency of technology and best practice
- Risk management and access to concessional professional indemnity insurance
- Independent peer review for those in public and corporate sectors
- Opportunity for higher fees because of market differentiation and greater professional capability
- Clear directions for new graduates towards professional development requirements.

**PRODUCT ACCREDITATION**

Primary producers face challenges of immense complexity. They are faced with the economic imperative of producing for sale farm outputs which meet the requirements of the market, both in quality of product and increasingly on how it is produced. There are also the environmental imperatives of maintaining and enhancing the resource base to meet the expectations of the community. Risks of non-compliance with quality and community expectations are loss of markets and best management producers being at the mercy of the lower management producers. Having accreditation schemes for production provides insurance towards minimising such risks. The benefits of the industry moving this way include:

- Product differentiation
- Preferred supplier status
- Quality assurance of product quality and process
- Best practice productivity benefits and income returns
- Risk minimisation
- Potential standards imposition for import competitors and
- Greater claims on the social licence to operate.

The organic farming movement in Australia is a case in point. Whether the case for organics is evidence-based is not argued here. What is evident is there is strong consumer support for the mantra of low pesticide inputs to food production and preparedness by a segment of the community to pay a premium for such product. The organic movement has
combined very strong self-governance involving clear, high, non-negotiable standards, which are independently audited, with a strong communications program to consumers. This is fully explained by Monk (2011) and provides the basis for the movement’s social licence to operate. This provides lessons for mainstream agriculture that includes the product being produced, processed and delivered in a transparent way. Accreditation provides that transparency as well as the confidence for consumers to want the product. Accreditation operates in a proactive way and obviates the need to justify actions when things go wrong. They are less likely to go wrong under accreditation.

The argument against accreditation is usually the cost of compliance. This is usually compensated for by better productivity and market assurance. It really is the question of whether producers can afford not to embrace accreditation as it will also likely deliver back the social licence to operate and avoid the compliance costs of regulation.

It is recognised that there are already accreditation programs but their coverage and implementation is ad hoc. It is time to pull the programs together and evaluate whether there can be some consolidation as well as identifying the gaps. Such an exercise will have a significant bearing on education and training programs to underpin the accreditation schemes.

MEETING THE CHALLENGES

This chapter is about the implementation by industry of a strategy to address the challenges outlined earlier. The image of agriculture, the labour force attitudes and value (incorporating education and training) and accreditation standards and professional accreditation have all been raised regularly in this Review and are fundamental to a modern, robust industry. Each issue is a component of the vision articulated in Chapter 1. Rather than them being just part of the rhetoric of a report to government, an outcome of this Review is to challenge the agricultural industries to consider the issues seriously and openly with a view to formulating a united way forward. To that end the Review proposes a project name of Operation 1-AG. This is to provide a descriptor in communication about the issues, which hopefully various industries will adopt. It also signifies that there is will and ambition towards a leading industry sector status and most importantly that there is unity of purpose across industries and agribusiness on those issues where agreement can be found.
GOVERNMENT RECOMMENDATION 27
The NSW Department of Primary Industries undertakes to complete the renewal of the Memorandum of Understanding on collaboration between the Department, the Royal Agricultural Society of NSW and NSW Farmers Association with the purpose of increasing the range of activities year round to support the education needs in agriculture. Opportunity should be taken to engage commercial, industry and other government parties.

INDUSTRY RECOMMENDATION 14
The Royal Agricultural Society establishes a close working relationship with Primary Industries Education Foundation to facilitate quality industry educational resources being made available within the educational resource bases of the NSW Department of Education and Communities Teaching and Learning Exchange, Scootle and the Board of Studies NSW Program Builder.

INDUSTRY RECOMMENDATION 15
The agriculture sector commits to the implementation of Operation 1-AG as described below:

Operation 1-AG
The primary industries are well known for their fragmented approach to matters of policy and action. This is understandable to a degree because of the range of industries involved, although the fragmentation remains a source of frustration in political and departmental circles and limits the extent to which the decision makers can satisfy their needs. Yet there are many aspects of the operation of these industries which could be common, at least in principle if not in application. In the context of this Review there have been identified numerous issues which apply universally to the industries described by agriculture. These are:

• Having a clear direction for the future
• Attracting new people into the agricultural workforce
• Addressing the issue of image and its consequences for the social licence to operate
• The importance of education and training in redressing the balance.

To promote discussion, encourage engagement and identify matters of common purpose the slogan or catch-word chosen for the concept is Operation 1-AG. The ‘1’ signifies that there is both unity of purpose and an intention to move the sector to the top of the ladders of performance and respect. The focus is on what could be done in New South Wales but there is scope for this approach to be used in other jurisdictions. This Review suggests that there are four phases emanating from the considerations undertaken.
Phase 1: The Vision
This Review has created a draft vision in order to have direction for the findings of this investigation. It tries to identify those aspects for which there might be agreement between industries. Sector declaration on such matters of agreement provides the basis for the way forward in addressing the other matters. It is recommended that key industry organisations such as NSW Farmers Association drive this agenda.

Phase 2: The Education and Careers Imperative
This Review has shown that there is a clear need for investment at all levels of the education process. The school system needs to be enriched with quality teaching resources linked directly to the curricula through accepted protocol arrangements. Students need to be provided with clear career advice along the agriculture value chain. The action required here is:

a. Endorsing Primary Industries Education Foundation (PIEF) as the portal for educational materials into the education system through:
   • Ensuring, before new materials are developed, that PIEF is consulted about key criteria that need to be met
   • Modifying existing materials so that they meet the criteria
   • Providing financial support to PIEF, particularly in the critical next 3 years.

b. Endorsing Career Harvest as the key professional portal for agriculture by:
   • Providing testimonials from people employed in particular jobs
   • Providing scholarship information on site
   • Establishing an internship information service on site
   • Contributing comment on current affairs related to careers and
   • Providing financial support to Career Harvest as it endeavours to create the modern image of agriculture.

c. Providing support to the Royal Agricultural Society of New South Wales for:
   • Its education program for schools, particularly in the metropolitan area, so the positivity of agriculture can be translated to metropolitan Australia
   • Development of its rural youth network and the associated competition and related activities.

Phase 3 The Workforce Imperative
Impetus for this Review was the struggle along the value chain of attracting new workforce into the sector and particularly young people to replace the high proportion of near retirees. It has not been clear that a strategy exists. Dependency on the fickle 457 Visa and the reluctance of the sector to embrace apprenticeships suggest that the sector needs to develop or reform its workforce strategy. This is a key component of the education and training needs for the future. The imperative therefore is for the primary industries sector to establish its workforce strategy so that there is clear direction in respect of its workforce in the 21st century.
Phase 4 The Accreditation Imperative
There is a strong case for the industry sector to undertake an evaluation of accreditation offerings and needs at all levels. It is a recommendation of this Review that the sector:

- Conduct a ‘whole of sector’ audit of accreditation programs to evaluate opportunities for consolidation, gaps in provision and education and training requirements
- Develop a strategy for industry accreditation which minimises the openings for charlatans, improves market advantages and delivers the social licence to operate.
CHAPTER 10
A WAY FORWARD

The Brand

Our agriculture is world class
At home it’s taken for granted,
We have so much to celebrate
But we constantly complain
Our esteem, it should be very high
Yet clods get kicked around.
We could achieve so much together,
Yet our own thing seems much better.

The tapestry of bush culture
Is very rich and rare,
With the home among the gum trees,
And the swaggie by the billabong,
The dog’s upon the tuckerbox
While Blue plays the didgeridoo,
The shears go click, click, click,
And emu runs the pants off kangaroo.
Let us rejoice.

Of course we can work harder, much harder
But let’s work smarter, much smarter,
We need to move forward but is it too late?
It’s never too late but we need to start now.
We need to build Vision, but what is the Vision?
Common purpose is a good place to start.
We need to build Brand, but what is the Brand?
Agriculture Australia, Agriculture Australia.
Let’s advance Australia’s fare.

Jim Pratley 2013
A REMINDER

We need to remind ourselves continually that agriculture is important to us. It helped build the nation as we know it. Agriculture provided much of the Australian character as we know it, including the cultural development of the nation. It continues to underpin the quality of life as we know it – food is readily available, abundant in choice, high quality and safe. Our nutrition plays a large part in our long life expectancy.

Our economy was built on agriculture. It continues to make its contribution, not solely on farm but in the extended contribution of the farm-dependent economy. The farm-dependent economy provides employment for one person in six. Australia is a major trading nation for primary produce. Agriculture continues to provide export earnings and thus contributes significantly to our balance of payments, as other players in our economy come and go. Our produce is highly regarded internationally for its quality and clean and green credentials. Our farmers achieve despite one of the lowest levels of government support.

Our farm performance occurs in the driest inhabited continent under the extremes of climate variability. Managing variability and risk defines what Australian agriculture is. This performance is underpinned by a long-term, strong research and development input. This research effort punches above its weight globally in terms of output and impact. The reputation so generated enables us to work on the world stage as humanitarians to help poorer nations increase food production and manage their environments and thus become more self-sustaining.

This is a record that should generate great pride. Our farmers should be very proud of their achievements and their ongoing contributions. Our agriprofessionals add value to that of the farm businesses and should share in the recognition of those achievements and contributions.

That said, the question must be asked as to why young people in particular shy away from considering agriculture in all its forms as a career choice. The purpose of this Review then has been to shed light on the many causes and recommend ways in which the trends can be corrected.

THE PROBLEM AT HAND

Australian agriculture faces a crisis in respect of its ongoing workforce. This occurs at all levels although the issues can be different at different levels. The job market is buoyant based both on job advertisements and widespread industry intelligence. A summary of the factors at this point is useful for indicating directions for actions. The factors include:

• **The definition of agriculture:** prospective entrants to the industry are discouraged from entry because they equate agriculture with farming. The message needs to be clear that there are many jobs off-farm, including in the cities, across a range of expertise

• **The image of agriculture:** the sector has allowed others to determine its image. The negative perceptions of its environmental and animal welfare credentials are entrenched in the community and there is a need for a strong campaign to re-establish the image and correct the perceptions

• **The education of children:** the education system has allowed students to progress through their education with little knowledge or understanding of the source of their food and how it is produced. As a society we need to ensure that the emerging generations have an appreciation of the issues of food, being security of supply, importance of diet and appreciation of diversity

• **Resourcing agricultural education:** there is a paucity of quality teaching and learning materials on agriculture within the resource bases used by teachers. This is a challenge for the sector and needs to be rectified. This has to be done systematically according to set protocols which are now understood
• **Career advice:** it is evident that students have not been informed of opportunities available in agriculture by the advice system currently in place. Action needs to be taken within the school system in order to change negative perceptions about agriculture as a career choice.

• **Data handling and interpretation:** much of the misinformation regarding graduate supply and demand relates to data coding and interpretation, whereby agriculture is categorised with environmental courses in the national database. Whilst this is not a matter for this Review, it has played a significant part in policy platforms and promotion to the detriment of the needs of agriculture.

• **Industry attitudes to education and careers of the workforce:** the evidence suggests that, with notable exceptions, education per se has not been a priority for the industry and that any training has been focused solely on the business and not on the worker. Qualifications are spurned, yet the modern currency for career improvement for individuals is the qualifications they possess. Unless there are joint outcomes, industry will find attracting workers increasingly difficult.

• **Workforce structure:** the sector, again with notable exceptions, has no overall strategy for its workforce going forward. In some cases there is a high level of dependence on bandaid solutions such as the highly political 457 Visa program. The development of a strategy that addresses a more stable structure needs to be undertaken.

• **Career pathways in agribusiness:** few agribusinesses have in place clear pathway options for new employees and attitudes to professional development is variable. Such matters need to be addressed if businesses are to become the employers of choice.

• **Career pathways in research:** the current system of research training and early career stability are anachronistic. Stipends and conditions need to be brought into the 21st century context if the ‘best and brightest’ are to be enticed into a research career to deliver the productivity gains needed for the primary industries to remain competitive and profitable.

• **Fragmentation:** many of these issues are everybody’s concerns but no-one’s responsibility. Unless there is unity of purpose amongst the industries and businesses, many of the issues will remain active to compromise future prospects.

**LOOKING FORWARD**

This Review provided the opportunity to look at the education and training system in agriculture as a whole. In that way it allowed an approach different from those in the past where components were the focus. With finite time and resources, there was necessarily a limit to what could be achieved in detail and so the processing part of the value chain was an area not considered to any extent. Detail in other areas is also variable as priorities were determined.

However, the Terms of Reference (Appendix 1.1) were comprehensive and allowed the education and training agenda to be considered in relation to the industry and the community. This provided a richness of engagement and perhaps outcomes that might not have been forthcoming with more restrictive Terms of Reference. The extent to which the Review has added value is for others to judge.

What is clear is that food and fibre production will be always needed. The increasing world population, the concern about food security, the increasing affluence and diet changes in Asia and the uncertainty about global warming and climate change auger well for the agricultural industries of Australia. Our reputation as a consistent and reliable supplier of safe, quality product will stand us in good stead. The political system in Australia supports this view with the emphasis on the Asian century and the National Food Plan.
The major concern for the agricultural industries is whether they can secure a sufficient workforce with the appropriate education and training profile to take advantage of the opportunities that are likely to be presented. Doing nothing is not the way forward. A concerted effort is needed to promote the role that the sector plays, to create career pathways that are transparent to newcomers and to show that education and training is valued. The sector is in desperate need of attracting young people into its fold and that will only happen if they can see the opportunities and identify agriculture as the sector of career choice.

Three industries in particular stand out for their need to have a strong strategy for their workforce. Production horticulture has high dependence on the 457 Visa program and thus is highly vulnerable to political processes. It has a poor record of engaging with education and training and yet has great potential as a beneficiary of the increasing market projections. Aquaculture is rapidly growing and will need to have a plan to attract new workers. Currently there is a strong family heritage in that industry and education and training will become increasingly important. The education and training structure is immature at this time in New South Wales. The forest industry is in a transition phase but there are prospects that tertiary education will disappear as a specialist course unless interest improves. The industry does need to rally to raise its profile, improve public perceptions, engage with higher education providers and plan constructively for its future.

Working together always achieves more than working in isolation. There are many aspects of this agenda that are common and which can form the basis of agreed action. Fortuitously many of the structures are in place but require industry support and cooperation.

The Review has highlighted many improvements that can be made. None is a ‘silver bullet’. Rather they are incremental and each will improve on the status quo. Action on all however is likely to deliver transformational change and restore agriculture to its rightful place as a real and perceived leading player in the Australian community.
This Review would not have been possible without the interest, support and encouragement of many people.

I firstly express my appreciation to the Ministers who approached me to undertake this project. It has been a privilege to be involved and I have enjoyed the challenge immensely. I hope that their confidence in me has been realised by this Report.

I thank all the participants who have provided input through meetings, email and telephone. Your time is valuable and your involvement has been much appreciated.

I am grateful to those who made the effort to provide a submission to the Review. The submissions have been very useful in identifying issues and informing direction.

I thank the Reference Group for their time and commitment to guide me in my recommendations and in the general thrust of the Report. The benefit of having a sounding board for ideas was highly valuable.

I also sincerely thank Dr Cameron Archer from the NSW Department of Primary Industries for his assistance, inputs and advice during the course of the Review.

I have formed a special relationship with my ‘team’ at the NSW Department of Education and Communities. Nallini Rajaretnam and Andrew Rolfe and Graham Wood have given outstanding assistance, guidance and access to key players. They have given invaluable help in creating this Report. I am very grateful.

Jim Pratley
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CHAPTER 5


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CHAPTER 6


**CHAPTER 7**


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TAFE NSW data.

NSW Department of Primary Industries data.

**CHAPTER 8**


Australian Council of Deans of Agriculture 2013


**CHAPTER 9**


Review into Agricultural Education and Training in New South Wales

In formulating advice the review will consider the following:

- Current and projected industry and workforce needs
- The effectiveness of current school, vet and higher education programs in light of these needs
- An assessment of the relevance and quality of course materials used in agriculture and other courses in NSW schools to support students’ knowledge of the agriculture sector
- How NSW government-owned agricultural teaching institutions and research facilities can best be positioned to develop NSW’s workforce capability
- Strategies to promote careers in agriculture
- Strategies to promote NSW agricultural education and training to international students.

The review is to provide a report and recommendations to the Minister for Education and the Minister for Primary Industries by 30 June 2013. In preparing the report the reviewer, assisted by a reference group, will:

- Consider previous inquiries, reports and reviews
- Consult directly with stakeholders, as appropriate
- Circulate a discussion paper
- Invite public submissions from interested parties.

A dedicated website will provide information as the review progresses, and to lodge submissions.
APPENDIX 1.2
LIST OF SUBMISSIONS RECEIVED AS AT 30 JUNE 2013

1. Ms Rosie Stern – Australian Honey Industry Education Committee
2. Dr Greg Rebetzke – CSIRO
3. Ms Amanda Conley – Mount Austin High School
4. Leeton Shire Council – Paul Maytom
5. Ms Diana Martin – Murwillumbah High School
6. Mr Rick Hutton – Bingara and District Vision 2020
7. Mrs Barbara and Mr Brent Bannister
8. Trangie Agricultural Research Centre, NSW Department of Primary Industries – Anne Mabey and Ron Hacker
9. Precision Agriculture Research Group, University of New England – Professor David Lamb
10. Country Women’s Association, Murrabi Branch – Mrs Jacqui Herrmann
11. Australian Bureau of Agriculture and Resource Economics and Sciences, Department of Agriculture, Fisheries and Forestry
12. Ms Jennifer Woodward – Byron Bay High School
13. Mr John Trounce
14. NSW Environmental Protection Authority – Dr Tony Hodgson
15. Ms Ana Cussinet
16. Ms Kay Carter – TAFE NSW Western Sydney Institute, Richmond
17. NSW Association of Agriculture Teachers – Graeme Harris
18. Professor Richard Bawden AM – Systemic Development Institute
19. Friends of Tocal Inc – Rex King
20. Australian College of Agriculture and Horticulture (ACAH) – Ram Gopal
21. G. Brown
22. Ms Katrina Blomfield
23. Ms Courtney Cheers – Yanco Agricultural High School
24. Dale Chadwick – Gundagai High School
25. TAFE NSW Riverina Institute – Norm Madden, Graeme Anderson and David Priem
26. Vocational Education in Schools Directorate, NSW Department of Education and Communities
27. Australian Institute of Agricultural Science and Technology – Mr Mike Stephens, National President
28. Ms Sheree Bourke – Menai High School
29. Dr WB McGlasson
30. DIG FNC Dairy Industry Inc – Leigh Shearman
31. University of Western Sydney – Professor Gregory Kolt
32. Isolated Children’s Parents’ Association of New South Wales – Duncan Taylor
33. Professor Stephen Garton – University of Sydney
34. Ecological Agricultural Australia Association – Kerry Cochrane
35. 7-12 Curriculum Team, New England Region, NSW Department of Education and Communities
36. Ms Jan Munro – Education Consultant
37. NORCO Co-operative Limited – Tony Wilson
38. Mr Gerard McEvilly
39. Agriculture Teaching Staff – Hurlstone Agricultural High School
40. Farrer Memorial Agricultural High School Council – James Houlanah
41. Charles Sturt University – Professor John Mawson
42. Ms Helen Dalton
43. Mr John Killeen – Bossley Park High School
44. Mr Michael Williams – TAFENSW – New England Institute
45. Junee High School – Matthew Brown
46. Mr David Gale
48. Rural Skills Australia – Mr Geoff Bloom
49. Sureway Employment and Training – Donna Swansborough
50. Ms Annette ten Broeke
51. Coonamble Employment Circle – Lee O’Connor
52. Ms Danielle Krix – Hurlstone Agricultural High School
53. Dr Andrea Leys
54. Country Women’s Association NSW – Donna Wilkins
55. James Ruse Agricultural High School – Larissa Treskin
56. Dr John Troughton and Mr Maurice Blackwood – The Wollondilly Agricultural Education Model
57. Tocal College Advisory Council – Margot Duncan
58. Dr Lindsay Campbell – University of Sydney
59. Professor Jerry Vanclay – Southern Cross University
60. NSW Young Farmer Council – Hollie Baillieu
61. Dairy Industry People Development Council
62. NSW Farmers – Angus Gidley-Baird
63. Agribusiness Council of Australia – Ian Joseph and Roy Duncanson
64. TAFE NSW – Pam Christie, Managing Director
65. Ms Joanna Newton – Farming Futures Project
66. Mrs Carolle & Mr Bob Leach
67. Ms Jennifer Woodward – Byron Bay High School
68. Mr Graham Bramley, Mick Melino, Rob Dolman
69. Mr Steve Auld – Bundarra Central School
70. Primary Industries Education Foundation – Ben Stockwin
71. Nursery & Garden Industry NSW & ACT – Bob Wynyard
72. AgriFood Skills Australia NSW Industry Training Advisory Body – Melissa Wortman
73. Mr Graeme Rolston – Tailor Made Fish Farms
74. Mr Graeme Worboys
75. Cotton Australia – Angela Bradburn
76. Mr Philip Best – Think Water
77. Ms Kerrie Wratten, Principal – Hurlstone Agricultural High School
78. Ms Jacqueline Heap
79. Royal Agricultural Society of NSW
80. Commonwealth Bank of Australia
81. Suncorp
### APPENDIX 1.3
LIST OF CONSULTATIONS UNDERTAKEN

<table>
<thead>
<tr>
<th>Date</th>
<th>Event/Stakeholder/Organisation</th>
<th>Type of consultation</th>
<th>Location</th>
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<tbody>
<tr>
<td>8 August 2012</td>
<td>Agvision</td>
<td>Careers-based expo</td>
<td>Junee High School, Junee</td>
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<td>Think-tank</td>
<td>Yanco</td>
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<td>John Collins</td>
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<td>Sturt Hemmings</td>
<td>Interview</td>
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<td>Cameron Archer</td>
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<td>NSW Department of Education and Communities</td>
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<td>3 September 2012</td>
<td>Isolated Children’s Parents Association – Duncan Taylor</td>
<td>Meeting</td>
<td>Wagga Wagga</td>
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<td>4 September 2012</td>
<td>Grains Research and Development Corporation – Southern Panel</td>
<td>Visit to Charles Sturt University</td>
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<td>6 September 2012</td>
<td>NSW Farmers’ Association</td>
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<td>Casual meeting</td>
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<td>Temora Agricultural Bureau</td>
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<td>Board of Vocational Education and Training</td>
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<td>4 October 2012</td>
<td>Young Aggies Network</td>
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<td>Visit and discussion</td>
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<td>Smart and Skilled – NSW Department of Education and Communities, Lynnette Dorn</td>
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<td>Glenfield</td>
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<td>Charles Sturt University</td>
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<td>University of New England Armidale</td>
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<td>Presentation and discussion</td>
<td>Sydney</td>
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<td>4 March 2013</td>
<td>Agriminds</td>
<td>Presentation and discussion</td>
<td>Sydney</td>
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<td>11 March, 2013</td>
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<td>Wagga Wagga</td>
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<td>Mallee Conservation Farming Conference</td>
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<td>22 March 2013</td>
<td>Reference Group</td>
<td>Project update</td>
<td>Sydney</td>
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<td>27 March 2013</td>
<td>Victorian Parliament House</td>
<td>Education forum</td>
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<td>9 April 2013</td>
<td>University of Sydney First Year students</td>
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<td>10 April 2013</td>
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<td>Charles Sturt University, Wagga Wagga</td>
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<td>Charles Sturt University, Wagga Wagga</td>
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<td>6 May 2013</td>
<td>Peter Noonan, Allen &amp; Associates</td>
<td>Discussion</td>
<td>Telephone interview</td>
</tr>
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<td>6 May 2013</td>
<td>Adam Farquharson, TAFE NSW - Riverina Institute (Tumut)</td>
<td>Discussion</td>
<td>Wagga Wagga over lunch</td>
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<tr>
<td>8 May 2013</td>
<td>Royal Agricultural Society</td>
<td>Discussion</td>
<td>RAS, Olympic Park, Sydney</td>
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<tr>
<td>8 May 2013</td>
<td>Horticulture Australia Ltd Board</td>
<td>Presentation</td>
<td>Sydney</td>
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<tr>
<td>9 May 2013</td>
<td>Education Services Australia</td>
<td>Evaluation of Scootle</td>
<td>Melbourne</td>
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<td>22 May 2013</td>
<td>Skills List consultations</td>
<td>Discussion</td>
<td>Melbourne</td>
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<td>28 May 2013</td>
<td>Horticulture Australia Ltd members</td>
<td>Presentation</td>
<td>Sydney</td>
</tr>
<tr>
<td>Date</td>
<td>Event/Stakeholder/Organisation</td>
<td>Type of consultation</td>
<td>Location</td>
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<tr>
<td>30 May 2013</td>
<td>NSW Department of Education and Communities</td>
<td>Discussion</td>
<td>Sydney</td>
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<tr>
<td>4 June 2013</td>
<td>Riverina Agricultural Education Alliance</td>
<td>Presentation</td>
<td>Yanco</td>
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<tr>
<td>6 June 2013</td>
<td>John Collins</td>
<td>Discussion</td>
<td>Wagga Wagga</td>
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<td>17 June 2013</td>
<td>Reference Group</td>
<td>Project update</td>
<td>Sydney</td>
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<td>20 June 2013</td>
<td>NSW Dairy Industry Association</td>
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<td>21 June 2013</td>
<td>Australian Workforce and Productivity Agency</td>
<td>Discussion</td>
<td>Sydney</td>
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<td>27 June 2013</td>
<td>Catholic Education and Independent Schools</td>
<td>Discussion</td>
<td>Sydney</td>
</tr>
</tbody>
</table>
## APPENDIX 1.4
### REFERENCE GROUP MEMBERSHIP

<table>
<thead>
<tr>
<th><strong>Reviewer</strong> (Chair)</th>
<th>Emeritus Professor Jim Pratley</th>
<th>Research Professor of Agriculture, Charles Sturt University</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professor Mark Adams</td>
<td></td>
<td>Dean, Faculty of Agriculture and Environment, University of Sydney (representative of the NSW Vice-Chancellors’ Committee)</td>
</tr>
<tr>
<td>The Hon Niall Blair MLC</td>
<td></td>
<td>Member of the Legislative Council</td>
</tr>
<tr>
<td>The Hon Rick Colless MLC</td>
<td></td>
<td>Deputy Government Whip in the Legislative Council</td>
</tr>
<tr>
<td>Mr Graeme Harris</td>
<td></td>
<td>President, NSW Association of Agriculture Teachers (representative of the schools sector)</td>
</tr>
<tr>
<td>Ms Kate Lorimer-Ward</td>
<td></td>
<td>NSW Department of Primary Industries</td>
</tr>
<tr>
<td>Mr John Mills</td>
<td></td>
<td>R/ Director, TAFE Industry Skills Unit Orange and Granville, TAFE NSW</td>
</tr>
<tr>
<td>Ms Gabriella Morona</td>
<td></td>
<td>Student and 2010 NSW and Australian Trainee of the Year</td>
</tr>
<tr>
<td>Ms Jane Simmons</td>
<td></td>
<td>A/ Executive Director, Learning and Leadership, NSW Department of Education and communities (representative of the NSW Department of Education and Communities)</td>
</tr>
<tr>
<td>Ms Sarah Thompson</td>
<td></td>
<td>Chair of the Rural Affairs Committee, Executive Councillor, NSW Farmers (representative of the NSW Farmers Federation)</td>
</tr>
<tr>
<td>Ms Melissa Wortman</td>
<td></td>
<td>Executive Officer, AgriFood NSW Industry Training Advisory Body (representative of the NSW Agrifood Skills Council)</td>
</tr>
</tbody>
</table>
The Australian Curriculum, Assessment and Reporting Authority (ACARA) is the independent authority responsible for the development of the Australian curriculum, national assessment program and national data collection and reporting for Australian students. The Australian curriculum emanates from the Melbourne Declaration on Educational Goals for Young Australians, adopted by the Ministerial Council in December 2008. The Declaration places emphasis on the importance of knowledge, skills and understanding of learning areas, general capabilities and cross-curriculum priorities as the basis for a curriculum designed to support 21st century learning.

The two key foci of activity are Foundation (Kindergarten) to Year 10 and Senior Secondary (Years 11 and 12). Key aspects are provided in Table A4.1 for F-10 and Table A4.2 for Senior Secondary.

### Table A4.1 Foundation to Year 10 – learning areas or subjects, general capabilities and cross-curriculum priorities

<table>
<thead>
<tr>
<th>Key learning areas</th>
<th>English</th>
<th>Mathematics</th>
<th>Science</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>General capabilities</td>
<td>Literacy</td>
<td>Numeracy</td>
<td>Information and communication technology capability</td>
<td>Critical and creative thinking</td>
</tr>
<tr>
<td>Cross-curriculum priorities</td>
<td>Aboriginal and Torres Strait Islander histories and cultures</td>
<td>Australia and Australia’s engagement with Asia</td>
<td>Sustainability</td>
<td></td>
</tr>
</tbody>
</table>

Sustainability represents a particular opportunity for agriculture and food to be a significant component. The ACARA website describes it as follows:

“Sustainability addresses the ongoing capacity of Earth to maintain all life.

Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are both individual and collective endeavours, shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.

Education for sustainability develops the knowledge, skills, values and world views necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence”.

The other cross-curriculum priorities also lend themselves to significant input from the agriculture and food sector.
<table>
<thead>
<tr>
<th>Table A4.2 Senior secondary – Australian curriculum for senior secondary subjects</th>
</tr>
</thead>
</table>
| **English** | English  
English as an additional language or dialect  
Essential English  
Literature |
| **Mathematics** | Essential Mathematics  
General Mathematics  
Mathematical Methods  
Specialist Mathematics |
| **Science** | Biology  
Chemistry  
Earth and Environmental Sciences  
Physics |
| **Humanities and Social sciences** | Ancient History  
Modern History |
## APPENDIX 4.2 AUSTRALIAN QUALIFICATIONS FRAMEWORK

### LEVEL DESCRIPTIONS

<table>
<thead>
<tr>
<th>Qualification type</th>
<th>Summary description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 – Certificate I</td>
<td>Graduates at this level will have knowledge and skills for initial work, community involvement and/or further learning</td>
</tr>
<tr>
<td>Level 2 – Certificate II</td>
<td>Graduates at this level will have knowledge and skills for work in a defined context and/or further learning</td>
</tr>
<tr>
<td>Level 3 – Certificate III</td>
<td>Graduates at this level will have theoretical and practical knowledge and skills for work and/or further learning</td>
</tr>
<tr>
<td>Level 4 – Certificate IV</td>
<td>Graduates at this level will have theoretical and practical knowledge and skills for specialised and/or skilled work and/or further learning</td>
</tr>
<tr>
<td>Level 5 – Diploma</td>
<td>Graduates at this level will have specialised knowledge and skills for skilled/paraprofessional work and/or further learning</td>
</tr>
<tr>
<td>Level 6 – Advanced Diploma or Associate Degree</td>
<td>Graduates at this level will have broad knowledge and skills for paraprofessional/highly skilled work and/or further learning</td>
</tr>
<tr>
<td>Level 7 – Bachelor Degree</td>
<td>Graduates at this level will have broad and coherent knowledge and skills for professional work and/or further learning</td>
</tr>
<tr>
<td>Level 8 – Bachelor Honours degree or Graduate and Vocational Graduate Certificate or Graduate and Vocational Graduate Diploma</td>
<td>Graduates at this level will have advanced knowledge and skills for professional/highly skilled work and/or further learning</td>
</tr>
<tr>
<td>Level 9 – Masters Degree</td>
<td>Graduates at this level will have specialised knowledge and skills for research, and/or professional practice and/or further learning</td>
</tr>
<tr>
<td>Level 10 – Doctoral Degree</td>
<td>Graduates at this level will have systematic and critical understanding of a complex field of learning and specialised research skills for the advancement of learning and/or for professional practice</td>
</tr>
</tbody>
</table>

Source: Australian Qualifications Framework, 2013
In the earlier stages of learning, from K-6, agriculture is introduced in Science and Human Society and Its Environment (HSIE). In Science, students learn about the living world, manufactured products and built environments. In HSIE students learn how people and technologies link to provide goods and services. Agriculture could be much more formally integrated into the curriculum in Years K-6. Opportunities such as kitchen gardens would be highly effective at linking agriculture with core curricula. Although agriculture-related content is introduced to students in these years, food and fibre is not a specific part of the K-6 curriculum.

STAGE 1:

SCIENCE (NSW SYLLABUS FOR AUSTRALIAN CURRICULUM)
Living World: describes external features, changes in and growth of living things

Earth and Space: identifies ways that people use science in their daily lives to care for the environment and the Earth’s resources

Built Environments: describes a range of places and spaces in the local environment and how their purposes influence their design

Products: describes a range of manufactured products in the local environment and how their different purposes influence their design.

HUMAN SOCIETY AND ITS ENVIRONMENT (CURRENT SYLLABUS)
Students study a range of units under the following outcomes: Change and Continuity, Cultures, Environments and Social Systems and Structures.

Topics under these outcomes that introduce students to agriculture are:

Patterns of Place and Location: Compares and contrasts natural and built features in their local area and the ways in which people interact with these features. Students examine the differences between natural and built features and places

Resource Systems: Explains how people and technologies in systems link to provide goods and services to satisfy needs and wants. Students:

- Identify people who meet their needs and the needs of others
- Talk about the origin of products used (i.e. milk comes from a cow etc.).

Units of work under ‘Resource Systems’ include Workers in the Community – Australians at Work series: Police Officers; Nurses; Veterinarians; Train Drivers; Postal Workers; Fire-fighters, Builders, Cooks, Dairy Farmers, Dentists, Park Rangers, Pilots.

STAGE 2:

SCIENCE (NSW SYLLABUS FOR AUSTRALIAN CURRICULUM)
Living World: describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things (students observe first-hand one animal or plant as it grows and develops, and sequence the stages in its life cycle and identify ways that the environment can affect the life cycle of plants and animals).

Material World: identifies the physical properties of natural and processed materials, and how these properties influence their use (students identify the properties of some natural and processed materials).

HUMAN SOCIETY AND ITS ENVIRONMENT (CURRENT SYLLABUS)
Patterns of Place and Location: describes places in the local area and other parts of Australia and explains their significance. Students:

- Name and locate natural, built and heritage features in their local area and evaluate their significance
- Give reasons why particular activities may be associated with particular natural, built and heritage features and places
- Compare natural and built features, sites and places in their local area with other locations in Australia or the world
• Compare ways in which members of the community use features of the local area to meet their needs.

Resource Systems: describes how and why people and technologies interact to meet needs and explains the effects of these interactions on people and the environment. Students:
• Identify the components of a system that provides goods and services and how the components would need to interlink
• Examine a variety of systems that have been designed to meet needs in communities and identify the advantages and disadvantages of their use
• Examine some of the goods and services provided within the community and by community organisations to meet needs
• Make statements about the responsibilities of producers and consumers within systems towards people and the environment
• Describe ways in which people obtain goods and services in the local community.

STAGE 3:

SCIENCE (NSW SYLLABUS FOR AUSTRALIAN CURRICULUM)

Living World: describes some physical conditions of the environment and how these affect the growth and survival of living things (students make predictions about how changing the physical conditions of the environment impacts on the growth and survival of living things, eg different amounts of light or water on plant growth or the effect of different temperatures on the growth of yeast or bread mould).

Earth and Space: explains rapid change at the Earth’s surface caused by natural events, using evidence provided by advances in technology and scientific understanding (students describe how Aboriginal and Torres Strait Islander peoples use observations of the night sky to inform decisions about some everyday activities, eg food gathering and ceremonies and investigate a recent Australian example of the effect on the Earth’s surface of extreme weather conditions, eg cyclones, droughts or flood).

Built Environments: describes systems in built environments and how social and environmental factors influence their design (generate and develop ideas about how built environments might be designed and constructed in the future to incorporate sustainable environmental practices, e.g., the use of recycled materials, natural lighting and solar energy).

HUMAN SOCIETY AND ITS ENVIRONMENT (CURRENT SYLLABUS)

Patterns of Place and Location: demonstrates an understanding of the interconnectedness between Australia and global environments and how individuals and groups can act in an ecologically responsible manner. In this unit, students:
• Use maps and globes to locate global and Australian reference points
• Locate patterns of movement of people, products and information including where the goods and services they use come from, migration and travel patterns of people
• Locate and describe patterns of human involvement in environmental areas of Australia (e.g., human use of rainforest areas or river systems such as the Murray Darling Basin)
• Compare human use of an environmental area with use in another area of the world (e.g., Sydney and Jakarta)
• Explains the effects of human changes on an environment, evaluating the positive and negative aspects of these changes
• Draws accurate sketch maps of a known area and includes title, key, scale and direction.

Relationships with Place: explains how various beliefs and practices influence the
ways in which people interact with, change and value their environment. Students:

- Examine how natural, cultural, religious, historical, economic and political factors can influence people’s interactions with environments
- Identify the different viewpoints that may be held by groups and individuals, including Aboriginal peoples, farmers and miners, about land use
- Examine issues associated with differing values about natural and built environments, using a variety of sources, including the media
- Express a personal point of view on an environmental issue and provide supporting evidence.

Resource Systems: describes how Australian people, systems and communities are globally interconnected and recognises global responsibilities. Students:

- Gather information about some of Australia’s major exports and imports
- Explain how global interactions need to be assessed for their global implications (eg the export of uranium)
- Describe how, and give reason why, Australia is interdependent with other nations
- Examine some reasons for changes in work and industries in Australia
- Identify some organisations that support employers and workers, eg associations, federations, unions
- Makes statements about global responsibilities, eg responsibilities of users and producers of goods and services, care of the planet.

YEARS K-6: POTENTIAL OPPORTUNITIES

PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
Currently under ‘Decision Making Outcomes and Indicators’ and ‘Personal Health Choices Outcomes and Indicators’ students learn about healthy foods and identify how climatic and cultural influences impact upon people’s health choices (i.e. clothes worn, foods eaten). An opportunity exists to extend this so that students learn where food comes from and undertake an industry excursion.

MATHEMATICS
For example, using crop areas as a numeracy exercise, fertiliser rates, livestock rations.

ENGLISH
Develop a story in English regarding a rural family, including character development. This could lead to a cross curricula unit where students can design and build the farm, the farm house and utility buildings.

There are opportunities to link agriculture into the Foundation Statements of K-6 and through key units of work (for example through Human Society and its Environment units). Further discussion with the Board of Studies NSW will need to take place for this to go forward.

CROSS-CURRICULAR
Kitchen and food gardens are an increasingly popular and effective way for schools to promote environmental and sustainability learning and to connect students with healthy food and lifestyles. These programs can assist schools in teaching environmental education and nutritional information, as well as introducing agriculture to students in an engaging and interactive way.
APPENDIX 6.1 SYLLABUS OUTLINE FOR GEOGRAPHY AND HISTORY IN YEARS 7 AND 8

GEORGRAPHY
Students develop skills in acquiring, processing and communicating geographical information. They will:

• Identify, gather and evaluate geographical information
• Analyse, organise and synthesise geographical information
• Select and use appropriate written, oral and graphic forms to communicate geographical information
• Demonstrate a sense of place about Australian environments
• Explain geographical processes that form and transform Australian environments
• Analyse impacts of different perspectives on geographical issues at local, national and global scales
• Account for differences within and between Australian communities
• Explain Australia's links with other countries and its role in the global community
• Identify and represent Australia's major physical features and patterns on a variety of maps
• Identify range of Australian communities based on shared space and/or social organisations
• Describe factors causing change in Australian communities.

Changes to the geography syllabus are likely to occur from 2014 with the introduction of the Australian Curriculum. There are prospects that the units on 'natural and built environments' will more adequately address issues related to agriculture, including sustainability. There is significant room for agriculture to be expanded in the new syllabus and the NSW Department of Education and Communities will have opportunity to contribute to syllabus redevelopment. It is important that advisors with agricultural expertise contribute to the syllabus development.

HISTORY
Students will develop:

• knowledge and understanding of significant developments in Australia's social, political and cultural history
• knowledge and understanding of Australia's international relationships
• knowledge and understanding of the changing rights and freedoms of Aboriginal peoples and other groups in Australia
• skills to undertake the process of historical inquiry
• skills to communicate their understanding of history.
Students experience aspects of an agricultural lifestyle through direct contact with plants and animals and a variety of outside activities. They explore the many and varied career opportunities in agriculture and its related service industries. Students investigate the viability of Australian agriculture through the careful management of issues relating to the sustainability of agricultural systems, as well as the relationships between production, processing and consumption. The study of a range of enterprises allows students to make responsible decisions about the appropriate use of agricultural technologies.

Students develop the capacity to design, produce, evaluate, use and manage marine and water-related environments in an environmentally sustainable way. Forty-eight modules are available from a broad range of marine and aquaculture areas, organised into biology, ecology, leisure, aquaculture, employment, management, and general interest. Students learn about the ethical and sustainable use, management and protection of marine and aquatic environments, water safety, general first aid and the selection, safe use and maintenance of equipment. Emphasis is on the economical sustainability of aquaculture and marine environments and preservation of wild seafood stocks.

Students develop a broad knowledge of the properties, performance and uses of textiles. Fabrics, colouration, yarns and fibres are explored. Students examine the historical, cultural and contemporary perspectives on textile design and develop an appreciation of the factors affecting them as textile consumers.

Students develop knowledge and understanding of materials and processes in a range of technologies. They develop skills relating to selection, use and application of materials, tools, machines and processes through the planning and production of quality practical projects. Students may undertake one or two courses in Industrial Technology and may elect to study one of eleven focus areas in each course, which are based on a range of technologies of industrial and domestic significance. These include studies in Automotive, Leather, Building and Construction, Metal, Ceramics, Multimedia/Photography, Electronics, Polymers, Engineering, Timber, and Farm Maintenance.

Students learn about the patterns, functions and issues associated with primary production including: types of primary production and learn to identify these (including agriculture, mining, fishing, forestry); global patterns of primary production (including agriculture, mining, fishing, forestry) and different types of primary production at a global scale; contemporary issues related to the primary production; current and future primary production; global patterns and characteristics of primary production; and environmental, social and economic impacts of primary production.

There are other opportunities that could be explored in terms of their contribution to the understanding of the role of agriculture in food production, national development and national economy. These include the electives in food technology, history and commerce.

Students develop a broad knowledge and understanding of food properties, processing, preparation and their interrelationship, nutritional considerations and consumption patterns.
HISTORY

Students learn about living conditions in Australia in early 20th century and to identify features of Australia in 1900 including transport, food, education, recreation and technology. Students also learn about the changing role of women and work, including working on farms. They undertake a site study that could include visiting a farm.

COMMERCE

Students study ‘consumer choice and personal finance’ and ‘law and society and employment issues’. Optional topics are selected from: investing; promoting and selling; E-commerce; global links; towards independence; political involvement; travel; law in action; our economy; community participation; running a business; and a school-developed option. Agriculture could successfully be integrated into most of the components in this subject.
Sustainability addresses the ongoing capacity of Earth to maintain all life. Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are both individual and collective endeavours shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.

Education for sustainability develops the knowledge, skills, values and world views necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence.

**ORGANISING IDEAS**

For each cross-curriculum priority, a set of organising ideas reflects the essential knowledge, understandings and skills for the priority. The organising ideas are embedded in the content descriptions and elaborations of each learning area as appropriate.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Oi.1</th>
<th>The biosphere is a dynamic system providing conditions that sustain life on Earth.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oi.2</td>
<td>All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival.</td>
</tr>
<tr>
<td></td>
<td>Oi.3</td>
<td>Sustainable patterns of living rely on the interdependence of healthy social, economic and ecological systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>World Views</th>
<th>Oi.4</th>
<th>World views that recognise the dependence of living things on healthy ecosystems, and value diversity and social justice are essential for achieving sustainability.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oi.5</td>
<td>World views are formed by experiences at personal, local, national and global levels, and are linked to individual and community actions for sustainability.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Futures</th>
<th>Oi.6</th>
<th>The sustainability of ecological, social and economic systems is achieved through informed individual and community action that values local and global equity and fairness across generations into the future.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oi.7</td>
<td>Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments.</td>
</tr>
</tbody>
</table>

The Board of Studies NSW has traditionally included in all its Years 7–10 syllabuses cross curriculum content related to the environment. Additionally, agriculture is included in Technology (Mandatory) and a specialised Agricultural Technology syllabus.
The Board of Studies NSW has recently developed new syllabuses for Kindergarten to Year 10 in the areas of English, Maths, Science and History. The NSW syllabuses incorporate the Australian Curriculum content descriptions, and make clear references to the Australian Curriculum general capabilities and cross-curriculum priorities.

One of the cross-curriculum priorities is sustainability. The Australian Curriculum, Assessment and Reporting Authority’s (ACARA) description of sustainability is presented in Appendix 4.1. In the NSW syllabus careful attention has been given to each of the cross curriculum priorities and that clear and appropriate content has been built around the Australian content descriptions. This marks a significant increase in emphasis from the elaborations within the Australian Curriculum, which are indicative only.

Table 1. References to sustainability in the F–10 Australian Curriculum for English, Mathematics, Science and History; and the NSW K–10 syllabuses for English, Mathematics, Science (including Science and Technology K–6) and History.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Australian Curriculum</th>
<th>NSW syllabuses</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>21</td>
<td>15</td>
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<tr>
<td>Mathematics</td>
<td>7</td>
<td>33</td>
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<tr>
<td>Science</td>
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<td>History</td>
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<td><strong>Total</strong></td>
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</table>

Learning across the curriculum content in the area of sustainability from the new NSW syllabuses is attached at Appendix 6.3a.

Within the new syllabuses for English, Mathematics, Science and History, a search reveals that the term agriculture / agricultural appears 8 times, farm / farming 12 times, and environment 69 times.

| OI.8 | Designing action for sustainability requires an evaluation of past practices, the assessment of scientific and technological developments, and balanced judgments based on projected future economic, social and environmental impacts. |
| OI.9 | Sustainable futures result from actions designed to preserve and/or restore the quality and uniqueness of environments. |

- 21 references in English
- 7 references in Mathematics
- 58 references in Science
- 19 references in History

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1 The NSW syllabus for Science includes Science and Technology for K–6
SUSTAINABILITY CONTENT IN THE NEW NSW SYLLABUSES

ENGLISH K–10

Sustainability

The study of English provides students with the skill required to investigate and understand issues of environmental and social sustainability, to communicate information about sustainability, and to advocate action to improve sustainability.

If people now and into the future are to be treated fairly, action to improve sustainability needs to be informed by a worldview of people, places and communities. Both literature and literacy are key elements in the development of each student’s worldview. More sustainable patterns of living are largely shaped by people’s behaviours. English provides an important means of influencing behaviours, facilitating interaction and expressing viewpoints through the creation of texts for a range of purposes, audiences and contexts, including multimodal texts and the use of visual language.

Early Stage 1

Expressing themselves

Respond to and compose texts

• Compose simple written and visual texts that include aspects of home, personal and local community life

Stage 1

Expressing themselves

Respond to and compose texts

• Respond to a range of texts, eg short films, documentaries and digital texts, that include issues about their world, including home life and the wider community.

Stage 2

Expressing themselves

Respond to and compose texts

• Compose a variety of texts, eg simple poetry, that include aspects of home and local community life

Stage 3

Writing and representing

Respond to and compose texts

• Compose texts that include sustained and effective use of persuasive devices, eg texts dealing with environmental issues

• Expressing themselves

• Engage personally with texts

• Consider how texts about local events and issues in the media are presented to engage the reader or viewer

Stage 4

Outcome 5

Respond to and compose texts

• Express considered points of view and arguments on areas such as sustainability and the environment accurately and coherently in speech or writing with confidence and fluency

Outcome 7

Understand and apply knowledge of language forms and features

• Analyse how combinations of words, sound and images can create particular perspectives of the same event or issue such as environmental sustainability

Stage 5

Outcome 5

Respond to and compose texts

• Formulate, develop and express their own ideas and beliefs creatively, thoughtfully, positively and confidently on issues such as sustainable patterns of living

Outcome 7

Understand and apply knowledge of language forms and features

• Use and analyse increasingly complex language features to present a viewpoint on issues such as environmental and social sustainability

Life Skills

Outcome 5

Respond to and compose texts
• Respond to a range of visual texts, media and multimedia for a variety of purposes in a range of contexts, e.g. recount the storyline of a text shown on a film or video, make judgements about the nature and accuracy of a magazine article, create an action plan for the school community in response to an advertising campaign promoting an environmental issue

Outcome 7
Engage personally with texts
• Develop a point of view in relation to an argument or issue presented in a text, e.g. an environmental issue

Respond to and compose texts
• Identify the main idea in a range of familiar written, visual and aural texts, e.g. advertising for the ‘Clean Up Australia’ campaign

Outcome 8
Respond to and compose texts
• Construct short texts using visual aids and/or appropriate technology, e.g. a poster promoting caring for the school environment

Outcome 9
Respond to and compose texts
• Compose simple texts that include aspects of home and local community life

Outcome 13
Respond to and compose texts
• Compose persuasive texts in response to another text, e.g. exposition/discussion on a theme of a novel, debate on the hero/villain of a story, argument for/against an environmental issue

MATHEMATICS K–10
Sustainability
Sustainability is concerned with the ongoing capacity of Earth to maintain all life. Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Education for sustainability develops the knowledge, skills, understanding, values and attitudes necessary for people to act in ways that contribute to more sustainable patterns of living.

Mathematics provides a foundation for the exploration of issues of sustainability. It equips students with, for example, the skills to investigate data, to evaluate and communicate findings, and to make predictions based on those findings. They can measure and evaluate sustainability changes over time and develop a deeper appreciation of the world around them through such aspects of mathematics as patterning, three-dimensional space, symmetry and tessellations. Mathematical knowledge, skills and understanding are necessary to monitor and quantify both the impact of human activity on ecosystems and changes to conditions in the biosphere.

The NSW K–10 Mathematics curriculum provides students with knowledge, skills and understanding to observe, record, organise and analyse data, and to engage in investigations regarding sustainability. The curriculum supports students in early stages to build connections with the natural world and their local community. In later stages, students can use probability concepts, mathematical and computer modelling, chance and probability, multiple data sets and statistical analysis to understand more complex concepts relevant to sustainability.

Early Stage 1
Volume and Capacity
Use direct and indirect comparisons to decide which holds more, and explain their reasoning using everyday language. (ACMMG006)
• Use the terms ‘full’, ‘empty’ and ‘about half-full’
  ° Recognise when a container, such as a watering can, is nearly full, about half-full or empty (Reasoning)
• Compare the capacities of two containers directly by filling one and pouring into the other
Predict which container has the greater capacity and explain the reasons for this prediction, eg plant pots of different sizes (Communicating, Reasoning)

Data
Answer yes/no questions to collect information (ACMSP011)

• Collect information about themselves and their environment, including by asking and answering yes/no questions

Stage 1
Multiplication and Division 2
Recognise and represent multiplication as repeated addition, groups and arrays. (ACMNA031)

• Recognise practical examples of arrays, such as seedling trays or vegetable gardens (Reasoning)

Fractions and Decimals 1
Recognise and describe one-half as one of two equal parts of a whole (ACMNA016)

• Use concrete materials to model half of a collection

• Describe two equal parts of a collection, eg ‘I have halves because the two parts have the same number of seedlings’ (Communicating)

Fractions and Decimals 2
Recognise and interpret common uses of halves, quarters and eighths of shapes and collections (ACMNA033)

• Use concrete materials to model a half, a quarter or an eighth of a collection

• Describe equal parts of a collection of objects, eg ‘I have quarters because the four parts have the same number of counters’ (Communicating)

Time 1
Name and order months and seasons (ACMMG040)

• Name and order the seasons, and name the months for each season

• Describe the environmental characteristics of each season, eg ‘Winter is cool and some trees lose their leaves’ (Communicating)

• Recognise that in some cultures seasonal changes mark the passing of time, eg the flowering of plants and the migration patterns of animals are used by many peoples, including Aboriginal people (Reasoning)

Stage 2
Length 2
Use scaled instruments to measure and compare temperatures. (ACMMG084)

• Record temperatures to the nearest degree Celsius using the symbol for degrees (°)

• Use a thermometer to take and record daily temperature readings (Communicating)

Volume and Capacity 2
Use scaled instruments to measure and compare capacities. (ACMMG084)

• Use the millilitre as a unit to measure volume and capacity, using a device calibrated in millilitres, eg place a measuring cylinder under a dripping tap to measure the volume of water lost over a particular period of time

Data 1
Identify questions or issues for categorical variables; identify data sources and plan methods of data collection and recording. (ACMSP068)

• Identify possible sources of data collected by others, eg newspapers, government data-collection agencies, sporting agencies, environmental groups

Stage 3
Fractions and Decimals 2
Make connections between equivalent fractions, decimals and percentages. (ACMNA131)

• Represent simple fractions as decimals and as percentages

• Interpret and explain the use of fractions, decimals and percentages in everyday contexts, eg 34 hour = 45 minutes, percentage of trees in the local area that are native to Australia (Communicating, Reasoning)
Area 1
Calculate the areas of rectangles using familiar metric units. (ACMMG109)

- Measure the dimensions of a large rectangular piece of land in metres and calculate its area in hectares, eg the local park.

Data 1
Pose questions and collect categorical or numerical data by observation or survey. (ACMSP118)

- Collect categorical and numerical data through observation or by conducting surveys, eg observe the number of a particular type of insect in one square metre of the playground over time.

Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies. (ACMSP119)

- Discuss and justify the choice of data display used (Communicating, Reasoning).

- Recognise that line graphs are used to represent data that demonstrates continuous change, eg hourly temperature (Communicating).

Stage 4
Fractions, Decimals and Percentages
Solve problems involving the use of percentages, including percentage increases and decreases, with and without the use of digital technologies. (ACMNA187)

- Solve a variety of real-life problems involving percentages, including percentage composition problems and problems involving money.

- Interpret and use statements about the environment involving percentages, eg energy use for different purposes, such as lighting (Problem Solving).

Volume
Choose appropriate units of measurement for volume and convert from one unit to another. (ACMMG195)

- Choose an appropriate unit to measure the volumes or capacities of different objects, eg swimming pools, household containers, dams.

Calculate the volumes of cylinders and solve related problems. (ACMMG217)

- Solve a variety of practical problems involving the volumes and capacities of right prisms and cylinders, eg find the capacity of a cylindrical drink can or a water tank.

Data Collection and Representation
Investigate techniques for collecting data, including census, sampling and observation. (ACMSP284)

- Investigate and determine the differences between collecting data by observation, census and sampling.

- Identify examples of variables for which data could be collected by observation, eg direction travelled by vehicles arriving at an intersection, native animals in a local area (Communicating).

- Identify and investigate issues involving numerical data collected from primary and secondary sources (ACMSP169).

- Collect and interpret information from secondary sources, presented as tables and/or graphs, about a matter of interest, eg sporting data, information about the relationship between wealth or education and the health of populations of different countries.

- Analyse a variety of data displays used in the print or digital media and in other school subject areas, eg share-movement graphs, data displays showing sustainable food production (Problem Solving).

Stage 5.1
Single Variable Data Analysis
Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data. (ACMSP253)

- Interpret media reports and advertising that quote various statistics, eg media ratings, house prices, sports results, environmental data.
Stage 5.2
Bivariate Data Analysis
Investigate and describe bivariate numerical data where the independent variable is time. (ACMSP252)

• Investigate a matter of interest, representing the dependent numerical variable against the independent variable, time, in an appropriate graphical form

• Describe changes in the dependent variable over time, eg describe changes in carbon pollution over time (Communicating)

Life Skills
Numeration: Counting
• Count in familiar contexts, eg count out books for a group or class, count uniforms for a sports team, count seedlings when re-planting

Numeration: Fractions
• Recognise fractions in everyday contexts, eg three-quarters of Australia is dry desert, more than half of the Earth is covered by water, one-quarter of the class have migrated to Australia

Time: Recognising Time
• Associate familiar activities with days and weeks

• Associate activities at particular times of the day/year with temperatures and seasons, eg ‘I go to swimming lessons in the summer’ (Communicating, Understanding, Fluency)

Two-Dimensional and Three-Dimensional Space: Recognising Objects and Shapes
• Recognise three-dimensional objects in the environment

• Identify two-dimensional shapes found in the environment

Two-Dimensional and Three-Dimensional Space: Features of Objects and Shapes
• Recognise and describe the attributes of two-dimensional shapes

• Identify circles, squares, triangles and rectangles in the built environment (Understanding)

Position: Recognising Maps and Plans
• Recognise the purpose and functions of maps and plans, eg to provide directions, to show the location of objects/features, to represent landforms

Position: Using Maps and Plans
• Use maps for a variety of purposes, eg a street directory, web-based maps, GPS technology

• Identify and describe features of an environment using map keys/legends (Communicating, Understanding)

Data: Recognising Data
• Recognise ways in which data about the environment can be displayed, eg data about climate and population growth

Data: Organising Data
• Gather and display data for a specific purpose, eg to determine the range of eye colour represented in a class of students

SCIENCE K-10
Sustainability
Sustainability is concerned with the ongoing capacity of the Earth to maintain all life. It provides authentic contexts for exploring, investigating and understanding systems in the natural and made environments. The Science K-10 (incorporating Science and Technology K-6) Syllabus provides students with opportunities to investigate relationships between systems and system components, to consider how systems respond to change and to develop appreciation for the interconnectedness of the Earth’s spheres.

Relationships, cycles and cause and effect are explored, and students develop observation and analytical skills to examine these relationships in the world around them to design solutions to identified sustainability problems.

Stage 1
Earth and Space
Observable changes occur in the sky and landscape. (ACSSU019)

• Describe some physical features of a landscape that have been changed by floods, droughts or processes, eg weathering and erosion
Earth’s resources, including water, are used in a variety of ways. (ACSSU032)

- Identify some actions which could be taken to care for and use water sustainably, eg turning off dripping taps and/or taking shorter showers

- Explore ways in which people use science knowledge and skills in their daily lives to care for the environment and use resources sustainably. (ACSHE022, ACSHE035)

**Products**

There is a range of manufactured products in the local environment.

- Discuss the purpose and usefulness of familiar applications of science and technology products used in everyday life, eg rechargeable batteries, recycled materials and single-use disposable food containers

- The different purposes of products influence their design.

- Explore ways that products may be designed and made to conserve resources, eg recyclable materials and reusable containers

**Stage 2**

**Working Technologically**

Students explore and define a task by:

- Working individually and collaboratively to develop a design brief that identifies simple design criteria relating to requirements that make the proposed solution useful and attractive while having minimal impact on the environment

**Earth and Space**

Earth’s surface changes over time as a result of natural processes and human activity. (ACSSU075)

- Research changes that have occurred in a local environment in Australia or an Asian region as a result of human activities, eg increasing erosion, construction of built environments and regeneration of an area

**Living World**

Living things, including plants and animals, depend on each other and the environment to survive. (ACSSU073)

- Gather information about some relationships between living things, eg predator-prey, competitors and mutually beneficial relationships

- Describe some examples of how science knowledge helps people to understand the effect of their actions on the environment and the survival of living things (ACSHE051, ACSHE062)

**Products**

People use products in a variety of ways.

- Explore the ways existing products can be reused and recycled to incorporate environmental considerations, eg products designed from recycled PET bottles

**Stage 3**

**Working Technologically**

Students explore and define a task by:

- Developing design criteria that considers, where relevant, function, aesthetics, social and environmental considerations

**Physical World**

Energy from a variety of sources can be used to generate electricity and this knowledge can inform personal and community-based decisions about using these sources sustainably. (ACSSU219)

- Describe how scientific knowledge can be used to inform personal and community decisions about the use and conservation of sustainable sources of energy. (ACSHE217, ACSHE220)

**Earth and Space**

Sudden geological changes or extreme weather conditions can affect Earth’s surface. (ACSSU096)

- Identify ways that advances in science and technology have assisted people to plan for and manage natural disasters to minimise their effects, eg detection systems for tsunamis, floods and bush fires
Living World
Living things have structural features and adaptations that help them to survive in their environment. (ACSSU043)

- Observe and describe the structural features of some native Australian animals and plants

The growth and survival of living things are affected by the physical conditions of their environment. (ACSSU094)

- Use gathered data to develop explanations about how changing the physical conditions of the environment affects the growth and survival of living things

Material World
The properties of materials determine their use for specific purposes.

- Research the reasons for and the benefits of using solid, liquid and gaseous fuels for heating

Products
Social and environmental factors can influence the design of products.

- Research the environmental impact of an everyday product from its production through to its use and disposal, e.g., a PET bottle, a car or newspaper
- Redesign a product to respond to a specific social or environmental consequence, e.g., redesign the packaging of a food product to reduce garbage

Stage 4
Physical World
Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations. (ACSHE120, ACSHE135)

- Research ways in which scientific knowledge and technological developments have led to finding a solution to a contemporary issue, e.g., improvements in devices to increase the efficiency of energy transfers or conversions
- Physical World

Additional content
- Debate intergenerational implications of the use of non-renewable energy resources

Earth and Space
Scientific knowledge influences the choices people make in regard to the use and management of the Earth’s resources.

- Classify a range of the Earth’s resources as renewable or non-renewable (ACSSU116)
- Investigate some strategies used by people to conserve and manage non-renewable resources, e.g., recycling and the alternative use of natural and made resources
- Outline the choices that need to be made when considering whether to use scientific and technological advances to obtain a resource from Earth’s spheres

Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management. (ACSHE121, ACSHE136)

- Demonstrate how scientific knowledge of the water cycle has influenced the development of household, industrial and agricultural water management practices
- Research how Aboriginal and Torres Strait Islander peoples’ knowledge is being used in decisions to care for country and place, e.g., terrestrial and aquatic resource management

Additional content
- Debate the economic and environmental impacts of mining and resource exploration

Living World
Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.

- Describe how scientific knowledge has influenced the development of practices in agriculture, e.g., animal husbandry or

2 Additional content is not prerequisite knowledge for following stages, but may be used to broaden and deepen students’ skills, knowledge and understanding
crop cultivation to improve yields and sustainability, or the effect of plant-cloning techniques in horticulture

Additional content
- Research the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects

Chemical World
Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques. (ACSSU113)

- Investigate the application of a physical separation technique used in everyday situations or industrial processes, e.g., water filtering, sorting waste materials, extracting pigments or oils from plants, separating blood products or cleaning up oil spills

In a chemical change, new substances are formed, which may have specific properties related to their uses in everyday life.

- Propose reasons why society should support scientific research, e.g., in the development of new pharmaceuticals and polymers

Stage 5
Physical World
Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

- Discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230)

- Discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources

Earth and Space
People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the atmosphere, biosphere, hydrosphere and lithosphere. (ACSHE160, ACSHE194)

- Evaluate scientific evidence of some current issues affecting society that are the result of human activity on global systems, e.g., the greenhouse effect, ozone layer depletion, effect of climate change on sea levels, long-term effects of waste management and loss of biodiversity

Additional content
- Research evidence relating global warming to changes in weather patterns, including El Niño and La Niña


Living World
Conserving and maintaining the quality and sustainability of the environment requires scientific understanding of interactions within, the cycling of matter and the flow of energy through ecosystems.

- Assess ways that Aboriginal and Torres Strait Islander peoples’ cultural practices and knowledge of the environment contribute to the conservation and management of sustainable ecosystems

- Evaluate some examples in ecosystems, of strategies used to balance conserving, protecting and maintaining the quality and sustainability of the environment with human activities and needs

Chemical World
Scientific understanding changes and is refined over time through a process of review by the scientific community.

- Evaluate the benefits and problems associated with medical and industrial uses of nuclear energy

Different types of chemical reactions are used to produce a range of products and can occur at different rates and involve energy transfer. (ACSSU187)
• Analyse how social, ethical and environmental considerations can influence decisions about scientific research related to the development and production of new materials

Life Skills

Physical World: Energy

Responsible use of energy is important for individuals and society.

• Identify why we should reduce our use of energy

• Explore ways in which individuals can reduce their use of energy, eg walking or cycling instead of driving, limiting the length of a shower or turning electrical appliances off instead of leaving them on standby

• Investigate new technologies and innovations to help reduce the amount of energy used around the home, eg energy-saving light globes, energy ratings on appliances or home insulation

Earth and Space: Earth’s Resources

The Earth is the source of all the resources needed in everyday life.

• Distinguish between some natural resources that are non-renewable, eg fossil fuels, minerals and those that are renewable, eg water and solar energy

Human activity has an impact on the effective management of the Earth’s resources.

• Explore human activities that negatively affect resources, eg logging, overfishing and destroying habitats

• Identify ways to conserve and protect the use of resources in everyday life, eg land care and water management

• Explore and/or participate in ways to improve the environment, eg composting, recycling, cleaning up the local area and planting trees

• Investigate strategies to prevent landform erosion or repair landforms after erosion

• Identify how human activity has affected the Earth’s atmosphere at a global level, eg climate change and ozone depletion

• Identify ways that individuals may change their lifestyle to reduce the negative effects of their actions on the atmosphere, eg cycling, car pooling or using electric/hybrid cars

Living World: Structure and Function

Features of living things

• Identify some micro-organisms in the environment, eg bacteria and viruses

• Outline some beneficial and harmful effects that micro-organisms can have on living things, eg contribution to health, production of useful products and disease

Living World: Environment

Living things depend on each other and on the environment.

• Identify the relationships between plants and animals within an ecosystem

Human activity can affect how an ecosystem functions.

• Engage with an ecosystem to recognise the effects of particular waste, eg plastic bags and bottles in the school environment, fishing lines and hair ties in rivers and streams, and oil and grease in drains

• Respond to ways to reduce the effect of waste on an ecosystem, eg putting rubbish in the bin, using biodegradable detergents and plastics, and exploring alternatives to dumping oil and grease into drains that feed rivers and streams

• Explore positive and negative changes to the environment as a result of human activity, eg building cities, farms and roads, fishing or pollution

• Recognise the difference between native and introduced species of plants and animals

• Explore ways that the introduction of plant or animal species, eg rabbits and boneseed, has affected a local ecosystem

• Participate in an investigation to reduce the effect of human activity on an environment, eg tree planting in the school or local environment
• Participate in and/or investigate caring for an ecosystem, e.g. planting trees or constructing fences to protect the habitat

Chemical World: Properties of Substances
Common chemicals have different uses.

• Describe the need for safe use and storage of household chemicals, including strategies to minimise harm

HISTORY K–10

Sustainability
History enables the development of students’ world views, particularly in relation to actions that require judgement about past societies and their access to and use of the Earth’s resources. Students are provided with opportunities to develop an historical perspective on sustainability by understanding, for example, the emergence of farming and settled communities, the positive and negative impacts of peoples and governments on pre-modern environments, the development of the Industrial Revolution and the growth of population, the overuse of natural resources, the rise of environmental movements as well as the global energy crisis and innovative technological responses to it. Making decisions about sustainability to help shape a better future requires an understanding of how the past relates to the present, and needs to be informed by historical trends and experiences.

Stage 1
The Past in the Present
The importance today of an historical site of cultural or spiritual significance; for example, a community building, a landmark, a war memorial. (ACHHK045)

• Identify an historical site or sites in the local community. Discuss their significance, why these sites have survived and the importance of preserving them

Stage 2
Community and Remembrance
Historical concepts and skills

• The historical concepts and skills to be taught throughout Stage 2 are listed in the Overview of Teaching and Learning.

Stage 3
The Australian Colonies
The nature of convict or colonial presence, including the factors that influenced patterns of development, aspects of the daily life of inhabitants (including Aboriginal and Torres Strait Islander peoples) and how the environment changed. (ACHHK094)

• The importance of Country and Place to Aboriginal and/or Torres Strait Islander peoples who belong to a local area. (This is intended to be a local area study with a focus on one Language group; however, if information or sources are not readily available, another representative area may be studied). (ACHHK060)

• Identify the special relationship that Aboriginal and/or Torres Strait Islander peoples have to Country and Place

ONE important example of change and ONE important example of continuity over time in the local community, region or state/territory. (ACHHK061)

• Using a range of sources, describe and explain how and why ONE area, e.g. transport, work, education, entertainment and daily life, has changed or ONE that has remained the same in the local area, region or state/territory since colonial times

First Contacts
Historical concepts and skills

• The historical concepts and skills to be taught throughout Stage 2 are listed in the Overview of Teaching and Learning.

The diversity and longevity of Australia’s first peoples and the ways Aboriginal and/or Torres Strait Islander peoples are connected to Country and Place (land, sea, waterways and skies) and the implications for their daily lives. (ACHHK077)

• Investigate, drawing on Aboriginal and Torres Strait Islander community representatives (where possible) and other sources, the traditional Aboriginal way of life, focusing on people, their beliefs, food, shelter, tools and weapons, customs and ceremonies, art works, dance, music, and relationship to Country

Stage 3
The Australian Colonies
The nature of convict or colonial presence, including the factors that influenced patterns of development, aspects of the daily life of inhabitants (including Aboriginal and Torres Strait Islander peoples) and how the environment changed. (ACHHK094)
- Discuss the impact of settlement on local Aboriginal peoples and the environment.
- Discuss the diverse relationships between Aboriginal peoples and the British.

**Stage 4**

*Depth Study 1: Investigating the Ancient Past*

The nature of the sources for ancient Australia and what they reveal about Australia's past in the ancient period, such as the use of resources. (ACDSEH031)

- Investigate what these sources reveal about Australia’s ancient past.

The importance of conserving the remains of the ancient past, including the heritage of Aboriginal and Torres Strait Islander peoples. (ACDSEH148)

- Identify ancient sites that have disappeared, or are threatened or have been protected and preserved, e.g. Akrotiri, Pompeii, the Pharos Lighthouse, Angkor Wat, Teotihuacan.
- Describe an Australian site which has preserved the heritage of Aboriginal and Torres Strait Islander peoples.

*Depth Study 2: The Mediterranean World*

The physical features of the ancient society and how they influenced the civilisation that developed there. (ACDSEH002, ACDSEH003, ACDSEH004)

- Explain how the geographical setting and natural features influenced the development of the society.

*Depth Study 3: The Asian World*

The physical features of the ancient society and how they influenced the civilisation that developed there. (ACDSEH006, ACDSEH005)

- Explain how the geographical setting and natural features influenced the development of the ancient society.

*Depth Study 5: The Asia-Pacific World*

The cultural achievements of the Khmer civilisation, including its system of water management and the building of the temples of Angkor. (ACDSEH061)

- Using a range of sources and the site of Angkor as an historical source, describe what it reveals about Angkor/Khmer life and culture. This could include:
  - The construction of the temples
  - The system of water management
  - Religion
  - Agriculture

Theories of the decline of Angkor, such as the overuse of water resources, neglect of public works as a result of ongoing war, and the effects of climate change. (ACDSEH062)

- Outline theories about the decline of Angkor and assess which factors were most significant.

The way Polynesian societies used environmental resources (sustainably and unsustainably), including the extinction of the moa in New Zealand, the use of religious/supernatural threats to conserve resources, and the exploitation of Easter Island’s palm trees. (ACDSEH068)

- Describe key environmental resources of Polynesian societies.
- Assess Polynesian uses of environmental resources in this period, including:
  - The extinction of the moa in New Zealand
  - The use of religious/supernatural threats to conserve resources
  - The exploitation of Easter Island’s palm trees

*Depth Study 6: Expanding Contacts*

**Topic 6d: Aboriginal and Indigenous Peoples, Colonisation and Contact History**

The nature of colonisation of ONE Indigenous community such as North America, the Pacific region, China, Africa, South-east Asia or South Asia.

- Describe the main features of the chosen Indigenous culture prior to colonisation.
Stage 5
Depth Study 1: Making a Better World?
Topic 1a: The Industrial Revolution. (1750–1914)

The technological innovations that led to the Industrial Revolution, and other conditions that influenced the industrialisation of Britain (the agricultural revolution, access to raw materials, wealthy middle class, cheap labour, transport system and expanding empire) and of Australia. (ACDSEH017)

- Identify the raw materials Britain obtained from its empire, eg sugar from Jamaica, wool from Australia, and cotton and tea from India

The short and long-term impacts of the Industrial Revolution, including global changes in landscapes, transport and communication. (ACDSEH082)

- Assess the short-term and long-term impacts of the Industrial Revolution, including:
  - Global changes in landscapes
  - Transport
  - Communication

Topic 1b: Movement of peoples (1750–1901)

The influence of the Industrial Revolution on the movement of peoples throughout the world, including the transatlantic slave trade and convict transportation. (ACDSEH018)

- Explain how the agricultural revolution caused British people to move from villages to towns and cities to create a cheap labour force

Depth Study 2: Australia and Asia

Topic 2a: Making a nation

The extension of settlement, including the effects of contact (intended and unintended) between European settlers in Australia and Aboriginal and Torres Strait Islander peoples. (ACDSEH020)

- Describe both the European impact on the landscape and how the landscape affected European settlement


The scope and nature of warfare. (ACDSEH095, ACDSEH107)

- Outline and sequence the changing scope and nature of warfare from trenches in World War I to the Holocaust and the use of the atomic bombs to end World War II

Depth Study 5: The Globalising World

Topic 5b: The environment movement (1960s–present)

The background to environmental awareness, including the nineteenth century National Parks movement in America and Australia. (ACDSEH028)

- Identify major threats to the natural environment
- Outline the origins of environmental awareness and activism
- Briefly describe the purpose of the nineteenth century National Parks movement in America and Australia

The intensification of environmental effects in the twentieth century as a result of population increase, urbanisation, increasing industrial production and trade. (ACDSEH125)

- Use a range of sources to explain how the growth of cities, population and industries have affected the environment in Australia and the world
- Discuss how global resource needs and trade have intensified environmental issues in developed and developing nations
- Describe the response to key environmental issues in Australian agriculture, eg the back-to-the-land
movement, organic farming and permaculture

The growth and influence of the environment movement within Australia and overseas, and developments in ideas about the environment (notion of ‘Gaia’, ‘limits to growth’, sustainability, ‘rights of nature’). (ACDSEH126)

• Discuss key events in the growing awareness of environmental issues in Australia and the world before 1975
• Outline the origins and policies of green political parties in the 1980s
• Describe the influence of at least ONE of the following environmental ideas:
  ° ‘Gaia’
  ° limits to growth
  ° sustainability
  ° rights of nature

Depth Study 5: The Globalising World
Responses of governments, including the Australian government, and international organisations to environmental threats since the 1960s, including deforestation and climate change. (ACDSEH128)

• Assess changing Australian government policies and actions towards environmental issues since the 1960s, including deforestation and climate change
• Discuss ONE Australian government achievement in response to an environmental threat since the 1960s

Life Skills
Investigating the Past
How we use sources to investigate the past

• Participate in an investigation of an historically or culturally significant location, eg local school, parks, town centres, public or heritage buildings, museums and memorials, using ICT and other sources as appropriate

The Ancient World
The location and geographical features of ancient societies

• Explore how the geographical features of a particular ancient society influenced its development, eg access to water, availability of natural resources, climate

The Ancient to the Modern World
The location and geographical features of a particular society, empire and/or historical development

• Explore how the geographical features of a society/empire influenced its development, eg access to water, availability of natural resources, climate

The history and culture of Indigenous groups prior to contact with other cultures

• Explore the ways Aboriginal and Torres Strait Islander peoples interact with and value the environment

The Modern World and Australia
Australia’s influence on popular culture

• Explore the contribution of one or more significant Australian people in the areas of the environment (eg Tim Flannery, Ian Kiernan), the arts (eg Graeme Murphy, Peter Sculthorpe, Brett Whiteley, David Williamson), sport (eg Allan Border, Evonne Goolagong Cawley, Dawn Fraser, Cathy Freeman, Louise Sauvage, Ian Thorpe), community welfare (eg Victor Chang, Fred Hollows, Dick Smith, Charles Teo) or entertainment (eg Peter Allen, Cate Blanchett, John Farnham, Nicole Kidman, Normie Rowe), using ICT and other sources as appropriate
### APPENDIX 6.4 OPPORTUNITIES FOR AGRICULTURE AND OTHER PRIMARY INDUSTRIES TO ENRICH THE CURRICULA IN YEARS 11 AND 12

<table>
<thead>
<tr>
<th>Subject</th>
<th>Description</th>
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<tbody>
<tr>
<td>Biology</td>
<td>Knowledge of development of ecosystems and food webs</td>
</tr>
<tr>
<td>Physics</td>
<td>Study of principles and technologies with agricultural impact</td>
</tr>
<tr>
<td>Earth and Environmental Science</td>
<td>Study of agricultural practices</td>
</tr>
<tr>
<td>Industrial Technology</td>
<td>Students learn about timber products and furniture technologies. It is noted that there are limited teaching resources available regarding the forestry industry and its sustainability and there are prospects for site visits.</td>
</tr>
<tr>
<td>Human Society and Its Environment: Society and Culture</td>
<td>Limited reference to agriculture through modules on industrialisation and living in urban and rural environments. Opportunity to have a rural/urban focus and relate how agriculture in NSW has changed throughout time and how this has affected society.</td>
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<tr>
<td>Economics</td>
<td>Potential opportunity to introduce agricultural studies under ‘Global Economy’ and ‘Australia’s Place in the Global Economy’ modules.</td>
</tr>
<tr>
<td>Geography: People and Economic Activity</td>
<td>Students learn about one economic activity in a global context. Options for students include: wheat farming, hydroponics, viticulture, textiles, tourism, advertising, retailing, wholesaling, information technologies, financial and business services industries. Students also undertake a geographical study of an economic enterprise operating at a local scale. The business could be an individual enterprise, firm or company such as a family farm, a mine or mining corporation, a hotel, chain of hotels, heritage or tourist site. Students can choose to study ‘Natural Resource Use’ (as one of four options). They learn about the nature of natural resources, economic and political issues related to the use of natural resources, their ownership and management, and environmental and social issues related to the use of natural resources such as ecologically sustainable development, and the impacts on, and responses of, Indigenous peoples.</td>
</tr>
<tr>
<td>Global Challenges</td>
<td>Students examine contemporary business issues including types of businesses in a variety of industries (including primary industries). Opportunity exists to study agribusiness, particularly for schools in regional or rural areas. Local agricultural businesses could be used as a case study with visits to the business and interaction directly with those involved in the industry.</td>
</tr>
<tr>
<td>Business Studies</td>
<td>Students study markets and Australia’s place in the global economy. Opportunity exists to evaluate market influences on the price of food and fibre.</td>
</tr>
<tr>
<td>Economics</td>
<td>Limited reference to textile industry (cotton, wool production) but opportunity to link agriculture more formally through industry visits. This would require units of work, worksheets, resources specifically addressing alternative natural fibres, sustainability and the journey from seed to clothing.</td>
</tr>
<tr>
<td>Textiles and Design Life Skills</td>
<td>This subject aims to familiarise students with life in the workforce. There are opportunities to include units on working in the agricultural industry, highlighting the variety of available agricultural careers and the skill sets required.</td>
</tr>
<tr>
<td>Work Studies – content endorsed course</td>
<td></td>
</tr>
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## APPENDIX 7.1 PRIMARY INDUSTRIES TRADE TRAINING CENTRES

NSW schools which are in clusters successfully funded for Primary Industries Trade Training Centre training facilities Rounds 1 - 4 of the Trade Training Centres in Schools Program.

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<thead>
<tr>
<th>Trades Training Facility</th>
<th>School Name</th>
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<td>New England Girls School</td>
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<td>Denison TTC</td>
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<td></td>
<td>Denison College Kelso Campus</td>
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<td>Denison Secondary College - Bathurst Campus</td>
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<td>Trades Training Facility</td>
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<td>Tamworth and District TTC</td>
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<td>Woodenbong TTC</td>
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### APPENDIX 7.2A EXISTING WORKER TRAINEESHIP COMPLETIONS IN PRIMARY INDUSTRIES IN NSW, 2008-2012

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<tr>
<th>Primary Industries</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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## APPENDIX 7.2B NEW ENTRANT TRAINEESHIP COMPLETIONS IN PRIMARY INDUSTRIES IN NSW, 2008-2012

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<td><strong>Teaching/meeting/business</strong></td>
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<td>• 600 seats in 15 classrooms</td>
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<td>• 35 seats in equipped teaching laboratories</td>
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<td>• 50 seats in open plan sheds and workshops</td>
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<td><strong>Catering</strong></td>
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<td>• 200+ capacity dining room</td>
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<td>• Commercial kitchen with servery (refurbished)</td>
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<td>• 15 double motel-style rooms</td>
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<td>• 114 single study rooms, shared facilities</td>
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<td>• 25 rooms with double bunks, shared facilities</td>
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<td><strong>Recreation</strong></td>
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<td>• Swimming pool</td>
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<td>• Sports fields</td>
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<td>• Load shifting</td>
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<td>• Fencing</td>
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<td>• Chainsaws, woodchipper, brushcutter</td>
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<td>• Forklifts</td>
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<td>• Safe use of motorbikes (2 and 4 wheel)</td>
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<td>• Off-road driving</td>
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<td><strong>Potential work spaces</strong></td>
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<td>• Confined spaces, working at heights,</td>
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<td>• Fire-fighting training facility</td>
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APPENDIX 9.1 DIGITAL CONTENT FOR SCHOOLS EDUCATION

STANDARDS APPROACH TO DIGITAL CONTENT FOR TEACHING AND LEARNING

Providing educational content to schools needs a standards based approach so that schools and students do not miss out on accessing content due to variations of technology or devices. With over 10,000 schools and 300,000 teachers in Australia, it is a complex process to ensure digital content reaches all teachers and students.

Teachers are time-poor due to classroom programs and other commitments in school time. They need to find learning resources quickly, and expect they are from authoritative and credible sources.

Education Services Australia (ESA) has managed the Nation Digital Learning Resource Network (NDLRN) for several years. This is an ICT based infrastructure that allows the publishing of learning resource content (or links to content on the web) directly to the State and Territory websites used by education departments for teaching and learning. In conjunction with this, ESA also manages Scootle, the national online repository for teachers to search for and discover content to support teaching and learning (www.scootle.edu.au). Scootle represents the vast majority of education jurisdictions and currently has 130,000 registered teachers.

ESA is always looking for content to help support teaching and learning across Australia. By utilising NDLRN and Scootle industry learning resources can be made discoverable by all schools in Australia.

WHAT IS INVOLVED?

It is important that digital content is clearly described and easy to find. ESA has worked with education jurisdictions and teachers to create a range of standards to help ensure that digital content meets the needs of a teacher and student but is also easy to find and described in a way to ensure that it represents how useful it is.

These standards are released openly for anyone to use to help with the development of materials. Below is a short discussion on some of the key elements when considering creating or sharing digital content.

PRIORITY, FOCUS AND ALIGNMENT – CONTENT FOR THE CLASSROOM

When developing or sharing content for teachers and students it is important to understand the educational value of the resources for teaching by answering the following questions:

• Does a resource support and align to the Australian Curriculum, pedagogical or professional standards?

• Does the digital resource focus on the learning needs of their intended audience?

• Does the resource have integrity from an authentic source?

To help answer those questions we have created a detailed Education Value Standard which is accessible here: http://ndlrn.edu.au/verve/_resources/Educational_value_standard_for_digital_resources.pdf
INTELLECTUAL PROPERTY AND COPYRIGHT

Teachers use content in a variety of ways in the classroom. They print worksheets, mash images into presentations, display content next to others on interactive content and even use them on mobile devices.

Copyright and other intellectual property are critical issues to ensure that teachers have a broad set of rights that allow them to fully utilise content for all teaching and learning activities.

Australia has some unique copyright laws in terms of using content in schools. Organisations that create content often do not realise that education departments and schools might have to pay copyright collecting society fees on materials even if they are made freely available. To learn more about this, the National Copyright Unit has released Smartcopying site – http://www.smartcopying.edu.au/ which is a detailed guide to issues relating to copyright for Australian Schools and TAFE NSW.

TECHNICAL AND ACCESSIBILITY STANDARDS

Schools contain a wide variety of operating environments for their computer hardware. They are facing new trends through students bringing their own devices as well as the operating systems in schools which may be older versions.

Using a technical standard approach to developing content ensures that content will work across multiple browsers, and that teachers and students are not confronted with the inability to access a resource because the browser or device does not support it.

Again to support this a technical standard as been developed to help, which can be found here: http://ndlrn.edu.au/verve/_resources/Technical_specification_guide_for_online_resources.pdf

ACCESSIBLE CONTENT FOR ALL

When developing or sharing content it must be noted that not all teachers and students are able to access content through keyboard and browser, rather relying on assistive technologies like screen readers.

Providing accessible content not only ensures broad access for all learners but also helps to provide good instructional design.

http://hdlrn.edu.au/verve/_resources/Accessibility_specification_for_content_development.pdf

METADATA – TO ENHANCE DISCOVERY

Metadata provides a description of an item and improves discoverability. Metadata helps to ensure teachers and students can find relevant digital resources via educational concepts. Quality metadata allows educators to organise digital resources into useful categories. It also allows resources to be easily identified in content management systems and education portals.

The guide is provided at: http://hdlrn.edu.au/standards_for.digital_resources/metadata/guide.to.metadata.html

WHERE TO NEXT?

The Primary Industries Education Foundation is an important conduit for educational materials developed for agricultural education and training;

Source: Education Services Australia