REPORT TO
AUSTRALIAN COUNCIL OF LEARNED ACADEMIES
(ACOLA)

20 JUNE 2014

AUSTRALIA’S
COMPARATIVE
ADVANTAGE

IN AGRICULTURE – FINAL DRAFT
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ACIL ALLEN (2014) AUSTRALIA’S COMPARATIVE ADVANTAGE IN AGRICULTURE

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1 Introduction

1.1 Purpose

The Australian Council of Learned Academies (ACOLA) commissioned ACIL Allen Consulting to prepare a report on Australia’s Comparative Advantage in Agriculture.

This report has been prepared for the “Australia’s Comparative Advantage” (ACA) project, which is part of a broader “Securing Australia’s Future” (SAF) project currently underway under the direction of ACOLA. The SAF project will deliver research-based evidence and findings to support policy development for the transitioning Australian economy. The project aims are relayed below:

“This multidisciplinary research program will identify Australia’s unique strengths and comparative advantages; establish which contexts and policy settings encourage creativity, adaptability and innovation; and explore the natural, social, geographical, economics, cultural and scientific attributes and capabilities needed to thrive as a nation”.

The first report prepared for ACA was a compendium of existing reports with the aim of generating a stocktake of work already done and identifying any gaps to help define the scope for the upcoming projects (ACOLA, 2013). There were four main findings:

1. There is an imbalance in the coverage of topics
2. Most reports are narrow in scope and in the range of methodologies employed. Plus they vary considerably in terms of purpose, complexity and advocacy role.
3. Most reports emphasise the importance of emerging global mega-trends likely to shape Australia’s competitive and social landscape over the next few decades.
4. The reports call for Australia to play to its strengths and comparative advantages but these strengths are identified by anecdotal and subjective factors than by objective analysis and evidence.

The last finding was the most significant one and a focal point for the forthcoming ACA projects.

The aim of this report is to objectively and evidence based identify Australia’s strengths and comparative advantages in agriculture and establish which contexts and policy settings will best ensure the future of Australia’s comparative advantage.
1.2 Australian agriculture’s comparative advantage

The agricultural sector is a long standing Australian industry that was established on the opportunity of developing the nation’s natural resources to produce food and fibre for domestic and export markets. As with many developed countries agriculture’s relative contribution declined during the last century as other sectors in the Australian economy grew and global agricultural production increased. There has also been decline in Australian agriculture’s terms of trade, which is a long-term trend that is unlikely to change.

None the less agriculture remains an important part of Australia’s society and economy.

In recent times perception has shifted from agriculture being a sunset sector to one of renaissance in light of continued increasing global demand for food and fibre. This has led to a renewed interest in understanding the basis of Australia’s comparative advantage in agriculture to identify opportunities for businesses and strengthen government policy.

Two recent national initiatives illustrate different but linked approaches to considering and focusing collaborative effort to secure Australia’s comparative advantage in agriculture – the National Blueprint for Australian Agriculture and the Agriculture Competitiveness White Paper. Both initiatives reflect long-standing concern that Australian agriculture may decline and desire to implement a coherent approach to realising future opportunities. The initiatives build on previous reviews and initiatives which highlight that agriculture must be profitable, productive, sustainable and competitive to be successful. A central concept is that comparative advantage is based on a number of elements that are combined to provide advantage. The comparative advantage is relative and unlikely to be absolute over time. Rather they are influenced by current and future drivers. Industry and government need to adapt the elements of comparative advantage to these drivers to continually improve and involve agriculture.

In February 2013 the National Farmer’s Federation published a National Blueprint for Australian Agriculture to build a vision for the sector to 2030.

The Australian agriculture sector is a world leader in providing high quality food and fibre for a global population using innovative technologies and sustainable natural resource management. It is productive, profitable, innovative and valued for its environmental, economic and social contribution to Australian life.


The Blueprint was developed through extensive consultation across the sector and identifies drivers that influence agriculture and a number of themes where action is need to realise the vision. The drivers were divided into world drivers that will influence the world and issues that have the potential to significantly transform agriculture that the sector should keep on its radar (Table 1). These drivers were used to establish seven themes where Australian agriculture needs to succeed to realise the vision (Table 2).

In February 2014 the Minister for Agriculture released an issues paper as the first step towards the Australian Government’s commitment to developing a White Paper “that will ensure that agriculture, as one of the five pillars of our economy, realises its full potential through innovation, productivity, investment and trade”. (Commonwealth of Australia, 2013). The paper seeks views on nine issues that affect the competitiveness of Australian agriculture (see Table 3).

This report can be found at www.acola.org.au © Australian Council of Learned Academies
### Table 1  Future drivers and issues influencing Australian agriculture

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<thead>
<tr>
<th>World drivers that will influence agriculture</th>
<th>Issues that could transform agriculture</th>
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<tr>
<td>• Strong population growth, with continued urbanisation of that population</td>
<td>• Changes to population growth estimates, as shown by leading indicators such as fertility rates and longevity technologies</td>
</tr>
<tr>
<td>• Significant climate change effects</td>
<td>• Climate change</td>
</tr>
<tr>
<td>• High levels of price volatility</td>
<td>• New technology developments that could impact on labour, such as robotic technology development</td>
</tr>
<tr>
<td>• Significant challenges in the availability and skills of labour</td>
<td>• New technology developments that could impact on production, such as human genomics, laboratory production of meat, 3D printing of food</td>
</tr>
<tr>
<td>• Sufficient telecommunications availability for business processes</td>
<td>• Reduction in government support for research and development.</td>
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<tr>
<td>• A significant requirement for R&amp;D investment to meet the challenges ahead</td>
<td>• Cultural changes influencing eating habits related to animal protein</td>
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<tr>
<td>• Tight profit margins in the sector</td>
<td>• Economic growth and volatility (e.g. a prolonged period of instability and poor growth)</td>
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<td>• Continued high levels of trade restrictions</td>
<td>• Urban farming</td>
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<td>• Low impacts from foreign ownership, urban farming, changes to customer cultural values, and demand for biofuel</td>
<td>• The impact of policy, regulation and legislation.</td>
</tr>
<tr>
<td>• Significant uncertainty around economic growth, energy costs, farm ownership structures, and consumer attitudes to natural versus technologically enhanced production and products</td>
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Source: (National Farmer’s Federation and Sefton & Associates, 2013)

### Table 2  What would success look like for the Blueprint themes?

**Theme 1: Innovation and RD&E**  
Food and fibre RD&E is enjoying increased levels of real government and private investment and an increase in the share of the total RD&E spend. Due to a strong focus on the adoption of research outcomes the sector is embracing proven biotechnologies.

**Theme 2: Competitiveness**  
Australian agriculture has a reliable supply chain and access to critical infrastructure. Access to advanced telecommunications is driving adoption of new technologies and practices. Along with improved availability of capital (foreign and domestic) and shifts in ownership models, the industry has become more highly competitive in global markets.

**Theme 3: People**  
Australian agriculture accesses a flexible workforce with the right levels of skill to meet the demand for labour. Farmers are best practice employers and agriculture as a career is positively viewed. The industry has adapted to the challenge of a labour shortage through various methods, including improving labour efficiency, new technologies and different approaches to the workforce.

**Theme 4: Trade and Market Access**  
Australia has established and completed multilateral and bilateral free trade agreements with key growth markets and improved overall access to key global markets. Australian agriculture has also developed other innovative ways to access global markets.

**Theme 5: Agriculture with Society**  
Australian agriculture has built better understanding and closer links with the rest of society. Public understanding and trust of agriculture is high. The industry speaks with a clear voice on key issues, using appropriate technologies and mediums to reach audiences.

**Theme 6: Natural Resources**  
Australian agriculture has brought about genuine improvements in environmental, economic and social health through improved understanding of land and water use systems and the use of sustainability indicators for agricultural production. Farmers are receiving sustainable income streams for their work in environmental care.

**Theme 7: Transformational Issues**  
A flexible and innovative industry that adopts and exploits new technologies and responds swiftly and proactively to changes—expected or unforeseen.

Source: (National Farmer’s Federation and Sefton & Associates, 2013)
Table 3  Agricultural competitiveness issues

<table>
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<th>Challenges to global food production</th>
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<td>• The role of technology</td>
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<td>• Australia’s food security</td>
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<td>• The importance of trade</td>
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Farmer decisions for improving farm gate returns

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<td>• Learning from top performing farms</td>
<td>• Succession planning</td>
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<td>• Managing risks</td>
<td>• Marketing</td>
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<tr>
<td>• Business structure and management</td>
<td>• Drought, flood and fire management</td>
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<td>• Scale and diversity of production</td>
<td>• Social and environmental pressures</td>
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<td>• Productivity growth</td>
<td>• On-farm non-agricultural income</td>
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Enhancing access to finance

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<td>• Business structures</td>
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<td>• Debt</td>
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<td>• Alternative financing models</td>
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Increasing the competitiveness of the agricultural sector and its value chains

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<td>• Farmers’ proportion of final sale returns</td>
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<td>• Supermarket power</td>
<td>• Competition with other sectors</td>
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<tr>
<td>• Food processing competitiveness</td>
<td>• Competition with other countries</td>
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Improving the competitiveness of inputs to the supply chain

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<td>• Skills, training, education and human capital</td>
<td>• Energy</td>
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<td>• Research and development</td>
<td>• Water resources</td>
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<td>• Infrastructure to assist development</td>
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Reducing ineffective regulations

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Enhancing agricultural exports

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<td>• Competition from imports</td>
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<td>• Role of the biosecurity system</td>
<td>• Market information</td>
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<td>• Trade negotiations</td>
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Assessing the effectiveness of incentives for investment and job creation

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<td>• Government programmes</td>
<td>• Labour market programmes</td>
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<td>• Tax concessions</td>
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Source: Commonwealth of Australia (2014)

1.3  Approach

This report explores elements commonly cited as the basis of our comparative advantage:

1. Grow what they want (better than others)
   - Outlines what agriculture produces and how this relates to global markets
2. Relentless pursuit of productivity
   - Discusses trends, drivers and the importance of productivity to agriculture
3. Making the most of “nature’s gift of rich and rare”
   - Discusses the diversity of Australia’s agro-ecological and environmental stewardship
4. Extending the capital life cycles (infrastructure and finance)
   - Discusses the significance of shared infrastructure and access to finance
5. Rebranding from woeful to wonderful
   - Explores how perception and reputation influences agriculture and workforce
2 Grow what they want (better than others)

The agricultural industry is a $42.6 billion farm and fish production sector that is valued added to create a $91.2 billion processing and $135.8 billion retail sectors (Figure 1). Agriculture produces an additional $2.3 billion of cotton and $2.7 billion of wool fibres which are predominantly processed overseas.

The ability to produce a diverse range of food and fibre is not a source of comparative advantage in itself, despite the fact demand will increase in line with domestic and global population growth in the future. This is illustrated by significant changes the fibre sector where natural fibres are growing at a slower rate than synthetics, resulting in a reduced total market share. Similarly, increased food production and quality by international competitors and associated trade arrangements does guarantee not markets access or profitable prices. Rather Australian agriculture must offer commodities at globally competitive price or differentiated on the basis of quality. The prices for bulk commodities, from agriculture, mining or any other sector where Australia has a comparative advantage, will decline in real terms. This is because no single country has ever been able continually corner a market or extract monopoly rents from a commodity.

The challenges indicate that the future success of agriculture depends on growing not only what people want, but growing what people want better than others, be that on a price or quality basis. This chapter establishes where agriculture sits in the Australian economy and those areas where our produce has comparative advantage in the global market. Finally it looks at future demand for agrifood products and consumer preferences.

Figure 1 Value chain for food in Australia

Notes: represents the value chain in 2011–12, farm value excludes non-food production.
Source: Commonwealth of Australia, 2014 citing Australian Food Statistics 2011–12, Department of Agriculture, Fisheries and Forestry, Canberra.
2.1 Agriculture as a part of the Australian economy

Australia’s trade in goods continues to grow in value as is shown in Figure 2. In 2013, rural goods (including meat and meat preparations, wool and sheepskins, cereals and cereal preparations and other rural) accounted for 14 per cent of Australia’s exports. However, thirty years earlier, in 1983, rural goods accounted for 32 per cent of total exports. The value of rural goods has been increasing, but its share as a proportion of total goods exported has been decreasing. The export of minerals and fuels (included in Figure 2 under ‘non-rural good exported’) has been the largest growth export industry. In 2013 minerals and fuels accounted for 60 per cent of the value of total goods exported, whereas 30 years earlier it accounted for 38 per cent.

Figure 2 Value of Australia’s exports and imports of goods, 1971 – 2013

Australian agriculture is a competitive net agricultural exporter, with around 60 per cent of all produce exported. In 2011/12, agricultural exports (excluding fisheries, forestry and rubber) accounted for 13.8 per cent of Australia’s merchandise exports by value. Wheat, beef, dairy, cotton and wool are the major exports.

Figure 3 shows the value of Australian agricultural exports (fob) from 1998/99 to 2012/13. The value of grains and oilseeds exported has increased the most since 1998/99 by more than double, whilst the dairy sector has decreased.
In terms of the value of imports of agricultural products, over the years 2005/06 to 2012/13, dairy product imports have increased by nearly 60 per cent to $689 million. This was namely cheese imports, accounting for $388 million (up by 28 per cent). Looking specifically at cheese in terms of quantity, imports rose from 50,800 tonnes to 73,550 tonnes (or, 45 per cent) (ABARES, 2013).

The value of pig meat imports has also increased significantly, almost doubling to $514 million over the same time period (ABARES, 2013). In terms of quantity, in 2005 162,300 tonnes of pig meat was imported which had risen by 83 per cent in 2012 to 296,400 tonnes (ABARES, 2013). Figure 4 shows the value of Australian agricultural imports over the years 2005/06 to 2012/13. Imports of grains and oilseeds are mainly rice and canola, and other consists largely of substantially and elaborately transformed foods.

On a State and Territory basis, Figure 5 shows the value of agricultural commodities produced in Australia in 2011/12. In total agriculture contributed more than $45 billion to the Australian economy in 2011/12. The eastern coast states contributed the most, with Queensland, NSW and Victoria all contributing $10 billion or more each. While significant
the total value of production is relatively small compared to competitors. For example the farm gate value of production of Iowa in the United States is $15 billion annually (Noonan, 2014).

In Victoria, $4.8 billion came from the growing of crops, with $1.2 billion from wheat and canola crops alone. The other major area was livestock products ($3.3 billion), with milk products contributing $2.5 billion and wool $671 million.

In NSW crops again were the biggest value area ($6.1 billion), with wheat contributing $1.6 billion and cotton $1.4 billion. This was followed by livestock slaughter ($3.1 billion), with cattle and calves contributing $1.6 billion and poultry $656 million.

Although the Northern Territory had the smallest value contributed, the composition of where that value came from was very different to the rest of the country. The NT derives around 22 per cent of its value from the growing of fruit and vegetables, namely melons and mangoes.

Figure 5  Value of agricultural commodities produced, 2011/12

Source: (ABS, 2013)
2.2 Australian agriculture in the global economy

Australian agriculture has some strong export commodities when compared with the amount of product exported by the rest of the world. Figure 6 shows Australia’s export volume of wheat, cotton, wool and rapeseed for 2012/13. Wool in particular is one commodity where Australia dominates the export market, accounting for 65 per cent of world trade in 2012/13. The major market for wool is China, taking close to 80 per cent of Australia’s exported wool in 2012/13.

Figure 6 Australia’s exports of selected grain, fibre and oilseed, 2012/13

Note: The numbers in the purple section represent the total ‘000 tonnes of produce exported by Australia. Cotton is measures as ‘000 tonnes of 480lb bales.
Source: (ABARES, 2013) (USDA, 2014)

Figure 7 shows export volume figures for commodities in the live animal, meat, horticulture and dairy products sectors. Australia exports significant amounts of live cattle, beef and veal meat and milk when compared with total world exports. Shelled almonds have been an interesting category over the years. Up until 2001/02 there were no almonds exported from Australia. Since then exports have grown rapidly from 2,500 tonnes in 2001/02 to 40,000 tonnes in 2012/13, now accounting for six per cent of world exports.
Figure 7  Australia and the world’s exports of selected live animals, meat, horticulture and dairy products, 2012/13*

![Graph showing exports of selected live animals, meat, horticulture and dairy products]

Note: *Dairy products are for calendar year 2013, whilst livestock and meat for calendar year 2012. The numbers in the purple section represent the total ‘000 tonnes of produce exported by Australia, live cattle units are ‘000 head.
Source: (USDA, 2014)

2.3 Future demand and consumer preferences

The Australian Government reports that Australia’s population will grow to around 35.9 million by 2050 (Australian Government, 2010), an increase of 12.4 million from today. This, coupled with increasing consumption per capita, will see a greater demand for domestic and imported agricultural goods. Currently Australia exports approximately 60 per cent of what is grown (NFF, 2012). Figure 8 shows the consumption of meat per person since 1980. Overall, it can be seen that total consumption of the four main meat groups has increased from 100.7kg per person to 112.4kg. Over this time poultry meat and pig meat have increased their share, whilst lamb and mutton consumption has halved and beef and veal has decreased by close to 30 per cent. It is predicted that in the short to medium term pig and poultry meat will continue to increase in demand, chicken in particular (ABARES, 2013).

Figure 8  Apparent meat consumption per person, 1980 – 2012 (kg)

![Graph showing meat consumption per person]

Source: (ABARES, 2013)
Other products such as milk and wheat consumption have been increasing also. Milk consumption per person in 2012/13 was 107 litres, 3.5 per cent higher than in 2006/07 (ABARES, 2013). Domestic use of wheat, for human and industrial, was 2.5 million tonnes in 2011/12, around 11 per cent higher than in 2006/07 (DAFF, 2013).

Globally as the population increases and the number of middle class people grows there will be greater demand for food. Rising incomes demand more meat and processed foods rather than traditional staple grains. ABARES modelling indicates that over the period 2007 to 2050, the real value of world agrifood consumption may increase by 77 per cent or 1.3 per cent annually (Linehan, Thorpe, Andrews, Kim, & Beaini, 2012). Consumption is projected to increase most strongly for meat, fish, fruit and vegetables and dairy products; an annual average value growth rate from 2007 to 2050 of 1.7 per cent for meat, 1.7 per cent for fish, 1.2 per cent for fruit and vegetables, and 1.1 per cent for dairy products. In terms of world food imports, an average value increase of 2.3 per cent per annum is projected. For Australia, it’s projected that exports are likely to increase most strongly for beef, wheat, dairy products, sheep meat and sugar, and overall.

The drive in global demand for food is expected to come from Asia, modelling has Asia accounting for 71 per cent of the rise in the real value of agrifood demand. In particular, it’s projected that China will account for 43 per cent of the increased demand, India 13 per cent and the rest of Asia the remainder. Given this, Australia’s geographic proximity and comparative advantage in many of these products, Australia is well placed to take advantage of this demand growth.

2.4 Agricultural produce SWOT analysis

The demand for agricultural goods will increase through population growth and rising standards of living within Australia and overseas. Australia agriculture has a diverse base to service the demand, particularly in grains, dairy, oil seeds, wine, aquaculture and wool where it has prominence. None the less productivity gains are crucial to offset continually declining terms of trade for commodities and to ensure differentiated and value added goods are competitive which are discussed in the next chapter.

Table 4  Grow what people want (better than others) SWOT

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can grow for export and domestic markets</td>
<td>Commodity rather than value added focus</td>
</tr>
<tr>
<td>Established player in key markets</td>
<td>Domestic lacks scale/growth opportunities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing demand for agricultural commodities</td>
<td>Increased global production and competition</td>
</tr>
<tr>
<td>Greater value adding/differentiated produce</td>
<td>Processing moves/remains overseas</td>
</tr>
</tbody>
</table>

Source: ACIL Allen Consulting, 2014
Productivity growth is the main mechanism that allows Australian growers to remain competitive in the international market. It has underpinned Australia’s agricultural performance and will remain important into the future, especially in the face of some of the issues mentioned in Table 1 and Table 3 (see chapter 1) such as climate change and water and land resources.

This chapter looks at Australia’s productivity growth amongst different sectors of the agricultural industry and internationally, and then explores where some of this growth may be attributed to by looking at agricultural policy with respect to assistance, trade and R&D. It finished by detailing examples of prior productivity policy and potential opportunities for the future.

3.1 Agricultural productivity growth

Productivity growth has been a key driver of Australia’s agricultural output; two thirds of the current real value of Australia’s output can be attributed to growth since the early 1950’s (Sheng, Mullen, & Zhao, 2010) (Mullen & Crean, 2007). However it appears that broadacre productivity growth, that is non-irrigated cropping and extensive livestock industries, has been slowing which is a concern for Australia’s export competitiveness. Sheng, Mullen and Zhao (2011) investigated this and concluded that a significant structural change in total factor productivity (TFP) had occurred in the mid-1990’s. Overall TFP has trended upwards since 1952/53 to 2006/07, averaging approximately two per cent a year. In 1999/2000 though there was a divergent downward trend where a decreasing rate of 1.7 per cent has been experienced. It was suggested that this downturn was due to a combination of adverse seasonal conditions and stagnant public R&D since the late 1970’s.

Nossal and Sheng (2010) earlier took at an in-depth look at broadacre TFP, breaking it down for cropping, mixed crop and livestock, beef and sheep enterprises over the period 1977/78 to 2007/08. The TFP growth rates and the output and input rates that make up the TFP number are shown in Table 5. Cropping enterprises have experienced the greatest productivity growth, driven by high output growth and minimal input growth. Mixed crop-livestock and beef enterprises have experienced similar TFP growth, but for opposite reasons; beef enterprises have seen strong output growth whereas mixed crop-livestock have decreased inputs. Sheep enterprises have been the poorest productivity performers with a TFP growth rate of 0.3%; input growth has been the lowest out of all the specific enterprises but there has been negative output growth.

---

1 Total factor productivity (TFP) is a ratio of a measure of total output to a measure of multiple inputs used in the production process.
Table 5  Average annual growth of broadacre agriculture, 1977/78 to 2007/08

<table>
<thead>
<tr>
<th></th>
<th>TFP growth (%)</th>
<th>Output growth (%)</th>
<th>Input growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total broadacre</td>
<td>1.4</td>
<td>0.8</td>
<td>-0.6</td>
</tr>
<tr>
<td>Cropping</td>
<td>1.9</td>
<td>2.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Mixed crop – livestock</td>
<td>1.4</td>
<td>-0.1</td>
<td>-1.6</td>
</tr>
<tr>
<td>Beef</td>
<td>1.5</td>
<td>1.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Sheep</td>
<td>0.3</td>
<td>-1.5</td>
<td>-1.7</td>
</tr>
</tbody>
</table>

Source: (Nossal & Sheng, 2010)

Comparing Australia with the rest of the world is difficult due to differences in methods, data and time periods under analysis. The most recent analysis of international agricultural productivity in Australia has been prepared by Nossal and Sheng (2013). Their study developed an internationally consistent data series for agricultural productivity in Australia and two key competitors, the United States of America and Canada. To develop a TFP index the main outputs analysed included grains and oilseeds; fruit, nuts and vegetables; other crops such as tobacco cotton and sugar; livestock including dairy and wool; and on farm activities and services such as packaging, processing, land lease and contract services. On the inputs side; land; capital; labour; and intermediate materials and services such as electricity, livestock purchases, repairs and maintenance, and veterinary services were analysed.

Figure 9 displays the TFP levels for Australia, Canada and the United States over the period 1961 to 2006. Growth in the United States has been more rapid than in Australia and Canada, averaging 1.8 per cent per annum in comparison to Australia at 1.6 per cent and Canada at 1.2 per cent per annum. Although Australia has a higher growth rate than Canada, Australia has not yet exceeded Canada’s total level.

Breaking Figure 9 into five approximate ten year time periods allows us to see how the broad growth trend has moved over time for each country (see Figure 10). Each country has had its periods of higher growth; Australia was well above the others in the 70’s and 90’s, whilst the US was in the 60’s and 80’s. Most recently Canada has experienced a rapid average growth rate of 3 per cent and Australia has entered negative growth at 0.3 per cent. This negative growth is in line with the downturn being reported in the broadacre agriculture sector in Australia, but given the recent short term estimate that it is (2000-2006) it may not
represent a fundamental shift in productivity but rather a random deviation (Nossal & Sheng, 2013).

Figure 10  Agricultural total factor productivity (TFP) levels, 1961 - 2006

Source: (Nossal & Sheng, 2013)

The USDA have also compiled their own data set of internationally comparable agricultural productivity data; again using all sectors of agriculture. The countries shown in Figure 11 were selected for their competitive relativeness to Australian agriculture, and shows how Australia’s productivity performance has been relatively lacklustre in comparison to traditional competitors and new competition in South America and Eastern Europe.

Figure 11  Agricultural total factor productivity (TFP) levels, 1961 - 2010

Note: 1961 = 100
Source: (USDA, 2013)
Box 1  **Australian cotton industry**

Cotton in Australia is grown in NSW and Queensland as an irrigated crop. On a global comparison, Australian growers are excellent at producing high cotton lint yields. In 2008/09, Australia recorded cotton lint yields of 1.86 tonnes per hectare, approximately two and a half times the global average. On the world export market in 2012/13, Australian cotton accounted for more than 10 per cent of total exports, similar to wheat exports (see Figure 6).

In terms of inputs, Australian growers have been working on increasing water efficiency and decreasing the use of pesticides. On a global level, Australian cotton growers are three times more water efficient than the global average, having doubled their water efficiency over the past 10 years through a combination of better water monitoring and irrigation scheduling, evaporation control and improved irrigation practices. The industry target is to double water efficiency again within the next five years. In terms of pesticide use, over the past 10 years the cotton industry has reduced its use by over 87 per cent through the implementation of biotechnology and integrated pest management practices.

Source: (National Farmers Federation, 2012)

### 3.2 Agricultural support and trade policy

One of the reasons Australian farmers are so efficient is due to the low levels of financial support and protection or other trade-distorting practices they receive from the Government. Since the 1970’s the Australian Government has worked to decrease tariff and other assistance measures, such as price supports, input subsidies, tax incentives and credit measures on agricultural and food products. This has kept the competitive pressure on producers, and encouraged them to find innovative ways of increasing production and decreasing costs. Today, the simple average applied tariff on agriculture is 1.4 per cent (Department of Foreign Affairs and Trade, 2014).

Figure 12 shows producer support estimates (subsidies) for OECD countries as a percentage of gross farm receipts for 2012. Australian farmers are among the most self-sufficient in the world, with a low support level of 2.7 per cent. The average producer support of the countries shown in the figure below is 26.4 per cent, or more than a quarter of gross farm receipts.

Source: (OECD, 2013)
Open trade policies and increased market access have also benefited Australian agriculture through greater access to cheaper farm inputs and a wider variety of inputs, plus broader trade markets to sell produce in.

### 3.3 R&D policy

The majority of funding for agricultural R&D in Australia comes from Government, with private R&D expenditure accounting for around a quarter (see Figure 13). The level of Government funding for R&D is similar in Canada as it is in Australia, however in the United States private expenditure on R&D accounts for the largest amount (Nossal & Sheng, 2013).

**Figure 13** Public and private R&D expenditure in Australia and the US

<table>
<thead>
<tr>
<th></th>
<th>Australia AUD$1.5b</th>
<th>US USD$11.1b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State R&amp;D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private R&amp;D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Data in own currency for most recent year, Australia 2008/09 and US 2006.

Source: (Nossal & Sheng, Cross-country Comparisons of Agricultural Productivity: An Australian perspective, 2013)

Figure 13 also displays the difference in the total expenditure on R&D in Australia and the US. R&D expenditure in the US is around seven times bigger than expenditure in Australia. This is one of the comparative advantages of the US over Australia, the larger size of their economy, more than 10 times the GDP of Australia’s, gives them greater capacity for R&D (Nossal & Sheng, Cross-country Comparisons of Agricultural Productivity: An Australian perspective, 2013). Aside from R&D capacity, the size of their economy also gives them the comparative advantages of greater gains from specialisation and scale and greater domestic consumption.

Due to this smaller capacity for R&D, Australia relies on international research spillovers. It is estimated that public agricultural R&D expenditure in the US could account for up to a third of long-term productivity growth in Australian broadacre agriculture (Sheng, E, Mullen, & Davidson, 2011).

R&D policy has been an important driver of productivity growth for Australian agriculture, and we have a well-established R&D sector, albeit smaller than others. It is estimated that productivity growth from Australia’s public R&D expenditure is around 17 per cent for
broadacre agriculture, and that extension efforts add another 14 per cent (Sheng, E, Mullen, & Davidson, 2011).

However, as Sheng, Mullen and Zhao (2011) indicated, public R&D in Australia has been in slow down since the late 1970s. Real public R&D investment in Australian agriculture grew at an average rate of 6.5 per cent per annum from 1953 to 1980, but from then till 2007 has fallen to an average growth rate of 0.6 per cent. In terms of agricultural research intensity, a ratio of investment to the gross value of production, investment peaked at five per cent in the late 1970’s and since then has fallen to be approximately three per cent in 2007.

3.4 Australia’s public R&D model

Australia has a sophisticated rural R&D model (see Figure 14) consisting of:

— 15 rural Research and Development Corporations funded by industry levies and matching Commonwealth contributions
— State Departments of Agriculture providing R&D and field services
— Agribusiness research and field services
— Industry representative body field services
— CSIRO and universities, and
— R&D by private and public organisations

The $1.5 billion of annual public investment is based on the principle that the level of investment would be sub-optimal if left to individual agricultural producers. The market failure arises primarily because of the existence of unpriced spill overs, risk and indivisibility.

Figure 14  Rural R&D investment framework

Source: (GHD, 2010)
R&D is widely agreed to be one of the key drivers of Australia’s comparative advantage and has generated significant gains for all agricultural industries to date.

There is a high level of support for public investment in rural R&D but on-going concern about the way it is organised and declining public funding (Productivity Commission, 2011).

The concerns stem from an increase in the range and number of RD&E priorities at a time when providers are seeking economies of scale and scope to deal with rising costs and a real decline in public funding and access to national initiatives such as CRC and the now defunct Natural Heritage Trust. At the same time there are other concerns that public-funding crowds out private investment, public benefits are discounted over private benefits, and players in the model are cost-shifting, particularly on to the rural Research and Development Corporations.

In response the R&D Sub-committee of the Primary Industry Standing Committee instigated the National Primary Industries RD&E Framework to facilitate coordination across the model (see box below).

Box 2  Purpose of the National Primary Industries RD&E Framework

Innovation and RD&E are key drivers to improving productivity and competitiveness in the primary industries sector, and making best use of Australia’s natural resources under a changing climate.

The National RD&E Framework will facilitate greater coordination among the different Commonwealth, State governments, CSIRO, RDCs, industry and university sectors to better harmonise their roles in RD&E related to primary industries and assure that they work together effectively to maximise net benefits to Australia.

The National RD&E Framework supports a strong culture of collaboration and coordination between the bodies, strengthens national research capability to better address sector and cross sector issues and focuses research, development and extension (RD&E) resources so they are used more effectively, efficiently and collaboratively, thereby reducing capability gaps, fragmentation and unnecessary duplication in primary industries RD&E.

When the Framework is fully implemented, it is expected that research capability will become more collaborative, have larger critical mass, and will be less fragmented. Efficiency and effectiveness of RD&E will be markedly improved overall.

Agencies will retain and build capability in fields strategically important to their jurisdictions and industries. Over time, capability will be consolidated into stronger national centres or networks, and it will become more apparent where career prospects in a particular industry or field lie. Agencies may also exit capability in some areas not strategically relevant.

Source: (National Primary Industries RD&E Framework, 2014)

The box overleaf provides an example of how the national framework is being applied in the cotton industry to improve R&D.
Box 3  
**Cotton industry drivers**

Cotton’s success is completely dependent on holding a comparative advantage over alternatives in the regions where cotton is grown and there being a demand for lint grown. Demand for cotton is growing but at a much slower rate than man-made fibres, leading to a smaller share of the global fibre market. The decline is driven by relative price, supply continuity, and functionality of cotton to man-made fibres.

The price of cotton, as with many agricultural commodity exports, is volatile due to variable supply, stockpiles and demand interactions. In the long-run competition with other exporters and man-made fibres limit the ability to significantly increase the real price of cotton. Australia has led and supported a wide range of on-farm improvements, branding strategies and quality systems and environmental assurance frameworks to improve production and differentiate (Australian) cotton to meet consumer and market expectations. To date these approaches have been more successful in improving on-farm production and maintaining markets rather than securing a premium for Australian cotton.

In response the cotton industry developed a national cotton sector RD&E under the National Primary Industries RD&E Framework in 2010 to improve cotton RD&E coordination and effectiveness. The major cotton industry and research organisations established the Cotton Innovation Network to implement the strategy in 2012. Through systematic analysis and on-going dialogue the Network has identified the key cotton industry drivers to focus on and off-farm RD&E and improvements to the cotton research model (Table 6).

Table 6  **Key cotton industry and research drivers**

<table>
<thead>
<tr>
<th>Cotton markets</th>
<th>Cotton production</th>
<th>Cotton research model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing expectations driver</td>
<td>Generating enough wealth to attract people and capital</td>
<td>Research asked to address more and more problems</td>
</tr>
<tr>
<td>• Functionality central to cotton as fibre and product of choice</td>
<td>• Continually improving environmental stewardship</td>
<td>• Industry to fund increasing proportion of research</td>
</tr>
<tr>
<td>• Quality and ethical certification condition of entry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to grow driver</td>
<td>Maintaining comparative advantage over other crops</td>
<td>Public funding increasingly contested and contingent</td>
</tr>
<tr>
<td>• Emulating functionality of synthetics</td>
<td>• Attracting investment to expand growing regions</td>
<td>• Significant capacity to develop new partnerships</td>
</tr>
<tr>
<td>• Potential to provide more high quality cotton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managing variability driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cotton price fluctuations</td>
<td>• Climate variability and biosecurity risk</td>
<td>Core revenue streams vary with industry revenues</td>
</tr>
<tr>
<td>• Demand subject to fashion if cotton narrows to and “authentic” fibre niche</td>
<td>• Adapting to higher variability and uncertainty</td>
<td>Key public roles uncertain through long reform process</td>
</tr>
<tr>
<td>Getting more from less driver</td>
<td>• Core revenue streams vary with industry revenues</td>
<td></td>
</tr>
<tr>
<td>• Improved quality and ethical assurances increase costs and don’t influence the price of high quality cotton</td>
<td>• Less resource access and increasing competition</td>
<td>Demand to generate internal and collaboration efficiencies</td>
</tr>
<tr>
<td></td>
<td>• Maintaining yield growth and limiting input cost increases</td>
<td>• New methods, disciplines &amp; partners lifts performance</td>
</tr>
</tbody>
</table>

Source: ACIL Allen analysis of cotton industry sources, 2014

None the less the adequacy of the current model continues to be challenged around the level of public funding, improving efficiency and linking to international efforts in order to increase impact.
3.5 Labour trends

Farm gross product has increased at an average rate of three per cent over the years 1975/76 to 2012/13, at the same time the number of people employed in agriculture has been reducing by an average rate of one per cent per annum (see Figure 15). Whilst gross farm product value has been on a general upward trajectory, employment numbers were steady from 1975/76 through to 2000/01 until they dropped dramatically in 2001/02 and have been falling at an average rate of three per cent per annum.

Figure 15 Farm gross product and agricultural employment, 1975/76 – 2012/13

The agriculture, forestry and fishing industry can be broken down further, as shown in Figure 16. Agriculture, that is grains and livestock products, is the largest sub-division accounting for 87 per cent of employment (or 278,000 jobs).

The trend of reducing total labour inputs is due to climatic/market conditions, substituting labour for technology while maintaining access to migrant labour. The latter two are important to Australia’s comparative advantage given that, as a developed country, labour costs are higher than in many competitor countries. Australian farm labour input costs are significantly more than Canada’s and the United States (Nossal & Sheng, 2013). Part of this is due to the tight labour market in Australia and also Australia’s lack of access to a large migrant labour force as is available to the United States and to a lesser extent Canada.

Total labour inputs for Australian agriculture declined at an average rate of 2.5 per cent per annum from 1961 to 2006. In comparison, the rate for the United States was 2.2 per cent and for Canada 1.7 per cent (Nossal & Sheng, 2013). This decline shows a movement away from labour inputs that can be explained by improvements in labour quality (more educated and experienced workers), capital investment and technology.

The general trend in the number of people employed in agriculture has been decreasing worldwide. Figure 17 shows how the percentage of people employed in agriculture has fallen in all reported countries from 200/02 to 2010/12.
Figure 16  Employment break down for the agriculture, forestry and fishing industry, 2012/13

Source: (ABARES, 2013)

Figure 17  People employed in agriculture

Note: There is data missing for selected countries in 2010/12
Source: (World Bank, 2014)
### 3.6 Productivity policy

#### Table 7  
**Some examples of agricultural productivity policy and its implications**

<table>
<thead>
<tr>
<th>Productivity policy</th>
<th>What was achieved</th>
<th>What it hampered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single desk for wheat</strong>: a statutory marketing arrangement that was abolished in 2008</td>
<td>Meant that growers weren’t hampered in their efforts to adjust to changing market conditions by distorted price signals</td>
<td>Reduced incentives to improve quality or finding new ways to enter new markets. Stopped buyers from seeking specialist producers.</td>
</tr>
<tr>
<td><strong>Tariff reductions</strong>: initial cut in 1973 &amp; subsequent reductions from 1980s onwards</td>
<td>Lower farm input costs; thus productivity growth through input savings</td>
<td></td>
</tr>
<tr>
<td><strong>Financial sector regulation</strong>: removed restriction on entry of new banks and requirement to provide concessional interest rates for rural loans</td>
<td>Access to a greater range and variety of lending options</td>
<td>Grower’s ability to innovate through access to financial resources</td>
</tr>
<tr>
<td><strong>Water reforms</strong>: as a part of National Competition Policy</td>
<td>Increased productivity through a movement away crops that used a lot of water and for little return towards higher value horticultural crops. Improved environmental outcomes</td>
<td></td>
</tr>
<tr>
<td><strong>Dairy industry reform</strong>: removal of state based controls over sourcing and pricing of milk</td>
<td>Improved productivity through structural adjustment. Input &amp; output have trended down, but input has contracted more rapidly.</td>
<td></td>
</tr>
<tr>
<td><strong>Wool Reserve Price Scheme</strong>: placed a floor price on wool sales, abolished 1991</td>
<td>Stabilised future large movements in wool prices by stockpiling wool that did not meet the floor price for future sale.</td>
<td>Since its collapse changes in the composition of the sheep flock and land management practices have delivered significant productivity growth in comparison to earlier periods.</td>
</tr>
</tbody>
</table>

Source: (Gray, Oss-Emer, & Sheng, 2014)

Looking past the major reform initiatives of the past, Gray, Oss-Emer & Sheng (2014), discuss four opportunity areas where Government can positively impact productivity:

i) Facilitating structural adjustment and efficient resource use across farms

ii) Reducing unnecessary regulatory burdens and setting appropriate regulatory standards

iii) Investing in RD&E and an efficient agricultural innovation system

iv) Building human capital through improving labour availability and skills

Much of this is echoed by Nossal and Sheng (2013), who make two suggestions of reform areas that could aid productivity growth in Australian agriculture:

R&D efficiency and effectiveness could, among other ways, be improved by leveraging Australia’s small domestic capacity for rural R&D through harvesting greater international knowledge spill-ins. This includes accelerating access to advanced farm inputs and operating practices that can be adapted or directly applied. This could complement efforts to improve the efficiency of Australia’s rural R&D system by avoiding duplication and better utilising existing innovations (Alston, 2002) (Productivity Commission, 2011).

In addition, labour market reforms are potentially a high priority—labour is significantly more costly for Australian agriculture than for North America. In this regard, various commentators have highlighted labour market rigidities as constraining Australian businesses (Banks, 2010) (Eslake & Walsh, 2011). Reforms that improve flexibility in wage determination and recruitment and enable businesses to readily make organisational changes could yield...
productivity improvements for many rural businesses. In addition, improving access to skilled labour, including temporary and permanent migrant workers could also serve to improve agricultural productivity.

3.7 Productivity SWOT analysis

Improving productivity is central to Australia’s future comparative advantage in agriculture. Regulatory reform and public research have been critical to historical productivity gains, but there are signs that the rate of gain is declining as reforms and research slow. Future regulatory reforms need to focus on not only reducing regulatory burden, but also on ensuring the efficient allocation and use of the factors of production. The current R&D model will need to evolve in order to maximise the spillovers of emergent sciences and technologies, international research and private investment.

<table>
<thead>
<tr>
<th>Table 8</th>
<th>Relentless pursuit of productivity SWOT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>Mature R&amp;D model to drive innovation</td>
<td>Limited pipeline of productivity innovations and declining public R&amp;D investment</td>
</tr>
<tr>
<td>Comparatively low levels of assistance</td>
<td>Inflexible factors of production</td>
</tr>
<tr>
<td>Increasing labour productivity</td>
<td>Poor economies of scale and scope</td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>Renewal of rural R&amp;D model</td>
<td>Limited market access developments</td>
</tr>
<tr>
<td>Increasing international innovation spillovers</td>
<td>Slowing of economic/competition reform</td>
</tr>
<tr>
<td>Reducing policy and regulatory constraints</td>
<td>Crowding out of private domestic and international R&amp;D investment</td>
</tr>
</tbody>
</table>

Source: ACIL Allen Consulting, 2014
4 Make the most of “nature’s gift of rich and rare”

Australia has some unique, country-specific characteristics that have impacted upon the agricultural industry’s structure and natural comparative advantage. These include physical, climatic and geographic characteristics. This chapter looks at Australia’s diverse agro-ecology and the way this lends itself to particular comparative advantages in agriculture. There is a section on growth potential in the future with respect to expanding agricultural production.

4.1 Diverse agro-ecology

Australia has a diverse range of agro-ecological zones that allows us to produce many agricultural products. These zones are as a result of the interaction between seasonal rainfall and temperatures. Arable land and freshwater are the two main natural resources that dictate whether extensive or intensive agriculture is implemented. Australia’s vast landscape and diverse agro-ecology is the foundation of our comparative advantage in many different areas of agriculture.

Figure 18 show the division of Australia into 11 different agro-ecological zones. Although a large proportion of Australia (the ‘temperate semi-arid plains and arid interior dry slopes and plains’ region) is too dry for agricultural use other than extensive livestock grazing utilising native vegetation, the other regions allow for agricultural production from broad acre cropping and cotton production to dairy, wine production and horticulture.

Figure 18 Agro-ecological regions of Australia

Source: (Williams, Hook, & Hamblin, 2002)
The predominate agricultural land use in northern Australia, including the ‘semi-arid tropical and subtropical plains’ and the ‘wet/dry tropics’ regions, is extensive sheep and cattle grazing. Small patches of the ‘wet tropical coast and tableland’ region also support beef cattle grazing plus sugarcane and other intensive crops. There are four major irrigated areas; the Ord River Irrigation area, the Mareeba-Dimbulah Irrigation area, the Katherine-Douglas Daly area and the Burdekin Irrigation area. There are also many smaller scale irrigation enterprises, normally less than 100 hectares in size. In total there is approximately 114,000 hectares of land currently under irrigation across the northern Australia area.

The east coast sub humid subtropical slopes and plains are noted for mixed wheat, sheep and cattle farming with specialist irrigation farming of cotton. The subtropical highlands region is dominate in intensive grazing of sheep and cattle, as well as engaging in irrigated agriculture and horticulture in the Hunter and Peel River Valleys.

The wet temperate highlands region in the tablelands and mountainous areas of NSW and Victoria supports the grazing of sheep and cattle on improved temperate pastures for wool, lamb, beef and dairy products.

The southern wheat, sheep and cattle belt (temperate seasonally dry slopes and plains) extends from southern WA through to the Eyre Peninsula in SA and then into the Mallee and the Riverina plains of the Murray –Darling, finishing up in the Eastern Highlands. Irrigation farming and horticulture is significant around the Murray, Murrumbidgee and Goulbourn Rivers.

Australia overall receives annual average rainfall of 534 millimetres. In comparison to some of our major competitors this is significantly low (see Figure 19). More importantly Australia has much greater variability in rainfall and consequently higher operational risks than comparable countries. As a result water storage, effective management and capital depth are essential to profitable and sustainable agricultural production. Variable production also requires greater sophistication in the value supply chain ensure continuity of supply through storage and/or sourcing from multiple regions or countries.

Figure 19  Average annual rainfall, 2011

Source: (World Bank, 2014)
4.2 Land use

Although Australia has 761 million hectares of land available for agricultural use it’s important to note the location and quality of this available land. Only 3 per cent, or 25 million hectares is currently used for cropping or more intensive uses such as horticulture (Keogh, 2012). There are vast areas of arid and semi-arid land that are best suited to extensive grazing of cattle and sheep on native pastures.

There is an attitude that Australia has an endless supply of land and that should there be another use for the land agriculture can be pushed to the side. This notion is slowly changing as Governments are starting to recognise the importance of agricultural land and the need to classify and map it. NSW and Queensland Governments are currently working to manage the impacts of mining and coal seam gas on their productive agricultural lands, and as a part of this process Queensland has released the Queensland Agricultural Audit.

Relative to other countries, Australia’s agriculture is land intensive. Nossal and Sheng (2013) in their cross country comparison of Australian agriculture with Canada and the United States, showed that Australia has used around ten times as much land per unit of output over the most recent decade (see Figure 20). Australia has been using land more productively over time, as shown by the decreasing line in Figure 20, however the nation’s natural endowments do lend itself to a comparative advantage in extensive livestock grazing.

Figure 20  Land input intensity

![Land input intensity graph](image)

Note: US in 1961=100
Source: (Nossal & Sheng, 2013)

Growth potential

Section 2.3 established the growing demand for agrifood food products from the domestic and international market. The global demand for agrifood in 2050 is expected to double from 2005/2007 production levels; key commodities such as cereals would need to grow by one billion tonnes (from two billion tonnes) and meat production by over 200 million tonnes (from 270 million tonnes) (FAO, 2009). Although Australia is well positioned in terms of proximity
and comparative advantage to provide for this additional demand growth it is uncertain where it can come from. Already at this point in time the total value of China’s agricultural imports far exceeds the total value of Australia’s agricultural export; if all of Australia’s agricultural exports were to go to China they would only account for around one quarter of the value of China’s total agricultural imports.

There are three main ways that Australia can expand its agricultural production;

— Farming new areas of land
— Swapping out of low input, low production systems into high input, high production systems, and
— Producing more from less (essentially water use efficiency)

Australia’s 25 million hectares of land used for cropping or more intensive uses such as horticulture has been reasonably static for the past decade, however there is some potential for new land to be opened up in northern Australia and Tasmania. Northern Australia also has the potential of moving some low input, low production grazing systems to higher productivity through the use of irrigation for fodder crops (see section 7.3 Innovating and securing the industry’s future). So too Tasmania as more irrigation infrastructure is built to service existing and new agricultural land. These two developments do offer potential for expanding agricultural production, however, overall will probably only add an additional couple of per cent to agricultural area and water resources (Keogh, 2014).

Figure 21 shows the percentage of agricultural land in Australia and some of our major agricultural competitors. In most cases, agricultural land between the years 2000/02 and 2009/11 has stayed static or receded. Globally, the area of agricultural land has not changed over those years, sitting at 38 per cent.

As far as producing more from less with respect to water use efficiency, the volume of irrigation water used each year by agriculture has been falling over the last decade; since 2005/06 the volume of irrigated water use by agriculture has fallen from 10.7 million mega litres to 8.1 million mega litres in 2011/12 (ABS, 2013). Although the trends in water use
efficiency are positive, essentially the amount of water available for irrigation is currently in a state of hold and not growth.

The remainder of this section takes a closer look at northern Australia, Tasmania and the Murray-Darling Basin with respect to the potential of expanding agricultural productivity.

**Northern Australia**

Northern Australia’s groundwater resources are another source of water for irrigation. Estimates of renewable ground water suggest that there are approximately 600 gigalitres available across northern Australia (CSIRO, 2009). This volume of water could support around 40,000 to 60,000 hectares of irrigated agriculture.

There are four major irrigated areas in northern Australia; the Ord River Irrigation area, the Mareeba-Dimbulah Irrigation area, the Katherine-Douglas Daly area and the Burdekin Irrigation area. There are also many smaller scale irrigation enterprises, normally less than 100 hectares in size, operating across northern Australia. In total there are approximately 114,000 hectares of land currently under irrigation.

The Ord River Irrigation Scheme, located in the north of Western Australia, recently doubled in size to 29,000 hectares after a $322 million investment by the State Government. There is also potential for the further expansion of the Ord River irrigation area. There is a 14,000 hectare parcel of land in the Northern Territory with soils suitable for a range of broad acre crops and a further 30,000 hectares of land around and to the north of Kununurra in Western Australia that also has the potential for agricultural development.

The Burdekin Irrigation area in Queensland is Australia’s largest irrigated area, with approximately 80,000 hectares of land under irrigation. There is the possibility of hydroelectricity on the Burdekin Falls Dam if the wall were to be heightened and the extra water could be used for other potential agricultural developments and for mining.

There is potentially suitable soil for irrigated agriculture in northern Queensland that is currently constrained due to sufficient water. This land is around the Flinders and Gilbert River catchments. It is currently being evaluated for water capture and storage options and the commercial viability of opportunities as part of the preparation of the North Queensland Irrigated Agriculture Strategy.

**Tasmania**

Since 2011 the Australian and Tasmanian Government, along with contributions from private investors, has been significantly investing in irrigation infrastructure in Tasmania. Table 9 shows nine irrigation scheme developments since 2011, delivering significant volumes of water for irrigated agriculture. The aim of the projects is to provide water with a reliability of more than 95 per cent, and to mitigate against the impacts of drought and climate change.
Table 9  Recent irrigation scheme developments in Tasmania

<table>
<thead>
<tr>
<th>Irrigation Scheme</th>
<th>Status</th>
<th>Volume (ML)</th>
<th>Irrigable area (ha)</th>
<th>Other comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headquarters Road Dam</td>
<td>Completed 2011</td>
<td>1,980</td>
<td>1,800</td>
<td></td>
</tr>
<tr>
<td>Whitemore</td>
<td>Completed 2011</td>
<td>5,500</td>
<td>12,000</td>
<td></td>
</tr>
<tr>
<td>Sassafras-Wesley Vale</td>
<td>Completed 2011</td>
<td>5,460</td>
<td>10,000</td>
<td>Services around</td>
</tr>
<tr>
<td>Winnaaleah Augmentation</td>
<td>Completed 2012</td>
<td>3,700</td>
<td>4,500</td>
<td>Services around</td>
</tr>
<tr>
<td>Lower South Esk</td>
<td>Completed 2013</td>
<td>5,300</td>
<td>41,000</td>
<td>Services between</td>
</tr>
<tr>
<td>Midlands Water Scheme</td>
<td>Completed 2014</td>
<td>38,500</td>
<td>55,484</td>
<td>Service between</td>
</tr>
<tr>
<td>Kindred North Molton</td>
<td>Completed 2014</td>
<td>2,500</td>
<td>8,485</td>
<td>Enable development</td>
</tr>
<tr>
<td>Upper Ringarooma</td>
<td>Completion 2015</td>
<td>5,700</td>
<td>10,177</td>
<td>Enable expansion, avoid contraction</td>
</tr>
<tr>
<td>South East</td>
<td>Completion 2015</td>
<td>3,000</td>
<td>5,780</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Tasmanian Irrigation, 2014) (Department of Environment, 2014)

In 2011/12, the ABS (2013) reported the area of irrigated land in Tasmania at 84,293 hectares and using 192,035 mega litres of water.

**The Murray-Darling Basin**

The Murray-Darling basin covers an extensive area of land over four states, as shown in Figure 22. It is considered Australia’s most important agricultural area, producing around a third of Australia’s food supply and supporting over a third of Australia’s total gross value of agrifood production. It is also the centre for irrigated agriculture, accounting for two thirds of all irrigated land in Australia (ABS, 2013).

Figure 22  Murray-Darling catchment location

Source: http://upload.wikimedia.org/wikipedia/en/d/de/Murray-catchment-map_MJC.png

Large scale irrigation in the Murray Darling Basin began in the 1880’s and since then has grown significantly. However today it’s accepted that the basin is now over allocated, and thus water is being re-allocated to the environment to strengthen the ecological functioning of the river systems. This is driving the need for infrastructure investments for more efficient
use of water and the updating of measurement and delivery systems to conserve water and ensure its future availability. Water use for irrigated agriculture in the Murray-Darling Basin was at 5.9 million mega litres in 2011/12, down from 7.4 million mega litres in 2005/06 (ABS, 2013).

In 2012, the NSW Government received $500 million in funding from the Commonwealth Government for major water infrastructure projects across the State. The four State priority projects include:

- The Basin Pipe Project to replace wasteful replenishment systems, open drains, channels and dams with pipeline schemes to provide farmers with more secure, better quality supplies of stock and domestic water
- NSW Metering Project to install or upgrade meters for regulated and unregulated rivers and ground water sources
- Irrigated Farm Modernisation Project to invest in management, information and technological farm infrastructure to improve water use efficiency, water savings, and increase water related productivity in irrigated farming systems, and
- The Healthy Floodplains Projects to reform the management of water on floodplains through the modification of floodplain structures and extraction control (NSW DPI, 2013).

4.3 Biosecurity and stewardship

Australia has a clear advantage in global markets when it comes to our relatively pest and disease free status. The absence of significant pests and disease, such as Foot and Mouth Disease (FMD) and Bovine Spongiform Encephalopathy (BSE or “Mad Cow”), allows Australia favourable market access.

There have been several studies into the impacts of a FMD outbreak, with the costs estimated upwards of $17.3 billion. The Centre for International Economics (2010) estimated the cost of a one year outbreak at $18 billion. This assumed full export market closure for the year, with recovery taking between 2 to 4 years. Market access losses represented 90 per cent of total losses. The Productivity Commission (2002) estimated losses of $17.3 - $20 billion (2012/13 dollars) over ten years with 75 per cent of this cost due to market loss. Most recently, ABARES estimated a large outbreak to cost $23.6 billion over ten years. This higher cost reflective of a longer time out of the market and a greater loss of market share based on data from overseas FMD outbreaks and Australia’s experience with other livestock diseases (Buetre, et al., 2013).

On top of this, Australia has a “clean and green” status. This is driven by the image of our beautiful, pristine environments where agriculture occurs and also by traceability and accountability of our products. An example of traceability and accountability in our livestock markets is the National Livestock Identification System and in our grains markets the Maximum Residue Limits for chemicals on out turned grain for domestic and export markets.

Australian farmers are responsible for a massive 61 per cent of Australia’s land mass and go to great effort and expense to care for it. Examples of this care are;

- Controlling wild animals, pests, weeds and disease. As an example, in 2009 the cost to agriculture of controlling wild dogs, rabbits, foxes, pigs, pest birds and mice was estimated at $745 million (DAFF, 2012)
- Caring for the land by using tilling practices that minimise land disturbance, help to control erosion, and conserve carbon in the soil; over the period 1974/75 - 2004/05 70
per cent of farmers had adopted both direct drilling and minimum tillage practices (OECD, 2008), and

— Australian farmers have set aside 9.2 million hectares, of the 417.3 hectares that they manage, for conservation/ protection purposes (ABS, 2010)

In terms of stewardship, animal welfare is becoming an increasingly prominent and emotionally charged issue in addition to the environment. As community values heighten animal welfare represents a major business and industry risk if not dealt with earnestly and proactively (Agrifood Skills Australia, 2014). Model Codes of Practice for the Welfare of Animals have supported livestock industries for the past 20 years. These will need to provide unambiguous standards that are consistently mandated and enforced to sustain livestock industries into the future.

4.4 Natural resources SWOT analysis

Australia has a diverse range of natural resources and climates that allow the nation to produce a wide range of different agricultural goods. The ability to produce many goods over an extended season provides a source of comparative advantage for some fresh foods. Physically there is limited potential to geographically expand agricultural production or develop new water resources and in many areas these will decline due to greater competition (e.g. urbanisation) or reduced access (e.g. higher environmental water allocations). Therefore future growth will mostly come from improving or substituting production systems.

Australia has comparatively high biosecurity and stewardship standards. However greater effort is needed to develop new products and markets off these feature and to ensure that the associated standards continue to evolve to meet societal, government and market expectations.

Table 10 Natural resources SWOT

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to grow a diverse range of produce</td>
<td>Biosecurity system effectiveness reducing due to lower investment and capability</td>
</tr>
<tr>
<td>Ability to extend fresh supply by growing horticulture produce in different zones</td>
<td>Cannot economically compete for land use</td>
</tr>
<tr>
<td>Disease and pest free status and clean-green image</td>
<td>Diversity of produce increases competition and inhibits industry development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build on disease and pest free status and clean and green image to gain market access and develop differentiated products</td>
<td>Loss of production systems and markets due to animal welfare concerns</td>
</tr>
<tr>
<td>Greater use of S&amp;T and controlled agriculture to minimise environmental impact and natural resource use efficiency</td>
<td>Introduction of new diseases and pests</td>
</tr>
<tr>
<td>Environmental stewardship obligations increases costs</td>
<td>Reduced access to natural resources</td>
</tr>
</tbody>
</table>

Source: ACIL Allen Consulting, 2014
Extending capital life cycles (finance and infrastructure)

Capital, including finance and infrastructure, are inputs into the farming system and supply chain that need to be cost-efficient and in the case of infrastructure also time-efficient to keep Australian agriculture competitive.

Enhancing access to finance features in the nine agricultural competitive issues under the spotlight for the development of the White Paper (see Table 3). Grower’s ability to cost-effectively finance their business impacts their ability to innovate and expand their business operation, which in turn impacts productivity. Infrastructure features in the competitive issues too, under improving the competitiveness of inputs to the supply chain. Reliable, efficient infrastructure is important to ensure agriculture’s productivity growth can get to market.

This chapter examines finance capital and the requirements of the agricultural industry, plus the infrastructure challenges.

5.1 Finance

The majority of Australian farming businesses are financed today the way they have been in the past; by farming families using their accumulated capital, mainly land, as security to obtain finance from banking institutions. Although alternative financing models are available, not many are seen in Australian agriculture.

Most farming businesses are structured as family partnerships, accounting for 67 per cent of business structures, followed by trusts at 21 per cent and the remainder as companies (Clark & O’Callaghan, 2013).

Headline data for Australian farm business debt shows that debt levels have increased significantly over the past two decades, however in the context of average farm sizes increasing and debt levels of the economy as a whole the situation is not as dramatic as it first appears.

The number of farm businesses has declined considerably over the past 30 years and as a consequence the average size of farms has increased, this has been seen most in the cropping and dairy farm businesses. Correcting average farm debt data to a per hectare basis accounts for the increase in farm business size and shows that the overall average farm debt per hectare has actually declined over at least the last two years (Keogh, Tomlinson, & Potard, 2013). Debt growth has also slowed due to restricted access to credit.

This is not to say that debt is not an issue, on some broad acre farms in Western Australia the cost of servicing debt is between 6 to 13 per cent of production costs (Stretch, Kingwell, & Carter, 2012). This cost means less money for investment in other areas such as technology for productivity improvements or land and machinery for greater economies of scale.

Approximately half of the additional debt that has been taken on by farms in the last decade (2000-2012) has been to finance the purchase of additional land, followed by working capital, and then machinery, plant and vehicle purchases, as shown in Figure 23 (Gooday,
2013). Purchases such as land and machinery are often to grow business, and so can borrowing for these purposes can be viewed in a positive light.

Figure 23  Borrowing purposes, 2000/01 – 2011/12

Source: (Gooday, 2013)

There is a delicate interface between industry assistance, finance and farm ownership that was discussed at the 2014 Australian Farm Institute’s “Funding Agriculture’s Future” conference. Climate and market variability create considerable operational risk that can place significant viability pressure on agricultural businesses, particularly when they converge. Government provides assistance when such circumstances are deemed to be exceptional but also creates the risk of simply delaying structural adjustment from occurring, which has often proven to be the case. At the same time the requirement of a long-term focus and effective management means that agriculture is generally more attractive to private equity rather than publically listed equity. There is also increasing interest by overseas interests in investing in Australian agriculture which provides the required capital but raises concerns over raising prices and foreign ownership. Higher entry costs and the need to manage both capital and operational risks are leading to an increase in various share farming arrangements and the use of dual structures. These issues interface to create challenges for government to ensure assistance policy supports rather than hinders reform and the finance sector to develop insurance and debt services that meet the greater diversity of business structures.

5.2 Infrastructure

Realising the potential growth opportunities in the agrifood area will require infrastructure that can move product cost and time effectively and efficiently. There are areas where infrastructure needs to be upgraded in order to realise this potential, such as the road network, and areas where it needs to be established, such as in northern Australia.

Economic infrastructure (including transport, water, energy and telecommunications facilities) provides essential services to many industries including Australia’s domestic and international food supply chains. These services accounted for 11 per cent of total intermediate input costs in the agriculture, forestry and fishing sector, 10 per cent in the food processing industry and 14 per cent in the food services industry in 2008/09. In total, infrastructure inputs were valued at $14.4 billion (Nguyen, et al., 2013). Cost-effective and
efficient infrastructure is an important factor for many industries, making it an important issue for Australia as a whole not just the agrifood sector.

**Transport infrastructure**

There is limited data available on freight movements, especially on the products being transported and the origin and destination of them, which is a key constraint in understanding and planning for the national freight task (Tulloh & Pearce, 2011).

In 2001, the movement of agrifood products in Australia accounted for approximately 30 per cent of total freight moved in Australia (ABS, 2002). Total freight moved in Australia was estimated at 2.5 billion tonnes in 2006/07. This volume has been increasing at an average annual rate of 3.4 per cent between 1983 and 2003, and is expected to continue to grow over the period to 2020 at a rate of 2.8 per cent with road transport expected to be the highest (Allen Consulting Group, 2010).

Agriculture has some unique characteristics when considering transport needs. The road network is the major supporting link in most agricultural supply chains and due to the export oriented nature of the industry generally requires passage from rural areas to port. Figure 24 and Figure 25 show the general transport modes for the beef and wheat supply chain. It can be seen that the use of road transport is extensive and it shows the need to get to port to enter the end user market via shipping. Other characteristics include the large and unpredictable seasonal variability in production volumes, for example the volume fluctuations experienced in grain harvests, and the sensitive nature of some products to the time taken to reach the processor or end market (Tulloh & Pearce, 2011). Examples of this include the transport of live animals to abattoirs or ports and the transport of fresh produce to the end user.

**Figure 24  General transport modes for the beef supply chain**

![General transport modes for the beef supply chain](image)

Source: (Nguyen, et al., 2013)
In comparison to many other countries Australia is relatively remote from its trading partners and requires more modes of transport. Take for example Canada and the US; Canada exports 49 per cent of its production to the US, a geographically close trading partner with direct border access to one another. The same could be said for most of the Europe Union. Part of Canada’s comparative advantage over Australia would be drawn from its geographical closeness to the US (Nossal & Sheng, 2013).

Domestic distances also have a role to play in terms of capital intensity and productivity. Australia is a vast country with long distances from production areas to port or the domestic market, and the population is concentrated in dispersed capital cities around the country. Dispersed populations can cause higher capital intensity and lower productivity due to reduced efficiency with which infrastructure can be used and fewer gains from economies of scale.

**Water infrastructure**

The majority of water used for irrigated agricultural production comes from irrigation channels, followed by water taken from rivers, creeks and lakes etc., and then groundwater and water from dams or tanks (see Figure 26). All of these sources of water require some degree of infrastructure to capture the water in the first place so as to be able to use it (such as dams or irrigation channels), or to be able to access it (such as windmills and bores for groundwater).
Pastures and cereal crops that are used for grazing or fed off are the largest irrigated water use in terms of land, as shown in Figure 27. In 2011/12, more than 600,000 hectares was irrigated for this use however it was not the largest user of water. The largest user of water in Australia is cotton, applying more than 2,068,907 ML of water to its irrigated area of 397,221 hectares (a rate of 5.2 ML/ha). In terms of application rates, rice is the most water intensive crop, requiring 11 ML/ha, more than double of that used by the next most intensive water user, cotton.
Australia’s area of irrigated agricultural land is very small (half a percent) compared to some of our major competitors, as shown in Figure 28. India and Israel dedicate around one third of agricultural land to irrigated agriculture.

![Figure 28](image)

**Figure 28** Irrigated agricultural land, 2009/11 (%)

<table>
<thead>
<tr>
<th>Country</th>
<th>% of irrigated agricultural land</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>35.2</td>
</tr>
<tr>
<td>Israel</td>
<td>31.8</td>
</tr>
<tr>
<td>Turkey</td>
<td>13.6</td>
</tr>
<tr>
<td>Ukraine</td>
<td>5.3</td>
</tr>
<tr>
<td>Germany</td>
<td>2.2</td>
</tr>
<tr>
<td>Canada</td>
<td>1.2</td>
</tr>
<tr>
<td>Australia</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Note: Agricultural irrigated land refers to agricultural areas purposely provided with water, including land irrigated by controlled flooding.

Source: (World Bank, 2014)

### 5.3 Infrastructure SWOT analysis

<table>
<thead>
<tr>
<th>Extending capital life cycles (finance and infrastructure) SWOT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
</tr>
<tr>
<td>• Extensive water and transport infrastructure in existing agricultural regions</td>
</tr>
<tr>
<td>• Advantage in long distance based freight technologies compared to lesser developed countries</td>
</tr>
<tr>
<td><strong>Weaknesses</strong></td>
</tr>
<tr>
<td>• Lack of infrastructure for the north</td>
</tr>
<tr>
<td>• Aging infrastructure elsewhere</td>
</tr>
<tr>
<td>• Lack of farm finance innovation</td>
</tr>
<tr>
<td>• Distorting assistance policies</td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td>• Introducing emergent technologies in telecommunications, robotics, remote sensing, spatial data to improve infrastructure efficiency</td>
</tr>
<tr>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>• Inability to finance infrastructure</td>
</tr>
<tr>
<td>• Agriculture unattractive to alternative investment classes</td>
</tr>
</tbody>
</table>

Source: ACIL Allen Consulting, 2014
6 Rebranding from woeful to wonderful

6.1 Reputation of agriculture in Australia

A key driver of the reputation of agriculture within Australia is the number of people employed compared to other sectors. Since the 1980’s total employment has grown by more than 50 per cent while agricultural employment has declined (Figure 29). This reduces the reputation of agriculture as one of the pillars of Australia’s economies and society and offers less job opportunities compared to other sectors.

Figure 29 Number of people employed for selected industries, 1985-2013

Source: (ABS, 2014)

This is illustrated by a review of agricultural training and employment in NSW (Pratley, 2013) which found:

— Low levels of qualified workers, especially university graduates in the agriculture sector
— That some teachers and students expressed negative views about agriculture, and that some career advisors discourage students from pursuing careers in agriculture due to perceptions that agriculture does not offer a secure career path
— The quality of science teaching varies across schools, and that primary teachers may feel uncomfortable teaching science because they do not have the requisite knowledge or training in the field, or access to resources
— That field equipment at agricultural high schools needs to be updated to reflect modern agriculture
That there is a critical need to increase the number of graduates in agriculture and related fields

That over the past two decades there has been a marked decline in the number of graduates. Downturn in demand for agriculture has particularly impacted upon University of Western Sydney (formerly Hawkesbury Agricultural College), which suspended intake in 2012 because of low demand. There is also generally weak demand for and limited offerings of courses in horticulture, forestry and aquaculture despite reasonable employment opportunities.

R&D is critical to improving productivity and promoting sustainable practices in agriculture, and post graduate scholars make an important contribution to such research. However the review found that stipends for postgraduate scholars are not competitive with graduate’s salaries, and employment of researchers is not stable.

Pratley (2013) identifies actions to challenge these current perceptions and promote a strong future for agriculture through:

- Strong engagement with the education system
- Development of a workforce strategy and strong career promotion
- Development of an industry accreditation strategy
- Strong community citizenship, and
- Using media to promulgate positive messages to community.

6.2 Attractiveness of the industry

Agriculture faces a well-documented critical skills and labour shortage at a time when the industry is growing.

The Food Fibre and Timber Industries Training Council WA outlines a number of occupations in high demand in the primary industry sub-sector of agriculture including mixed crop and livestock farmers, wool classers, agricultural and horticultural mobile plant operators, agricultural technicians, farriers, shearers and wool handlers. They highlight a desperate need to understand the current and future needs of the grains industry and to develop a strategy and executable plan for building the capacity of employees and attracting new ones.

The main factors driving the need to build capacity in the agricultural industry include environmental change, market deregulation, new technology, an ageing workforce, inter-industry labour competition, a negative industry image with a lack of visible careers pathways and an industry that in general lacks a training culture.

The issue of clear and defined career paths in the agricultural industry is regularly cited as a barrier to the attraction and retention of workers in the industry. Agrifood Skills Australia (2012) recognises that this issue is twofold;

“Firstly that without better recognised career paths, skills of the existing workforce and individuals’ potential in other job roles is unlikely to be realised. Secondly, that failure to formalise and promote career paths means that industry does not have one of the most fundamental building blocks in place needed to attract young people and retain its existing workers.”

There is also a duality in the way agriculture is presented within Australia. A Richard Waterhouse notes in A Vision Splendid that the bush is a key representation of national identity demonstrating resilience, independence, collaboration (mateship), innovation and initiative, often in the face of adversity. At the same time agriculture can no longer support
communities on its own, and successful regional communities have diversified their economies to sustain population and services.

There is an expectation that government’s support agricultural businesses through exceptional circumstances, and the track record of various assistance programs is mixed. The welfare outcomes are incredibly important to deal with immediate hardship, however the programs are less successful in retaining businesses, particularly those with high debt and limited capacity/options over the long-run. This is demonstrated by the continual decline in the number of farms.

There is however increasing interest in Australian agriculture from domestic and overseas people and capital. The interest stems from a sound institutional and legal framework and availability of land on which existing systems can be enhanced and new methods introduced to offer reasonable security and returns.

6.3 Agriculture brand SWOT analysis

Table 12 Rebranding from woeful to wonderful SWOT

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound legal and institutional framework</td>
<td>Skills and labour shortage</td>
</tr>
<tr>
<td>Factors of production available</td>
<td>Reputation as a sunset industry</td>
</tr>
<tr>
<td>Opportunities</td>
<td>Threats</td>
</tr>
<tr>
<td>Introducing new capital and methods</td>
<td>Uncompetitive compared to other sectors</td>
</tr>
<tr>
<td>Revitalisation of agricultural education</td>
<td>Assistance programs ineffective</td>
</tr>
</tbody>
</table>

Source: ACIL Allen Consulting, 2014
7 Northern beef industry case study

7.1 Natural endowments of the North and the beef industry

Northern Australia is characterised by a harsh climate with distinct wet and dry seasons and generally low fertility soils that are prone to high erosion rates. It covers a vast area that can make moving produce to market a costly and risky exercise.

Due to these natural endowments, the production systems and scale of businesses in the northern beef industry is markedly different from the southern. Figure 30 shows how sparsely populated the cattle in the north of Western Australia and The Northern Territory are, generally less than five head per square kilometre. Production systems here are dominated by the live export trade, with many animals leaving through the ports of Darwin and Broome (see Figure 31). Cattle numbers in northern Queensland are higher, especially on the eastern coastal side, and the cattle industry is more focused on beef export markets, thus the abattoir facilities at Townsville, Mackay and Rockhampton.

Approximately 6.7 million cattle (25% of the national herd) are located in northern Australia; 3.5 million cattle in northern Queensland, 2.1 million in the Northern Territory and 1.1 million in northern Western Australia (ABARES, 2011).
Figure 31 shows the number of live cattle exported through the major northern ports from 1993 to 2013. Over the last 20 years, Darwin has seen around 5.8 million head of cattle through its port, accounting for 40 per cent of all Australian live cattle exports. Although not included in the graph below due to being in southern Australia, the port of Fremantle in WA is the second largest port for live cattle at 2.3 million since 1993, surpassing Broome at 1.5 million and Townsville at 1.1 million.

In 2010-11, eight per cent of the Australian cattle industry was concerned with live export. Of this eight per cent, 66 per cent of live cattle exports went through northern ports, the majority to Indonesia (87 per cent). In 2009/10, the gross value of this market was $416 million. Of the remaining 92 per cent of the industry that concerns domestic slaughter, 49 per cent was processed in the north of Australia (primarily Queensland), with a gross value of $4.6 billion in 2009/10. The market is dominated by the export of frozen boxed beef, mainly into Japan, and the rest is domestically consumed (Gleeson, Martin, & Mifsud, 2012).

7.2 Comparative advantage

The comparative advantage of Australia’s northern beef industry, including the live cattle industry and beef meat exports, lies in some key factors;

— The proximity of northern Australia to key markets, particularly South East Asia; most of our markets are in countries no more than 10 transport days away. This helps to reduce transport costs and with respect to live animals to minimise the journey time so as to maintain the animals health and condition.

— Australia has the ability to provide a consistent quantity and quality of live animals and beef meat due to our large industry and stable economy

— Northern Australia has bred cattle for live export that meet the market requirements of customers in terms of the physical animal itself and that animals ability to survive in the climate of the importing country, and

— Australian beef is free of pests and disease, specifically Foot and Mouth disease.
The comparative advantage that Indonesia holds with the live cattle trade is their ability to fatten and process Australian cattle due to their relatively lower costs for feed and labour in comparison to Australia’s operation.

**Global positioning of beef meat exports**

In 2013 there was approximately 9.2 million tonnes of beef exported around the world. The top three exporting countries, including Australia, accounted for more than half of that (see Figure 33). Although Australia only produced 2.4 million tonnes of beef in 2013, equivalent to 4 per cent of global production, we accounted for 17 per cent of all beef meat exported.

**Figure 32  Beef meat exports 2013 (‘000 tonnes carcass weight equivalent)**

![Beef meat exports 2013 graph]

**Source:** (USDA, 2014)

**Global positioning of live cattle exports**

Aside from exporting live feeder/slaughter cattle to Indonesia, other major destinations over the past few years have been Turkey, Israel, Egypt and Vietnam. In 2010 the largest markets for live cattle, aside from Indonesia (65 per cent by volume), was Turkey (8 per cent) and Egypt (7 per cent) (MLA, 2010). In 2013 the largest markets, aside from Indonesia (62 per cent by volume) was Israel (14 per cent) and Vietnam (9 per cent). The Israeli market has been there for a number of years, averaging 47,000 head exported over the years 2008-2012, however in 2013 exploded out to 98,320 head (MLA, 2014). Vietnam on the other hand is a relatively new market, with very little exported there before 2013.

In the Independent review of Australia’s livestock export trade (2011) commented on Australia’s major competitors in the live cattle export market, these included Uruguay, Brazil and Ethiopia in the Egyptian market and Uruguay, Brazil and Hungary in the Turkish market. It would be a fair assumption that there is no major competitor against Australia in the South East Asian market. New Zealand in the past has been an exporter of live animals for slaughter, however a change in government policy in 2007 effectively ended the trade.
Figure 33 shows global exports of live cattle from the major participating countries since 2004. Note that this will include all feeder/slaughter cattle plus dairy breeders and beef breeders. The USA is a large importer of live cattle (around 2 million head in 2013) (USDA, 2014), it would be fair to assume that many of these animals enter from large exporting neighbouring countries, such as Canada and Mexico Canada, by land transport. The bulk of European exports are between European countries (Farmer, 2011).

Figure 33  Global exports of live cattle 2004 – 2013, ‘000 head

Source: (USDA, 2014)

7.3 Innovating and securing the industry’s future

Meat processing facilities in northern Australia

Until recently, the only export certified meat processing works in northern Australia were located in Queensland at Townsville, Rockhampton and Biloela. The northern region of Western Australia had not had a meatworks facility since the Broome abattoir closed in 1994, and the nearest existing abattoir for the Northern Territory was at Townsville.

In 2014 the opening of an abattoir at Livingstone Valley, 50 kilometres south of Darwin and another in WA located 70 km east of Broome, will enhance the northern beef industry as a complementary activity to the live export trade. Both abattoirs will be focused on cattle that are unable to enter the live Indonesian market due to weight restrictions. The volatility in the live cattle export market has driven the establishment of these meatwork facilities.

The Darwin abattoir, owned by AACo, is expected to process 225,000 head of cattle per annum and the Broome abattoir, owned by Yeeda Pastoral Company, will be able process 50,000 to 60,000 head of cattle per year. AACo’s abattoir has been built as a hot boning facility with the flexibility to incorporate chillers for prime cattle processing when required, and Yeeda’s abattoir will include hot boning facilities also after securing a contract with prominent North American and Chinese burger companies.

Irrigation

The northern beef industry has traditionally been focused on low inputs, low efficiency and low return production and marketing systems (Higgins, 2013). In an effort to grow the
industry, government and private business are looking for alternative ways to enhance production via intensification and greater diversification and flexibility in land use. One area of potential involves irrigation.

The Northern Australia Land and Water Taskforce (2009) suggested that mosaic irrigation (small-scale irrigation areas amongst unirrigated pastures) was a prospective model for agricultural development in the north of Australia. Mosaic irrigation has the potential to increase the seasonal production window for cattle, thus aiding the development of a more integrated supply chain allowing producers opportunities to value-add and improve product availability and quality (Gleeson, Martin, & Mifsud, 2012).

Box 4  
Mine waste water for pastoral irrigation

A mining company in the Pilbara region of WA is utilising surplus water from their iron-ore mine to irrigate 850 hectares of pastoral station country to grow 30,000 tonnes of hay annually.

Using a pivot irrigation system comprising of 17 self-propelled centre pivots, each covering an area up to 40-50 hectares in size, the hay will be used to feed the company’s 25,000 head of cattle.

It is estimated that up to 200 billion litres of water could be available annually in the north of Western Australia from the process of mining below the water table.

This project reduces the grazing pressure on rangelands and aids in the regeneration and rehabilitation of pastoral land due to herds being contained in a smaller area due to the increased availability of feed. There are also positive environmental and flow on social impacts of this project.

For further information please visit www.riotinto.com.au

Infrastructure for efficient paths to market

The natural advantage for beef production in northern Australia is the proximity to Asian markets. However, this advantage is only applicable for those cattle being moved from properties relatively close to a port or processing facility. Economic Associates (2010) reported that nearly half of all cattle in the NT travel upwards of 1,000 kilometres by road to reach an abattoir, or port, at a cost of more than $150/head. This cost can comprise up to 35 per cent of the market price for stock, highlighting the need for optimising transport logistics (Higgins, 2013). The establishment of abattoirs at Broome and Darwin will help to alleviate some of this, but the north is still a vast area and it is not only costly to transport outputs but this also applies to inputs.

Strategic infrastructure investment in roads, bridges, yards, feedlots, abattoirs, cold stores and export facilities that creates lowest cost and highest value will be important for the future of the beef industry in the north.
8 Conclusions

Basically Australian agriculture’s success since World War II has been based on growing produce that people want and a relentless pursuit of productivity from a sound natural resource base.

The first (growing things that people want) gets harder and harder as changes in consumer trends, slow trade-reform and the emergence of competition in traditional markets (e.g. Black Sea grains) has changed this point of difference to growing things that people want better than others (price, quality, timeliness etc.). Australia has been less successful in building businesses and markets off its sound natural resource base compared to competitors such as New Zealand. None the less the base is there and available.

Productivity is confounded by the fact we don’t measure it very well at the scale (such as region or crop) where people have confidence to act, particularly total or multifactor productivity. The traditional stalwarts have been:

- New science and technology
- Substituting labour with technology
- Cheap land and avoidance of many biosecurity costs faced by competitors, and
- Under-priced/subsidised infrastructure.

There is evidence that productivity has slowed and in some industries declined. The decline has been correlated to a reduction in public spending in R&D and called for more investment in this space. While this has merit additional investment needs to be understood in light of greater capacity within many agricultural businesses and the increasingly globalised approach to R&D. The Australian rural R&D model has a unique feature of industry and government using a joint venture (Rural Research and Development Corporations) to co-invest in R&D and marketing. The model is 25 years old and so has an established stakeholder group who are increasingly drawing on the model to fund:

- Industry representation
- Service previous provided by state government Departments of Agriculture
- Applied development and extension with higher short-term gain above strategic research with longer term gain and higher risks
- Private benefits over public benefits, and
- Their own position, potentially crowding out private and international investment.

None the less science and technology is crucial as is public investment in that space. The challenge is how to evolve the model so that it remains a source of competitive advantage.

Agriculture will continue to rely on access to natural resources as part of its comparative advantage. As the largest land use by area, agriculture also plays a critical role in environmental stewardship. High land values make it harder for new entrants, while devaluation influences the financial viability of existing producers. The sector faces genuine competition for land-use due to urbanisation and mining expansion into traditional agricultural areas. In many cases the economic returns from these alternative uses will be greater than agriculture. These create policy challenges in:

- Maintaining an effective finance mechanism for the sector, and
Reconciling higher economic returns from alternative land-uses with community expectations and environmental stewardship

Infrastructure is potentially the most challenging issue for agriculture. A large proportion of the ports, rail, dams, irrigation channel, road and other shared infrastructure were publically built and are beyond their design life. They now require renewal or, in the case of the north, need to be built. So the question is who pays for this infrastructure and how is it re-couped? The public, the farmers or the supply chain will end up paying individually or through some sort of joint venture. Recoup will presumably be through cost-reflective service charges – this won't necessarily increase productivity in the short term.

In conclusion Australian agriculture started on the basis of individual enterprise way in the 19th Century. Government then established supporting infrastructure (water, transport etc.) and institutions (R&D, regulations etc.) further developed the sector in the 20th century.

The nation is now at the stage where the businesses, infrastructure and institutions all need to evolve and in many cases significantly reform to realise the opportunities which will sustain agriculture’s domestic and international comparative advantage. There is confusion for some as to who leads - business or government?

At the end of the day agriculture is simply a commercial enterprise – as such business should lead. The challenge for government is how do they support agricultural businesses, particularly when they are asked to bear the cost of any structural adjustment? Key areas where government needs to establish innovative and effective policies in partnership with agricultural businesses are:

— Pursuing greater market access and de-regulation
— Increasing the level of effective public and private investment in science and technology
— Securing renewal of key infrastructure through private and public investment, and
— Establishing equitable land-use planning while protecting key environmental and highly productive assets.
9 Works Cited


ABS. (2013). *Value of Agricultural Commodities Produced, Australia, 2011-12 (cat. no. 7503.0*. ABS.


FAO. (2009). Global agriculture towards 2050. FAO.


Appendix A

Project terms of reference extract

This ACA project is focused especially on, but is not limited to, the following:

— What are the strengths we can build on, or weaknesses that we can alleviate, that will enable us to manage the end of the resources boom and ensure continued prosperity in the 21st century global environment?

— Which distinctive characteristics of Australian environment, biodiversity, location, demography, cultural attitudes, and other contexts will help identify the niches that will define Australia’s enduring advantages over the long run?

— What makes us unique and/or attractive as partners in R&D, industry and innovation?

— What are the key features and distinctive characteristics in this area in Australia, including its geographical location, linkages, significance for employment, growth, trade, communities, natural resource use/impact, technology, etc.?

— What has been the evolution or changes in the nature and role of the area, especially over the last several decades? How have society, technology, economy, environment, population and political factors determined or affected this trajectory?

— Where do we stand in the area globally?

— What are the strengths and weaknesses of the area?

— What opportunities and threats are now facing this field? How far are these short, medium or long-term considerations?

— What will determine how well the area performs in the future? What are the major risks or uncertainties? Are there clear alternative scenarios facing this area?

Where does this area stand in relation to its own and wider resilience and sustainability, linkage to natural resource use/impact, locational change, knowledge achievement and potential, relationship to society and culture?