Industry sectors
Analysis and forecasting

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

Industry Sectors: Analysis and Forecasting

July 2013
## Contents

1. Executive Summary .................................................. 2
2. Multi-criteria analysis ................................................. 5

Attachments

1. Biomass ................................................................. 9
2. Biotechnology .......................................................... 12
3. Built Environment & Construction .............................. 15
4. Cross-Sector Design .................................................. 18
5. Digital ................................................................. 20
6. Environment & Sustainability ..................................... 23
7. Finance ................................................................. 27
8. Health & Medical Technology ..................................... 30
9. Industrial Materials ................................................... 34
10. Resources & Energy ................................................. 38
11. Space & Spatial Industry ............................................ 43
12. Sports, Communities & Tourism ............................... 46
13. Transport ............................................................... 49
14. Tropical ................................................................. 52
15. Water ................................................................. 56
1 Executive Summary

To assist the Board in making its recommendations to the Minister, PwC has developed briefs on the 15 industry sectors nominated for consideration. These briefs summarise the emerging trends for the sectors, including Australia’s competitive advantage and the current employment outcomes and potential for growth.

To summarise the findings of these briefs, we have undertaken a multi-criteria analysis to highlight comparisons between each sector. In order to analyse the information collected for each of the 15 industry sectors relative to others, we identified five key criteria, specifically:

1. expected growth path of the industry in Australia and globally
2. competitive advantage of the Australian industry
3. size of the industry sector in Australia
4. potential for Australian employment growth
5. extent to which the industry is established (or emerging).

Each brief contains an assessment against these criteria. Further, to assist the Board to compare and contrast the industry sectors analysed, these results are represented graphically overleaf. Figure 1 is an industry analysis chart that shows our assessment of the industries against the first four criteria above, and relative to each other. This information is also shown in Table 1.

- The size of the circle shows the relative size of the industry sector in Australia which considers a number of different factors, including: current workforce, number of Australian (owned or headquartered) businesses operating in the sector, total estimated capital expenditure and the contribution to Australia’s GDP.
- The colour of the circle shows the relative potential for Australian employment growth using the colour scale shown in the legend.

Interestingly, the graph shows that:

- there are two industry sectors with very strong potential for employment growth where Australia has strong competitive advantage: Tropical and Digital
- there are two large industry sectors with strong potential for employment growth where Australia has moderate to strong competitive advantage: Health & Medical Technology and Transport.
- There are further seven industry sectors with moderate potential for employment growth, with three that are identified as having strong competitive advantage: Space & Spatial, Finance and Resource & Energy.

It is important to note that these results do not constitute recommendations by PwC. The figure does not provide the full extent of information the Board will need to consider when making recommendations for the Industry Innovation Precincts program. The figure serves to compare the different ratings given for each industry in one easy to understand graphic.
Figure 1: Summary of comparative analysis results

Explanation of chart:
- The size of the circle represents the relative size of the industry
- The colour of the circle represents the relative potential for employment growth, using the legend below:
  - very weak
  - weak
  - moderate
  - strong
  - very strong
Table 1 presents the same results as shown in Figure 1 for each industry sector against the five criteria used in the multi-criteria analysis.

**Table 1: Summary of comparative analysis results**

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Expected Growth Path</th>
<th>Competitive Advantage</th>
<th>Potential for Employment growth</th>
<th>Relative size of industry sector</th>
<th>Emerging or Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Biomass</td>
<td>Weak</td>
<td>Weak</td>
<td>Weak</td>
<td>Very small</td>
<td>Emerging</td>
</tr>
<tr>
<td>2. Biotechnology</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Medium</td>
<td>Emerging</td>
</tr>
<tr>
<td>3. Built environment &amp; Construction</td>
<td><strong>Strong</strong></td>
<td>Weak</td>
<td>Moderate</td>
<td>Large</td>
<td>Established</td>
</tr>
<tr>
<td>4. Cross-sector</td>
<td>Very weak</td>
<td>Very weak</td>
<td>Very weak</td>
<td>Small</td>
<td>Established</td>
</tr>
<tr>
<td>5. Digital</td>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td><strong>Very strong</strong></td>
<td>Medium</td>
<td>Emerging</td>
</tr>
<tr>
<td>6. Environment &amp; Sustainability</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Small</td>
<td>Emerging</td>
</tr>
<tr>
<td>7. Finance</td>
<td><strong>Strong</strong></td>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td>Very large</td>
<td>Established</td>
</tr>
<tr>
<td>8. Health &amp; Medical Technology</td>
<td><strong>Very strong</strong></td>
<td><strong>Strong</strong></td>
<td><strong>Strong</strong></td>
<td>Very large</td>
<td>Established</td>
</tr>
<tr>
<td>9. Industrial Materials</td>
<td>Moderate</td>
<td>Weak</td>
<td>Moderate</td>
<td>Very small</td>
<td>Emerging</td>
</tr>
<tr>
<td>10. Resource &amp; Energy</td>
<td><strong>Strong</strong></td>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td>Very large</td>
<td>Established</td>
</tr>
<tr>
<td>11. Space &amp; Spatial</td>
<td><strong>Strong</strong></td>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td>Medium</td>
<td>Emerging</td>
</tr>
<tr>
<td>12. Sports, Communities &amp; Tourism</td>
<td><strong>Strong</strong></td>
<td>Moderate</td>
<td>Weak</td>
<td>Medium</td>
<td>Established</td>
</tr>
<tr>
<td>13. Transport</td>
<td><strong>Strong</strong></td>
<td>Weak</td>
<td><strong>Strong</strong></td>
<td>Very large</td>
<td>Established</td>
</tr>
<tr>
<td>14. Tropical</td>
<td><strong>Very strong</strong></td>
<td><strong>Very strong</strong></td>
<td><strong>Very strong</strong></td>
<td>Small</td>
<td>Emerging</td>
</tr>
<tr>
<td>15. Water</td>
<td>Weak</td>
<td>Moderate</td>
<td>Weak</td>
<td>Small</td>
<td>Established</td>
</tr>
</tbody>
</table>
2 Multi-criteria analysis

2.1 Introduction

To assist the Board to compare the growth prospects and potential employment outcomes within each sector, we have concentrated on providing forecasts where available and supplemented this with industry commentary on the trends within each sector either globally or nationally (where available). This information has then been used to inform our multi-criteria analysis (MCA).

MCA is a specific form of cost–benefit analysis that brings a degree of structure, analysis and openness to decision-making. It is particularly useful in circumstances where it is necessary to consider a range of evaluation criteria which cannot be satisfactorily quantified and/or valued.

A key challenge for the preparation of our briefs was that the 15 industry sectors do not necessarily align with standard industry definitions, e.g. the Australian and New Zealand Standard Industry Classification codes (ANZSIC). Therefore, we are unable to provide consistent information for all 15 briefs and for some sectors there was limited information available. MCA provides a valuable tool to compare the analysis and forecasting for the 15 industry sectors as consistent, quantifiable information is not available. MCA establishes preferences between options by reference to an explicit set of objectives and scalable criteria to assess the extent to which the objectives can be achieved.

2.2 Assessment criteria

In order to analyse the information collected for each industry sector relative to others, we have identified five key criteria, specifically the:

- expected growth path of the industry in Australian and globally
- competitive advantage of the Australian industry
- size of the industry sector in Australia
- potential for Australian employment growth
- extent to which the industry is established (or emerging)

2.2.1 Expected growth path

This criterion considers the current forecasted growth path of the industry both nationally and globally. The reason for considering both is to look beyond the trajectory of current businesses operating in the industry. We have also considered the total forecasted demand for the industry, reflecting the potential market that Australian business could reach.

The expected growth path of each sector was assessed using a five point ‘likert’ scale:

1. Very Weak: considered to be minimal to no growth forecasted
2. Weak
3. Moderate: growth is considered to be in line with the Australian economy
4. Strong
5. Very Strong: growth is forecasted to greatly exceed baseline growth path

2.2.2 Competitive advantage

This criterion considers the Australian industry’s competitive advantage within the global and regional economies and within the Australian economy. An industry’s ability to gain competitive advantage depends on four conditions; effective use of production factors, a home market demand which encourages innovation, the location of the industry relative to markets it serves, and the degree to which the industry collaborates.
Domestic barriers to competitive advantage are related to productivity and innovation barriers since both are enablers of efficient production, marketing and operations of firms. Other regulatory barriers include tax systems which are not uniform across industry and may be additional burden for companies, domestic policies such as requirements for product and service which also vary across industries. Future infrastructure investment (such as the National Broadband Network) can also impact on competitive advantage at it enhances capacity of transport and communications networks.

The Asian markets present unprecedented export opportunities for Australian industries. There are, however, international factors which impede Australian industries from succeeding in Asian markets. Domestic laws of Asian countries often restrict the commercial establishment of foreign firms. For example, Malaysia and Singapore discourage foreign suppliers from gaining or expanding market access through their domestic laws such as the Telecommunications Act. In China, the import of certain goods (chemicals, used machinery, used electronics, and used transport equipment) is prohibited. Other barriers such as tariff and custom duty rates imposed by individual countries make the prices of our exports less competitive. Another international factor is red tape in the logistics chain, which is a dominant cost to the APEC merchants.¹

The competitive advantage each industry sector was assessed using a five point ‘likert’ scale:

1. Very Weak: there is little to no observable competitive advantage
2. Weak
3. Moderate: the Australian sector is able to compete both nationally and internationally, but is not considered to be a leader in the field
4. Strong
5. Very Strong: the Australian sector is recognised by nationally and internationally as being a leader in the field and has demonstrated the right investment and skills environment exists.

2.2.3 Relative size of the industry sector

This criterion considers a number of different factors that signify the relative size of the industry sectors identified, including: current workforce, number of Australian (owned or headquartered) businesses operating in the sector, total estimated capital expenditure and the contribution to Australia’s GDP.

The relative size of each industry sector was assessed using a five point ‘likert’ scale:

1. Very Small
2. Small
3. Medium
4. Large
5. Very Large

2.2.4 Potential for employment growth

This criterion highlights the potential for sustained employment opportunities to be created in Australia within each industry sector. The assessment considers the estimated capital to labour balance within the industry; the degree to which the expected growth path is driven by advances in technology alone; and the ability for Australian skills development to be competitive with international labour forces. Where available, forecasts for the employment

growth rates are used to inform the assessment and are included in the briefs. However, as some identified industry sectors are not formal industries but a grouping of sub-sectors or like-technologies, we have used our judgements based on the information available as no formal industry employment figures are available.

The potential for employment growth was assessed using a five point ‘likert’ scale:

1. **Very Weak**: there is little to no potential for sustained job opportunities to be created
2. **Weak**
3. **Moderate**: the potential employment growth is likely to be driven by baseline growth in the Australian economy
4. **Strong**
5. **Very Strong**: the expected growth and innovation developments in the industry are likely to lead to significant increases in job opportunities in Australia.

### 2.2.5 Emerging or established industry

The Board recommendations will be made having regard to whether the industry sectors are established or represent emerging economic opportunities. We have therefore assessed the extent to which each industry sector is emerging or established as shown in Table 2.

**Table 2: Established and emerging industry groupings**

<table>
<thead>
<tr>
<th>Established</th>
<th>Emerging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built Environment &amp; Construction</td>
<td>Bio-mass</td>
</tr>
<tr>
<td>Cross-sector</td>
<td>Biotechnology</td>
</tr>
<tr>
<td>Finance</td>
<td>Digital</td>
</tr>
<tr>
<td>Health &amp; Medical Technology</td>
<td>Environment &amp; Sustainability</td>
</tr>
<tr>
<td>Resource &amp; Energy</td>
<td>Industrial Materials</td>
</tr>
<tr>
<td>Sports, Communities &amp; Tourism</td>
<td>Space &amp; Spatial</td>
</tr>
<tr>
<td>Transport</td>
<td>Tropical</td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Established industry is where there are many Australian businesses with a stable presence and a skilled workforce already engaged in the sector. Emerging industry has a relatively new presence in Australia and new opportunities for innovation and skills development are being identified.
## Attachments

### Industry sector briefs

1. Biomass  
2. Biotechnology  
3. Built Environment & Construction  
4. Cross-Sector Design  
5. Digital  
6. Environment & Sustainability  
7. Finance  
8. Health & Medical Technology  
9. Industrial Materials  
10. Resources & Energy  
11. Space & Spatial Industry  
12. Sports, Communities & Tourism  
13. Transport  
14. Tropical  
15. Water
1. **Biomass**

**Assessment against criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Emerging</td>
<td>Currently a small industry in Australia that is dependent on dissemination of technological advances.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Weak</td>
<td>While strong growth rates could be achievable, this is dependent upon transformational land use and significant investment.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Weak</td>
<td>Disadvantaged by cost relative to other renewable energy sources, Australian R&amp;D in this field is lagging behind other countries, and the industry is extremely reliant upon government incentives</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Very small</td>
<td>The Australian biofuels industry is currently very small (it supplies less than 0.5% of the nation’s transport fuel) and is concentrated in Qld and NSW reflecting ethanol petrol blends mandated in these states/</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Weak</td>
<td>Would require significant policy shift to generate sustained employment growth</td>
</tr>
</tbody>
</table>

**Introduction**

Biomass is biological material from living or recently living organisms such as wood, waste materials, gases and alcohol fuels. It can be used for a variety of purposes. This analysis of the biomass sector considers:

- gas and waste production of electricity which comprises 23.4 per cent of the ‘wind and other electricity’ industry in Australia
- other uses of biomass, specifically advanced biofuels which are a more sustainable alternative to traditional biofuels using non-food biomass sources including waste streams and dedicated energy crops (including algae) that do not typically compete with food.

Australia’s main hub for bioelectricity production is in Queensland (57.7 per cent in 2010), followed by New South Wales (NSW) with approximately 22 per cent. The largest amount of production is from bagasse (a fibrous matter from crushed sugarcane) which accounts for 61.0 per cent of all bioelectricity production. The Clayton landfill in Victoria was one of the first in the world to incorporate electricity generation. Australian companies are now advising several South East Asian countries (such as Indonesia and Malaysia) on generating electricity from landfill. Western Australia (WA) has become a world leader in emerging sources of biomass such as algae biofuels.

The Australian biofuels industry is currently very small (it supplies less than 0.5% of the nation’s transport fuel) and is concentrated in Qld and NSW reflecting ethanol petrol blends mandated in these states. It should be noted that in NSW a higher mandated target for biodiesel blends has been suspended due to inadequate domestic production (the majority would need to the imported to meet the target).

Around 10 per cent of the world’s primary energy consumption comes from bioenergy. The main growth markets for power generation from bioenergy are the United States (US), European Union (EU) led by Germany, Sweden and the United Kingdom (UK), Brazil, China and Japan. The International Energy Agency projects a five-fold increase in global bio-fuels production to 2030. Australia’s production is very small in comparison to the consumption targets being set by the US and Europe (Australian production of ethanol and biodiesel in 2009 was only 294ML).
Competitive advantage

Australia’s competitive advantages in the biofuels industry include the factors listed below.

- Abundance of flat land and sunlight, climate suitable for growing dedicated energy crops. Significant waste streams and supplies of saline/brackish water.
- World class agricultural R&D capabilities in areas of plant breeding and genetic modification. Australia can produce GM crops that meet strict regulatory regimes.
- Can capitalise on natural resources and advances using existing skills in areas of value in global biofuel value chain.
- Strong political and trading alliances (e.g. US defence sector) and regional neighbours which have growing transport fuel demands (e.g. China). Access to existing and emerging bio-refining capacity (e.g. Singapore and India).

However, there are also a number of disadvantages to the biofuels industry that impact on Australia’s competitiveness in this area, including:

- Cost relative to traditional and other renewable energy sources
- Bio-based products R&D in Australia lags behind other developed countries
- Sugar cane products which are the dominant biomass products are not produced at sufficient scale be competitive in global market.
- Currently vulnerable to changes in government policy settings that provide incentives for the sector (e.g. RET, carbon price, state based biofuel mandates).

Technological advances across the renewable energy industry mean biomass may not have a competitive advantage within Australia compared to wind or solar for electricity production. Cost effectiveness for transport fuels will be dependent on technological advances in each subsector, particularly advanced biofuels (ABF).

Level of innovation

ABF offer the potential for Australia to build a sustainable new industry which could increase national fuel security, assist in reducing greenhouse gas emissions and stimulate regional development. The figure below shows perceived ABF production potential for Australia with innovations in plant breeding and offshore algae cultivation. A base level of around 30 GL per annum would see ABF supplying a majority of fuels for those key sectors with greatest need for ABF but could only occur if ABF becomes cost competitive. An industry of that scale would require transformational land use change and significant investment.

Figure: Scalability of feedstocks: sensitivity analysis (2011)
Employment

Employment in this sector is not measured but is considered very low. There could be considerable job creation potential in advanced biofuels. However, this is a long term prospect. It may be at least 5 to 10 years before advanced biofuels start to generate more significant employment – biofuels production could become one of Australia’s largest land based industries if it becomes cost effective.

Unlike other renewables, bioenergy has the potential to provide significant permanent ongoing employment opportunities, both in skilled and unskilled roles and mostly in regional areas, including: (i) biomass feedstock production, sourcing and transportation; (ii) plant operation, and (iii) ongoing plant maintenance.

Capital expenditure

The wind and other electricity generation industry is highly capital intensive. That industry has a capital to labour ratio of 1:1.47. It could also require more than $50b in upfront capital to establish a 15-30 GL industry in advanced biofuels. This level of production would require as much as five to ten million hectares of new crop-based plantations although other feedstocks may be less land intensive.

Value added

Gas and waste production of electricity, comprises 23.4 per cent of revenue of the ‘wind and other electricity’ industry. This is equivalent to $344 million in revenue (domestic) – less in value added terms. Biofuels accounted for less than 0.5 per cent of transport fuels industry value add (<$100 million).

Contribution to GDP

Biomass currently contributes only a very small amount to GDP (much less than 1 per cent). LEK have estimated that if a 15-30 GL ABF industry was established, it would be a $10 to $20 billion industry amounting to 1-2 per cent of Australia’s 2011 GDP (about one fifth of the size of the mining sector). This is a long term (10 plus years) prospect depending on whether ABF can become cost-effective.

Exports or exports potential

Exports of biomass for the purposes of electricity are low given that the electricity generated within Australia is not tradable, due to the absence of commercial, transportable large scale storage technology.

The design and technology aspects of this sector are much more capable of being exported and generating ongoing revenue streams.

Australia does ship wood pellets to consumption centres in Central Europe, US and Asia. Biofuels are currently insufficient for domestic demand.

Import or import replacement potential

Imports of biofuels are low. Advanced biofuels could have potential to replace imports of non-renewable fuels and even create exports but this would be a long term prospect (beyond ten years) given currently very low levels of production and early stages of innovation.
2. Biotechnology

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Emerging</td>
<td>This is a growing market that benefits from high levels of government support.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Moderate</td>
<td>Expected to grow in line with baseline economic growth</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Moderate</td>
<td>High skilled workforce and strong research capacity, but success is being driven by Government investment.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Moderate</td>
<td>In line with expected industry growth path.</td>
</tr>
</tbody>
</table>

Introduction

Biotechnology is the application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge and biotechnology products and services.

The sector is characterised by small innovative businesses that ultimately partner with a large business to move products to commercialisation. The largest market share in terms of sales revenue is held by CSL Limited (10 per cent) and CSIRO (5.5 per cent).

Table: Share of employment by state or territory and a description of industry in state (all biotechnology)

<table>
<thead>
<tr>
<th>State</th>
<th>Share of employment (%)</th>
<th>Description of industry by state</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>20.0</td>
<td>Mainly located in Sydney, includes:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Local representatives of global pharmaceutical companies such as Bayer, Eli Lilly and GlaxoSmithKline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Research facilities owned by Johnson and Johnson</td>
</tr>
<tr>
<td>VIC</td>
<td>48.0</td>
<td>Has the holdings of larger publicly listed biotech companies, major research centres including CSIRO as well as hospitals and research institutes</td>
</tr>
<tr>
<td>QLD</td>
<td>15.0</td>
<td>Growing market, strongly supported by Queensland Government, across agbiotech as well as molecular biosciences.</td>
</tr>
<tr>
<td>WA</td>
<td>6.0</td>
<td>Small but growing industry which includes human therapeutics</td>
</tr>
<tr>
<td>SA</td>
<td>9.0</td>
<td>Headquarters for FH Faulding &amp; Co Limited</td>
</tr>
<tr>
<td>ACT</td>
<td>1.0</td>
<td>Third largest biotechnology R&amp;D cluster in Australia, includes university based research centres and CSIRO labs.</td>
</tr>
<tr>
<td>NT</td>
<td>0.0</td>
<td>-</td>
</tr>
<tr>
<td>TAS</td>
<td>1.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: ARENA (2011) Advance Biofuels Study
The international biotechnology market is dominated by the US. The US has a total market share of around 60 per cent. Other countries with a large sector include the UK, Germany and France from Europe and Canada. Nations such as China, India and South Korea are challengers. India’s sector is growing rapidly with low-cost manufacturing of generics.

The level of industry assistance in Australia and in other countries is high. Key Australian initiatives include the Research and Development Tax Credit, Commercialisation Australia, the National Health and Medical Research Council and Cooperative Research Centres.

**Competitive advantage**

The biotechnology industry in Australia is sixth in the world in terms of number of biotechnology companies (527 in 2006).

Factors contributing to Australia’s competitive advantage include:

- Strong research institutions in Australia, with niche capabilities.
- Research is conducted in a low risk environment due to IP protection and ease of contractual enforcement.
- There have been numerous examples of pioneering Australian research that have been successful on a world stage.
- Strong relationships with other leading companies with good opportunities for joint ventures and capacity for international partnerships.
- High quality infrastructure and a highly skilled biotech workforce with expertise in medical research, gene technology and high-tech manufacturing.
- Historic focus on exporting to South East Asia and New Zealand due to geographic proximity and lower regulatory barriers in Asia.
- Australia is the leading originator of biotechnology companies in the Asia Pacific.
- The R&D Tax Incentive provides a targeted offset designed to encourage more companies to engage in research and development in Australia.

Factors detracting from Australia’s competitive advantage:

- Poor availability of venture capital. Australia is ranked 15th in the world for financing through local equity market and 12th in the world for venture capital availability.
- Geographic positioning makes targeting American and European markets difficult.
- Success of industry is driven in part by Government investment in R&D. Australia lags behind other countries in terms of outlays on Research and Development, ranked as 19th out of 27 in terms of dollars spent by OECD countries.

**Level of innovation**

Australia ranked fourth internationally for ‘Intensity’ which measures a country’s overall efforts to drive biotechnology innovation. Research in Australia tends to occur in niches with Australian companies attempting to create a relatively strong patent position in sub-classes. Current trends in innovation are driven by the demand for products which address:

- Demographic trends including rising income and wealth and an ageing population
  - Obesity creates a substantial new market in weight loss and reducing disease related to obesity
  - Ageing populations increase the prevalence of cancer and heart disease
- New technologies reducing demand for health services.

**Employment**

There are estimated to be 17,000 people employed in the biotechnology sector as a whole (0.15 per cent of the Australian workforce). Employment is expected to grow to over 21,000 people over the next five years, a compound annual growth rate of 4.3 per cent.
Capital expenditure
Capital intensity for the sector is considered low with an industry wages to depreciation ratio of 2.3:1. However, the industry is technology intensive and capital plays an important part in how it functions. About 9 per cent of industry costs were depreciation in 2012-13.

Value added
Industry value added in 2012-13 is estimated to be $2,235 million. It is expected to grow over the next five years by 2.6 per cent per annum (compound annual growth rate) to $2,959 million by 2019.

Contribution to GDP
Based on value added, contribution of the sector to GDP in 2012-13 was around 0.15 per cent. With growth in value added of around 2.6 per cent this proportion is expected to remain steady.

Exports or exports potential
Biotechnology as a sector does not align with one ANZSIC industry classification hence accurate trade information is unavailable. Biotechnology exporters tend to enter global markets through joint ventures and licensing agreements – to date export revenue from royalties and licence fees has been very low. Exports account for a small part of industry sales due to the early stages of development for most of the industry’s products but are rapidly rising. Larger companies reported in a study that exports contribute less than 10 per cent of their sales. Most exports are sent to South East Asia and New Zealand due to their geographic proximity. Australian companies prefer to focus on Asia where regulatory barriers to entry are perceived as lower and competition levels are not as high as the US or EU.

Import or import replacement potential
Imports in the industry are low and increasing. International trade in the sector is generally low. The sector is innovation based and hence there might not be direct substitutability for new imported innovations.

For manufactured pharmaceuticals (a related sector), Australia is a net importer of medicinal and pharmaceutical products - $2.14 billion in 2011-12, about five times exports. Cost competitiveness of our manufacturing sectors means Australia is unlikely to be able to substitute imports for mass produced pharmaceuticals which are increasingly manufactured in developing countries.
3. Built Environment & Construction

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging industry</td>
<td>Established</td>
<td>We believe there is a potential to tap into the Asian markets.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>Our competitive advantage is linked to the value of the Australian dollar.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Weak</td>
<td>Accounts for between seven and eight per cent of Australia’s GDP</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Large</td>
<td>Total employment is forecast to increase by almost 10 per cent between FY13 and FY18</td>
</tr>
</tbody>
</table>

Introduction

The construction and built environment sector includes a broad range of activities involved in the design, building, supply of materials and services for structural development. In 2012-13 it included over 385,000 businesses with total revenue of $374.5bn. The industry is often viewed as having a low level of concentration due to the large number of small businesses, sole traders or contractors. There are a number of large players, however, who control approximately 10 per cent of the market.

Construction is by far the biggest industry within this sector, including; heavy industry and non-building construction; residential; commercial, industrial and institutional building; building completion services; structural services; installation services; and site works.

Revenue for the over 350,000 businesses in the construction industry totalled $332.8bn in 2012-13. Businesses involved in construction are heavily concentrated in the eastern states of Australia and activity is strongly correlated to the population in each state. The level of construction work done, however, is increasingly concentrated in the states of Queensland and Western Australia as a result of large investments in infrastructure and engineering projects related to mining.

The construction sector is supported by a number of professional and technical industries, including architectural services, engineering consultancy and survey and mapping services. These industries provide services, including:

- Architectural services – contract documentation, contract administration, design development, schematic design, pre-design and architectural drafting services
- Engineering consultancy - project management, asset management, project design and documentation, environmental services, construction management, feasibility studies and process management and design
- Survey and mapping services – cadastral boundary surveys, construction surveying, geophysical surveying, topographical surveying, geospatial image acquisition and processing services, and integrated geophysical services and data sales

These industries include over 36,000 businesses that are collectively responsible for $41.7bn in revenue. The geographical spread of these businesses broadly corresponds to the distribution of population and economic activity across Australia. Therefore in large part, these industries are concentrated in the major capital cities.
The industry plays a significant role in the Australian economy and governments have tended to use the industry to prime the economy or insulate it from negative global economic forces. Innovation in the industry can get lost in such programs which tend to be more focused on speed and cost. The industry is largely based on Australian activity, although a number of the large key players have expanded into global markets and some local businesses are now significantly owned by foreign investors or multinational corporations. The opening up of international competition has, however, resulted in some progress in exporting of professional services in engineering and architecture.

**Competitive advantage**

The sector is increasingly global and Australia’s proximity to Asia provides an opportunity for Australian companies to increase their market in this sector. However, currently Australia does not have a competitive advantage in this sector.

Other developed nations are already further advanced in their adoption of building information modelling. This technology helps to increase productivity by reducing costs, as well as increasing safety and quality by streamlining processes throughout a building’s lifecycle. The lack of take up in Australia therefore provides a critical competitive disadvantage to the Australian industry.

A lack of training in and uptake of new technologies that are widely adopted elsewhere, a lack of innovation in procurement practices and the failure to move to onsite assembly of prefabricated components are now hindering the industry’s ability to compete internationally.

**Level of innovation**

Innovation within the construction and built environment industry sector is accepted as important by both government and industry. It has resulted in the establishment of a number of bodies to examine, promote and undertake research on innovation within the industry.

Innovation within the sector, however, exists within silos as a result of the fragmented nature of the industry. Individual firms may innovate, but given competitive pressures, also resist sharing this innovation with others. Innovations in the sector include:

- increased uptake in off-site manufacturing and associated technologies
- lighter weight materials and use of nano-technology embedded in materials
- energy efficient design and reducing whole of life environmental impact.

These innovations can assist Australia’s construction and built environment industry in overcoming the limitations of being a smaller competitor by offsetting this with high-end specialisation. Australia’s mineral wealth, design expertise and scientific institutions may hold the key to collaborative processes that can stimulate a new wave of innovation that is targeted to meeting future challenges in the global construction industry. These challenges are likely to stem from a wide range of issues such as climate change and more intense weather events, resource scarcity and the growing middle class and affluence in the Asian region. Innovation is only likely to occur though if there is support for increased collaboration, training and research into new technologies.

**Employment**

The construction industry currently employs over 1 million people, representing approximately 8.6 per cent of total employment in Australia. Total employment is forecast to increase by almost 10 per cent between FY13 and FY18, with higher growth forecast over the next two years FY14-FY15, before a tapering off in growth up until FY18.

In addition, professional and technical industries supporting construction also employ approximately 160,000 people. Small increases in employment in architectural, surveying and mapping services are expected to be offset by decreases in engineering consultancy by 2018 as investment begins to subside in some sub-markets – especially mining.

**Capital expenditure**

The construction and built environment industry sector is characterised by low levels of capital intensity. The construction sector currently requires $15.33 for every $1 of capital
invested due to the large number of manual tasks. This is matched by supporting professional and technical services, which add value through professional knowledge, experience and skills, over and above highly expensive capital. The level of capital intensity is expected to increase in coming years as businesses become reliant on sophisticated technology in order to compete internationally.

**Value added**

Industry value added output in the construction and built environment sector is estimated to reach approximately $169bn in FY13. This represents approximately 45 per cent of total industry revenue and is forecast to increase to approximately $187bn by FY18. Supporting sectors of architecture, engineering and mapping provide a higher proportion of industry value as a percentage of revenue in comparison to the construction sector.

**Contribution to GDP**

The construction and built environment industry sector accounts for between seven and eight per cent of Australia’s GDP. The construction industry is by far the largest contributor within the sector. The importance of the construction and built environment industry to the Australian economy has increased during the past decade.

**Exports or exports potential**

Exports are estimated to reach approximately $3.2bn in FY13. The largest contributors were construction and engineering consultancy each with $1.4bn. Exports are forecast to grow by approximately 18 per cent by FY18 to $3.75bn. Exports represent less than 1 per cent of industry revenue, although this is close to 5 per cent for engineering consultancy services.

Exports are led by key industry players and are focused on construction management services and engineering consultancy services

**Import or import replacement potential**

Imports are estimated to total over $5bn in FY13. Similar to exports the largest contributors were engineering consultancy and construction. Imports are forecast to grow by over 3 per cent to $5.3bn by FY18. Imports consist of two fundamental items - professional services such as construction management and engineering consultancy and construction materials. Construction products are imported due to their relatively cost when compared to Australian manufactured building materials. This cost efficiency poses a real threat to the local construction supply industry.
4. Cross-Sector Design

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging industry</td>
<td>Established</td>
<td></td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Very weak</td>
<td>The industry is expected to experience continued downward trends.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Very weak</td>
<td>Competition for work from major global companies is intense, with strong links to most regions and countries becoming more necessary in obtaining accounts or contracts from these clients.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Small</td>
<td>Approximately 1.3 per cent of Australia’s workforce.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Very weak</td>
<td>Employment is expected to grow at very low rates or even decline in some sub-sectors (architecture, engineering and specialised design firms).</td>
</tr>
</tbody>
</table>

Introduction

Cross-sector design is a broad category that compromises a number of interconnected disciplines including engineering, architecture, and specialised artistic design. The nearest proxy for this sector are consulting engineers, architects and designers who operate independently from similar competencies than within areas such as manufacturing or construction.

Services provided by consulting engineers include the preparation of feasibility studies, plans and designs, technical services during the construction or installation, inspect and evaluate projects, and other related services. Architectural consulting services include planning and designing buildings and structures; or planning and designing the development of land. The specialised artistic design segment consists of units mainly engaged in providing specialised design services not elsewhere classified, but could include commercial art, fashion design, graphic design, and interior design services.

In terms of industry globalisation, the architectural and engineering industries have a low level of international globalisation with few foreign-owned companies permanently operating in the Australian market. Within the engineering space, several local businesses are subsidiaries of global giants, and these firms repatriate earnings back to parent companies and regularly draw on international technical resources for their local operations.

The specialised design industry largely services the Australian market, but some major operators are establishing links in the Asia-Pacific region, United Kingdom, North and South America. The extent of foreign ownership is increasing rapidly, with major international advertising agencies purchasing public relations and related design companies as part of a strategy to offer a one-stop service to global clients covering all major regions or countries.

Competitive advantage

Australia does not have a competitive advantage in this industry sector.

Within the engineering space, advancements in communications and design technologies over the past decade have facilitated the provision of consulting services from remote (low cost) locations, placing Australia at a disadvantage. Competition for work from major global...
companies is intense, with strong links to most regions and countries becoming more necessary in obtaining accounts or contracts from these clients.

Unlike specialised design, the requirement for architects to be registered and accredited for practice within state jurisdictions in Australia discouraged some import competition. Similar regulatory constraints in most developed countries limits the entry of Australian firms into export markets.

**Employment**

Within the broader professional, scientific and technical services sector, architecture, engineering and specialised design employs approximately 154,000 workers. This represents 16.9 per cent of employment within the broader professional, scientific and technical services sector and approximately 1.3 per cent of Australia’s workforce. Looking solely at architecture, engineering and specialised design, engineers represent the bulk of employment accounting for 71.1 per cent of employment.

Looking ahead to 2018, employment within architecture, engineering and specialised design firms is expected to decrease by 0.1 per cent largely as a result of a slow down the engineering consultancy services. Employment in both architectural services and specialised designs services are forecast to grow by 1.0 per cent and 2.5 per cent respectively.

Structural change within the engineering space is placing pressure on employment as more and more services are outsourced. For example, large private firms are increasingly outsourcing services in an effort to drive efficiency gains. Typically, where firms employ this sort of labour model, these firms retain an in-house competency not to deliver in-house services by to oversee the procurement and management of consultants. Further, Australian firms are increasingly entering into strategic alliances and mergers with overseas-based firms in response to provide larger multidisciplinary offerings and creating a one-stop shop for their clients, ranging across a wider array design and engineering services.

**Capital expenditure**

The sector has a labour intensive cost structure and relatively low capital intensity. Expenditures within the sector mainly include computer hardware and software technology, which is a necessary requirement for all players in the sector, large and small. The sector has seen some recent change in the capital to labour ratio. For example, many firms have adopted ‘flatter’ management structures, employed of sophisticated modelling or design technologies, and/or made significant investments in information and communication technologies. Despite this recent trend, the value add from the sector is predominantly the result of the skills and training of the workforce.

**Value added / Contribution to GDP**

Value add from architecture, engineering and specialised design is approximately $22.8 billion or 1.6 per cent of Australia’s $1.4 trillion economy. Growth in value add from the architecture, engineering and specialised design is expected to decrease by 1.0 per cent over the next five years, largely the result of an expected slowdown in the engineering consulting services industry.

The slower growth likely reflects slower than expected growth in mineral and energy developments as well as weaker conditions in the transport infrastructure market. Architecture and specialised design are both expected to grow over the next five years by 2.1 per cent and 2.9 per cent respectively.

With respect to engineering consultancy services, the trend over the last five years through has been a downward trend in the value of non-residential construction by approximately 3.0 per cent. This has likely been in response to slower domestic growth, global economic volatility, and reduced availability of global investment.
5. **Digital**

### Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Emerging</td>
<td>PwC has forecast that the tech startup sector alone could generate firms which contribute 4 per cent of GDP by 2033, contributing $109 billion to GDP</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>Australia has a stable regulatory environment that is conducive to investment. However, Australia’s digital industry has relatively low levels of research and development spending.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Moderate</td>
<td>The largest subsector by employment is ICT which contributed 5 per cent of total employment in 2011/12.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Medium</td>
<td>Talent and skills are essential to the innovation in the digital sector.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Very strong</td>
<td></td>
</tr>
</tbody>
</table>

### Introduction

Digital technology is being applied throughout the economy. The ‘digital’ sectors of the economy are generally considered to be those at the forefront of this process. This includes technology startups (both those commercialising IP protected technology (so called ‘deep tech’) and those using enabling technology to disrupt existing business models (e.g. internet startups)). It also includes the digital creative industries such as advertising, film and television, architecture and design.

The digital sector is by nature fast moving and firms are constantly required to innovate in the products and services they provide, the business models used, the way they manage their supply chains and the way they manage their operations. The innovations of the digital sector have important flow on impacts for the rest of the economy and other industries. Innovation drives productivity, growth, sustainability and prosperity. The technological innovations of the digital sector can drive productivity improvements in sectors from financial services to agriculture to manufacturing.

### Data limitations

Due to the significant diversity of the digital sector and the industry classifications used by data collections (such as the ABS), no data exists to present aggregate statistics on the digital sector as a whole. To give an indication of the scale of the digital sector, data is presented on the following subsectors of the digital industry:

- Information media and telecommunications
- Creative Digital Industries
- Tech startups
- ICT goods and services
- Internet advertising.

The data from each of these subsectors should not be aggregated to try to reflect all of the digital sector. This is because these four sub-sectors do not cover the entire digital sector or would result in double-counting of some activities.


**Competitive advantage**

Australia has a stable regulatory environment that is conducive to investment, a skilled workforce, strong research infrastructure and one of the highest rates of technology use in the world. These factors contributed to Australia’s IT industry being listed by the Economist Intelligence Unit as the second most competitive in the world.

Particularly Australia’s system of intellectual property protection gives the digital industry a competitive advantage. According to the Economist Intelligence Unit, Australia has one of the most effective systems of intellectual property protection and one of the most developed bodies of e-commerce laws in the world. Additionally, Australia has established research infrastructure with a unified national university system with strong links to research institutes and industry. The roll-out of the National Broadband Network will contribute significantly to the strength of the digital industry in Australia.

Australia’s digital industry has relatively low levels of R&D spending. The Economist Intelligence Unit ranked Australia 20th in the world for the research and development environment, whereas as already described, Australia ranked in the top five in other areas. Australia also has relatively low levels of venture capital, which is often essential for the development of digital technologies which may not be commercially viable straight away.

**Employment**

The below table shows the employment by subsector of the digital sector. The largest subsector is ICT which contributed 5 per cent of total employment in 2011-12.

<table>
<thead>
<tr>
<th>Subsector</th>
<th>Employment in 2011/12</th>
<th>Forecast employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT</td>
<td>545,000 jobs / 5.07%</td>
<td>Growth of up to 2.6 per cent per annum to 2015, and up to 2.1 per cent per annum 2015-2025</td>
</tr>
<tr>
<td>Information media and telecommunications</td>
<td>175,000 jobs / 1.64% of total employment</td>
<td>n/a</td>
</tr>
<tr>
<td>CDIs</td>
<td>370,000 jobs</td>
<td>n/a</td>
</tr>
<tr>
<td>Internet advertising</td>
<td>162,000 jobs</td>
<td>n/a</td>
</tr>
<tr>
<td>Tech start-ups</td>
<td>&lt;10,000</td>
<td>540,000 jobs in 2033</td>
</tr>
</tbody>
</table>


There is a significant reliance on contractors (both short term and long term) in the digital sector. This may be because of the startup nature of some firms in the industry and also due to the highly skilled and educated nature of the workforce.

Talent and skills are essential to the innovation in the digital sector, this creates challenges in effective recruitment in the digital sector. Though there are challenges in providing the skilled workforce necessary for the digital sector in Australia, jobs in digital industries provide opportunities and benefits. As a highly skilled workforce, jobs in innovative industries such as the digital sector have a multiplier effect. US research suggests that for each high tech job, five additional jobs are created outside the tech sector (higher than the 2.2 jobs reported for manufacturing in the US). Therefore, though employment in the digital industry may not be significant compared to larger, labour intensive industries, there are benefits to digital jobs.

**Value added**

Traditionally, the value of an industry can be measured by the value of the goods and services that industry produces less the cost of producing those goods and services (in other words, the value added). However, this is not necessarily the best measure for the value of the digital sector due to its reliance on innovation and the capability of its people.

In December 2012, the information media and telecommunications industry contributed $10 billion of gross value added or 2.9 per cent of gross value added in the Australian industry.
economy. However, it should be noted that the contribution of the digital sector would be greater than this as the sector covers more than information media and telecommunications. To put this in context, means the contribution of information and telecommunications alone is greater than the value added of agriculture, forestry and fishing (2.00 per cent) and electricity, gas and water services (2.42 per cent).

**Contribution to GDP**

The direct contribution of the digital economy to GDP has been estimated to be $50 billion (see table below). According to one estimate, the digital economies contribution to GDP is forecast to grow at 7 per cent per annum from 2012 to 2017.

PwC has forecast that the tech startup sector alone could generate firms which contribute 4 per cent of GDP by 2033, contributing $109 billion to GDP. The internet advertising industry ecosystem contributed $17.1 billion in GDP in 2012 and is forecast to grow at 7.5 per cent per annum to $26.5 billion in by 2017.

**Table: Digital sector contribution to GDP**

<table>
<thead>
<tr>
<th>Subsector</th>
<th>GDP contribution in 2012</th>
<th>Forecast contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital economy</td>
<td>$50 bn</td>
<td>$70 bn by 2016</td>
</tr>
<tr>
<td>ICT</td>
<td>$92 bn</td>
<td>n/a</td>
</tr>
<tr>
<td>Information media and</td>
<td>$100.6 bn</td>
<td>n/a</td>
</tr>
<tr>
<td>telecommunications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDIs</td>
<td>$31.1 bn</td>
<td>n/a</td>
</tr>
<tr>
<td>Internet advertising ecosystem</td>
<td>$17.1 bn</td>
<td>$26.5 bn by 2017</td>
</tr>
<tr>
<td>Tech startups</td>
<td>&lt;$1bn</td>
<td>$109 bn or 4% of GDP by 2033</td>
</tr>
</tbody>
</table>

Source: Australian Computer Society 2012, Telstra and Deloitte Digital 2012 and PwC

It should also be noted that the digital industries can contribute significantly to GDP in other industries and sectors. The application of the innovations of the digital sector can drive productivity growth throughout the economy by reducing the per unit labour and capital inputs required to produce goods and services.

**Exports or exports potential**

Digital services are highly transportable across national boundaries. Via the internet most digital companies can reach a pool of 2 billion potential consumers at a relatively low cost of distribution. This creates significant opportunities for export, as well as creating challenges with significant imports.

Due to the significant diversity within the digital sector, the value and growth of exports of digital goods and services differ. In the five years to 2012 exports of ICT goods and services decreased by 2 per cent whilst imports increased by 2.4 per cent. At the same time, in 2011-12 there has been strong growth in exports of computer software licences (12.7 per cent), consumer electronic equipment (14.1 per cent) and electronic components (17 per cent). Australia is also a net exporter of some specialist and emerging goods and services offered by the digital sector including architectural services, database services and advertising, marketing and public opinion polling.

**Import or import replacement potential**

The high Australian dollar and the falling cost of shipping to Australia is driving digital imports. In the five years to 2012 total ICT imports (including goods and services) trend growth was 2.4 per cent per annum.

There is significant diversity in the scale and growth of imports of digital goods and services. For example, over the 5 years to 2011-12 imports of electronic components increased by 12.8 per cent and communication equipment increased by 8.1 per cent. Whereas over 5 years to 2011-12 imports of telecommunications services decreased by 11.7 per cent.

Over 50 per cent of imports for ICT goods and services to Australia are from China, followed second by the US which provides 10.7 per cent of imports of ICT goods and services.
6. Environment & Sustainability

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging industry</td>
<td>Emerging</td>
<td>Expected to grow moderately above baseline GDP growth.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Moderate</td>
<td>Expected to grow moderately above baseline GDP growth.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Moderate</td>
<td>In the past Australia’s wealth of fossil fuels has caused delay in transitioning to renewable energy production. Despite this, Australia has begun to exploit its competitive advantage, owing to its geographical composition.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Small</td>
<td>In line with forecasted growth path of the sector.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Moderate</td>
<td>In line with forecasted growth path of the sector.</td>
</tr>
</tbody>
</table>

Introduction

Globally, the environment and sustainability sector has seen unprecedented growth on the back of worldwide recognition of anthropogenic climate change. Innovation in the renewable energy sector continues to be paramount in the effort to curb emissions. Australia’s recent carbon tax and clean energy plans aim to provide 20 per cent of Australia’s electricity via renewable resources by the year 2020. These, together with assistance packages and mitigation plans ensure that Australia will remain at the forefront of reducing carbon emissions from energy generation. Our geographical composition of trade winds, high solar radiation and renewable energy sources ensure that Australia enjoys a favourable positioned to innovate in climate change technology.

Given the prominence of climate change innovation, the key focus of this overview is on the current trends of the renewable energy industry. Nevertheless, the environment and sustainability sector is not limited to those related to low carbon energy generation. For instance, Australia is currently dealing with unprecedented levels of e-waste as we continually move to a highly technological society.

This overview focuses exclusively on the low carbon and recycling/waste management industries. Nevertheless, we highlight that the environment and sustainability sector is larger than these two key components.

Competitive advantage

In the past Australia’s wealth of fossil fuels has caused delay in transitioning to renewable energy production. Despite this, in recent years Australia has begun to exploit substantially its competitive advantage in the field, owing to its geographical composition which places it in a highly favourable position to take advantage of renewable energy sources.

Hydro

For many years Australia has taken advantage of hydro electricity production with 7 per cent of electricity currently produced through Hydro sources. The industry’s maturity, recent healthy rainfalls, and flexible energy supply in peak periods (comparative to coal generation) has ensured that the industry has maintained healthy margins. However, Australia’s relatively small water supply means that the allocation of potential hydro electricity...
generation in Australia is likely to have already been largely exhausted. While hydro will continue to innovate through productivity improvements via refurbishment of large scale hydro plants and development of small scale private generators, there appears to be minimal competitive advantage in future hydro production for Australia.

**Wind**
Recent years have seen the maturity of wind technology resulting in increased cost competitiveness and spurring growth in wind energy generation. Australia’s southern coasts are among some of the most suitable positions for wind generation in the world, creating opportunity to further capitalise on maturing technology. This, combined with government incentives for development in renewable energy, is creating a competitive environment for Australia to become a world leader in wind generation technology. However at this stage, uncertainty in the regulation (planning controls and renewable energy targets) and pricing (relative to fossil fuels) is delaying potential investment in the sector. In addition, the lack of certainty has caused some component manufacturers to move from Australia and most of the high value components for the industry are now required to be imported.

**Solar**
Compared to wind generation, solar generation technology is in its infancy within Australia with the majority of current solar generation coming in the form of private water heating. However, investment in large scale solar electricity generation is increasing rapidly. With the highest average solar radiation per square metre of any continent and leading research capabilities in technology development, Australia has a position of natural advantage. However on the industrial side, China has made significant investment and Germany is the global leader on production of quality solar panels. Australia lags behind these two countries in the development and application of solar technology.

**Geothermal**
While in its infancy, Australia has some potential to utilise hot rock geothermal energy with resources plentiful in Central Australia. Australia’s position in the middle of a tectonic plate has stymied technological development, however development projects are underway as Australia explores alternative avenues for renewable energy. Currently opinions are divided as to whether geothermal energy production is a viable option for the future, particularly given the remoteness of geothermal sources from population centres and the inefficiency of electricity transmission.

**Ocean**
Ocean energy technologies remain largely underdeveloped globally. However, the potential for both wave energy (along our southern coastlines) and tidal (in the North West) are world class and could provide extremely substantial quantities of energy. Adoption of technologies will depend on development of commercially viable ventures, but Australia is poised to take full advantage should steady development occur.

**Bioenergy**
While not a catalyst for large scale electricity production, bioenergy is being heavily developed as a cleaner alternative to fossil fuel. With an abundance of forest and potential biomass, Australia is well positioned to utilise developments in bio energy technology.

**Waste management and recycling**
Currently Australia has a developed privatised waste management industry which has witnessed an increase in recycling quantities. The continued maturing of recycling hazardous electrical appliance waste will create further room for growth in the industry of urban mining. Currently, Australia recycles around 17 per cent of its television and computer waste, the government aims to increase recycling level to 80 per cent by 2021-2022. Increased material supply coupled with benefits from economies of scale could see current waste management companies capitalise on potential advances in urban mining potential.

**Level of innovation**
Building global pressure for countries to reduce carbon emissions has lead to Australia developing a carbon mitigation system that both discourages the continuation of fossil fuel energy production and incentivises innovation in the field of renewable energy. This mix is creating an innovative hotbed, with renewable electricity generation predicted to grow significantly in the next 5 years. Currently, 19GW of renewable electricity are anticipated to
enter the grid through 2018, including projects at all stages of their development lifecycle with an estimated capital expenditure of $40bn.

Table: Number of projects by capacity and capital expenditure in 2013

<table>
<thead>
<tr>
<th>Projects well advanced within their development lifecycle</th>
<th>Number of projects</th>
<th>New Capacity (MW)</th>
<th>Capital expenditure ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>13</td>
<td>1,945</td>
<td>4487</td>
</tr>
<tr>
<td>Hydro</td>
<td>1</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Solar</td>
<td>1</td>
<td>44</td>
<td>105</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Projects less well advanced within their development lifecycle</th>
<th>Number of projects</th>
<th>New Capacity (MW)</th>
<th>Capital expenditure ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>72</td>
<td>14,676</td>
<td>Unknown</td>
</tr>
<tr>
<td>Hydro</td>
<td>1</td>
<td>37</td>
<td>Unknown</td>
</tr>
<tr>
<td>Ocean</td>
<td>3</td>
<td>786</td>
<td>Unknown</td>
</tr>
<tr>
<td>Biomass</td>
<td>1</td>
<td>83</td>
<td>Unknown</td>
</tr>
<tr>
<td>Solar</td>
<td>11</td>
<td>1,035</td>
<td>Unknown</td>
</tr>
<tr>
<td>Geothermal</td>
<td>3</td>
<td>220</td>
<td>Unknown</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>106</strong></td>
<td><strong>18,866</strong></td>
<td><strong>4,612 known</strong></td>
</tr>
</tbody>
</table>

Source: Australian Renewable Energy Agency 2013

Despite these projects, Australia has to some extent relied on imported technology and components in installed renewable generation to date. Nevertheless, the government has three bodies responsible for providing financial support for the development of Australia’s clean energy technology, these are detailed below.

**Clean Energy Finance Corporation (CEFC)**
With a $10bn budget, CEFC’s primary function is to invest in businesses seeking to get innovative renewable energy technology initiatives off the ground. Returns from investments are reinvested in other projects, fuelling Australia’s move to a clean energy future.

**Australian Renewable Energy Agency (ARENA)**
Focusing on R&D within the industry, ARENA has $3.2bn to dedicate support in the research, development and commercialisation of renewable energy technologies as well as the storage and sharing of knowledge obtained through this process.

**Clean Technology Innovation Program**
The government has a grant based program to provide support to business investment in low emissions R&D in the field of renewable energy. The program will spend $200m in both the public sector (universities, research bodies) and private investment over five years and be based on a 50:50 co-investment basis.

In addition to these three programs the existing Renewable Energy Target (RET) is legislated to ensure that 20 per cent of Australia’s electricity supply is generated from renewable sources by 2020. The RET has overseen the rapid growth of wind technology over the last decade, with generation capacity growing from 100MW in 2001 to currently over 2000MW. The RET has also supported the installation of over 30,000 small scale solar panel systems since 2001, with investment set to increase as solar technology improves.

**CCS Flagships Program**
The government is allocating $1.18bn to the program that is testing the commercial viability of carbon capture and storage technology. The goal is for 20 demonstration facilities to be operational in G8 countries by 2020.

**Recycling**
While waste management technology and growth remains relatively steady, technological advancements are occurring with improved sorting mechanisms for the recovery of recyclable products. The public’s environmental awareness and government schemes like the NTCRS are fuelling growth in recycling levels. This coupled with medium market concentration, is creating opportunity for companies to benefit from economies of scale in the future.
### Employment

In 2012/13 the renewable energy sector employed around 6,000 people, predominantly in the existing industries of hydro and wind generation.

Employment growth in the hydro industry is anticipated to be modest with only two small scale facilities in development; employment growth is predicted to grow at 1.84 per cent CAGR over the next 5 years. However, with high growth anticipated in other renewable energy industries over the next 5 years employment is predicted to grow by 4.26 per cent CAGR over the next 5 years.

High wages and strong skill sets are necessary to gain employment in the industry. This will ensure that while investment in new facilities remains high, tenure and job security will remain long and high through the foreseeable future.

With high levels of employment growth in the waste management industry over the last decade, 14,280 people are employed nationally. Growth in employment is expected to slow from 5 per cent per year in 2013 to 2 per cent by 2018.

### Capital expenditure

Capital expenditure figures for the renewable energy sector can be found in the innovation section of this overview, above. While it is hard to gauge the level of expenditure anticipated in the waste management industry, the mature nature of the industry is likely to result in relatively low levels of capital expenditure.

### Contribution to GDP

In 2012-13 the hydro energy generation industry is expected to contribute $1.4bn to GDP, with the remaining renewable energy industry contributing $1.03bn. Together this accounts for roughly 0.17 per cent of GDP with above average growth expected for both industries over the next 5 years. The renewable energy (other than hydro) contribution to GDP is expected to grow at an average CAGR of 14.9 per cent over the next 5 years, while the hydro industry is expected to grow at a more modest average of 4.3 per cent over the next 5 years.

The waste management industry is also expected to grow significantly over the next five years as recycling continues to add value to the industry. In 2012/13 the industry is expected to contribute $1.2bn to GDP and is expected to grow at an average CAGR of 5 per cent over the next 5 years.

### Exports or exports potential

Due to the lack of commercial storage and transport technology, electricity is not a commodity that can be traded viably. However, there may be opportunity to capitalise on technology advancements, intellectual property and a highly experienced workforce as Australia develops its techniques in the industry. However, currently globalisation trends and knowledge share between countries is low with countries choosing their own paths in the fight against climate change. The story is similar in the recycling industry with trade volumes of recycled waste very low, but with the possibility to export techniques and knowhow.

### Import or import replacement potential

Australia has relied on imported technology and components for installed renewable energy technology to date.
7. Finance

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Established</td>
<td></td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>The largest subsectors of this industry are expected to grow by around 6.5 per cent each year.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Strong</td>
<td>Despite a disadvantage given the scale of Australia’s operations, Australia has a highly sophisticated sector and is highly regarded across Asia.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Very large</td>
<td>Financial services and insurance sector employs more than 421,000 people and is one of the largest sector contributors to GDP.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Moderate</td>
<td>The strong expected growth for the industry will be led by technical innovation and embracing digital technologies. Employment is expected to grow in line with baseline GDP.</td>
</tr>
</tbody>
</table>

Introduction

The financial and insurance services sector includes firms mainly engaged in financial transactions involving the creation, liquidation, or change in ownership of financial assets, and/or in facilitating financial transactions. The range of activities includes:

- raising funds by taking deposits and/or issuing securities
- investing funds in a range of assets
- pooling risk by underwriting insurance and annuities
- separate funds engaged in the provision of retirement income (ie superannuation)
- auxiliary services that facilitate or support financial intermediation, insurance and employee benefit programs such as brokerages or consultancies.

The Australian financial and insurance services sector is primarily located on the east coast in the capital cities of Brisbane, Melbourne and Sydney. The sector can be characterised broadly as a moderate growth sector, highly concentrated among several large firms. Competition in the sector is moderate and undergoing significant technological change. The sector is highly regulated (particularly since the GFC) but receives only low levels of direct support from Australian governments.

The past five years since the GFC have resulted in a number of significant changes across the sector. Increasingly there has been a consolidation of the finance and insurance services sector (in Australia and globally) and a growing trend for convergence in the delivery of financial services. Despite major equity markets worldwide reaching new highs since the GFC, the lending business still appears to be sluggish placing pressure on margins. Uncertainty surrounding Australia’s residential property market has dampened investor enthusiasm.

Competitive advantage

Global competitive advantage in the sector is typically driven by several key factors such as access to and cost of funding, presence, price and reputation. Australia has a strong competitive advantage in the Finance sector due to a highly sophisticated sector and is highly regarded in terms of financial capability across Asia.
However, the broader global context, the Australian finance and insurance sector is somewhat at a disadvantage given the scale of their operations relative to their global peers. Australian banks, for instance, continue to be some of the most profitable in the world, however profitability has been largely the result of sound risk management through the GFC (and beyond). One important point of differentiation for the finance and insurance services sector in Australia is the superannuation system. Australia currently has $1.4 trillion in funds under management which is the fourth largest in the world and the largest in the Asia Pacific region.

**Level of innovation**

The financial and insurance services sector has undergone a high degree of innovation and technological change, particularly with respect to uptake of communication and computing technology into day-to-day operations.

A significant impact of this investment over the past two decades has been a shift from ‘over-the-counter’ services to self-service service via technologies such as the web, ATMs, EFTPOS, etc. This shift to self-service has resulted in cost reductions and productivity gains.

Advances in “big data” analytics are already allowing life and superannuation businesses to develop a better understanding of their risks and price more accurately. An important differentiator is going to be obtaining and analysing customer profiling data from purchasing, social media and other digital trails. Further, advances in remote medical technology, devices and preventative care may help both increase life expectancy and also generate richer information for pricing, product development and analytics. Analysis of these rich sources of data would allow insurance and superannuation industry to develop a clear and comprehensive profile of the health, wealth and behaviour of their customers.

**Employment**

The most recent data indicates that the financial services and insurance sector employs more than 421,000 people, around 3.6 per cent of total employment. The finance industry employs 205,100 people and accounts almost half of employment within the sector. Within the industry, the single largest employer is banking which employs some 163,000 people. The auxiliary financial and insurance services industry is the next largest employing 120,000 people with the largest proportion, some 82.0 per cent, employed in finance and investment services. The insurance and superannuation industries employ the remaining 93,000 people, with health and general insurance accounting for 78.8 per cent of employment in the industry. Over the past 10 years, the contribution to total employment in Australia from the finance industry has remained in a tight range between 3.6 and 3.9 per cent.

By 2017 employment in the financial and insurance services sector is expected to grow by 3.8 per cent. Over this period, the finance industry is expected to shrink by 1.8 per cent primarily driven by a contraction of employment in banking which is expected to decrease by 4.0 per cent. This is likely the result of drives by the banks to automate internal operations and/or rationalise their businesses lines or off shoring certain functions.

Employment in the auxiliary finance and insurance services industry is expected to grow by 6.1 per cent over the next five years. This growth will be driven primarily by the finance and investments services which are forecast to grow by 10.6 per cent. This is in contrast to the insurance services industry which is expected to decrease employment by 6.9 per cent. General and health insurance is forecast to grow by of 15.0 per cent while employment in life insurance is expected to grow by 20.6 per cent. The superannuation industry, however, is expected to shed approximately 5.0 per cent of its employment over the same period. Likely this growth will be driven by both organic growth and efforts to expand service networks into new markets and cross-sell (or integrate) products across business units or strategic partnerships.

**Capital expenditure**

The wider financial and insurance services sector is labour intensive, with wages accounting for a high proportion of revenue. Labour expenses include the wages, salaries and benefits paid to professionals and administrative staff. The industry has seen increased investments in technology in an attempt to improve productivity and lower costs, particularly we respect to administration. This trend is likely to continue well into the future. For example, in the
finance space, investment banks are increasingly introducing more customised software tailored to the needs of larger customers who might experience considerable paper burden as a result of large transaction volumes. This includes integrated brokerage and electronic trading platforms to allow customers to monitor their investment positions in real-time, as well as conduct global trading across a wide variety of asset classes, and in turn facilitate both regulatory and management reporting.

Value added / Contribution to GDP

The finance and insurance sector contributes $142.3 billion to Australia’s economy, and is one of largest sector contributors overall. Within the broader economic context, the mining sector was the largest contributor to national output, generating 10.3 per cent of total value add. However, this was followed by the financial and insurance services, construction, and manufacturing, which account for 10.0 per cent, 8.0 per cent and 7.9 per cent respectively. Professional, scientific and technical industries accounted for around 7 per cent of value add, reflecting the highly skilled, innovative nature of the Australian economy.

Within the sector, the finance industry along represents approximately $86.8 billion (or 60.9 per cent) of the sector value add, while the auxiliary financial and insurance services (i.e. brokerage, consultancy, and other professional services) represent another $34.4 billion or 24.2 per cent. The insurance and superannuation industry represents $21.2 billion or 14.9 per cent of sector value add.

Going forward, higher borrowing costs, increased regulatory scrutiny and lower levels of leveraging could mean slow growth in the financial markets over the five years. The steady flow of funds into superannuation however is forecast help growth in many of the finance and auxiliary service industries. Despite slower growth overall service industries will likely continue to be the main engine of growth even as the manufacturing industries continues to take a secondary role in the broader economy.

On a five year forward looking basis, the value add created by the sector is expected to grow by an average of 5.5 per cent. This will largely be the result of growth in both the finance industry and the auxiliary finance and investment services sectors which are expected to grow by 6.2 per cent and 6.5 per cent respectively. Overall sector growth will be offset somewhat the insurance and superannuation industries which are forecast to grow by 0.7 per cent. This slower growth is expected to be partly the result of the general insurance and life insurance industries which are forecast to decline in the by 1.4 per cent and 3.0 per cent.

Exports or exports potential / Import or import replacement potential

Exports of financial services are estimated to be approximately $1.42 billion, targeted predominately towards the United Kingdom and the United States which represent 14.4 per cent and 12.5 per cent of financial services exports respectively. The past five years have seen a reduction in the exports of financial services by 15.8 per cent, but has seen improvements in exports to places like China and Singapore.

Imports of financial services are estimated at $890 million. The primary source of imports of financial services is the United States which represents 52.6 per cent of imports of financial services. The United Kingdom is a second place and represents 12.4 per cent of imports of financial services. The past five years have seen a decline in financial service imports by 14.5 per cent.

Exports of insurance and superannuation services are estimated to be approximately $450 million. The primary markets for Australian exports of insurance and superannuation services is predominately New Zealand which represents 55.6 per cent of exports, with Malaysia and China representing the next largest export markets. The past five years have seen exports grow by 6.3 per cent particularly to Malaysia and China which have grown by 13.6 per cent and 25.7 per cent respectively.

Imports of insurance and superannuation services represent approximately $660 million. The trend over the past five years has seen imports grow by 2.9 per cent. The largest source of imports is from the United Kingdom which represents 61.5 per cent of imports in insurance and superannuation services, which has also growth by 14.1 per cent over the same period.
8. Health & Medical Technology

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging industry</td>
<td>Established</td>
<td>A guaranteed additional $16.4 billion will be provided by the Federal Government up until 2019-20. The global market for medical technology is forecasted to grow at approximately 10 per cent per annum.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Very strong</td>
<td>Despite the size of the domestic market, Australian medical technology companies are considered to be globally competitive organisations. Domestically, the sector is very competitive for government support due to it being a fundamental service especially with an ageing population.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Very large</td>
<td>The Australian health industry alone employs about 6.8% of total employment in Australia.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Strong</td>
<td>It is forecasted that approximately 30% growth in Australian employment will be required to support the future expansion of the industry.</td>
</tr>
</tbody>
</table>

Introduction

The health industry in Australia is funded jointly by the Federal and State Governments. Under the 2011 Heads of Agreement on National Health Reform, the Federal Government agreed to increase its contribution to efficient growth funding for hospitals to 45% from 1 July 2014, increasing to 50% from 1 July 2017. A guaranteed additional $16.4 billion will be provided by the Federal Government under this new agreement up until 2019-20. This funding is on top of the level of funding that the Federal Government would have otherwise provided. This funding will in turn be allocated to the states by the Independent Hospital Pricing Authority.

One of the key relevant segments of the health sector is the health and medical technology industry, which comprises a broad range of focus areas including (but not limited to):
- Medical technology and procedural research, development and production
- Biomedical technologies and ICT with health services delivery, including the use of eHealth and Telehealth
- Health and information services, including mobile health (mHealth) and genomics
- Pharmaceuticals, health science sector and medical tourism.

The global market for medical technology is worth an estimated US$300 billion a year, and is forecasted to grow at approximately 10 per cent per annum. The United States has the largest share of the market (about 40 per cent), and is Australia’s main import and export market for the industry. Other key players include Germany, Switzerland, Ireland, United Kingdom and China. Australia’s share of the global market is significantly smaller at 2.6 per cent. Further,
the size of the international medical technology market is half that of the global pharmaceutical market (which is growing steadily, with sales reaching $1.08 trillion in 2011).

The majority of innovation in this industry occurs in the private sector as opposed to the public sector. There are over 500 medical technology companies in Australia, 53 of which are listed on the ASX with a combined market capitalisation of $2.4 billion. The geographical concentration of the industry is shown in the figure below (note that TAS, ACT and NT are not represented as there is limited presence in these locations).

**Figure: Location of medical technology companies in Australia, 2011**

![Graph showing the percentage of medical technology companies in each Australian state in 2011.](source)

**Competitive advantage**

Although the global medical technology market is dominated by US companies, Australian companies like ResMed and Cochlear are considered to be globally competitive organisations. However, emerging economies are capturing an increasing share of the industry, and will be Australia’s biggest competition going forward. Countries such as China, Brazil and India are able to deliver cheaper technology faster.

Because of the small size of the Australian market, companies need to consider the translation of medical research and the potential return on investment when developing new technology locally.

**Level of innovation**

Current and future trends in health and medical innovation include but are not limited to the following.

**Genomics**

It is predicted that in the decades ahead, the pace of biomedical discovery will accelerate. The state of an individual will be characterised with increasing precision from the molecular level to the genomic level to the organ level. This precision medicine will become possible because of enhanced use of comprehensive clinical data. The next frontier for genomic medicine (and where much of the market value may actually lie) is in using genetic testing to screen patients at risk for developing chronic diseases and to manage those patients with the medications that work best for their genetic makeup.

**mHealth**

While still in its infancy in Australia, mHealth is expected to revolutionise health care in the future by encouraging patients to take responsibility for their own health and provide a means of measuring key health parameters in a comprehensive, continuous fashion. More recently, pharmaceutical companies have taken the lead in integrating mobility (through wireless devices and cellular phones) into their R&D; leveraging mobile technology to increase patient recruitment while cutting costs by up to 25%. Mobility also allows for improved regulatory compliance, product development and distribution by offering pharmaceutical and R&D licensing partners a more effective tool to record and report adverse events during and after clinical trials. Innovation in mHealth is likely to result from the private sector (particularly from private health insurers), rather than in the public sector.
**eHealth**

Electronic Health Records (eHRs) are quickly becoming the rule rather than the exception in Australian public and private healthcare, and stand to dramatically improve health care coordination as they overtake the paper-based medical chart. Two systems prominent on the eHR landscape are electronic Medical Records (eMRs) and the Personally Controlled Electronic Health Record (PCEHR) These systems have a focus in different areas – eMRs in the public and private hospital setting and the PCEHR in primary care.

**Telehealth**

Opportunities to extend telehealth services to the primary care market are currently being explored in WA to enable General Practitioners to consult remotely to patients with low acuity.

Future developments in health and medical research are likely to be driven by changes in health care delivery and research (see figure below).

**Figure: Likely future developments in health and medical research**

- **Health care trends**
  - Personalised medicine (e.g. genomics)
  - Ageing population
  - Environmental challenges
  - Medical tourism
  - Rising costs of health care
  - Preventative health
  - Evidence-based practice
  - New delivery modes (e.g. home care)

- **Research trends**
  - Globalised research teams
  - Emergence of developing economies (e.g. India, China)
  - Advances in technology and sharing of infrastructure
  - Electronic dissemination
  - Rapid grant application processes
  - Innovative sources of funding

- **Health and medical research trends**
  - Integration of health services delivery and research
  - Top-down strategic research
  - Streamlining grant processes
  - Preventative health research
  - Increased use of evidence in health care practice and policy
  - Increased use of philanthropy and new funding sources (e.g. social bonds)

Source: Department of Health and Ageing 2013

**Employment**

The Australian health industry employs almost 780,000 people, which is about 6.8% of total employment in Australia. Due to productivity gains in the industry, the number of people employed is forecast to increase by 3.0% per annum. In comparison, the medical technology industry in Australia employs approximately 17,500 people. The majority of companies (77%) employ between 20-100 staff, however more companies are anticipated to use technology to automate processes previously carried out by employees to increase productivity.

Personnel generally fall in one of the three stages of the continuum for the development and delivery of medical technology:

- research and development – biological and physical sciences, biomedical sciences and engineering, medicine, medical research and technology, and nursing
- manufacturing – biological and physical sciences, biomedical sciences and engineering, commerce, information technology, manufacturing, medicine, nursing, regulatory and quality, and reimbursement
• distribution – biomedical sciences, education, medicine, nursing, product specialists, sales and marketing, regulatory and quality, reimbursement, and health economics.

Skills shortages are current in various sectors of the industry and are expected to grow. Skills shortages and gaps exist for regulatory affairs specialists, reimbursement specialists, product R&D engineers, business development and project management personnel, and sales and marketing (particularly export sales and market development). It is forecasted that approximately 30% growth in Australian employment will be required to support the future expansion of the industry.

**Capital expenditure and value added**

Total expenditure on health in Australia was estimated to be $130.3 billion in 2010-11, of which $6.6 billion was estimated capital expenditure, which is 5.1% of total health expenditure. The annual spend by Australian medical technology businesses in 2008-09 was $388 million divided between medical biotechnology, nanotechnology and biomedical engineering. This declined in 2009-10 to $194 million.

The health industry value add is projected to increase by an annualised 4.0% in the 10 years through to 2017-18, significantly exceeding the growth of the Australian economy (GDP growth of an annualised 2.4%). Over the 10 years through to 2017-18, value add for the medical and surgical equipment manufacturing sector is estimated to increase at an annualised rate of 1.4%, compared with estimated annualised GDP growth of 2.4% over the same period. These factors indicate that the sector is in a growth/maturity stage of its life cycle, with steady growth forecast in future years.

**Contribution to GDP**

It is projected that the Australian health industry will generate revenue totalling $116.5 billion in 2012-13 rising to $143 billion by 2017-18, at an annualised growth rate of 4.2% per year. Total revenue for the Australian medical technology industry in 2010-11 was estimated at $8.02 billion, of which roughly $3 billion was generated by the medical and surgical equipment manufacturing sector. From 2008-12, the industry grew at a rate of 9% per annum.

The medical and surgical equipment manufacturing sector is projected to grow by 2.7% per annum between 2013 and 2018 to reach an estimated $3.81 billion. This result can be attributed to key external drivers such as technological advances and product innovation in the industry, and demand from health care providers to service an ageing population.

**Exports and imports**

The medical technology industry engages in significant international trade. The majority of medical technology products manufactured in Australia are exported, while most of the products used locally are imported. However, industry revenue from exports has fallen from 68.8% in 2007-08 to an estimated 51% in 2012-13, due to the global financial crisis and subsequent cuts to health care expenditure as well as the high Australian dollar. This suggests the domestic market has increased as a source of revenue and contributed to the continued growth of the industry. From 2007-08 to 2012-13, exports decreased at an annualised rate of 2.4% to $1.7 billion. It is expected that exports will continue to fall if global demand and domestic output do not increase.

The total value of imports has increased at an annualised rate of 1.9% over the last five years to $3.96 billion. Import penetration within the industry has remained high over this period and in 2012-13 is estimated to account for 70.8% of domestic demand. Import growth continues to be supported by the strong Australian dollar, and the import replacement potential of the industry is not expected to be high in the future. The comparative import and export values for pharmaceuticals were $8.7 and $3.3 billion respectively in 2012-13.
9. Industrial Materials

### Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging industry</td>
<td>Emerging</td>
<td>Due to new technologies being employed.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Moderate</td>
<td>Currently expected to be in line with baseline GDP as the development and transfer of these technologies is dependent upon Government support.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Weak</td>
<td>Globally, Australia is falling behind other regions in the development and transfer of these technologies.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Very small</td>
<td></td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Moderate</td>
<td>In line with forecasted growth path.</td>
</tr>
</tbody>
</table>

### Introduction

'Industrial materials' refers to a grouping of three technologies (solar photovoltaics, carbon fibre composites and photonics) that can be used for a variety purposes including energy generation and as a manufacturing material. As this is not an industry in itself, this has affected the ability to obtain reliable data and information, especially in an Australian context. Therefore this brief deals with each of the three technologies separately.

**Solar Photovoltaics (PV)**

Solar PV remains the third most important renewable energy source, after hydro and wind power, in terms of globally installed capacity. PV technology has grown over the past decade at a remarkable rate – even during difficult economic times – and is on the way to becoming a major source of power generation for the world.

Europe remains the world’s leading region in terms of cumulative installed capacity, with more than 70 GW as of 2012. This represents about 70% of the world’s cumulative PV capacity. Next in the ranking are China (8.3 GW) and the USA (7.8 GW), followed by Japan (6.9 GW). Many of the markets outside EU – in particular China, the USA and Japan, but also Australia (2.4 GW) and India (1.2 GW) – have addressed only a very small part of the potential use of PV.

The Australian PV system market is defined as the market of all nationally installed PV applications with a PV capacity of 40W or more. A PV system consists of modules, inverters, batteries and all installation and control components for modules, inverters and batteries.

The demand for and installation of residential solar PV systems in Australia continues to be driven by up-front cost, industry marketing, rising electricity prices, environmental awareness and government incentives through feed-in tariffs and Small-scale technology certificates (STCs). With the progressive roll-back of solar feed-in tariffs across most states, the Small-scale Renewable Energy Scheme (SRES) has become the key support mechanism for solar PV in Australia.

Residential grid-connect PV systems are projected to have peaked in 2011 and will steadily reduce each year out to 2015 as shown in the below figure.
As above, non-residential (commercial) grid-connect PV systems are also projected to increase to 2015.

For many small-to-medium businesses, solar PV can represent a highly profitable investment, however there are many barriers to uptake that prevent greater level of installation in Australia. These include:

- Most small-to-medium businesses lease their premises. Payback may take longer than the lease term, and the building owner does not pay the electricity bill.
- Businesses prefer to invest in their own operations rather than in non-core activities
- Electricity represents a relatively small proportion of a business’s costs and as such gets little attention from business owners.

Despite these barriers, the profitability of installing solar PV systems will grow as system prices decline, electricity prices rise and governments continue to provide feed-in tariffs and clean technology grants to manufacturers.

Employment

As the Australian PV market has grown in volume, the channels to market have evolved and expanded as well. By the end of 2012, there were an estimated 4,200 businesses active in the PV industry in Australia, estimated to employ approximately 16,000 people, including support industries. Over 80 per cent of this labour relates to system installation companies and other services such as financial, legal, market analysts, consultants and training providers.

The highest number of companies in the PV industry is electrical contractors who represent around 70 per cent of the total number of businesses active in the PV industry in 2012.

Electrical contractors play a vital role in the installation of PV and their number is a crucial measure of the industry’s capacity to install any given volume. However, as these companies have increasingly represented sub-contractors taking advantage of what is now relatively low revenue installation work, their entry and exit from the industry shifts rapidly with demand. It is also arguably the case that this segment of the channel is on the whole far less engaged in the development of or advocacy for the industry.

Business value

The most recent available estimate of the value of PV businesses in Australia is shown in the table overleaf. These values are based on the installation types and system and component prices of solar PV. Although installations doubled from 2010 levels, the value of business remained steady, due to the significant fall in component and system prices achieved in 2011.
### Table: Value of PV business in Australia (2011)

<table>
<thead>
<tr>
<th>Sub-market</th>
<th>Capacity installed (W)</th>
<th>Price ($ per W)</th>
<th>Value ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-grid domestic</td>
<td>57,562</td>
<td>10.50</td>
<td>604</td>
</tr>
<tr>
<td>Off-grid non-domestic</td>
<td>18,418</td>
<td>14.00</td>
<td>258</td>
</tr>
<tr>
<td>Grid-connected distributed</td>
<td>757,418</td>
<td>3.90</td>
<td>2,954</td>
</tr>
<tr>
<td>Grid-connected</td>
<td>3,605</td>
<td>3.00</td>
<td>11</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td><strong>3,827</strong></td>
</tr>
<tr>
<td>Export of PV products</td>
<td></td>
<td></td>
<td><strong>17</strong></td>
</tr>
<tr>
<td>Import of PV products</td>
<td></td>
<td></td>
<td><strong>-2,595</strong></td>
</tr>
<tr>
<td><strong>Value of PV business</strong></td>
<td></td>
<td></td>
<td><strong>1,249</strong></td>
</tr>
</tbody>
</table>

Source: Australian PV Association (May 2012)

### Competitive advantage

Australia does not have a competitive advantage in solar PV as innovation in solar generation technology is in its infancy within Australia with the majority of current solar generation coming in the form of private water heating. However, investment in large scale solar electricity generation is increasing. With the highest average solar radiation per square metre of any continent and leading research capabilities in technology development, Australia has potential to become highly competitive against the rest of the globe.

### Exports or exports potential/Import or import replacement potential

Australia is a relatively late starter in terms of being a ‘material’ sized market and has comparatively low barriers due to 95 per cent of systems being installed for residential use. Therefore, international companies seeking to test new products, clear old models or sell Tier 2 or Tier 3 products have been attracted to Australia.

Australia is seen as an attractive market and had one of the highest proportions of Tier 2 and 3 products in 2011 (estimated at 65 per cent). The result of this has been average PV prices at or below the lowest average world prices.

### Carbon Fibre Reinforced Polymer (CFRP)

CFRP composites are seen by many as ‘the’ new material to help provide lighter, stronger and lower emission cars, trains and aeroplanes, support for more efficient energy generation and civil construction materials and other products where light-weight and strength are key.

### Value of carbon fibre

The global volume demand for CFRP was estimated at around 67,000 metric tons in 2012, and is projected to maintain a 2012-2020 CAGR of 15.3 per cent to reach 210,000 metric tons by 2020. The total value of this demand was estimated at US$10.25bn in 2012 and is expected to grow annually by 11.9 per cent over 2012-2020 to reach US$25.2bn by 2020.

In tandem with the CFRP market, global demand for carbon fibres in terms of volume, was estimated at 45,000 metric tons in 2012 and is projected to reach 141,000 metric tons by 2020, registering a 2012-2020 CAGR of 15.4 per cent. In terms of value, consumption of carbon fibres globally is estimated to stand at US$2.03bn in 2012 and projected to reach around US$5bn by 2020. However, these statistics refer to the use of carbon fibre as a raw material for the production of CFRP which is only a portion of the applications of carbon fibre and therefore only a portion of the whole global market.

The total demand and value of CFRP or carbon fibres in Australia has not been identified. However, estimates that the Australian composite end-product market is worth in excess of $3bn each year, gives an indication of the potential market size for a material such as CFRP.

### Competitive advantage

While Australia does not currently have a competitive advantage in this area, there has been significant work from the Australian and Victorian governments to explore options to
advance carbon fibre developments. Majority of the R&D capability for carbon fibre is located in Victoria.

**Cooperative Research Centre for Advanced Composite Structures (CRC-ACS)**

The CRC-ACS is currently undertaking a $65 million research program in composites and related technologies for the oil & gas, aerospace and defence industries. This internationally collaborative program includes participants from 28 organisations from eight countries and connects into Australian industry via Composites Australia, the key local association.

**Photonics**

Photonics, also referred to as optoelectronics, is technology for generating, guiding and detecting light. It is fundamental to the communications industry and is an enabling technology for manufacturing, medical, defence, environmental and other industries.

The current global photonics market is estimated to be around $420 billion in 2012, and the leveraged impact of photonics in other enabled industries is reportedly substantially greater in terms of turnover and employment levels. The global market is expected to grow significantly over the next few years, with the estimated market size approaching $670 billion by 2015.

The biggest driver of growth in this market is LCD displays, which enables a variety of consumer based products, from TVs to mobile phones. Photonics is now an element in 35 per cent of all consumer devices.

There is little analysis of the current photonics market in Australia. This is in contrast to the well established industry organisations and information available for the US and European industries in particular. The Centre for Ultra high Bandwidth Devices for Optical Systems (CUDOS) has secured $33 million research budget for the seven year period to 2017, participating universities include: University of Sydney, Macquarie University, Swinburne University of Technology, Australian National University, RMIT University and Monash University.

In addition to the funding for CUDOS, in 2012 the Federal and Victorian Governments agreed to a $95 million funding arrangement for the ongoing operation of the Australian Synchrotron. Research conducted at the Australian Synchrotron is cutting edge and spans the science spectrum from medicine to manufacturing. The intense beams allow researchers and scientists to examine sub-microscopic structures to improve research in medicine, agriculture, bioscience, engineering, forensics and environmental science.
# 10. Resources & Energy

## Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Established</td>
<td>Revenue from mining and oil and gas is expected to grow annually by 8.8% and 18.1% respectively in the years to 2018. However, skills shortages are impacting on MET sector growth which is vital for a sustainable industry.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>Very strong competitive advantage in the sector due to its quality of resources and location to Asia, however there are challenges to this going forward.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Strong</td>
<td>The mineral and resources sectors are significant contributors to Australian GDP.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Very large</td>
<td>The sector faces skills shortages and forecasted growth will necessarily be driven by innovation and technological improvements, creating moderate potential for employment growth.</td>
</tr>
</tbody>
</table>

## Introduction

Australia has a large and diverse energy resource base which includes coal, natural gas (both conventional and unconventional), oil and natural gas liquids (LPG, and condensate), uranium and renewable energy resources.

The Resources and Energy sector can be categorised into the subsets of Mining, Oil & Gas and Mining Equipment, Technology & Services (METS).

### Mining

The Mining sector incorporates the exploration, extraction and mining of ore or minerals. While all states have mineral deposits WA is most heavily endowed with iron ore and QLD and NSW with black coal.

The key Australian players in the mining industry are BHP Billiton (18% market share), Rio Tinto (15%) and Xstrata (4%). The mining industry exhibits a high level of globalisation, with all major players having substantial mining interests overseas.

### Oil & Gas

The Oil & Gas extraction sector incorporates the production of crude oil, natural gas and condensate both onshore and offshore, as well as separation, treatment and stabilisation of these products. The resources available to Australia include conventional (trapped in reservoirs by impervious rock under the earth) and unconventional gas (including CSG, shale and tight gas) natural gas liquids and oil. Australia has only limited remaining domestic resources of crude oil. The prospect of Australian tight gas is currently being investigated.

The key Australian players in the oil & gas industry are Woodside Petroleum, BHP Billiton, ExxonMobil, Chevron, Shell and Santos. The industry is highly internationalised and foreign firms own nearly 40 per cent of Australia’s crude oil output and half our natural gas production. Local firms active in the industry, such as BHP and Santos, have substantial overseas oil and gas holdings.
Mining Equipment, Technology & Services (METS)

METS includes associated services (such as contract mining and specialist oilfield services), suppliers, equipment and technologies for the mining and oil & gas sectors. This is a diverse sector, encompassing large contract mining, engineering and construction companies, as well as small or specialist consulting and technology firms.

The key players in this sector include Orica, Thiess, Downer EDI, Leighton Contractors, Boart Longyear, Macmahon, Toll, Monadelphous, Ausdrill (mining services), WestTrac, Hastings Deering, Arrium, Sandvik Australia, Liebherr (mineral processing equipment) and Maptek, MST, GroundProbe and Remote Control technologies (technology companies). The sector has 84 per cent Australian ownership.

**Competitive advantage**

**Mining**

Australia has enjoyed a competitive advantage in the mining sector due to its quality of resources (particularly iron ore and coal) and geographic location close to key Asia Pacific demand centres. The key challenge for Australia going forward is improving productivity due to the challenge from low-cost producing countries.

- Australia has the world’s largest reserves of brown coal, minerals sands, nickel, zinc, iron ore, lead, silver and uranium, the second largest reserves of bauxite and tantalum and third largest reserves of copper. This abundant supply of natural resources can sustain current rates of mine production for many decades.

- Australia is ideally positioned to meet growing Asia-Pacific demand. China currently accounts for 40% of global copper and 50% of global steel demand and regional demand is forecast to grow.

Australia’s attractiveness as an investment location for mining is slipping due to increasing costs (labour, energy and transportation) decreasing productivity and less industry focused policies; we are losing global market share to other resource rich, but lower cost economies.

- Within the highly competitive global markets for thermal and coking coal, copper and nickel, more than half of Australia’s mines now have operating costs above global averages. Australian iron ore projects are 30% more expensive than the global average and thermal coal projects 66% more expensive.

- Regaining our competitive advantage will require significant structural reform in the minerals sector. Without improvements in our competitiveness, real GDP in 2040 is 5.3% lower and real wages 6.3% lower than under a competitive scenario.

- The mining sector has slowing investment, with $24.7bn worth of planned projects in Q1 of 2013 not receiving funding due to the high AUD and competitive pressures. Global capital spending by mining companies is forecast to decrease by one third in 2014 to $9bn, a decrease from $141bn in 2012.

- The main factors affecting the performance of the mining industry over the next five years will be the pace of world economic growth, the competitiveness of Australian produces and the value of the AUD.

- Sustainable competitive advantage will come from low-cost and long-life production. Efficiency of both labour and capital is a key focus for the mining industry globally.

**Oil & Gas**

Australia’s competitive advantage is in the production and export of LNG, with $165bn worth of capital investment committed and a growing LNG export market due to strong demand in the Asia-Pacific region.

- Australia is the world’s ninth largest energy producer, accounting for 2.7% of global energy production (including coal). Australia’s reserves of oil and gas represent 0.1% and 0.5% of the world’s totals respectively.
• Vast deposits in QLD and large conventional gas resources in WA are critical to meeting future regional demand for LNG. Eight new plants are under construction which will see Australia become the world’s second largest LNG exporter after Qatar

• While LNG has traditionally be sold based on long term, oil linked, supply contracts, the performance of the industry depends on volatile factors such as exchanges rates, production volumes and oil prices, global supply and demand and the impact of liquid regional gas markets (such as the US and UK) on the global LNG market.

METS
Australia enjoys a competitive advantage in the METS sector, particularly in the development of IT applications. Australia invests heavily in R&D in this sector, supporting the mining industry by aiding the discovery of high quality resources.

• Australia is highly competitive in the R&D of mining software and equipment, scientific analysis, exploration assessment technology, mineral processing technology, environmental services and health and safety equipment.

• Driven by the expansion of mining investment and production both within and outside Australia, the METS sector has grown approximately five-fold over the past 15 years and achieved a high level of internationalisation, with the majority of Australian firms having offices or subsidiaries offshore.

Level of innovation
Mining
As Australian resources become more difficult to mine, mining companies will need to continue to innovate to remain competitive, with automotive technologies and communication systems critical to support output growth.

• Australia has a history of innovation in underground and hard-rock mining, having employed block-caving and sub-level-caving technologies. However, although new technology is being applied in new mine establishments, R&D expenditure relative to mining output reduced over the 2000s

• A number of Australian businesses are investing in and trialling automated technologies such as trucks, dump loaders and blast-drilling equipment and productivity improvements through increases in truck sizes and safer and cheaper explosives which could lead to significant industry innovation

Oil & Gas
R&D expenditure is increasing and innovation will be key to maintaining productivity and competitive advantage despite regulatory barriers and the high AUD.

• In the energy sector, the majority of R&D is undertaken by private businesses. R&D expenditure has increased at an annualised average rate of 28% since 2000-01, reaching $2.6bn in 2010-11 which represents 14% of total Australian R&D expenditure

• Barriers to innovation include lengthy approvals process, government regulation, environmental regulatory uncertainty, shortage of skilled labour and the high AUD

• The first CSG to LNG projects are being developed in Australia, Further expansion of the unconventional gas industry will require new technologies to enable economic extraction and efficient reservoir management.

METS
The METS sector has been innovative in the area of IT (geological mapping, data acquisition, modelling of ore bodies, mine sites and production operations), exploration technologies, mining and metallurgy innovations, institutional innovation and supplier development.

• The total R&D spend in 2012 was $1.6bn. However, despite the substantial R&D and technological strengths in Australia, the mining industry as a whole is not yet organised for the sustained effort required to achieve the necessary pace of innovation
Employment

Mining

High wages, fly-in fly out working arrangements and the growth of labour markets in regional mining towns are key employment trends in the mining sector.

- Employees in mining are well renumerated with high rates of pay reflecting skill levels and the remote locations of most mining projects. Job growth is estimated at an annualised 12.5% over the five years to 2012-13. Wage costs are substantial for the mining industry and account for 12.5% of revenue.

- Mining industry employment has tripled since 2000, peaking at over 270,000 in May 2012. Workers in the mining industry work an average 51 hour week (substantially longer than the 35 hours on average for Australia).

Oil & Gas

- Employment is concentrated in the oil and gas rich states. Worker demand increases significantly in the infrastructure development stages of the project life cycle.

- Deploying FIFO workers represents a solution to workforce issues; however the need to transport workers to and from remote areas can increase development costs and contribute to other social pressures.

METS

- The METS sector employed 265,000 in 2012 across over 1,500 companies.

- Skills shortages are impacting on sector growth.

Capital expenditure

There are currently 73 committed mining and energy projects to the total value of $286bn (primarily in LNG, gas and petroleum with the remainder in iron ore and coal). Mega projects over $5bn have been the main driver of this record level of investment.

Mining

The mining industry is highly capital intensive and is experiencing increasing capital costs.

- The mining sector’s net capital expenditure is substantial, accounting for $119bn in 2012-13. Capital expenditure is heavily influenced by minerals prices.

- Mining industry gross fixed capital formation was 4.3% of GDP in 2011, the highest contribution of any Australian industry.

Oil & Gas

The majority of committed projects are Mega projects in the oil & gas sector, with high value projects such as Gorgon LNG ($9bn) and QLD CSG to LNG projects.

- The total value of committed oil & gas infrastructure projects (such as port and rail expansions) is currently $3.6bn. However, rapidly increasing operating and wage costs and the high Australian dollar have led to the cancellation of projects such as Woodside’s Browse LNG. This is likely to be a prevailing trend for Australian operators in the medium term.

- It is anticipated proposed oil and gas projects will spend on average $23bn in capital outlays per year over the period through to 2017 (excluding ongoing operating expenditure).

Value added

The energy & resources sector represents significant contribution to the Australian economy.

Mining

- In 2011-12, gross value added from the mining industry was $140bn; 90% from mining operations and 10% from mineral exploration.
Revenue from mining was $241.1bn in 2012-13, representing annual growth of 8.2% from 2008 to 2013. Revenue is forecast to grow at 8.8% p.a. from 2013-2018.

Oil & Gas
- In 2011, gross value added from the oil & gas industry was $28.3bn. It is expected to reach $66bn by 2020, to represent 3.5% of the national economy.
- Revenue is forecast to grow at an annual rate of 18.1% from 2013-18.

METS
- The METS sector provides products and services which increase the economic value of the mining and oil and gas industries, e.g. through providing technologies that make low grade deposit mining economic.

Contribution to GDP
The mineral and resources sectors are significant contributors to Australian GDP, supported by the METS sector.
- The resources sector contributed $117bn to GDP in 2011, accounting for 9% of Australia’s total.
- The oil & gas sector represents 2% of GDP, or $28.3bn in dollar terms. The share of oil & gas industry to Australian GDP is expected to increase to 2.8% by 2025.
- The mining and exploration support services sector (including equipment, technology and services) contributed approximately A$9.1bn to the economy in 2010-11. The mining support services sector accounts for 0.4% of total GDP.

Exports or exports potential
Australia is a key exporter of minerals, LNG and services to the Asia Pacific region and globe.
- In 2013-14, total export earnings for energy and mineral commodities are forecast to increase by 11% from 2011-12 to total $197bn, driven by significant increases in iron ore, coal and LNG exports.
- Exports from the Mining industry totalled $159.1bn in 2012-13. The demand for mined commodities is heavily dependent on the changes in economic activity globally.
- In 2011-12, the value of LNG exports was $12bn, with 19Mt exported. Australian exports of LNG are forecast to total 25Mt in 2013-14 due to the Pluto facility which will give a dollar value of $18bn.
- In 2012, METS sector exports exceeded $12bn with offshore sales accounting for a third of sector income. 2012 export revenues from this sector substantially exceeded the wine and automotive industries.

Import or import replacement potential
Australia imports crude oil and petroleum due to low domestic production.
- Australia is a net importer of crude oil and refined petroleum. It is more economical to export crude oil from WA than to transport it to east coast refineries and WA produces more light-grade crude oil than Australia’s refineries can absorb.
- Heavier grades of oil are imported so that refineries locally can still manufacture the full range of petroleum products. Lower domestic production of oil from fields in the Bass Strait and onshore have increased the requirement for imports.
- It is estimated that 71.5% of Australia’s demand for oil and gas will be met by imports in 2012-13, with 29,200 megalitres of crude oil imported. The value of these imports is expected to be $22.7bn.


11. Space & Spatial Industry

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Emerging</td>
<td></td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>Space and Spatial technologies are growing at rates in excess of economic growth.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Strong</td>
<td>Excluding the US, Australia is the second-most effective country in space usage and is the leading user of Global Navigation Satellite Systems.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Medium</td>
<td>Approximately 100,000 people are directly employed across the two industries.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Moderate</td>
<td>While there will be moderate employment growth needed to support the development and dissemination of new technologies, the strong growth in the sector will be driven by innovation.</td>
</tr>
</tbody>
</table>

Introduction

The Space and Spatial Industry grouping brings together two rapidly maturing industry sectors that together enable us to better understand and quantify our real-world environment and to develop technologies and services that deliver social and economic value not otherwise achievable.

The following table is a high level map of the Space and Spatial industry value chain. Each item represents a distinctive aspect of value creation within the industry and an opportunity for growth and export.

Table: Space and special industry value chain

<table>
<thead>
<tr>
<th>Domains</th>
<th>Infrastructure</th>
<th>Services</th>
<th>Products</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Observation</td>
<td>Spectrum allocation, earth reference frameworks</td>
<td>Data Storage</td>
<td>Back-end geoprocessing services</td>
<td>Mining, Energy and Resource management</td>
</tr>
<tr>
<td>Positioning, navigation and timing</td>
<td>Ground stations and terminals</td>
<td>Data validation and calibration</td>
<td>Data management, access, and delivery services</td>
<td>Agriculture and environmental monitoring</td>
</tr>
<tr>
<td>Communication</td>
<td>Space-borne, airborne, and terrestrial platforms</td>
<td>Satellite Operations</td>
<td>Data publishing services</td>
<td>Weather, natural disaster management and response</td>
</tr>
<tr>
<td>Niche Technologies</td>
<td>Test and evaluation</td>
<td>Telecommunication</td>
<td>Data integration and visualisation services</td>
<td>Aviation</td>
</tr>
<tr>
<td>Capacity and Skills Development</td>
<td>Specification, design and engineering</td>
<td>Space debris tracking and space weather monitoring</td>
<td>VSAT (satellite broadband)</td>
<td>Defence and national security</td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td>Niche Technologies</td>
<td>Many more...</td>
</tr>
</tbody>
</table>

Source: CRC-SI
Competitive advantage

Space Industry

In a competitive benchmarking analysis of eight countries excluding USA, Australia was the second-most effective country in space usage. The National Space Utilisation Comparison Model results show that on a normalised basis relative to seven peer nations, Australia, as a user of space products and services, places:

- First in Global Navigation Satellite Systems
- Second in Natural Disaster Management; Earth Observation and Resources Management; Satellite Communications; Weather and Meteorology
- Third in Coordination and Integration.

Australia’s second-place positioning is reflected in the following chart.

Figure: Aggregated Space Usage Effectiveness by Country (Relative Rankings, Normalised for National Variables)

Australia, in relative terms, is the leading user of Global Navigation Satellite Systems, based on an effective, if localised, navigation infrastructure base, numerous navigation-related organisations and firms, and extensive patent filing activity, indicating active development of value added satellite navigation products.

Australia also placed second in four application areas (Natural Disaster Management; Earth Observation and Resources Management; Satellite Communication; Weather and Meteorology) and third in one cross-cutting application area (Coordination and Integration).

Level of innovation

Space Industry

Australia is recognised as one of the most sophisticated operators and users of satellite communications in the Asia-Pacific region. With 22 teleports and 11,000 very small aperture terminals (VSATs) in service, Australia compares favourably with its peers when normalised for population. Australia is well known worldwide as a ground station operator and hosts many major facilities for international networks.

Spatial Industry

The CRC-SI, which was established in 2003 and is now recognised worldwide for its contribution to the industry. CRC-SI has 94 partners comprising 53 companies, 20 government agencies and 21 research organisations. It has 8 strong portfolio programs including agriculture, natural resources, urban development, defence, energy, and health.

Employment

Space Industry

There are 59 organisations involved in the development of Space Systems; 23 organisations contributing to Launch Activities & Support Services; 153 organisations involved in Ground Systems; 430 organisations developing Space Enabled Services & applications; and 94 delivering Space Activity Support Services. In total it is estimated that the space industry in Australia directly employs 8,400 people with tens of thousands more relying on the products and services generated.
Spatial Industry, including remote sensing
The Spatial Education Advisory Committee (SEAC) suggests that the number of people employed directly in the spatial information industry was around 31,400 people with another 61,000 people engaged in using spatial information services in government and industry (SEAC, 2007) (AGIMO, 2002) a total of around 93,000 people directly involved in spatial information services in industry and government.

Capital expenditure

Space Industry
The Australian Space Research Program invested $40 million in the delivery of 14 individual projects. This program helped to develop strategic partnerships and build capacity in the Australian space industry. The program engaged a total of 60 different organisations, including 19 international organisations, 16 industry organisations, 12 universities and 7 research organisations.

Remote Sensing Industry
For the Earth Observation from Space sector alone there are 92 government programs within the Australian and state and territory governments with a combined value of $1.3 billion in 2008-09 that are dependent on assured access to space-derived data and services.

Contribution to GDP

Taken together the space and spatial industries create about $450 to $570B of revenue globally. There is the potential given the development of a clear the national strategy, a supporting roadmap and development activities to position Australia to take a 2.2% share of this market, valued at $9.9 to $12.5B annually by 2023.

There are three key growth estimates identified for the next year or so; global geoservices at 30% pa, the global GNSS market at 11% pa and global satellite imagery sales at 12%. Contrast this with world GDP growth that is estimated to be around 3% for the 2013 and Australia’s GDP growth at a little over 2%. Spatial technologies are growing at rates in excess of economic growth.

Exports or exports potential

Space Industry
Survey respondents indicated stability of revenues, exports, imports, and employment in their outlook on trends relating to their space activities in the last 3 years and the next three years. Roughly 30-40% of respondents expected no change, 30-40% indicated growth ranging as high as 25%, and 10-15% expected small declines.

Spatial Industry
The Spatially Enabling Australia report by ACIL Tasman found that the impact of spatial information on the trade balance was positive:

- Exports increasing by between $1.26 billion and $2.30 billion
- Imports increasing by $1.18 billion $2.23 billion

Import or import replacement potential

We were unable, in the time available, to determine the value of imports relating to space and spatial. Reliance of the global value chain, and hence the need to import data and services from global providers will remain. Australia’s existing strengths in technical expertise and services, enhanced further by the establishment of a Space and Spatial precinct can be expected to support a growing export opportunity in excess of any import reduction or replacement.
12. Sports, Communities & Tourism

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Established</td>
<td>Ageing population coupled with strong growth in international visitors from Asia will support strong growth in tourism.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>Strongly linked to the value of the Australian dollar.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Moderate</td>
<td>Average share of GDP around 3 per cent.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Medium</td>
<td>From 2013-2018, employment is expected to rise, on average, by 0.5 per cent per year.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Weak</td>
<td>From 2013-2018, employment is expected to rise, on average, by 0.5 per cent per year.</td>
</tr>
</tbody>
</table>

Introduction

Sport and recreation maintains a strong reputation in Australia’s cultural identity. It is a mature industry, with demand for sporting goods receiving a boost over the past 5 years due to changing attitudes towards exercise and fitness. Australian manufacturers of sport technologies are driven to develop goods to assist with sporting excellence at a high-level, with a trickle-down to grassroots participation. However, domestic manufacturers are struggling to compete with imported sporting goods in the domestic market, resulting in a dramatic reduction in total exports in recent years.

Total exports of Australian sport and recreation goods

Source: ABS 2012

Australia’s tourism industry is facing the same structural challenges that face many of our export orientated industries: a high Australian dollar and higher relative input costs eroding global competitiveness. This has had two effects:

- Decreasing the international competitiveness of Australia as a destination
- Increased competition for domestic tourist market from overseas destination.

Since 2008, Australian resident departures have increased at a greater rate than visitor arrivals to Australia, and domestic visitor nights spent in Australia have declined. The appreciation of the Australian dollar has reduced the real cost of international travel for Australian consumers, whilst making domestic trips relatively more expensive. At the same time...
time, international visitor arrivals, led by an emerging middle class of tourists from China, are contributing 30 per cent of total industry revenue. Domestic overnight visitors are concentrated in NSW and Queensland, making up just over half of total stays. State and federal government support for tourism promotions is estimated at $237 million per year.

**Figures: Sports, communities and tourism exports**

![Graph: Australian resident departures vs international visitor arrivals to Australia vs domestic visitor nights spent in Australia](image)

Source: ABS 2012

**Competitive advantage**

There is a high, intensive level of competition within the sporting industry, particularly focused on price differentiation, media publicity and the level of technology present. However, sporting goods are facing a competitive disadvantage in Australia: facing higher input costs (wages), a smaller local market, niche sports and higher Australian dollar. Countries with the greatest competitive advantage are ones that have a natural manufacturing competitive advantage (i.e. China) or large domestic, and highly professional sporting market where there is an private sector incentive to invest (i.e. the US).

Australia’s competitive advantage for tourism is its unique natural environment and lifestyle. Australia also has a potential competitive advantage in education tourism, offering high quality English language education to an emerging Asian middle class, at lower costs than US or European education. However, balancing these advantages is Australia’s isolation – it is a long flight from other major centres and a very large country to travel around.

**Level of innovation**

Since 2000, Australia has been experiencing a declining success rate at international sporting events, in both total Olympic medals and number of world championships achieved. The federal government, through its funding of the Australian Sports Technologies Network, and the Australian Institute of Sport, are pushing for innovation in high-performance sport technologies targeted towards elite athletes. This innovation is being restrained by limitations in the sport technology development cycle, where small private businesses are developing niche products, which are not being picked up by larger manufacturing companies. The current potential of sport technologies being developed in Australia are not being realised in a financially viable manner, limiting their competitiveness on an international scale.

In addressing the structural changes of Australia’s tourism industry, innovation in embracing digital technologies as a marketing platform will drive the future competitiveness of the industry. Australia’s tourism industry is focused on enhancing the customer service experience, as it cannot compete on price, especially when compared to South East Asia and Pacific Islands destinations. Increasing the industry’s digital technical capabilities will both cater to increasing demand for tourism experience from China and India, and provide niche offerings to targeted segments (i.e luxury lodges).

**Employment**

As of 2011, employment in sport and recreation accounts for just under 1 per cent of total employed persons in Australia, at approximately 96,000 persons. The most common industry occupation is ‘fitness instructor,’ dominating their presence within the ‘health,
fitness centres and physical recreation activities’ sub-industry. From 2013-2018, employment is expected to rise, on average, by 0.6 per cent per year.

Tourism is a major employer across Australia. In 2012, the tourism industry accounted for 4.6 per cent of total employed persons in Australia, at approximately 530,000 persons. From 2013-2018, employment is expected to rise, on average, by 0.5 per cent per year.

**Capital expenditure**

Capital investment into sport technologies is dominated by the cost of manufacturing facilities, operations and equipment, especially in research and development stages. The use of digital technologies has contributed to enabling an increase in capital intensity, with a strong desire to find greater efficiencies in utilizing resources in an industry faced with high inputs costs into manufacturing.

In 2012, the value of tourism expenditure was $44B, increasing by 22 per cent from the previous year. Future expenditure within this area is expected to be strong, despite the intense international competition and competition for capital, to overcome underinvestment in the past decade and re-position to address the structural changes facing the industry.

**Value added and Contribution to GDP**

As a whole, Australia’s sport industry value added was approximately $5.8 billion for 2012-13. From 2008-13, the industry has been experiencing an average annual growth of 2.3 per cent, expected to pick up slightly to 2.7 per cent from 2013-18.

In 2011-12, the tourism industry’s share of total gross value added in Australia was 2.7 per cent, below its average of 3.1 per cent since 2000. This accounts for the $37.6 billion of direct tourism value added, with a third of total contributions coming from the ‘accommodation’ and ‘air, water and other transport’ sub-industries. As a result, the tourism industry accounts for $41 billion, or 2.8 per cent of total domestic GDP. The industry’s average share of GDP from 2000 is 3.1 per cent, with 59 per cent of total direct tourism contributions coming from domestic households.

**Exports or exports potential**

Due to the competitive disadvantage being faced by sporting goods manufacturers in Australia, exports have decreased in value by 44 per cent from 2006-07, at $511 million, to $286 million in 2011-12. Boats, yachts and other vessels, and horses, contributed 59 per cent of the total value of exported sporting goods, with major export destinations of New Zealand, the USA and Hong Kong.

The tourism industry represents Australia’s largest service export industry, earning nearly 10 per cent of total export earnings, with a substantial proportion of expenditure coming from international visitors. Total international tourism expenditure is, on average, expected to grow by 4.6 per cent from 2012-17, and 3.1 per cent from 2017-22, with the largest increase in expenditure forecasted for tourists from China and India.

**Import or import replacement potential**

Australians imported $2 billion of sport and recreation goods in 2011-12 (seven times our exports), with China and the USA as major sources of goods imported into Australia. The value of sporting goods imports have remained close to this figure since 2006, and have been dominated by boats, yachts and other vessels, and general physical exercise equipment over this period.

Over the past decade there has been a decline in the propensity of Australians to holiday domestically. International short breaks to destinations such as South East Asia, Pacific Islands, West Coast USA and New Zealand are a relatively new phenomenon. These destinations have become direct competitors to domestic travel offerings. A number of other factors have impacted negatively on travel within Australia, including the strong Australian dollar, high petrol prices (record prices were observed in 2005, contributing to the sharp drop in domestic visitor nights during that period), higher levels of personal and household debt, and growth in international low cost carriers.
13. Transport

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Established</td>
<td>Domestically, the industry is projected to growth slightly higher than projected GDP growth, however the market globally is expected to grow significantly with the transport needs in emerging economies growing.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Strong</td>
<td>While the industry is a large focus of Government infrastructure spend, Australia lags behind other countries in adapting large scale technological advances.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Weak</td>
<td>Accounts for 8.3 per cent of total capital expenditure within all Australian industries.</td>
</tr>
<tr>
<td>Relative size of the industry</td>
<td>Very large</td>
<td>If Australian industries are able to tap into the global market for supplying the transport needs of emerging markets than the potential for employment growth is strong.</td>
</tr>
</tbody>
</table>

Introduction

The transport sector is a critical part of the Australian economy. The Bureau of Infrastructure, Transport and Regional Economics (BITRE) estimates that road congestion will cost Australians $20.4 billion by 2020. Freight traffic growth is currently the major contributor to increasing congestion. Australia’s total freight movements are expected to increase by as much as 50 per cent by 2020. Volume growth is also expected to result from growth in population and international trade.

Federal and state governments have recognised that investment in new infrastructure is critical to productivity growth. The total cost of transport related projects on the 2013 National Infrastructure Priority List is between $80B and $90B.

Figure 1 presents this breakdown by stage of the ‘transport lifecycle’. This can be applied across all modes of transport; rail, road, air and water. Integrated transport logistics and associated technologies are continuing to play a major role in improving supply chain efficiency by offering efficient door-to-door transport, storage and distribution services.

Figure: Transport lifecycle

Source: PwC
In Australia, there have been a number of noteworthy innovations within the transport sector, which have gone on to be adopted by other countries. These include:

- **Sydney Coordinated Adaptive Traffic System (SCATS)** is a computerised traffic management system developed by Roads and Maritime Services (RMS) (now part of Transport for NSW) several decades ago. SCATS has been distributed to 263 cities in 27 countries worldwide. SCATS is a recognised worldwide market leader in intelligent transport systems (ITS) and RMS continue to enter into collaborative R&D agreements in order to investigate options for longer-term improvements for managing traffic.

- The world’s first and largest electronic toll collection system for an interurban environment was Melbourne’s *City Link* project. The cashless, multi-lane free-flow electronic toll system implemented in 1998 and Transurban has leveraged this technology for the United States with the commencement of a concession to expand, operate and maintain the Washington D.C beltway (toll road) in 2006.

**Employment**

The *Transport, Postal and Warehousing* industry directly employs approximately 570,000 (as at June 2011), a share of 5.4 per cent of total industry employment in Australia. The sub-sector with the highest employment is road transport with 263,000 employees.

The projected employment growth in the *Transport, Postal and Warehousing* industry to 2016-17 is aligned with overall projected employment growth of all industries at 1.4 per cent per annum.

**Capital expenditure**

Transport industry activity (e.g. rail, roads, port, airlines and even warehouses) require large capital investments, while transport logistics / operations require relatively low levels of capital investment. The level of capital expenditure within the *Transport, Postal and Warehousing* industry increased from $17.8 billion in 2008-09 to $22.3 billion in 2011-12, comprising 8.3 per cent of the total capital expenditure within all industries. Capital expenditure within *Transport equipment manufacturing* contributed $1.2 billion, or 0.5 per cent of total capital expenditure, in 2011-12.

**Value added / Contribution to GDP**

The *Transport, Postal and Warehousing* industry and *Transport equipment manufacturing* industry combined contributed $80.0 billion, or 7 per cent to Australia’s GDP in 2011-12. Over the four years to 2011-12, the *Transport, Postal and Warehousing* sector as a whole experienced a CAGR of 8.0 per cent per annum. However, given the diversity of the sector and competitiveness between transport modes, the growth trends within sub-sectors of transport differ significantly.

The IBISWorld estimate of projected CAGR of IVA for the *Transport, Postal and Warehousing* industry combined, over the period 2012-13 to 2018-19 is slightly higher than projected GDP growth at 2.71 per cent per annum.

**Competitive advantage and level of innovation**

*Integrated transport logistics*

Over the past 10 years, focus on the efficient use of transport infrastructure has led to a shift towards integrated logistics networks, which span across transport modes and international borders.

There has also been rapid growth in application of technology, including radio-frequency identification, automatic picking and distribution systems, vehicle tracking and even lighting systems. This has improved the seamless transition of freight and allowed for accurate freight tracking and modelling of different distribution routes.

However, Australia is not currently identified as a leader in innovation in integrated transport logistics.
Rail and supply sectors

Australia currently boasts some world-leading rail technologies and systems including heavy rail operations in the resource sector.

There may be an opportunity for the rail supply sector to be globally competitive, particularly in heavy haul rail. However, in order to ensure that local suppliers can compete with international suppliers, Australian governments will play a role in supporting the recommended implementation actions identified within the roadmap On Track to 2040, developed in June 2012, along with supporting the momentum of the roadmap by facilitating industry collaboration.

Exports or exports potential

Given the nature of the rail supply industry, exports fluctuate widely from year to year. Over the five years to 2012-13, exports are expected to decline at a CAGR of 6.1 per cent. Over the next five years, a slower global economy and historically high Australian dollar is expected to further reduce rail supply exports, declining at a CAGR of 8.2 per cent per annum. The majority of Australia’s rail equipment exports totalling $99.6 million in 2012-13 are through the supply networks of global companies that win major contracts around the world.

Figure: Railway equipment manufacturing and repair in Australia

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports $M</th>
<th>Imports $M</th>
<th>Industry Value-Add $M</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1,300</td>
<td>1,500</td>
<td>1,400</td>
</tr>
<tr>
<td>2014</td>
<td>1,200</td>
<td>1,200</td>
<td>1,300</td>
</tr>
<tr>
<td>2015</td>
<td>1,100</td>
<td>1,100</td>
<td>1,200</td>
</tr>
<tr>
<td>2016</td>
<td>1,000</td>
<td>1,000</td>
<td>1,100</td>
</tr>
<tr>
<td>2017</td>
<td>900</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>2018</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>2019</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
</tbody>
</table>

Source: IBISWorld 2012

Australia’s world leading position in the area of heavy haul provides export potential for Australian suppliers in this area. The demand for increased axle loads in the heavy haul sector provides the opportunity potential for Australian suppliers to develop capabilities in materials and technology to increase the capacity performance of heavy rail, which could be exported to international markets. There is a potential global market for competitive, high-quality short run solutions. In particular, there is demand for retrofit products to extend the life of ageing equipment.

Import or import replacement potential

Currently, Australia imports 13.7 times more rail equipment than it exports, but this tends to be highly variable (in 2008-09, imports grew by 146 per cent, while in 2010-11 it fell 20.3 per cent). Over the five years through to 2012-13, imports are expected to grow at a CAGR of 17.5 per cent to $997.9 million in 2012-13, driven by strong demand for new locomotives, manufacturing capacity constraints in Australia and increased activity from manufacturers overseas, most notably China. Around 70 per cent of rail equipment imports are from China (46 per cent in 2012-13) and Singapore (24 per cent) combined. While the Australian dollar remains historically high, local manufacturers face an increasing level of competition from foreign suppliers. In our opinion, and supported by IBISWorld estimates, import replacement potential for the rail supply industry is limited.
14. Tropical

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td>Emerging</td>
<td>Tropical Australia is currently over-performing against the national average in many key areas and Australia is likely to continue growing strongly and continue to increase in terms of contribution to overall GDP.</td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Very strong</td>
<td>Domestic, Tropical Australia has the competitive advantage for cultural and eco-tourism, health and medical services, natural resources, and the geographic benefits to support the research architecture essential to meeting the challenges associated with living sustainably in remote tropic locations.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Very strong</td>
<td>A vast expanse of land with relatively small population</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Very strong</td>
<td>There is very strong growth potential for Northern Australia which is likely to generate significant employment growth founded on sectors such as tourism, energy and agriculture.</td>
</tr>
</tbody>
</table>

Introduction

Tropical Australia includes parts of Northern Territory, Queensland and Western Australia that are situated north of the Tropic of Capricorn.

The tropics of Australia are a vast expanse of land including several world heritage and wilderness sites with relatively small population (just over 1m people around 5 per cent of Australia’s population). Two of Australia’s most recognisable ecological resources fall in the tropical territory: the World Heritage sites of the tropical rainforests of the wet tropics and the Great Barrier Reef. Furthermore, as a developed country, Australia’s northern cities are uniquely located to serve and support the expanding economic and population centres of Asia.

Ecotourism in Tropical Australia is more than a green-washing branding exercise; it is committing the business ethics and practices to the following guidelines:

- Offering visitors tourism experiences that foster an appreciation and understanding of natural and cultural heritage
- Providing visitors with opportunities to experience attractions that occur in a diverse range of terrestrial and marine environments
- Contributing to the conservation of the natural and cultural environments through the establishment of partnerships between government, industry and the community
- Being a model for other forms of tourism, encouraging wider use of sustainable technologies and the promotion of best practice
- Assisting in realising the tourism potential areas through sustainable economic development.

The north of Australia is already the base for Australia’s expanding defence capability, for specialist tropical health, medical and crisis response resources, and an expanding energy
exploration and processing sector. Whilst not providing the same impact to the GDP or employment figures as other more defined industries, these northern based industries provide an unequalled opportunity for capitalising on current trends, innovation and thought leadership from around the world; as well as providing Australia an industry in which it can rise to global leadership.

**Competitive advantage**

Australia’s competitive advantages in the tropical industry include the factors listed below:

- The established northern cities of Darwin, Townsville and Cairns have internationally recognised institutions specialising in tropical health and medical research and in trauma and response capability for Australia and our close Asian neighbours. These organisations could not only be supported to provide increased direct services, they could be grown to increase training for the rapidly expanding health needs of the region internationally, to expand specialist research and development in disease treatment and prevention specific to the tropics, and expand research and responses to biosecurity issues across the wider tropical region.

- The natural resources located in the Pilbara, Mackay, Gladstone and around Darwin and other parts of the Northern Territory are rapidly being developed for export, stimulating unprecedented employment and infrastructure growth in the region.

- There is a largely untapped potential for the vast amount of water (over 60 per cent of Australia’s water falls above the Tropic of Capricorn) and arable land in the north. There are opportunities to build upon some existing projects (e.g. Stage II of the Ord Project in the Kimberly) to expand the food production via land based agriculture and through aquaculture. Potential private sector and Asian investment in these industries could be significant.

- There is a strategic advantage for tropical Australia in terms of defence and border protection. Currently 19 of Australia’s defence estates are located in the tropical north. The recent expansion of both Australian and US defence resources in northern Australia builds up on the existing capability and strengthens the region as the base for joint training and deployment purposes.

- Ecotourism is a fast growing sector of the world’s largest service industry. Despite the growing size and value of the market, ecotourism plays a very small role in Tourism Australia’s 2020 strategy. With ecotourism growing globally, the two biggest competitors are South Africa and Costa Rica.

**Level of innovation**

**Research leadership**

Charles Darwin University in collaboration with the Australian National University, James Cook University and the Australian Institute of Marine Science have funding under the Australian Government’s Collaborative Research Network to create a national program of collaborative social, coastal/marine and environmental research and innovation in the northern Australian region.

These trends in research diversity and new offerings are positioning Australian universities as global leaders in thought leadership and research opportunities for tropical related issues and sustainability. The outputs of these initiatives will likely shape the future of ecotourism in Australia in the immediate and long-term.

**Government Coordination**

In mid-2010 the Australian Government committed to implement the Northern Australia Sustainable Futures Program as an initial response to the findings and recommendations of the Northern Australia Land and Water Taskforce.

Whilst these are significant steps in the right direction, these lack in terms of innovative solutions. In focusing on development, agriculture, energy and mining; these initiatives provide a role that functions more in an oversight manner than an innovative manner. Most of the produced work comes in the form of reports on usage and impacts, offering few
solutions to areas outside of typical management actions and even less of an approach to innovative solutions.

**Employment**

Northern Australia has a relatively young workforce. From 2008-2010, overall growth in the labour force in Northern Australia (12.2 per cent) outstripped Australia (5.5 per cent) despite Northern Australia experiencing two quarters of decline in the March quarters of 2009 and 2010; eventually recovering strongly from the effects of the GFC. During this same timeframe unemployment in the area only rose from 4.7 per cent to 4.8 per cent, whereas the national average rose from 4.5 per cent to 5.0 per cent.

**Value added**

It is difficult to quantify the value being generated by the health and research capability in tropical Australia. Further, due to the relative newness of the ecotourism industry and lack of formal data collection, exact figures on this industry are unavailable. However the following figures are deemed relevant and informative. Trends demonstrated by international visitors to Australia align well with those of international visitors to other countries’ ecotourism destinations:

- 44 per cent of all international visitors to Australia came for ‘holiday’
- 51 per cent of all holiday visitors had visited before and were seeking new experiences
- 43 per cent of all holiday visitors were on a group tour or inclusive package

With help from innovative solutions, more ecotourist friendly destinations could find ways to increase the tourism industry by offering packages and offerings for repeat travellers searching for new experience. The expected benefit for Australia’s entire tropical region is high as Tropical North Queensland received the country’s highest expenditure for ‘regional’ (non-urban based) areas of $873m in 2012.

The value being added to the Australian economy from the mining and energy resources sector is significant and it should be recognised that many of these industries are based in the north Tropical regions of the country. For example, the gross value of the oil and gas sector is expected to reach $66bn by 2020, to represent 3.5 per cent of the national economy, and 90 per cent of Australia’s gas reserves are located in the tropical region.

**Contribution to GDP**

Current economic statistics indicate that Tropical Australia is currently over-performing against the national average in many key areas. The northern parts of Queensland, Northern Territory and Western Australia each had higher average salary incomes than the wider populations of their respective states and the nation. In 2010 the average Tropical Australia’s wage and salary income was $42,218, compared to $42,081 for the nation.

In 2011-12, the Northern Territory’s Gross State Product increased by 4.4 per cent to $18bn compared to a nationally growth of 3.4 per cent to $1,415 bn over 2011-12. Deloitte Access Economics has forecast the average annual five-year economic growth rate for the Northern Territory through to 2016-17 to be 4.5 per cent. This compares to a national average annual growth rate of 3.0 per cent and is the highest growth rate of all jurisdictions over this period. The main drivers of economic growth are expected to be private engineering construction, equipment and housing investment and international exports, reflecting the development of the Ichthys LNG plant.

The trends would seem to indicate that the economy of Northern Australia is likely to continue growing strongly and continue to increase in terms of contribution to overall GDP. This is likely to be founded on sectors such as tourism, energy and agriculture, flowing into related industries and the wider economy.

**Exports or exports potential**

The value of exports via maritime ports of Northern Australia was just over $96bn, representing 53.7 per cent of the Australian total value in 2009–10; more than a 50 per cent increase from 2005 when maritime exports resulted in just over $60bn. This can be directly attributed to sustainable demand for commodities which causing faster rises in minerals and
energy prices than the cost to export them. The overall pattern for the value of exports via sea ports is a strong increase in value, but there was a drop in value for the last financial year from $109b, which can likely be attributed to the global financial crisis.

**Import or import replacement potential**

Import tonnages via Tropical Australia’s maritime ports represented only 21.1 (18.1m tonnes) per cent of the corresponding Australian total in 2009–10 (85.7m tonnes). Import tonnages grew on a pace similar to export tonnage, rising approximately 50 per cent from 12.1m tonnes in 2005-06. Regional import growth outpaced export growth, growing 4.4 percentage points in the same time frame.

Northern Australia’s value of ‘direct’ imports via sea ports was 11.8 percent ($18.5bn) of the corresponding Australian value of imports in 2009–10 ($157bn). During the past five years, the value of imported goods to the region has more than doubled from $7.96bn in 2005-06, highlighting both a growing capacity as well as Australia’s growing role in global trade. Interestingly though, there exists a discrepancy between higher tonnage of imports and the lower value of those imports when compared to the rest of the country. This is likely due to the difference in importing raw production supplies versus finished consumer goods, and their distribution around the country.
15. Water

Assessment against criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established or emerging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected growth path</td>
<td>Weak</td>
<td>While the industry is expected to experience moderate growth, services provided with respect to industry revenue is expected to decline.</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>Moderate</td>
<td>Australia is well regarded for water management, but is not as advanced in water related technologies as compared to other countries. Innovation in the industry is dependent upon government support of water management.</td>
</tr>
<tr>
<td>Relative size of the industry in Australia</td>
<td>Small</td>
<td>Represents 0.2% of total labour force.</td>
</tr>
<tr>
<td>Potential for employment growth</td>
<td>Weak</td>
<td>Employment in the water industry is forecast to increase by an average of 0.5 per cent per annum until 2017-18.</td>
</tr>
</tbody>
</table>

Introduction

Australia is the driest inhabited continent in the world. Despite this, data collected by the Food and Agriculture Organization of the United Nations (FAO) shows that Australia has one of the highest levels of water use per capita of any country. For these reasons, the efficiency and sustainability of the Australian water industry is paramount.

The Australian water industry is characterised by a range of capabilities which span across the water cycle. This includes water capture, storage, treatment, distribution, recovery and re-use for urban, industrial and rural applications. According to the Australian Bureau of Statistics (2013), the Agriculture sector consumed the largest volume of water in 2010/11, responsible for approximately 54 per cent of total consumption. This was followed by households (13 per cent); water supply (i.e. sewerage and drainage services, waste collection, treatment and disposal services) (12 per cent); other industries (9 per cent); manufacturing (5 per cent); and mining (4 per cent).

As a result of reforms implemented over the past twenty years, the Australian water industry is highly regarded internationally. For example, according to Austrade, Australia’s urban water industry is considered to be ‘dynamic’ and ‘innovative’. Not only does it provide first class scientific expertise and technical capabilities, but it develops quality products that are delivered by robust institutions.

Likewise, Australia’s agricultural sector is highly respected as it is considered to be instrumental in the development of open markets for water supply, and has emerged as a leader in the design, implementation and maintenance of irrigation flow and management systems. Austrade also identified the Australian mining and resources sector as a world leader in securing water suppliers in remote areas, and implementing technologies and practices which promote water-use efficiency (eg water re-use).

The quality of Australia’s educational and research institutions, the strength of its governance frameworks, as well as a considerable level of government support have positioned Australia as a dynamic, global leader in the management of water resources.
Competitive advantage

In comparison to the water industries of other jurisdictions, the Australian water industry is renowned for developing innovative and integrated solutions to help conserve and effectively manage water (and liquid waste). This has enabled the Australian water industry to develop a strong competitive advantage over its counterparts with respect to the level of capability and know-how in water management. This competitive advantage is driven by:

- the level of its technological innovation
- the quality of its product design
- the energy efficiency of its proposed solutions
- its manufacturing capabilities, and
- its stringent environmental standards and regulations.

Over the next five years (ie up to 2018), it is likely the Australian water industry will continue to capitalise on this competitive advantage. As detailed below, Australia currently has a range of premier research centres and robust institutions that are dedicated to identifying innovative solutions that not only deliver world-class outcomes in water management, but seek to promote growth in the industry.

Level of innovation

Due to highly variable rainfall levels in Australia, the Australian water industry has had to innovate to survive. Specifically, Australian firms – many of which are renowned for their efficiency and capability – have developed innovative solutions, management services and technologies to encourage the growth of the water industry.

According to Austrade, the innovative solutions in the Australian water industry have been implemented so successfully that Australian water industry expertise is in demand internationally. This includes expertise in governance, system management, water treatment technologies, and river and environmental management.

In the past decade, Australia’s research centres and institutions have helped inform a number of policies, schemes and technologies that have been implemented across the water industry for urban, industrial and rural applications. These include the:

- establishment of the ‘National Water Initiative’ – an intergovernmental agreement between the Australian, state and territory governments to improve the management of the nation’s water resources and provide greater certainty for future investment
- development of the ‘National Water Accounts’ – an annual publication delivered by the Bureau of Meteorology that contains standardised information about the management of Australia’s water resources (eg volume of water traded)
- the introduction of the Australian Government’s ‘Water for the Future’ initiative – a 10 year $12.9 billion initiative that implements a suite of urban and rural policies to provide funding for water purchases, irrigation modernisation, desalination, recycling and stormwater capture
- provision of new technologies to diversify supply (eg aquifer storage and recovery)
- development of software for water management issues (eg eWater CRC); and
- facilitation of irrigation renewal and modernisation (eg Northern Victoria Irrigation Renewal Project)

The continued success of these organisations in developing innovative solutions to water-related issues contributes to the future competitive advantage of the Australian water industry by positioning the industry as a global example of ‘best practice’.

Employment

The data in this brief has been obtained from IBISWorld (2013). Statistics for the Australian water industry are based on IBISWorld data for the ‘Water Supply’ industry and the ‘Sewerage and Drainage Services’ industry. As the on-farm operation of irrigation systems is
not included by IBISWorld as a component of either of these industries, it has been excluded from this analysis.

The total number of employees in the Australian water industry in 2012-13 was 25,118. This represents approximately 17.2 per cent of the labour force in the Electricity, Water and Gas industry (or 0.2 per cent of Australia’s total labour force). As illustrated in the table below, employment in the water industry is forecast to increase by an average of 0.5 per cent per annum until 2017-18.

Table: Number of employees in the Australian water industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Sewerage and Drainage</th>
<th>Water Supply</th>
<th>Total employees</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>9,200</td>
<td>15,918</td>
<td>25,118</td>
<td></td>
</tr>
<tr>
<td>2013-14</td>
<td>9,300</td>
<td>15,866</td>
<td>25,166</td>
<td>0.2</td>
</tr>
<tr>
<td>2014-15</td>
<td>9,500</td>
<td>15,854</td>
<td>25,354</td>
<td>0.7</td>
</tr>
<tr>
<td>2015-16</td>
<td>9,700</td>
<td>15,822</td>
<td>25,522</td>
<td>0.7</td>
</tr>
<tr>
<td>2016-17</td>
<td>9,800</td>
<td>15,791</td>
<td>25,591</td>
<td>0.3</td>
</tr>
<tr>
<td>2017-18</td>
<td>10,000</td>
<td>15,759</td>
<td>25,759</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: ABS 2013

Capital expenditure

Due to time constraints, the level of capital expenditure in the Australian water industry has not been calculated. However, considering the process of catching, storing, purifying and distributing water, it is clear the water industry is very capital intensive. Therefore, one can assume that the level of capital expenditure in the water industry is high, and will continue to remain so into the future.

Contribution to GDP

Table below shows the total industry value added (IVA) for the Australian water industry. IVA is expected to increase over time. However, the proportion of value added products or services provided by the water industry with respect to industry revenue is expected to decline in the future.

Table: Industry value added products or services provided by the water industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Industry Value Added (IVA) ($m)</th>
<th>IVA/ Revenue (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-13</td>
<td>4,248.0</td>
<td>47.4</td>
</tr>
<tr>
<td>2013-14</td>
<td>4,475.8</td>
<td>47.2</td>
</tr>
<tr>
<td>2014-15</td>
<td>4,757.9</td>
<td>47.1</td>
</tr>
<tr>
<td>2015-16</td>
<td>5,029.1</td>
<td>46.8</td>
</tr>
<tr>
<td>2016-17</td>
<td>5,395.9</td>
<td>46.8</td>
</tr>
<tr>
<td>2017-18</td>
<td>5,583.3</td>
<td>46.6</td>
</tr>
</tbody>
</table>

Source: ABS 2013

Exports or exports potential

Due to the impracticality of doing so, Australia does not export water. However, Australian innovations and technical know-how in regard to water management is frequently exported to other countries. Due to data constraints, the dollar value of these exports is unavailable. Australia’s strong research centres and robust intuitions mean that it has high potential to export its water management services and technical capabilities well into the future.

Import or import replacement potential

Australia does not import water. It does, however, import the materials needed to establish the necessary infrastructure for the operation of the industry. However, due to data constraints, this information has not been collected.