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BANKWEST CURTIN ECONOMICS CENTRE

# FUTURE-PROOFING THE WA ECONOMY

## A roadmap to industrial diversification and regional growth

**Focus on Industry Series, No. 4**
August 2019

# About the Centre

The Bankwest Curtin Economics Centre is an independent economic and social research organisation located within the Curtin Business School at Curtin University. The Centre was established in 2012 through the generous support of Bankwest, a division of the Commonwealth Bank of Australia. The Centre's core mission is to deliver high quality, accessible research that enhances our understanding of key economic and social issues that contribute to the wellbeing of West Australian families, businesses and communities.

The Bankwest Curtin Economics Centre is the first research organisation of its kind in WA, and draws great strength and credibility from its partnership with Bankwest, Curtin University and the Western Australian government. The Centre brings a unique philosophy to research on the major economic issues facing the State.

By bringing together experts from the research, policy and business communities at all stages of the process – from framing and conceptualising research questions, through the conduct of research, to the communication and implementation of research findings – we ensure that our research is relevant, fit for purpose, and makes a genuine difference to the lives of Australians, both in WA and nationally.

The Centre is able to capitalise on Curtin University's reputation for excellence in economic modelling, forecasting, public policy research, trade and industrial economics and spatial sciences. Centre researchers have specific expertise in economic forecasting, quantitative modelling, micro-data analysis and economic and social policy evaluation. The Centre also derives great value from its close association with experts from the corporate, business, public and not-for-profit sectors.

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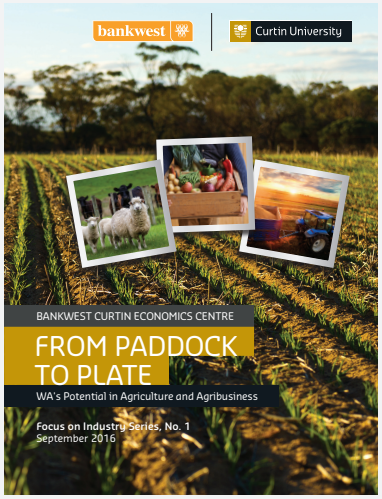


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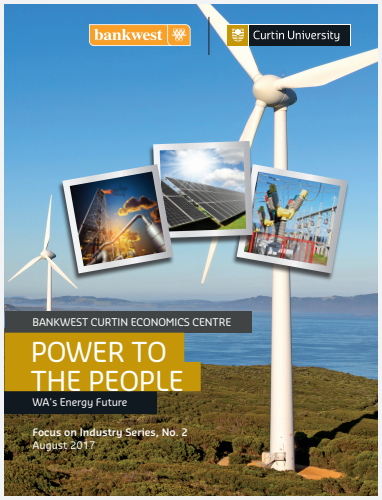


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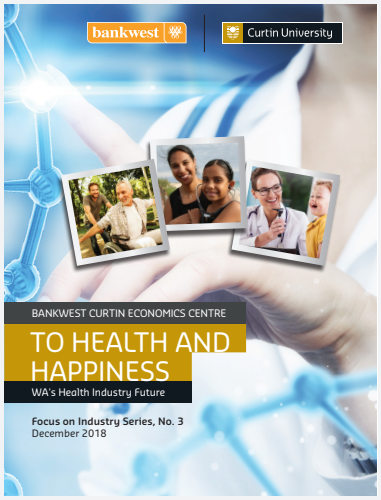


# Foreword

The Western Australian economy has shown impressive growth over recent decades, with much commentary around the nation's avoidance of a recession during and post-GFC. WA has enjoyed many benefits from the mining boom. However, WA's *after-the-boom* economy has been hard for many Western Australians, especially in regional areas.

WA should take advantage of growth opportunities as they arise, and as they align, not only with our economic outlook and vision, but also with our cultural, political and environmental perspectives and values. Diversification would make the WA economy more resilient to price swings in global commodity markets, trade wars, and external shocks, helping to unlock sustained long-term growth and ensuring that the WA economy and regional economies can thrive.

*Future-Proofing the WA Economy* is the fourth report in the Bankwest Curtin Economics Centre's *Focus on Industry* report series. The report recommends the implementation of a 'smart specialisation' approach to regional diversification, to ensure that new development opportunities build on existing regional capabilities and capitalise on local conditions and networks.

Of course, this doesn't mean taking our 'foot off the gas' in the parts of the economy that are going well. A fundamental element of smart specialisation is to support those industries that the regions are leading in. But the smart specialisation policy is useful to encourage diversification into new industries that build on WA's existing advantages.

This report contributes an important new evidence base to inform the State's diversification strategy, based on a data-driven approach to identify current industry strengths and emerging opportunities in each of WA's ten regions.

The report puts forward a series of recommendations to support the State's diversification strategies. In doing so, our hope is that more economic development opportunities in Western Australia will be seized rather than lost.

**Professor Alan Duncan**
Director, Bankwest Curtin Economics Centre
Curtin Business School, Curtin University

# Executive summary

WA has enjoyed many economic benefits from the mining boom, but no state or region can afford to rely on past successes. Nor should the prospects for WA's continued economic growth rely on a narrow concentration of economic strengths within a few industry sectors. Constant transformation and re-invention is necessary for continued prosperity.

WA should of course pursue lucrative mining opportunities, including lithium and other rare earths. But a broader industrial and regional strategy would enable WA to capture a range of related opportunities, offer a wider diversity of industries, support sustained and inclusive growth, as well as promote a more resilient State economy.

Diversification can be challenging, but we know strategies that build on existing strengths and expertise are more likely to succeed. Smart specialisation is one such strategy.

Smart specialisation is a policy approach used around the world to promote sustained and inclusive growth, by supporting a region's strengths and diversifycation into related industries.

In this fourth *Focus on Industry* report we analyse the existing strengths and assets of WA's regions and identify future industries that could diversify and strengthen every regional economy across WA.

Our analysis reveals that a smart specialisation strategy would result in almost 165,000 new jobs in WA by 2025, with more than 48,000 of these jobs spread across WA's regions. These identified sectors would add more than $19 billion to WA's economy by 2025 in addition to current growth expectations.

The identified new ventures or expansion opportunities for WA are industries that could be expected to be already strong in WA, but have not yet been fully realised relative to their intrinsic potential. These include defence technologies, rare-earth minerals, big data and tourism.

Our report recommends a closer examination of each industry to identify barriers to development, including supply chains, industry networks, infrastructure requirements and skill shortages.

Rather than 'picking winners', smart specialisation strategies are effective because they seek logical policy responses to resolve identified issues so that sectors can flourish by enabling the entry of new businesses or the expansion of existing businesses.

Importantly, diversification strategies must be local, taking into account local conditions, capabilities, expertise and preferences. And local people must be engaged in the process. Our report takes a big step in this direction, by analysing the expertise of regional economies and identifying opportunities that build on local capabilities.

# Key findings

## State of play

### WA's growth trends: volatility and concentration

In 2018, WA's GSP per capita stood at $98,725, compared to $72,876 nationally. Over the past 25 years, the WA economy has grown by an average of 2.6% per year, compared to 1.8% nationally.

WA's economic growth is more volatile than other states or nationally. Volatility has increased steadily since 2014 in WA, reaching a peak of 2.7 in 2017, before declining to 2.5 in 2018. The WA-Australia volatility gap also peaked in 2017.

The Mining sector in WA grew by 313% from $18.5bn in June 1992 to $76.7bn in 2018.

The top 4 industries in Australia accounted for 37% of the national economy. By contrast, in WA, Mining alone accounts for 34% of the State's economy.

The Herfindahl-Hirschman (HH) Index is a commonly accepted measure of market concentration.

In GVA terms, the WA economy is now more concentrated (less diversified) than at any other time over the past 25 years, with a GVA-based HH Index of 0.125.

SA is the most diversified region in Australia with a GVA-based HH Index of 0.045.

The Construction industry had an average annual growth rate of 10.1% between 1998 and 2008, with an average annual growth rate of 1.4% between 2008 and 2018.

Only two industries report higher growth in the most recent 5 year period (2013 to 2018) relative to the earlier 2008 to 2013 5 year period. These sectors are Information media and communications (representing a 1.2% share of the WA economy) and Financial and insurance services (4.8% share).

### Risk, volatility and impacts

In WA, total employment in the Mining industry increased 72% between 2009 and 2019.

In 2019, Professional, scientific and technical services had a total employment of over 110,000 people in WA, up 53% from 2009.

WA's Agriculture and manufacturing sectors saw a decline in total employment between 2009 and 2019 of 7.8% and 10.5%, respectively.

Construction in WA has declined annually by an average of 5.9% over the past 5 years in GVA terms.

Total employment is significantly more volatile in WA than nationally. Indeed, total employment growth across all industries in WA has been lower than national trend growth for each of the last 7 years.

Total employment in Mining is particularly volatile in WA, with a strong and demonstrable association to changes in the price of iron ore.

### Regional concentration and impacts

Employment is more concentrated across WA's regions relative to WA overall, and has also increased over time. In 2016, the top 5 employing industries in regional WA accounted for 49.8% of employment compared to 47.0% across the State (a 2.8ppt gap).

Between 2011 and 2016 in regional WA, full-time employment declined by 12.2% in Construction, 26.5% in Manufacturing and 18.7% in Wholesale trade.

## Diversifying the WA economy

### Policy history

WA has an enviable record of economic development based on its natural resources, aided by quality governance and provision of relevant infrastructure and public goods.

Federal and state government policies have historically had limited success in WA in driving diversification, and have typically incurred significant net costs to taxpayers, consumers and the economy.

Policies include trade protectionism; government controls over production, marketing and prices; and numerous failed efforts to promote downstream processing.

Regional economic development has now emerged as an objective in its own right as WA has matured geo-politically. The Royalties for Regions program and the Regional Development Commissions have both featured prominently in past regional development policies in WA.

A lack of consistent, transparent and rigorous methodologies to guide decision-making, and a lack of horizontal alignment (across regions) and vertical integration (across layers of governance) have all been highlighted as shortcomings in the conduct of regional development policy.

### Smart specialisation framework

The review of history reveals three key pitfalls associated with industry development policy:

- a misplaced or unsupported confidence in the ability to 'pick winners'
- attempts to work against economic or market fundamentals
- decisions possibly captured by vested interests.

Smart specialisation is an emerging 'place-based' integration of regional development and industry policies that potentially overcomes these shortcomings.

At the centre of the smart specialisation strategy is the concept of an 'entrepreneurial discovery process'. Smart specialisation seeks to foster that process by identifying potential activities and market opportunities for regions that build upon their existing strengths.

A number of the tools developed under the smart specialisation approach for identifying potential opportunities, including ways of revealing regional comparative advantages, related industries and economic complexity, can be applied to support the entrepreneurial discovery process of the WA regions.

## Industry perspectives

### New technologies

Clean technologies are broader than renewable energy. The growing global use of renewable generation is likely to generate demand for batteries and lithium, as well as impact negatively on fossil fuel industries.

Connectivity has become a key enabler of modern economic growth but modern economies are increasingly knowledge-based. The combination of these two trends makes economic activity increasingly concentrated in cities. Regional economies can compensate for their isolation by supporting connectivity and/or targeting industries with a local factor of production.

Automation is an on going trend. This has benefits for productivity, public transport and local manufacturing.

### Trade

WA's merchandise exports are dominated by commodities but imports are dominated by machinery and fossil fuels.

WA's service exports and imports are relatively small shares of overall trade. Travel is the most significant service sector export and import, followed by transport.

### Infrastructure

Ports facilitate WA's trade. Iron ore dominates the traded volumes predominantly through Port Hedland, while container shipping is currently only available at Fremantle.

Regions are reasonably well connected by air to Perth, but many regions may lack scale for cost-effective air transport. There is significant rail infrastructure interconnecting the regions to the south west of WA, with potential for greater utilisation for freight and passenger transport.

WA's universities are concentrated in Perth, with a few satellite campuses in regional centres.

### Resources

Significant resource endowments such as iron ore, or climate, are crucial to industries in WA's regional economies.

### Revealed comparative advantage

Revealed comparative advantage (RCA) is used to identify current regional industry strengths and prospective diversification opportunities.

In WA, mining industries such as gold ore mining emerge as strengths in Goldfields-Esperance, Peel, Mid West and Pilbara.

Perth specialises in mineral exploration and other mining support services, as expected of a mining state capital.

The Pilbara has the highest RCA in iron ore mining in Australia. In fact, the Pilbara has 103 times more capabilities in iron ore mining relative to the Australian average.

The West Coast (TAS) and the Gascoyne are the second and third regions with the highest RCA on iron ore mining. However, their RCA lags way below the Pilbara; for example, Gascoyne has a relative comparative advantage of 13 times that of the Australian average, but only 1/8 the RCA of the Pilbara.

The RCA numbers fall rapidly outside these areas, with only a handful of regions with endowments to exploit iron ore mining.

### Related industries

Relatedness describes how closely related two industries are to each other. Research on relatedness shows that regions diversify over time by expanding into industries related to their existing strengths.

The key industries related to WA's strength in iron ore mining are nickel ore mining, exploration and bauxite mining, as expected given that the biggest branches of industries are closely related to each other.

Manufacturing is highly related to the Transport, postal and warehousing sector as well as to Wholesale trade and Electricity, gas, water and waste services.

The Financial and insurance services industry is most closely related to Professional, scientific and technical services but also to Information media and telecommunications, Public administration and to a lesser extent Real estate services.

Our analysis also reveals strong relationships between the Health care sector and Education, and between Retail trade and Hospitality.

## Industry diversification criteria

There are a number of criteria used in this report to identify diversification opportunities.

The concept of relatedness is used to develop a **feasibility** indicator for potential new industries in each region. An industry is considered more feasible if the region already has strengths in related industries. This decreases risk and lowers the cost of diversification by targeting industries that build on existing capabilities of the region.

Relatedness is also used to estimate potential local embeddedness. **Embeddedness** describes the extent to which an industry's networks and relationships are expected to be uniquely local. Embeddedness provides a basis to identify industries that are likely to be more sustainable in the longer term, because they are more interconnected with other industries in the local economy.

### Strategic industries

An industry with a high level of 'economic complexity' requires greater knowledge and networks to develop and sustain itself. Complex economics contain many complex industries.

Research has found economic complexity to be highly predictive of future income growth. On this basis, the concept of economic complexity is used to develop an indicator of **strategic gain** to identify diversification opportunities for WA.

The competitive advantage from diversification into new industries is also related to the **uniqueness** or ubiquity of the industry sector, whether nationally or globally, with greater uniqueness giving rise to greater advantage.

## Industry diversification opportunities

The smart specialisation framework used in this report identifies potential diversification opportunities for WA, based on a series of new indicators of the feasibility and value of new industries in WA. Our strategy takes into account the capabilities of existing sectors and the relative comparative advantages of WA.

Building on the State's existing industry strengths, our analysis highlights a number of new sectors that offer strong growth and diversification opportunities,

including:

- defence services and defence technology innovation
- medical services
- lithium, rare earths and other non-ferrous metals, including downstream technologies
- science research, analytics and testing services, and data and information analytics
- childcare and residential aged care services
- science tourism, cultural tourism, eco tourism, adventure tourism and industry tourism (gold, resources and agriculture)
- offshore aquaculture
- air and space technologies
- downstream timber and wood production
- rail and sea transport maintenance and services.

## Regional profiles

### Common themes

A smart specialisation approach to industry diversification has the potential to contribute:

- more than **163,000 new jobs** across the state in 2025, with
- more than **48,000 of these jobs in regional areas**
- around **$19.5bn to WA's GVA in 2025** in addition to current growth expectations.

The prospectus in this report will help to relieve population decline in many regional areas.

One of the most significant areas for further potential jobs growth is in the Peel region, especially in Rail, boat and freight transport construction, Scientific support, Agriculture and food processing.

The Defence industry is recommended to support diversification in the Gascoyne, Mid West and Kimberley regions.

Many of WA's regions are well-placed to expand the Scientific testing and analysis services industry. This service industry is a key component of WA's main strengths in mining and agriculture.

There are opportunities for regional economies to export services, and develop knowledge-based industries in the regions.

#### Perth

Key opportunities in Perth include Engineering design and Engineering consulting services, General insurance, Multi-discipline professional scientific and technical services, Residential and non-residential construction, Employment placement and recruitment services.

The identified industry classes could generate an additional 15,816 jobs and $3.5bn in additional GVA.

#### Kimberley

Key opportunities in the Kimberley include Defence, offshore caged aquaculture, Non-iron ore mining industries, Oil and gas extraction and Hydro electricity generation.

The identified industry classes could generate an additional 2,700 jobs and $1.2bn in additional GVA[1].

1 GVA estimates exclude Defence.

### Pilbara

Key opportunities in the Pilbara include Non-iron ore mining industries (including lithium), Scientific testing and analysis services, Corporate head office services, Petroleum refining and Petroleum fuel manufacturing, Air and space transport, and Airport operations.

The identified industry classes could generate an additional 5,200 jobs and $3.4bn in extra GVA.

### Gascoyne

The Gascoyne is the smallest region by population, but there are still significant opportunities.

Key opportunities include Defence, Oil and gas extraction, Aquaculture, Air and space transport, Airport operations, Real estate services as well as Residential construction.

The identified industry classes could generate an additional 1,050 jobs and $373m in additional GVA[2].

### Mid West

Key opportunities in the Mid West include Scientific testing and analysis services, Oil and gas extraction, Defence, Offshore caged aquaculture, Offshore longline and rack aquaculture, Airport operations and Air and space transport.

These industry classes have the potential to generate an additional 7,250 jobs and $3.5bn in additional GVA.

## Goldfields-Esperance

Key opportunities in the Goldfields-Esperance region include Non-ferrous metal refining (including lithium), Air and space transport, Rail passenger transport and Gas supply.

The identified industry classes could generate an additional 5,450 jobs and $3.2bn extra GVA.

### Wheatbelt

Key opportunities for the Wheatbelt include other types of Agriculture and horticulture, Downstream food processing, other types of Mining, Log sawmilling, Accommodation and Grain wholesaling.

The identified industry classes could generate an additional 3,850 jobs and 1.2bn dollars in additional GVA.

### Peel

Key opportunities in Peel include Scientific testing and analysis services, other types of Agriculture and Downstream food processing activities, Rail freight transport and Other mining support services.

The identified industry classes could generate an additional 10,350 jobs and $781m in additional GVA.

### South West

Key diversification opportunities in the South West include Lithium mining, Offshore longline and rack aquaculture, Adventure tourism, other types of Agriculture, other types of Fishing, Landscape construction services, and other types of Retailing.

The identified industry classes could generate an additional 7,750 jobs and $769m in additional GVA.

### Great Southern

Key opportunities in the Great Southern region include Offshore longline and rack aquaculture, Offshore caged aquaculture, other types of Agriculture and horticulture, Log sawmilling, Timber dressing and Accommodation.

2 GVA estimates exclude Defence.

The identified industries could generate an additional 2,300 jobs and $200m in additional GVA.

## How do we get there?

### Principles

The concept of smart specialisation is 'smart' for two main reasons:

1. It links regional development and industry policies through the entrepreneurial discovery process and priority setting by policy makers using objective evidence in close cooperation with local actors.
2. This process is outward-looking, forcing both regions and businesses to be ambitious beyond current traditional industries, but to be realistic about what can be achieved. The process links local capabilities and assets with new areas for potential and addresses barriers to their development.

This report makes key contributions to these principles. However, while each regional and industry strategy share some common features, the place-based policy approach puts an emphasis on local context as a crucial aspect of successful policy, strategy and project design.

### Processes

Targeting new sectors with a smart specialisation approach is not 'picking winners'. Instead, strategies for smart specialisation identify priorities based on the strength and potential of the region, identify industrial development barriers, support activities that address those barriers, and research and innovation activities related to those sectors.

Entrepreneurs, businesses and locals drive new businesses and economic expansion, enabled by regional competitive advantages, local clusters, connectivity, and collaborative regional leadership.

There are six steps to implementing a strategy for smart specialisation:

1. Analysis of regional context and potential
2. Establishment of sound and inclusive governance and regulatory structures
3. Production of shared vision for the future of regions
4. Selection of a series of priorities for regional development
5. Establishment of policy mixes
6. Monitoring and evaluation mechanisms.

This report makes significant contributions to steps 1, 3 and 4, as well as offering a number of options under step 5.

The evidence in this report offers a basis for regional development commissions to articulate a long-term vision for their region.

The industry classes identified by this report have the potential to become leading areas of economic development in each region.

A close examination of these industries also reveals challenges faced and promising strategies to drive development.

## Recommendations

A number of strategies and actions should be considered to build a long-term and sustainable vision for regional economic growth:

- It is important that the State's regulatory settings continue to evolve to support smaller scale investment projects.
- Regional Development Commissions should develop roadmaps for industry development and diversification, but should do so in collaboration with state agencies, local stakeholders and local industry.
- The case for diversification should be supported by measurable targets that assess the implementation, impact and result of new ventures, as well as timelines.
- Networks and knowledge transfer are crucial factors in the success of new ventures and diversification opportunities. The state government and industry peak agencies have an important role to play in connecting local businesses with local, national and global best practice.
- A evidence-based framework to target new diversification opportunities across regions, and to facilitate international business delegation visits to support and inspire local entrepreneurs.
- A two-way approach exposing international business investors to regional development opportunities and local entrepreneurs.
- Regional coordination to seize opportunities, capitalising on complementarities across industries and regions, rather than competition between them.
- Continuous evaluation and monitoring is a recognised principle of the smart specialisation framework.

# Introduction

Almost from its colonial inception, the Western Australian economy has been heavily reliant on the export of primary commodities from agriculture and mining. There can be no doubt that the good fortune of this vast endowment of land and resources has underpinned the enviable standard of living we enjoy today, and contributed to the quite remarkable economic success story of the most recent three decades. In looking to the future, however, it would not be prudent to assume we will be able to sit back and ride the same waves of success. While we cannot predict the future, we can take steps to bolster the economy's ability to respond to changing economic times.

The economy's concentration in primary production exposes the State to pronounced fluctuations that typify commodity price cycles. The Bankwest Curtin Economics Centre's report *Back to the future: WA's economic future after the boom* documented how the economy and WA families were hit hard by the end of the mining boom. Those impacts reverberate even more strongly in regional WA.

There are a number of arguments for the need to diversify the WA economy, and particularly the regional economies. More diversified economies, with output spread across a broader range of industry sectors, are less vulnerable to the vagaries of impacts from technological shifts, globalisation, and price swings. Diversified economies are more able to make the structural adjustments required to grasp new opportunities that arise and to wean themselves off declining sectors. Of particular relevance to the WA economy, there is a widely held perception that the high-value industries and high-wage jobs of the future will increasingly leverage knowledge and new technological advancements, with the relative value of primary commodities falling. These arguments all point to the need for diversification to future proof the economy against shocks and to ensure maintenance of WA's high standard of living.

We do not accept these narratives unquestioningly and nor, should policy-makers. In fact, we review the somewhat chequered history of industry policy in Western Australia and Australia, and highlight some conspicuous failures as lessons from the past. In this report, we put forward a policy framework that draws upon the emerging 'smart specialisation' approach that provides a guide to the appropriate role for government and policy in the face of inevitable uncertainty, and which complements the existing roles of the Regional Development Commissions.

Smart specialisation evolved out of policies to promote regional cohesion within the European Union, and represents a 'place based' integration of industry and regional development policies. Smart specialisation emphasises the role of entrepreneurship and networks in promoting innovation to increase regional value added. Smart specialisation emphasises the importance of local contexts and capacities and attempts to develop networks to build on regional strengths. Given the geographical vastness and diversity of this State, it is imperative that any approach to regional policy is formulated from the ground up.

A limitation of many approaches to industry and regional development, including in WA, has been the lack of an evidence-based and transparent methodology to identify what those local strengths are. In this report we apply empirical methods developed to support the smart specialisation approach to present a data-driven methodology for identifying current strengths and potential opportunities for diversification in each

of WA's nine Regional Development Commission regions. These include concepts of feasibility, embeddedness, complexity and strategic gain, calculated from detailed data on the existing industrial structure of the regions and the inter-relationships between local industries. For each region a range of potential diversification options are put forward to complement activities that the regions already do well.

These are not intended to preclude exploiting new agricultural or mining opportunities, such as lithium, as they arise. WA should of course pursue those opportunities. But they are intended to raise awareness, to start conversations and, where appropriate, foster the development of innovation networks to grasp diversification opportunities. These include 'vertical' linkages to international markets that state and federal governments are well placed to facilitate and often beyond the horizons of local actors. The aim of policy under this approach is to promote the conditions for entrepreneurial discovery rather than direct intervention, through legitimate roles for government of providing information and other public goods, funding infrastructure, supporting education and R&D, and addressing coordination failures. In this way the approach avoids the key pitfalls of past industry policy of governments trying to 'pick winners', working against economic and market fundamentals, and becoming captive to vested interests.

While the analytical tools we use in this report are at the forefront of policy approaches in the European Union, the United Kingdom and elsewhere, there is more that can be done. Beyond introducing the approach and instigating these discussions, the Bankwest Curtin Economics Centre hopes the report and our engagement with stakeholders leads to an ongoing assessment of regional capacities and opportunities with new data and method refinements as they become available. Evaluation and monitoring is a recognised principle of the smart specialisation approach. Implemented correctly, the approach should lead not only to the identification of existing opportunities in the regions, but a dynamic benefit through heightened ability of the regions to identify and grasp opportunities as the future unfolds, supporting sustained and inclusive growth and a more resilient state economy.

# State of play

# Introduction

This chapter provides an overview of the current state of play in the Western Australian economy, and the trajectory over recent decades. Economic trends over recent decades are discussed, with a focus on the volatility and concentration of WA's economy and industry composition, relative to the national picture. In addition to reporting on gross state product, gross value added and employment trends over time, changes in business count at a regional and industry level are also reported.

The impact of recent changes in industry composition, as the WA economy shifted from the construction phase to the production phase of mining work, are also reported, with changes in population growth, regional employment and youth unemployment.

# Economic growth, volatility and concentration: Part 1 - GSP and GVA

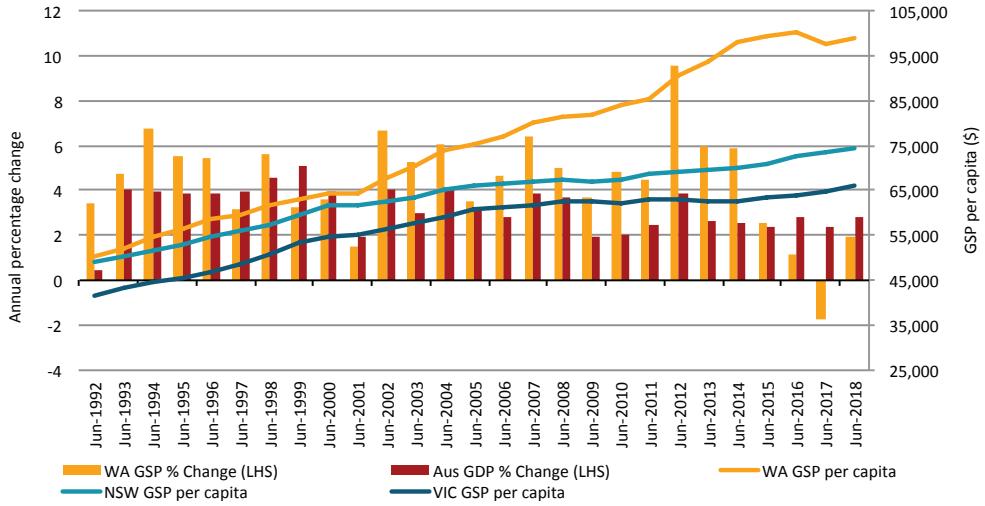
## A quarter century of economic growth - WA's GSP growth trajectory

In 2018, WA's GSP per capita stood at $98,725, compared to $72,876 nationally.

The Australian economy has shown impressive and consistently positive growth in GDP over recent decades, with much commentary around the nation's avoidance of a recession during and post-GFC. In per capita terms, Figure 1 and Figure 2 show that, since 1992, the WA economy has grown at an even faster pace than that displayed nationally. WA's GSP per capita stood at $98,725 in 2018 (the most recent year for which annual GSP data is currently available), and despite a decline from a peak of almost $100,000 in 2016, it remains $25,850 above that of Australia's GDP per capita ($72,876).

For the 26 years reported in Figure 1, actual GSP growth in WA was higher than GDP growth in Australia for all years bar seven – 1997, 1999 to 2001 and 2016 to 2018. The fact that three of these seven years have been the most recent years reported, the negative GSP growth for the year to June 2017, coupled with high levels of public debt, have led to questions relating to the need for new sources of economic growth.

**Figure 1** GSP per capita WA and a selection of states, and Australian GDP per capita, 1992 to 2018

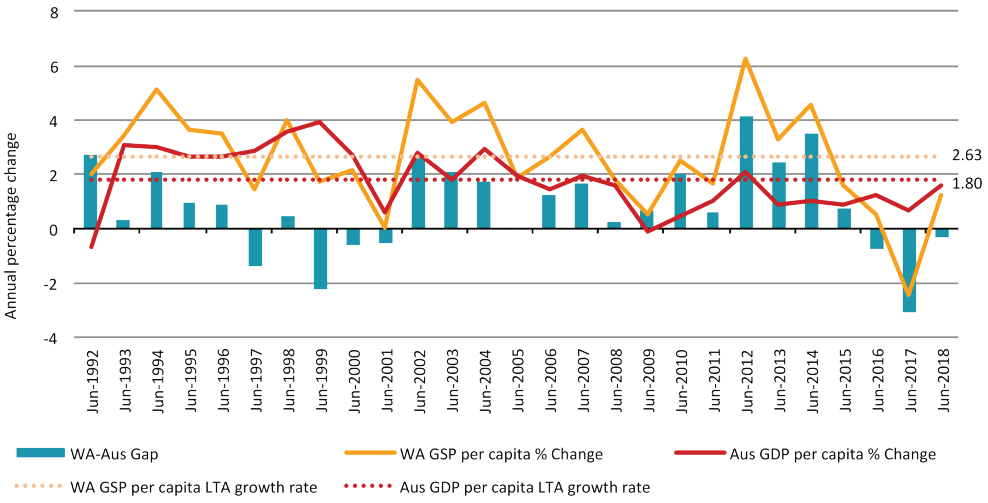



Source: Bankwest Curtin Economics Centre | ABS 5220, Table 1, reproduced from BCEC Quarterly Economic Commentary 2019.

Accounting for population growth, Figure 2 shows the annual percentage change in GSP per capita for WA, and the annual percentage change in GDP per capita for Australia. WA's long term (between 1992 and 2018) average GSP per capita growth rate stands at 2.6 per cent. This compares to 1.8 per cent nationally.

Over the past 25 years, the WA economy grew by an average of 2.6% annually, compared to 1.8% nationally.

**Figure 2** Annual change in GSP per capita, WA, and Australian GDP per capita, 1992 to 2018



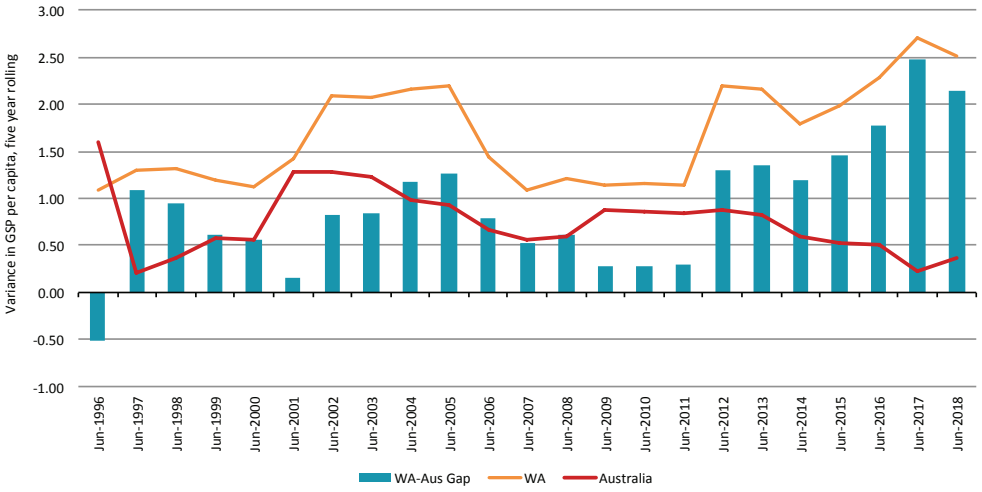

Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 1.

WA's economic growth is more volatile than that reported nationally.

While WA's economic growth has been, on average, stronger than that seen nationally, this success story is accompanied by one of greater volatility. Applying a five year rolling standard deviation metric, Figure 3 shows that, since 1997, WA's economic growth is more volatile than that reported nationally. The standard deviation (deviation from the long term State mean) for WA has remained above one for the period reported, with the national figure hovering between zero and one since 1994. WA's mining 'sister' state of Queensland has experienced similar volatility to WA during certain times, but not to the extent of that seen in WA. WA's economic volatility has increased in recent years, coinciding with economic growth below the long term average growth rate. In fact volatility has increased steadily since 2014, reaching a peak of 2.7 in 2017, before declining to 2.5 in 2018. The WA-Aus volatility gap also peaked in 2017, as demonstrated by the blue bars in Figure 3.

Volatility has increased steadily since 2014, reaching a peak of 2.7 in 2017, before declining to 2.5 in 2018.

**Figure 3** Level of volatility in per capita growth, WA and Australia, 1996 to 2018




Note: A five year rolling standard deviation is applied to GSP (WA) and GDP (Australia) per capita growth rates.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 1.

## A one horse town? Industry (GVA) growth and concentration over time

In terms of real dollar value, the nineteen industry groups in WA contributed to a total gross value added (GVA) of almost $234 billion (Table 1). Mining accounted for 33.8 per cent of this contribution, which implied almost $30,500 on a per capita basis. This is followed by Construction (9.1%), Health care and social assistance (6.2%), Manufacturing (5.9%), and Professional, scientific and technical services (5.8%).

**Table 1** **Gross value added by industry, WA, June 2018**

| | $m | per capita | % share | rank by share |
|---|---|---|---|---|
| Mining | 79,013 | 30,485 | 33.8 | 1 |
| Construction | 21,190 | 8,176 | 9.1 | 2 |
| Health care and social assistance | 14,431 | 5,568 | 6.2 | 3 |
| Manufacturing | 13,890 | 5,359 | 5.9 | 4 |
| Professional, scientific and technical services | 13,627 | 5,258 | 5.8 | 5 |
| Financial and insurance services | 11,240 | 4,337 | 4.8 | 6 |
| Public administration and safety | 10,329 | 3,985 | 4.4 | 7 |
| Transport, postal and warehousing | 10,120 | 3,904 | 4.3 | 8 |
| Education and training | 9,418 | 3,634 | 4.0 | 9 |
| Retail trade | 8,255 | 3,185 | 3.5 | 10 |
| Wholesale trade | 8,115 | 3,131 | 3.5 | 11 |
| Agriculture, forestry and fishing | 6,245 | 2,409 | 2.7 | 12 |
| Administrative and support services | 5,659 | 2,183 | 2.4 | 13 |
| Rental, hiring and real estate services | 5,230 | 2,018 | 2.2 | 14 |
| Electricity, gas, water and waste services | 4,617 | 1,781 | 2.0 | 15 |
| Accommodation and food services | 4,379 | 1,690 | 1.9 | 16 |
| Other services | 4,019 | 1,551 | 1.7 | 17 |
| Information media and telecommunications | 2,740 | 1,057 | 1.2 | 18 |
| Arts and recreation services | 1,392 | 537 | 0.6 | 19 |
| **Total all industries** | **233,909** | **90,247** | **100.0** | |

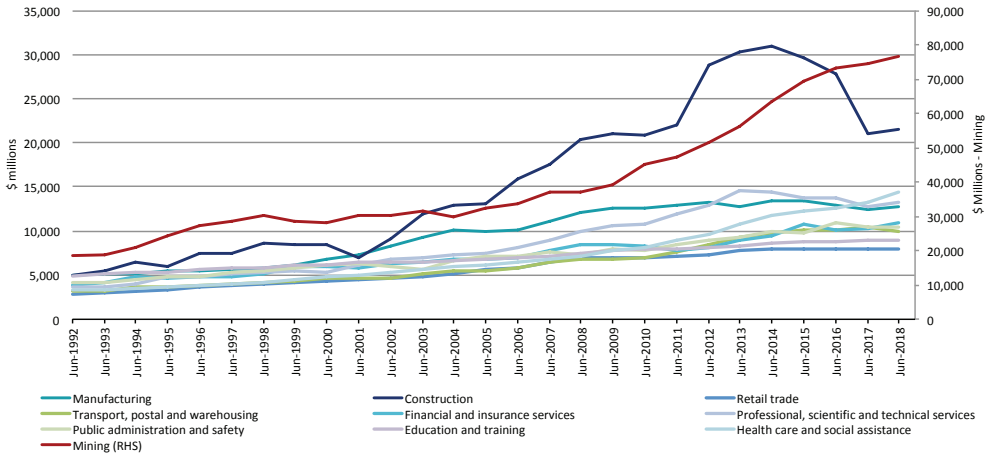
Note: GVA dollar values are in current prices. Excludes ownership of dwellings, taxes less subsides and statistical discrepancies.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 6.

In real dollar terms, the Mining sector in WA grew by 313 per cent from $18.5 billion in June 1992 to $76.7 billion in 2018 (Figure 4). Amongst the other top five industries (by GVA share), Construction grew by 337 per cent over the same period, from $4.9 billion to $21.6 billion, albeit declining from a height of $31.0 billion in 2014. The latter decline can be attributed to the structural shift in the WA economy, from the construction to production phase of the mining boom, and with, more recently, slower activity in the housing market. Heath care and social assistance grew by 342 per cent between 1992 and 2018, while Manufacturing grew by 160 per cent and Professional, scientific and technical services by 265 per cent.

The mining sector in WA grew by 313% from $18.5bn in June 1992 to $76.7bn in 2018.

The top four industries in Australia accounted for 37% of the national economy. In WA, mining alone accounts for 34% of the State's economy.

**Figure 4** GVA by industry, real dollar terms, 1992 to 2018



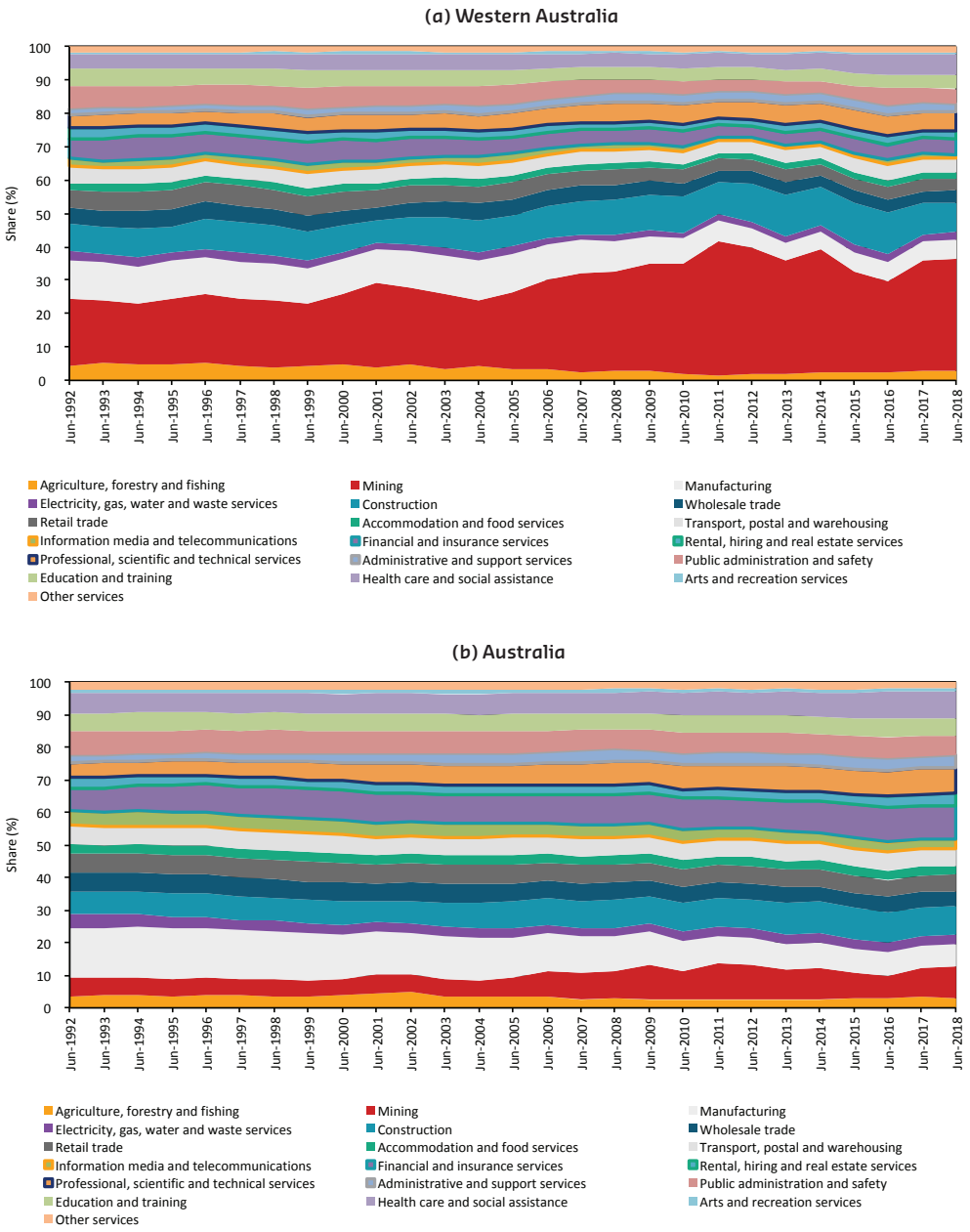

Note: GVA $ Values in Chain Volume.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 6.

The high level of industry concentration of the WA economy in GVA terms relative to that observed nationally is displayed in Figure 5. In terms of industry share of GVA, the Mining sector accounted for 33.9 per cent of the WA economy in 2018. This is up from a share of 20.0 per cent in 1992, but down from a height of 40.1 per cent displayed in 2011 (Figure 5, Panel a).

The growth in the share of GVA attributable to mining has, by definition, led to reduced shares held elsewhere. For example, the Manufacturing sector in WA held a share of 12.3 per cent in 2004, with a low of 5.2 per cent in 2014. Manufacturing now accounts for 5.9 per cent of WA's GVA. The Agriculture sector in WA displayed a height in GVA share of 5.2 per cent in 1996, with a low of 1.4 per cent in 2011 coinciding with a peak in the Mining sectors share. The Agricultural sector accounted for 2.7 per cent of the WA economy in 2018.

At a national level (Figure 5, Panel b), Financial and insurance services account for 10.4 per cent of GVA, followed by Mining (9.6%), Construction (8.9%), Health care and social assistance (8.1%) and Professional, scientific and technical services (8.0%). Australia's top four industries by GVA share in 2018 accounted for 37.0 per cent of the economy. This is almost equivalent to the 34 per cent contribution of the Mining industry to WA.

**Figure 5** Industry share of GVA, WA and Australia, 1992 to 2018




Note: Shares based on current Prices and excludes Ownership of dwellings and Statistical discrepancies.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 6 and Table 10.

In GVA terms, the WA economy is now more concentrated (less diversified) than at any other time over the last quarter of a century.

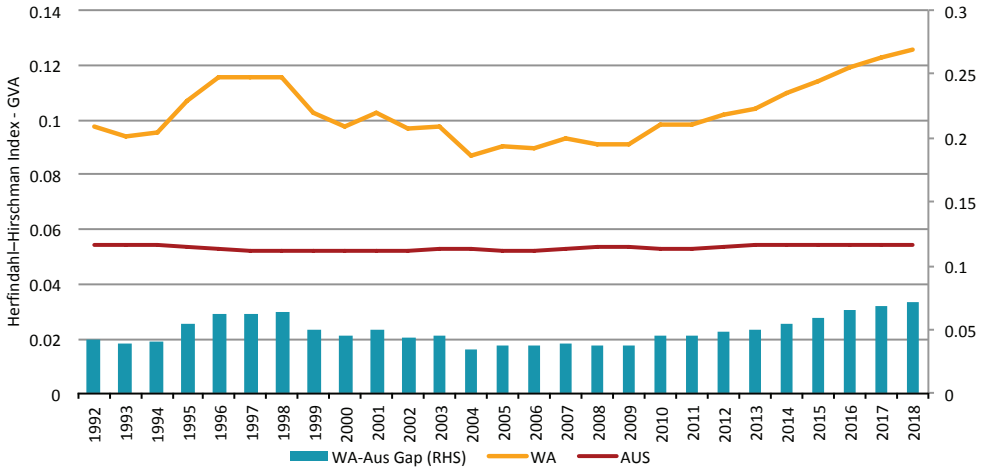
## Industry concentration over time

To further investigate whether the WA economy has become more or less diversified over time, the Herfindahl-Hirschman Index (HH Index) is constructed and presented in Figure 6.

The HH Index is a commonly used metric of industry concentration and is calculated by squaring the market share of each industry in the economy and summing the squares (for further details see Herfindahl, 1950; Hirschman, 1980). The Index ranges from 0 to 1, with a lower HH Index indicating a more diversified economy and a higher HH Index indicating a more specialised economy. Put another way, an increasing (decreasing) HH Index line implies a less (more) diversified economy over time.

Figure 6 shows the GVA-based HH Index over time for WA and Australia between 1992 and 2018. Australia's GVA-based HH Index has remained reasonably stable over time, hovering at around 0.053. However, for WA, the GVA-based HH Index has shown greater variation (average of 0.102), and has increased each year since 2008, to now stand at its highest (0.125) over the period reported. That is, in GVA terms, the WA economy is now more concentrated (less diversified) than it has ever been over the last 25 years. The WA-Aus gap is also at an all-time high, reaching 0.071 in 2018.

**Figure 6** Industry concentration, WA and Australia, 1992 to 2018, GVA-based Herfindahl-Hirschman Index

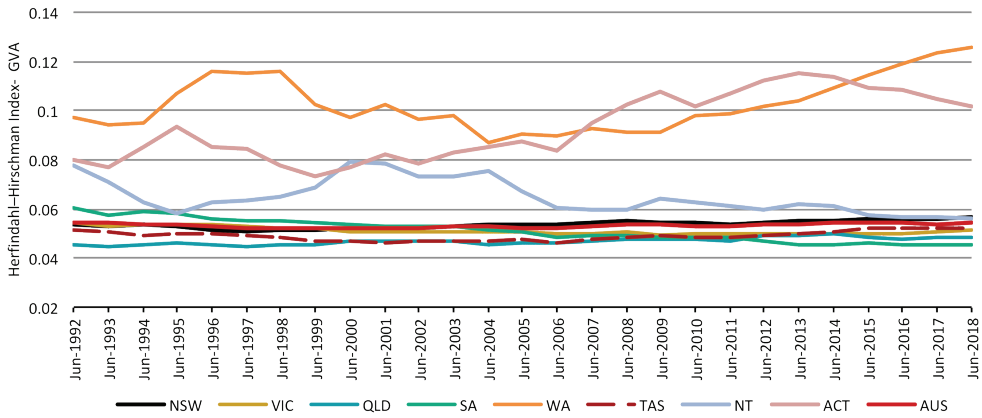



Note: Higher values of the index represent less industry diversification. Ownership of dwellings is excluded.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Tables 2 to 10.

In 2018, and for much of the time period reported here, WA is the most concentrated (least diversified) economy across the nation. The only other economy nationally to display similar concentration levels to WA is that of the ACT (Figure 7), which has a large public sector contributing to this phenomenon. The ACT had a higher HH Index than that reported for WA between 2007 and 2014. As of 2018, amongst the states, South Australia is the most diversified region in Australia with a GVA-based HH Index of 0.045, followed by Qld (0.048), Vic (0.051) and NSW (0.056).

South Australia is the most diversified region in Australia with a GVA-based HH Index of 0.045.

**Figure 7 Industry concentration, WA and Australia, 1992 to 2018, GVA-based Herfindahl-Hirschman Index**




Note: Higher values of the index represent less industry diversification. Ownership of dwellings is excluded.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Tables 2 to 10.

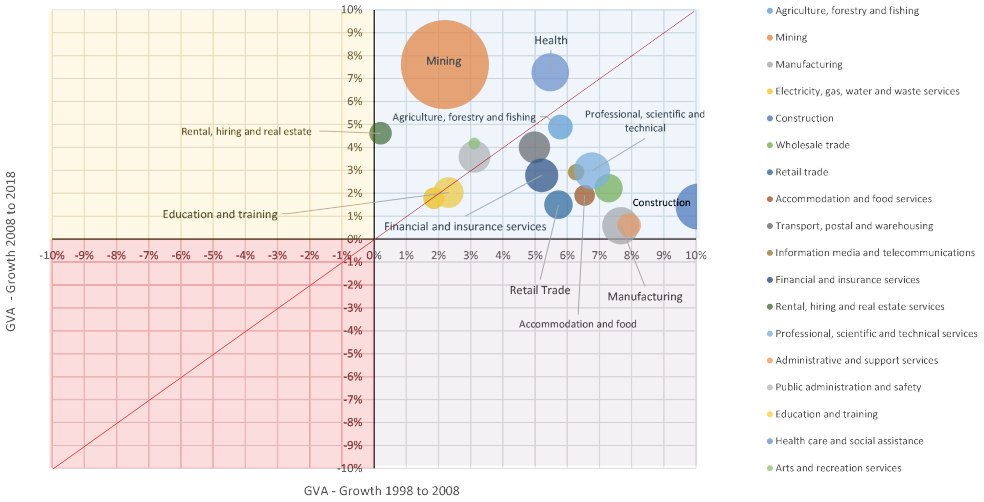
Only two industries report higher growth in the most recent five year period relative to the earlier 2008 to 2013 period.

## Industry growth in GVA

Taking a closer look at industry growth over recent periods in WA paints an additional interesting dimension of the economy. Figure 8 displays average GVA growth by industry in WA over two periods. The horizontal axis displays average industry growth over the ten year period between 1998 and 2008, while the vertical axis shows the average growth over the more recent ten year period between 2008 and 2018. Industries with a larger (smaller) industry share in 2018 are displayed in a larger (smaller) size. All industries lie within the top right hand quadrant, which implies positive average GVA growth across both periods.

Industries that lie to the right (left) of the red 45 degree line had growth was higher (lower) in the earlier period than in the most recent period for that industry. For example, the Construction industry had an average annual growth rate of 10.1 per cent between 1998 and 2008, with an average annual growth rate of 1.4 per cent between 2008 and 2018. Mining, displayed on the opposite side of the 45 degree line, had an annual average growth rate of 2.2 per cent between 1998 and 2008, increasing to 7.6 per cent between 2008 and 2018. Only five of the nineteen industry groups displayed greater average annual growth in the most recent period relative to the earlier ten year period.

**Figure 8** Growth in industry GVA in WA, average annual growth rate, 1998 to 2008 and 2008 to 2018




Note: Ten year average annual GVA growth rates. Bubble size denotes GVA share in 2018. Excludes Ownership of dwellings and Statistical discrepancies.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 6.

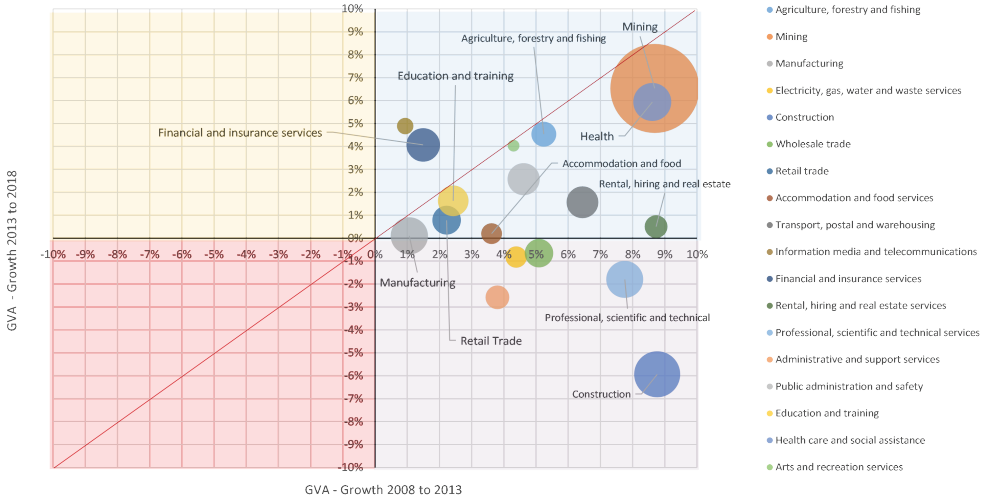
Breaking the 2008 to 2018 ten year period into two five year periods shows an even more concerning picture (Figure 9). Here the horizontal axis shows average annual growth between 2008 and 2013, while the vertical axis shows average annual growth between 2013 and 2018. Only two industries – Information media and communications (1.2% share of the WA economy) and Financial and insurance services (4.8% share) report higher growth in the most recent five year period relative to the earlier 2008 to 2013 period.

Furthermore, five industries are in the bottom right hand side quadrant, implying negative average annual GVA growth between 2013 and 2018. The decline of the Construction industry is particularly evident. While Manufacturing maintained its place in the positive growth quadrant, its average annual GVA growth rate was effectively zero between 2013 and 2018.

The Mining and Health sectors continue to post the highest average annual growth rates, but both were lower for the more recent time period. Agriculture, forestry and fishing displays much volatility on an annual basis (with for example, heavy reliance on climatic circumstances) and hovers around the 45 degree line, with average annual growth between 4.5 and 5.5 per cent.

Construction in WA declined annually (GVA terms) by an average of 5.9% over the past five years.

**Figure 9** Growth in industry GVA in WA, average annual growth rate, 1998 to 2008 and 2008 to 2018




Note: Ten year average annual GVA growth rates. Bubble size denotes GVA share in 2018. Excludes Ownership of dwellings and Statistical discrepancies.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS 5220, Table 6.

# Economic growth, volatility and concentration: Part 2 - employment and business count

In WA, total employment in the mining industry increased 72% between 2009 and 2019.

GSP and GVA are two critical measures of how the WA economy and individual industries are tracking. However, it is also important to consider other metrics for a more holistic perspective. Employment across industries is another critical metric to assess, as is business counts.

## Industry employment

Total employment (full-time and part-time) by industry in WA is presented in Table 2 for a selection of years, with a comparison in levels and shares to that seen nationally (for a selection of industries) provided in Figure 10.

Health care and social assistance is WA's largest employer in 2019, with an 11.5 per cent share leading to over 155,000 employed. This sector was the third largest employer in 2009. In 2019, health is followed by Retail trade (9.7% share), Construction (9.2%), Professional, scientific and technical services (8.2%), with Mining (7.7%) closing out the top five industries by total employment size.

Mining is particularly interesting, in that, while business investment declined significantly in recent years, total employment in the Mining sector remains, in absolute terms, strong, and in fact has grown since 2014. While employment in the Mining sector is lower than the height reported in 2012 (115,500; 9% share), total employment increased by 72 per cent between 2009 and 2019 (Table 2). However, total employment in mining is volatile, a point which will be returned to later in this section.

**Table 2** Total employment by industry, WA, 2009 to 2019

| | 2009 | | | 2014 | | | 2019 | | | 2019-2009 change |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. ('000) | Rank | % | No. ('000) | Rank | % | No. ('000) | Rank | % | % |
| Health care and social assistance | 122.6 | 3 | 10.4 | 140.1 | 1 | 10.7 | 154.7 | 1 | 11.5 | 26.2 |
| Retail trade | 137.8 | 1 | 11.7 | 136.0 | 3 | 10.3 | 131.4 | 2 | 9.7 | -4.7 |
| Construction | 125.7 | 2 | 10.7 | 136.3 | 2 | 10.4 | 124.5 | 3 | 9.2 | -1.0 |
| Professional, scientific and technical services | 72.2 | 7 | 6.1 | 109.0 | 4 | 8.3 | 110.5 | 4 | 8.2 | 53.2 |
| Mining | 60.5 | 10 | 5.1 | 98.5 | 6 | 7.5 | 104.0 | 5 | 7.7 | 71.9 |
| Education and training | 88.6 | 5 | 7.5 | 99.2 | 5 | 7.5 | 103.8 | 6 | 7.7 | 17.1 |
| Accommodation and food services | 69.3 | 8 | 5.9 | 78.6 | 8 | 6.0 | 92.6 | 7 | 6.9 | 33.6 |
| Public administration and safety | 72.7 | 6 | 6.2 | 75.2 | 9 | 5.7 | 89.9 | 8 | 6.7 | 23.7 |
| Manufacturing | 98.6 | 4 | 8.4 | 85.8 | 7 | 6.5 | 88.3 | 9 | 6.6 | -10.5 |
| Transport, postal and warehousing | 63.6 | 9 | 5.4 | 66.2 | 10 | 5.0 | 63.1 | 10 | 4.7 | -0.8 |
| Wholesale trade | 41.1 | 11 | 3.5 | 41.1 | 11 | 3.1 | 43.2 | 11 | 3.2 | 5.3 |
| Administrative and support services | 37.4 | 13 | 3.2 | 40.6 | 12 | 3.1 | 42.7 | 12 | 3.2 | 14.4 |
| Agriculture, forestry and fishing | 38.4 | 12 | 3.3 | 30.6 | 15 | 2.3 | 35.4 | 13 | 2.6 | -7.8 |
| Financial and insurance services | 29.1 | 14 | 2.5 | 34.5 | 13 | 2.6 | 28.1 | 14 | 2.1 | -3.6 |
| Arts and recreation services | 20.3 | 15 | 1.7 | 25.3 | 16 | 1.9 | 23.5 | 15 | 1.7 | 15.9 |
| Rental, hiring and real estate services | 20.1 | 16 | 1.7 | 30.9 | 14 | 2.4 | 22.8 | 16 | 1.7 | 13.6 |
| Electricity, gas, water and waste services | 15.5 | 17 | 1.3 | 18.1 | 17 | 1.4 | 20.6 | 17 | 1.5 | 33.0 |
| Information media and telecommunications | 15.0 | 18 | 1.3 | 14.0 | 18 | 1.1 | 12.1 | 18 | 0.9 | -19.4 |
| Other services | 48.9 | | 4.2 | 53.8 | | 4.1 | 56.3 | | 4.2 | 15.1 |
| **Total** | **1,177** | | **100.0** | **1,314** | | **100.0** | **1,348** | | **100.0** | **14.5** |

Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

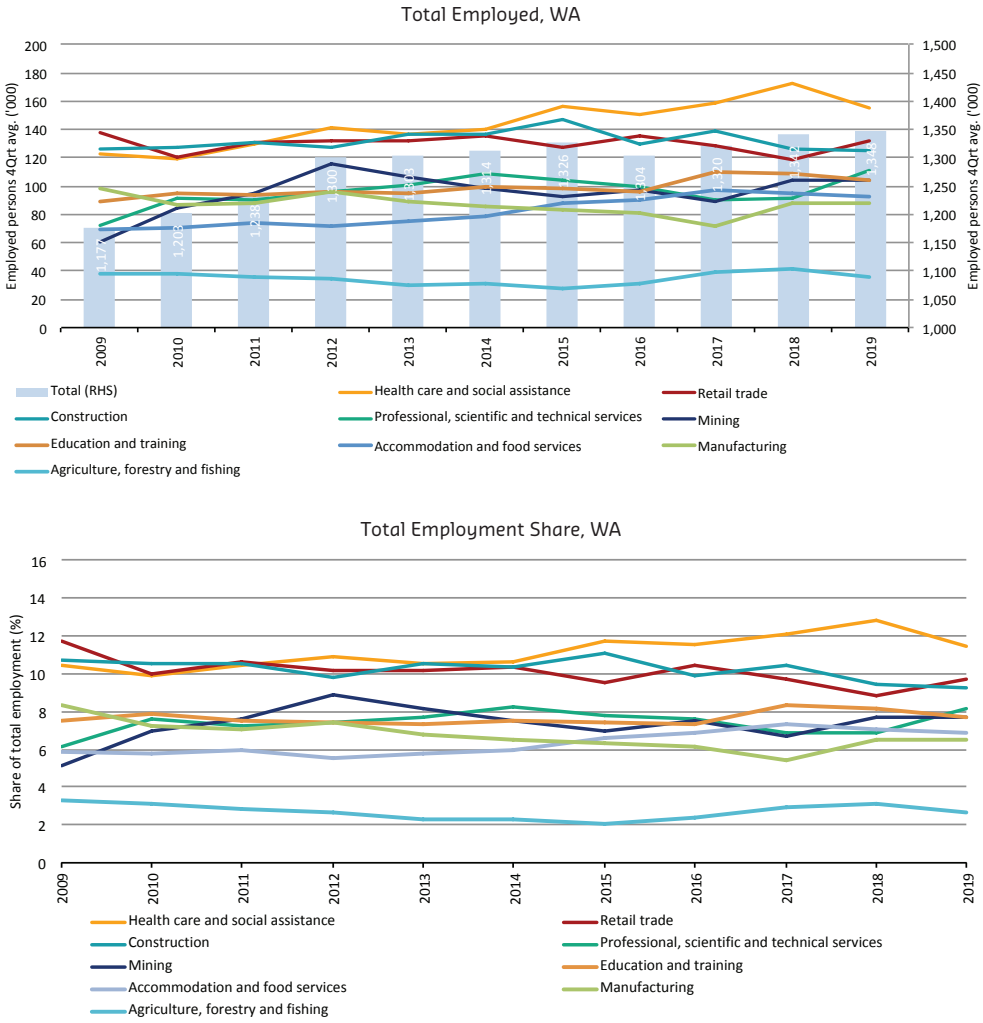
Construction remains a significant employer in WA, but also saw a decline from the heights of 137,100 jobs in 2013 to 124,500 in 2019. Manufacturing has also seen substantial shifts over the past decade, from being the fourth largest employer in 2009 (8.4% share) to being the ninth largest employer (6.6% share) in 2019, with a decline in total employment of over 10.5 per cent. The Agricultural sector also saw declines of 7.8 per cent, with a decline of 4.7 per cent in Retail trade, and almost 20 per cent in Information media and telecommunications.

Another notable change is in Professional, scientific and technical services, which is now the fourth largest employer in WA, up from seventh in 2009. Total employment in this industry has increased from 72,700 people in 2009 to 110,500 in 2019, that is, a 53 per cent increase. Total employment in Accommodation and food services also saw significant gains, increasing by 33.6 per cent between 2009 and 2019.

In 2019 professional, scientific and technical services had a total employment of over 110,000 in WA, up 53% from that reported in 2009.

Between 2009 and 2019 in WA, Agriculture and Manufacturing saw a decline in total employment of 7.8% and 10.5%, respectively.

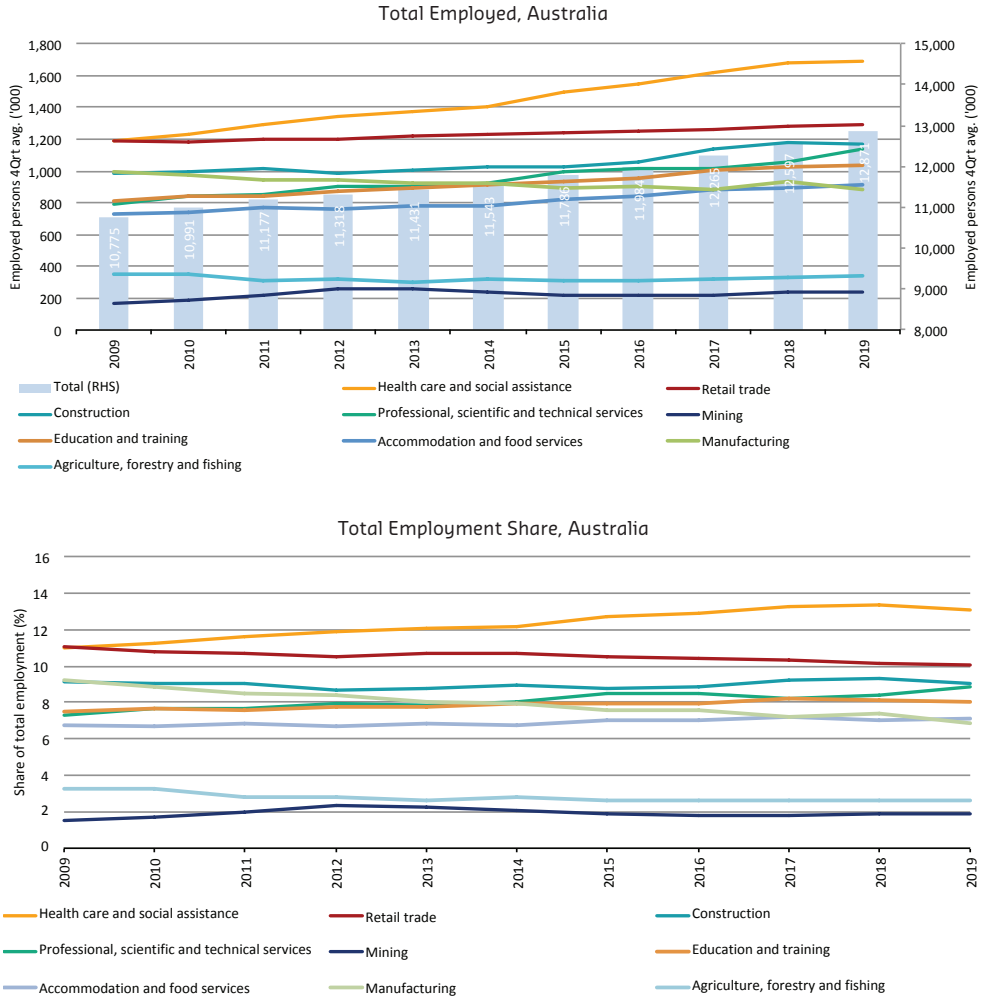
**Figure 10** Total employment by industry, and industry share of total employment, WA and Australia, 2009 to 2019




Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019. Selection of Industries.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

**Figure 10** Total employment by industry, and industry share of total employment, WA and Australia, 2009 to 2019 (continued)




Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019. Selection of Industries.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

The Australian economy saw stronger growth in total employment (Table 3) between 2009 and 2019 (19.5%) relative to that in WA (14.5%). However, in 2019, WA's top five industries (by total employment) generated 46.4 per cent of total employment, compared to 49.1 per cent for the top four nationally, which suggests a more diversified economy in WA in employment terms relative to that seen nationally.

Declines in total employment by industry between 2009 and 2019 generally align with those seen in WA, albeit to different degrees. For Australia, total employment in Agriculture declined by 2.4 per cent (-7.8%, WA), Manufacturing by 11.5 per cent (-10.5%, WA), and Information media and telecommunications by 4.3 per cent (-19.4%, WA). Total employment in Wholesale trade declined by 3.5 per cent nationally, but saw an increase of 5 per cent in WA.

Education and training is the fifth largest employer nationally, experiencing a 28 per cent increase between 2009 and 2019. This compares to a 17 per cent increase in total employment in the industry for WA (ranked sixth in share terms).

More detailed total employment data at an industry sub-divisional level is presented in a latter section of this report.

In total employment terms, the WA economy presents as being slightly more diversified than that seen nationally.

**Table 3** **Total employment by industry, Australia, 2009 to 2019**

| | 2009 | | | 2014 | | | 2019 | | | 2019-2009 change |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. ('000) | Rank | % | No. ('000) | Rank | % | No. ('000) | Rank | % | % |
| Health care and social Assistance | 1,186 | 2 | 11.0 | 1,404 | 1 | 12.2 | 1,689 | 1 | 13.1 | +42.4 |
| Retail trade | 1,192 | 1 | 11.1 | 1,236 | 2 | 10.7 | 1,296 | 2 | 10.1 | +8.7 |
| Construction | 984 | 4 | 9.1 | 1,031 | 3 | 8.9 | 1,165 | 3 | 9.1 | +18.5 |
| Professional, scientific and technical services | 787 | 6 | 7.3 | 925 | 4 | 8.0 | 1,138 | 4 | 8.8 | +44.6 |
| Education and training | 809 | 5 | 7.5 | 914 | 6 | 7.9 | 1,037 | 5 | 8.1 | +28.2 |
| Accommodation and food services | 725 | 7 | 6.7 | 776 | 7 | 6.7 | 915 | 6 | 7.1 | +26.2 |
| Manufacturing | 998 | 3 | 9.3 | 922 | 5 | 8.0 | 884 | 7 | 6.9 | -11.5 |
| Public administration and safety | 667 | 8 | 6.2 | 727 | 8 | 6.3 | 848 | 8 | 6.6 | +27.1 |
| Transport, postal and warehousing | 583 | 9 | 5.4 | 593 | 9 | 5.1 | 665 | 9 | 5.2 | +14.2 |
| Administrative and support services | 355 | 12 | 3.3 | 381 | 12 | 3.3 | 453 | 10 | 3.5 | +27.6 |
| Financial and insurance services | 396 | 11 | 3.7 | 416 | 10 | 3.6 | 445 | 11 | 3.5 | +12.4 |
| Wholesale trade | 407 | 10 | 3.8 | 386 | 11 | 3.3 | 393 | 12 | 3.1 | -3.5 |
| Agriculture, forestry and fishing | 348 | 13 | 3.2 | 323 | 13 | 2.8 | 340 | 13 | 2.6 | -2.4 |
| Arts and recreation services | 201 | 15 | 1.9 | 210 | 16 | 1.8 | 257 | 14 | 2.0 | +27.8 |
| Mining | 163 | 17 | 1.5 | 243 | 14 | 2.1 | 242 | 15 | 1.9 | +48.8 |
| Rental, hiring and real estate services | 183 | 16 | 1.7 | 215 | 15 | 1.9 | 212 | 16 | 1.6 | +15.9 |
| Information media and telecommunications | 217 | 14 | 2.0 | 208 | 17 | 1.8 | 208 | 17 | 1.6 | -4.3 |
| Electricity, gas, water and waste services | 133 | 18 | 1.2 | 145 | 18 | 1.3 | 157 | 18 | 1.2 | +18.2 |
| Other services | 441 | | 4.1 | 486 | | 4.2 | 527 | | 4.1 | +19.5 |
| **All industries** | **10,775** | | **100.0** | **11,543** | | **100.0** | **12,871** | | **100.0** | **+19.5** |

Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

Total employment in WA is far more volatile that that displayed nationally.

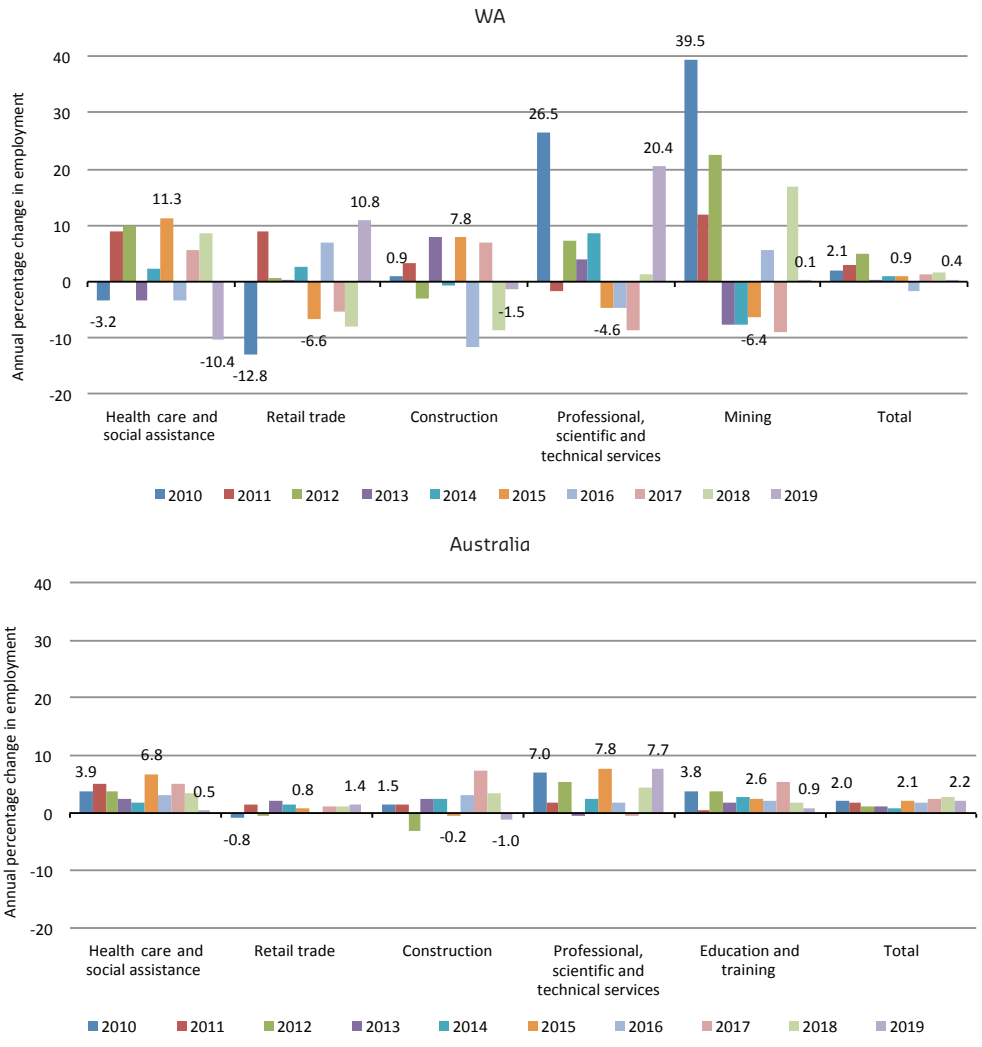
Total employment growth across all industries in WA has been lower than that observed nationally for each of the last 7 years.

## Volatile employment growth

While the WA economy is somewhat less concentrated in employment terms relative to that seen nationally, total employment experiences significantly more volatility in WA. Figure 11 displays the change in the top five employing industries in WA and Australia over the decade, along with the change to total employment across all industries. While Mining is WA's fifth largest employer, Education and training is the fifth largest employer nationally. Otherwise the top five industry ranking is consistent across the two constituencies.

With both the WA and Australian charts displayed on the same scale (Figure 11), it is clearly evident that total employment in WA is far more volatile across the top five industries, relative to that seen nationally. Furthermore, WA has had weaker total employment growth (all industries) to that observed nationally for the last seven years, averaging 1.3 percentage points lower.

**Figure 11** Change in total employment for top five industries by employment share, 2009 to 2019, WA and Australia



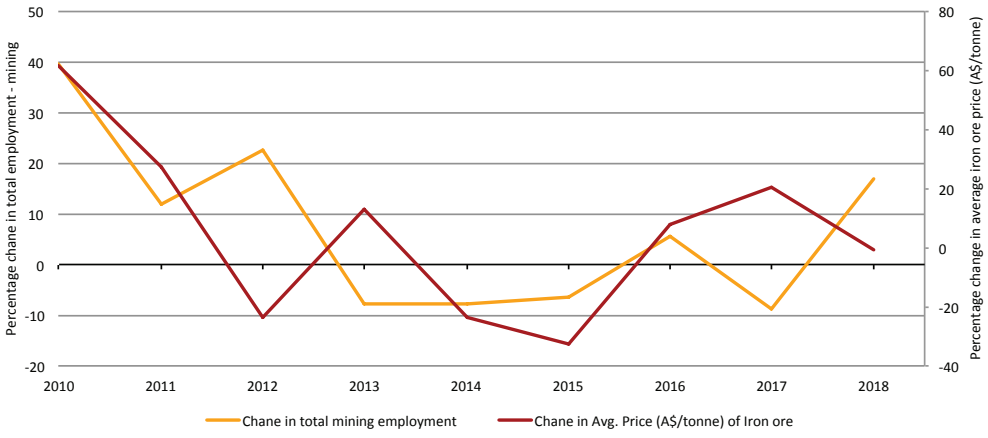

Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019. Top five industries by total employment share in 2019 are selected. Data labels relate to 2010, 2015 and 2019.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

Total employment volatility is particularly evident in mining (Figure 11), with for example, increases of 39.5 per cent in total employment (24,000 persons) in 2010, 11.8 per cent in 2011 and 22.5 per cent in 2012, followed by an average annual decline of 7.6 per cent over the next three years. This in turn, was followed by a roller coaster of a 5.6 per cent increase in 2016, an 8.9 per cent decline in 2017 and a 16.9 per cent increase in 2018.

Of course the dominance of iron ore in WA's mining industry means that there is an association between changes in iron ore price and changes in total employment in the mining sector, which is displayed in Figure 12.

**Figure 12** Change in iron ore price and total employment in the mining industry in WA, 2010 to 2018




Note: Average total employment over the previous four quarters are used.
Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0 and Department of Mines, Industry Regulation and Safety, Government of Western Australia.

Employment is more concentrated across WA's regions relative to WA overall, and has also increased over time.

In 2016, the top 5 employing industries in regional WA accounted for 49.8% of employment. This was 47.0% across the State (a 2.8ppt gap).

## Regional employment

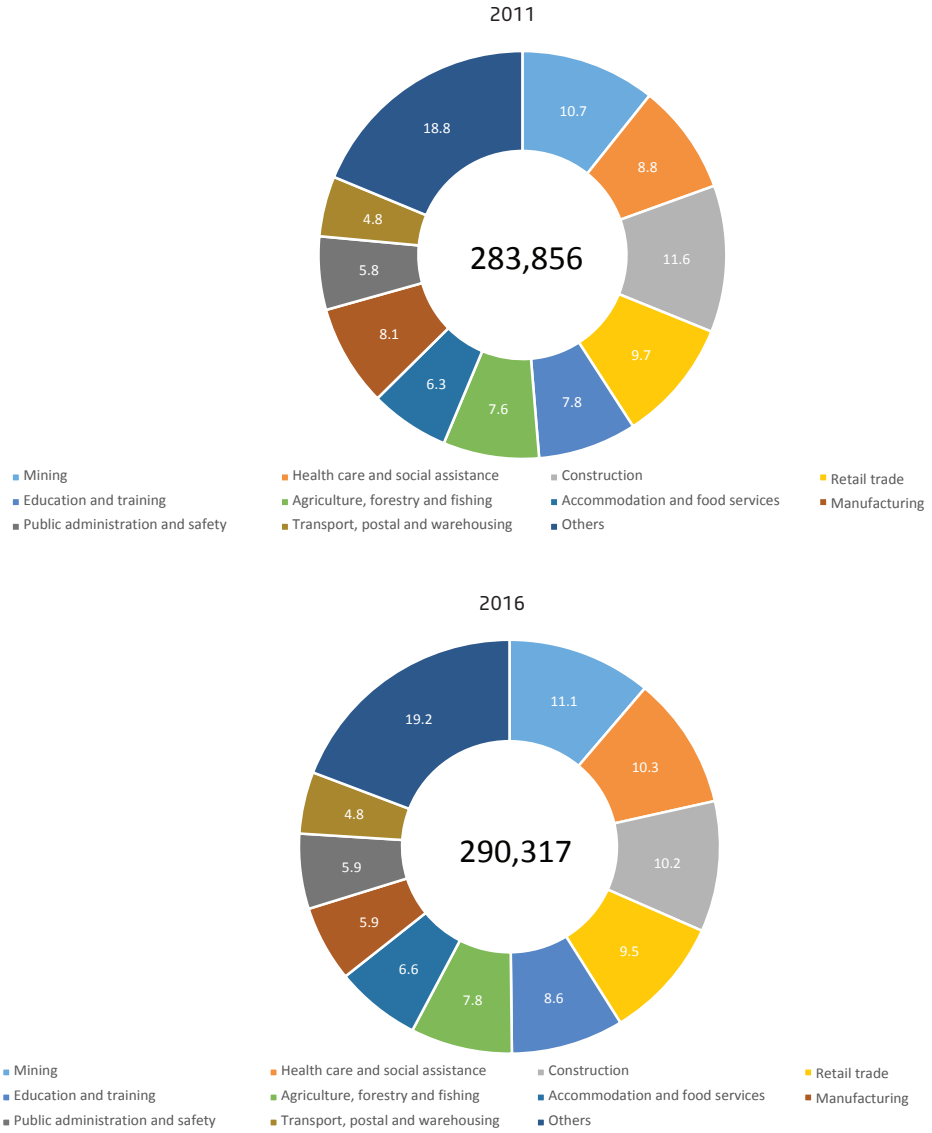
It is imperative to also look at WA's regions when we talk about economic growth, volatility and concentration. Using Census data we can see that full-time employment in the regions increased by only 6,500 persons between 2011 and 2016 (Figure 13).

Employment is more concentrated across WA's regions relative to WA overall, and has also increased over time. For example, in 2011, the top five employing industries in regional WA accounted for 48.7 per cent of full-time employment. This was 46.8 per cent across the State (a 1.9ppt gap). In 2016, the top five employing industries in regional WA accounted for 49.8 per cent of employment. This was 47.0 per cent across the State (a 2.8ppt gap).

The Mining industry is the largest source of employment across WA's regions (all regions excluding Perth). In 2016, mining accounted for 11.1 per cent of regional employment, up from a 10.7 per cent share in 2011. The Health sector has also increased in share terms from 8.8 per cent in 2011 to 10.3 per cent in 2016. Meanwhile, Construction and Retail trade have experienced a decline in share, with an increase in Education and training and Agriculture, forestry and fishing.

Between 2011 and 2016 in regional WA, full-time employment declined by 12.2% in Construction, 26.5% in Manufacturing and 18.7% in Wholesale trade.

**Figure 13** Employment share in regional WA, by industry, 2011 and 2016




Note: Full-time employment. Regional WA is defined as WA less Perth. Sorted based on 2016 share. Others includes all nine industries outside the top 10 largest industries by 2016 employment share.

Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Census 2011 and 2016.

Looking in more detail at full-time employment in regional WA shows that between 2011 and 2016, the number of persons employed full-time remained flat, increasing by a mere 0.2 per cent (500 persons). By industry, the number of full-time persons employed declined by 12.2 per cent in Construction, 26.5 per cent in Manufacturing and 18.7 per cent in Wholesale trade in regional WA. Retail trade declined by 2.1 per cent. Health care and social assistance saw increases of almost 18 per cent, while Mining increased by 4 per cent, Education and training by 11 per cent and Accommodation and food services by 5 per cent. Full-time employment in Agriculture increased by almost 3 per cent. Albeit from a small base, Arts and recreation services saw a whopping 46.3 per cent growth in full-time employment between 2011 and 2016.

**Table 4** Employment in regional WA, by industry, 2011 and 2016

| Industry sector | Number of employees | | Change 2011 share | | Industry concentration 2011-2016 | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Share of total employment | | | |
| | 2011 | 2016 | Count | Percent | 2011 share | Rank | 2016 share | Rank |
| Construction | 32,287 | 28,359 | -3,928 | -12.2 | 11.6 | 1 | 10.2 | 3 |
| Mining | 29,709 | 30,885 | +1,176 | +4.0 | 10.7 | 2 | 11.1 | 1 |
| Retail trade | 27,034 | 26,456 | -578 | -2.1 | 9.7 | 3 | 9.5 | 4 |
| Health care and social Assistance | 24,362 | 28,728 | +4,366 | +17.9 | 8.8 | 4 | 10.3 | 2 |
| Manufacturing | 22,379 | 16,455 | -5,924 | -26.5 | 8.1 | 5 | 5.9 | 8 |
| Education and training | 21,681 | 24,028 | +2,347 | +10.8 | 7.8 | 6 | 8.6 | 5 |
| Agriculture, forestry and fishing | 21,107 | 21,711 | +604 | +2.9 | 7.6 | 7 | 7.8 | 6 |
| Accommodation and food services | 17,456 | 18,328 | +872 | +5.0 | 6.3 | 8 | 6.6 | 7 |
| Public administration and safety | 16,123 | 16,316 | +193 | +1.2 | 5.8 | 9 | 5.9 | 9 |
| Transport, postal and warehousing | 13,254 | 13,416 | +162 | +1.2 | 4.8 | 10 | 4.8 | 10 |
| Other services | 11,092 | 11,195 | +103 | +0.9 | 4.0 | 11 | 4.0 | 11 |
| Professional, scientific and technical services | 9,941 | 10,228 | +287 | +2.9 | 3.6 | 12 | 3.7 | 12 |
| Administrative and support services | 7,846 | 9,006 | +1,160 | +14.8 | 2.8 | 13 | 3.2 | 13 |
| Wholesale trade | 7,160 | 5,818 | -1,342 | -18.7 | 2.6 | 14 | 2.1 | 14 |
| Rental, hiring and real estate services | 4,542 | 4,468 | -74 | -1.6 | 1.6 | 15 | 1.6 | 15 |
| Financial and insurance services | 3,738 | 3,587 | -151 | -4.0 | 1.3 | 16 | 1.3 | 17 |
| Electricity, gas, water and waste services | 3,567 | 3,717 | +150 | +4.2 | 1.3 | 17 | 1.3 | 16 |
| Arts and recreation services | 2,358 | 3,449 | +1,091 | +46.3 | 0.8 | 18 | 1.2 | 18 |
| Information media and telecommunications | 1,776 | 1,763 | -13 | -0.7 | 0.6 | 19 | 0.6 | 19 |
| **Total** | **277,412** | **277,913** | **+501** | **+0.2** | **100.0** | | **100.0** | |
| Inadequately described | 3,441 | 9,444 | +6,003 | | | | | |
| Not stated | 3,010 | 2,967 | -43 | | | | | |
| **Grand total** | **283,856** | **290,317** | **+6,461** | **+2.3** | | | | |

Note: Full-time employment. Regional WA is defined as WA less Perth. Rank is based on 2011 share.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Census 2011 and 2016.

## Business counts by region: Industry share and concentration

Of the 231,000 businesses located in WA in 2018, 75 per cent were based in Perth, with the remaining 25 per cent spread across the nine regions. In Table 5, the proportion of businesses (count) by region are displayed, with the top three industries, in share terms, highlighted in gold, silver and bronze for each region.

Across all regions, Construction features in the top two by business count, with Rental, hiring and real estate services in the top three for all regions bar Gascoyne. Agriculture, forestry and fishing features as a dominant industry by business count across most regions, albeit lower in Peel, Perth and the Pilbara, as one would expect.

75% of businesses in WA are located in Perth.

For Perth, 18% of businesses are in Construction, followed by Professional, scientific and technical services (14%), Rental hiring and real estate (11%) and Financial and insurance services (10%).

For Perth, 18 per cent of businesses are in Construction, followed by Professional, scientific and technical services (14%), Rental hiring and real estate (11%) and Financial and insurance services (10%).

On this measure, Pilbara, South West, and Peel, as well as the Kimberley are all particularly exposed to the Construction industry, with shares of business count exceeding that of the total State average (18%). This exposure reiterates the vulnerability of the regions discussed under the employment section previously outlined.

**Table 5** Industry composition of regional businesses, WA regions, 2018

| All businesses | Gascoyne | Goldfields - Esperance | Great Southern | Kimberley | Mid West | Peel | Perth | Pilbara | South West | Wheatbelt | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, forestry and fishing | 27.9 | 18.8 | 35.3 | 9.3 | 27.2 | 7.8 | 1.8 | 3.7 | 18.6 | 46.5 | 7.1 |
| Mining | 1.0 | 4.2 | 0.3 | 0.3 | 0.7 | 0.6 | 1.3 | 1.6 | 0.3 | 0.6 | 1.3 |
| Manufacturing | 2.8 | 3.8 | 3.8 | 3.2 | 3.1 | 3.8 | 3.9 | 2.8 | 4.4 | 3.0 | 3.8 |
| Electricity, gas, water and waste services | 0.7 | 0.4 | 0.2 | 0.3 | 0.5 | 0.4 | 0.3 | 0.7 | 0.4 | 0.3 | 0.3 |
| Construction | 15.4 | 14.7 | 13.1 | 20.3 | 14.4 | 25.3 | 17.9 | 19.6 | 19.6 | 10.6 | 17.7 |
| Wholesale trade | 1.3 | 1.9 | 1.9 | 2.3 | 1.7 | 2.2 | 3.2 | 1.5 | 2.3 | 2.0 | 3.0 |
| Retail trade | 6.9 | 5.7 | 5.3 | 8.7 | 5.7 | 6.3 | 5.2 | 6.0 | 6.2 | 4.9 | 5.4 |
| Accommodation and food services | 6.7 | 4.2 | 3.9 | 5.8 | 4.1 | 3.7 | 3.8 | 5.1 | 4.6 | 2.5 | 3.8 |
| Transport, postal and warehousing | 9.2 | 6.9 | 3.9 | 6.3 | 6.1 | 8.4 | 8.7 | 8.4 | 3.7 | 5.6 | 7.9 |
| Information media and tele-Communications | 0.3 | 0.2 | 0.6 | 0.8 | 0.2 | 0.3 | 0.8 | 0.1 | 0.4 | 0.1 | 0.7 |
| Financial and insurance services | 4.0 | 6.6 | 5.1 | 6.0 | 8.3 | 7.7 | 10.3 | 6.3 | 7.6 | 4.3 | 9.4 |
| Rental, hiring and real estate services | 7.7 | 10.8 | 9.6 | 11.2 | 9.1 | 8.9 | 11.1 | 12.0 | 9.7 | 7.3 | 10.7 |
| Professional, scientific and technical services | 3.7 | 5.8 | 5.7 | 7.0 | 4.9 | 7.9 | 13.6 | 7.5 | 7.4 | 3.6 | 11.8 |
| Administrative and support services | 3.5 | 2.9 | 2.0 | 5.8 | 2.3 | 3.3 | 3.9 | 6.7 | 3.2 | 1.7 | 3.7 |
| Public administration and safety | 0.3 | 0.2 | 0.1 | 0.4 | 0.3 | 0.4 | 0.3 | 0.6 | 0.2 | 0.1 | 0.3 |
| Education and training | 0.5 | 1.0 | 0.6 | 0.9 | 0.7 | 0.9 | 1.3 | 1.2 | 0.8 | 0.3 | 1.1 |
| Health care and social assistance | 1.9 | 3.6 | 3.4 | 3.4 | 3.7 | 4.7 | 6.1 | 4.5 | 4.4 | 1.5 | 5.5 |
| Arts and recreation services | 0.6 | 0.7 | 0.5 | 1.1 | 0.5 | 1.4 | 1.1 | 0.6 | 1.0 | 0.4 | 1.1 |
| Other services | 4.8 | 7.0 | 3.9 | 5.9 | 5.1 | 5.3 | 4.3 | 9.2 | 4.5 | 3.9 | 4.4 |
| Currently unknown | 0.9 | 0.6 | 0.8 | 1.0 | 1.4 | 0.6 | 1.0 | 1.9 | 0.7 | 0.8 | 1.0 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

Note: Percentage share.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Cat 8165.

## Business counts by region: Industry change between 2011 and 2018

The impact of the structural shifts seen in the WA economy on business count is shown in Table 6. While there was an overall increase in the number of businesses in WA of 4.6 per cent, this was driven primarily by increases in the count of businesses in Perth (+7.0%). Peel (+1.9%), South West (+2.3%) and Gascoyne (+7.0%). However, Goldfields-Esperance (-7.8%), Great Southern (-2.1%), Kimberley (-9.3%), Mid West (-5.9%), Pilbara (-10.5%) and Wheatbelt (-6.1%) all saw declines in business count between 2011 and 2018.

By industry, between 2011 and 2018, Agriculture's business count declined by 14 per cent (3,450 businesses), followed by Retail trade (-12%; 1,750 businesses), Manufacturing (-6.3%; 635 businesses), Wholesale trade (-3.8%; 315 businesses) and Mining (-3.6%; 125 businesses). Various factors may be at play for the latter industries, with for example, the mining sector shifting from construction to production phase, and related employment and population changes; productivity growth and technological advancement; and online trade, amongst others playing a role.

Between 2011 and 2018, the number of businesses in Agriculture declined by 14 per cent, followed by Retail trade (-12%). For Mining the figure was -3.6%.

**Table 6** **Change in the number of businesses WA, percentage change in business counts by region, 2011 to 2018**

| All businesses | Gascoyne | Goldfields - Esperance | Great Southern | Kimberley | Mid West | Peel | Perth | Pilbara | South West | Wheatbelt | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Health care and social assistance | (a) | +25.4 | +24.2 | +22.2 | -0.6 | +51.6 | +41.7 | +55.7 | +29.8 | -7.7 | +39.0 |
| Transport, postal and warehousing | +25.7 | -9.0 | -7.2 | -10.7 | -9.7 | +25.5 | +42.2 | -0.6 | +8.2 | -11.9 | +33.1 |
| Accommodation and food services | +13.3 | -10.9 | +14.8 | -6.4 | +1.5 | +1.0 | +29.4 | -3.6 | +7.8 | -18.3 | +20.7 |
| Financial and insurance services | +29.0 | +19.2 | +39.8 | +32.0 | +32.2 | +62.0 | +12.6 | +49.4 | +59.7 | +30.3 | +16.9 |
| Information media and telecommunications | -50.0 | -11.1 | +81.8 | -32.1 | -40.0 | -18.5 | +19.7 | +0.0 | -6.0 | -71.4 | +15.1 |
| Electricity, gas, water and waste services | +16.7 | -33.3 | -26.7 | - | +8.3 | +50.0 | +11.0 | +25.0 | +24.1 | +29.2 | +12.6 |
| Rental, hiring and real estate services | +25.8 | +8.4 | +4.3 | +2.0 | +12.2 | +5.5 | +11.4 | -1.2 | +9.9 | +9.8 | +10.6 |
| Public administration and safety | - | -55.6 | (a) | +33.3 | (a) | -16.7 | +7.6 | +33.3 | +52.4 | +100.0 | +10.4 |
| Education and training | +66.7 | +10.8 | -43.1 | -25.0 | +50.0 | -2.5 | +17.3 | -21.9 | -22.0 | -31.0 | +10.4 |
| Professional, scientific and technical services | +37.0 | -10.4 | +0.3 | +0.0 | +2.6 | +7.2 | +8.8 | +0.6 | +4.0 | +4.0 | +8.0 |
| Other services | +33.3 | -3.2 | +11.8 | +8.1 | +2.5 | +3.8 | +8.0 | +37.9 | +8.3 | +2.2 | +7.7 |
| Administrative and support services | +34.6 | -11.4 | -0.7 | -1.5 | -11.8 | -3.2 | +9.0 | -5.4 | +8.0 | -8.9 | +6.9 |
| Arts and recreation services | -33.3 | -28.2 | -18.2 | +33.3 | -43.9 | -0.9 | +5.7 | +0.0 | +20.3 | -30.0 | +3.6 |
| Construction | -4.9 | -21.5 | -9.4 | -19.2 | -20.8 | -5.1 | +1.2 | -30.9 | -6.5 | -6.7 | -1.9 |
| Mining | - | -15.0 | +0.0 | +16.7 | -7.9 | -14.8 | -2.2 | -19.0 | +2.0 | -17.2 | -3.6 |
| Wholesale trade | -13.3 | +7.9 | -8.9 | +12.8 | -14.1 | -14.2 | -3.2 | -29.5 | +6.9 | -18.6 | -3.8 |
| Manufacturing | +12.0 | +3.1 | +0.8 | -12.0 | -3.1 | -1.6 | -7.2 | -41.0 | -3.6 | +2.2 | -6.3 |
| Retail trade | -10.3 | -20.7 | -19.4 | -12.5 | -16.8 | -12.3 | -10.6 | -13.7 | -14.2 | -14.4 | -11.8 |
| Agriculture, forestry and fishing | -4.1 | -5.0 | -4.5 | -17.4 | -10.1 | -15.8 | -34.3 | -45.4 | -3.4 | -7.7 | -14.2 |
| **All Industries** | **+7.0** | **-7.8** | **-2.1** | **-9.3** | **-5.9** | **+1.9** | **+7.0** | **-10.5** | **+2.3** | **-6.1** | **+4.6** |

Note: (a) is not shown due to large percentage changes resulting from low business counts.
Source: nkwest Curtin Economics Centre | Authors calculations based on ABS Cat 8165.

The number of businesses in construction declined by 1.9% (920 businesses) across the State between 2011 and 2018, with such declines largely hitting the regions.

The number of businesses in Construction declined by 1.9 per cent (920 businesses) across the State between 2011 and 2018, with such declines largely hitting the regions. For example, in the Pilbara businesses in the Construction sector declined by 31 per cent (185 businesses by count). This was 22 per cent in Goldfields-Esperance (175 businesses), with a decline of 6.5 per cent implying a loss of almost 220 construction businesses in the South West.

Retail trade and Agriculture were the only industries to see declines across all regions, with Financial and insurance services being the only industry to see growth in business count for all regions.

For those thirteen industries that saw growth in the number of business counts in WA, such growth is being driven primarily by Perth. For example, Perth saw a 42 per cent growth in Transport, postal and warehousing (+4,500 businesses), a 42 per cent increase (+3,130 businesses) in Health care and social assistance, and a 13 per cent growth in Finance and insurance businesses (+2,010 businesses).

# A regional punch to population change

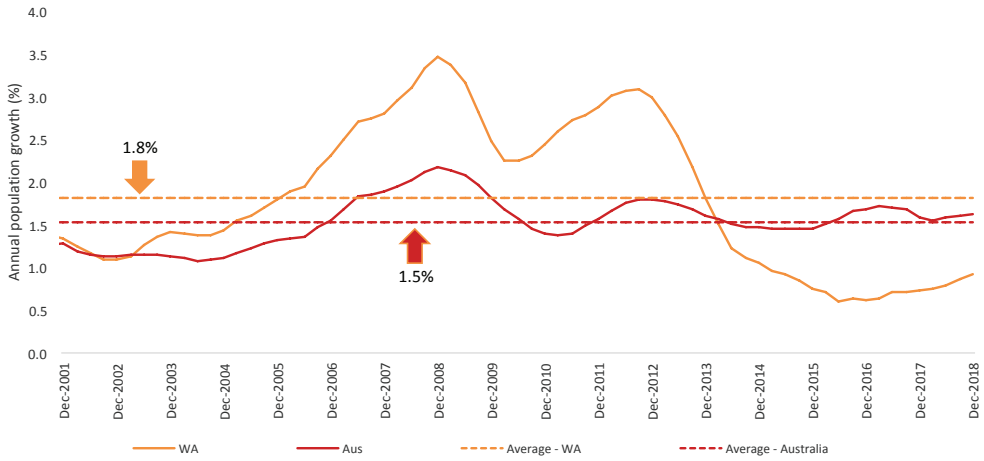
## Population growth across the state

The variability and volatility of economic growth in WA has in turn, led to a more volatile population. Figure 14 shows that WA's average annual population growth between 2001 and 2018 was 1.8 per cent. This compares to 1.5 per cent nationally. However, WA's population growth is far more variable, hitting heights of 3.5 per cent in the year to December 2008, and lows of 0.6 per cent in the year to June 2016. Over the same time period, Australia saw an annual population growth peak of 2.2 per cent in December 2008 (coinciding with the timing of WA's peak growth), with a low of 1.0 per cent as far back as September 2004.

WA's average annual population growth between 2001 and 2018 was 1.8%, compared to 1.5% nationally.

WA's population growth hit a height of 3.5% in the year to December 2008, and a low of 0.6% in the year to June 2016.

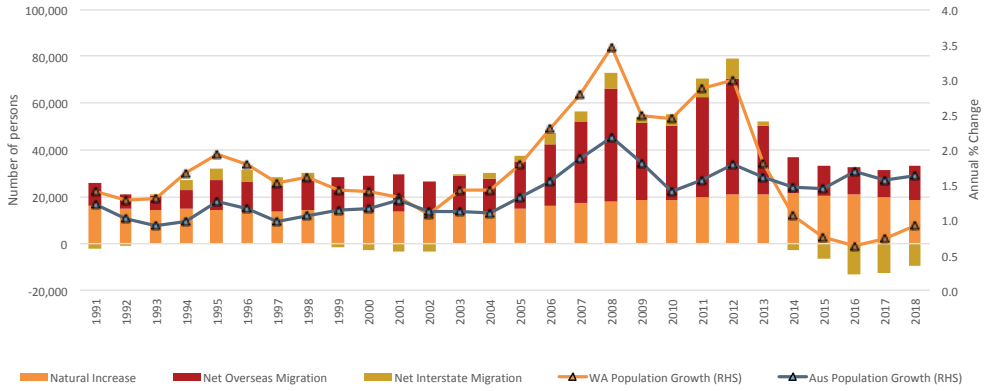
**Figure 14** Annual population growth, WA and Australia, 2001 to 2018




Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Cat 3101, Table 4.

WA's population growth was higher than that seen nationally between June 2003 and March 2014, but has since been lower (Figure 14). The components of population growth in WA are shown in Figure 15. Net overseas migration played a critical role in meeting labour supply shortages during the boom years in WA. Net interstate migration was also positive during this period, and has been negative since 2014, as workers have looked elsewhere in Australia for employment opportunities.

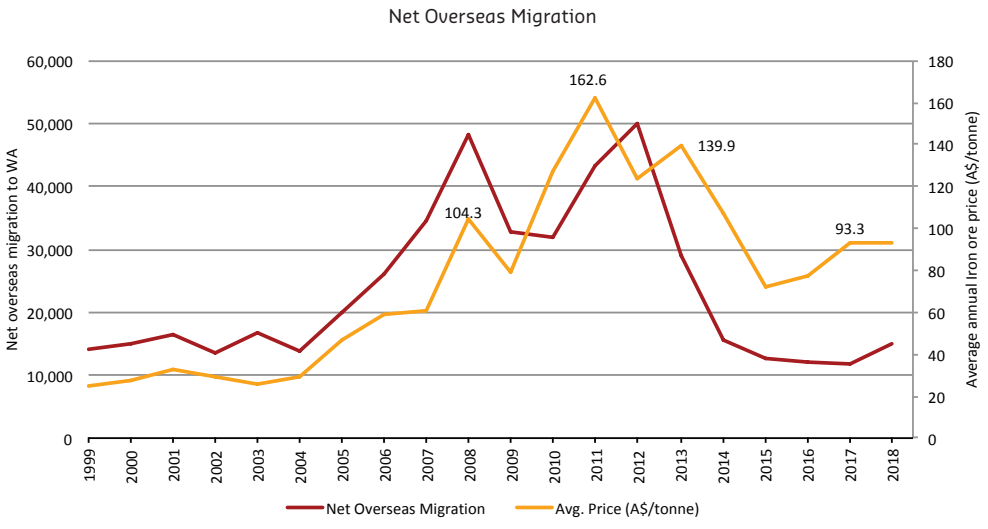
**Figure 15** Components of population growth, 2001 to 2018




Note: Year to December.
Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Cat 3101, Table 2.

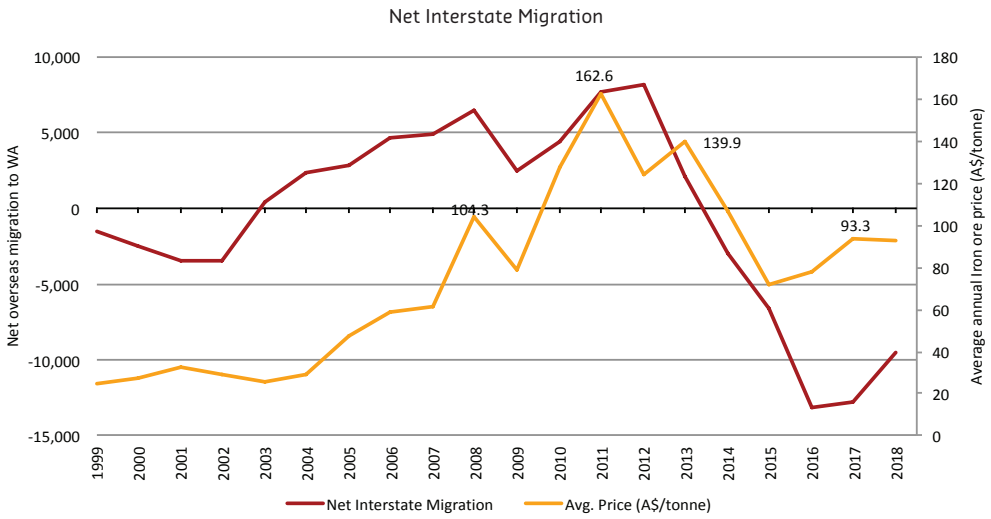
Of course, the WA economy's reliance on the mining sector, and related fluctuations to employment across the mining and construction sectors are contributors to population change. The association between the iron ore price and migration have previously been reported in the *BCEC Quarterly Economic Commentary*, and while it is a relationship that is sometimes imperfect, it is none the less a strong one over time, and further points towards the reliance of the WA economy on the mining sector.

**Figure 16** Migration and iron ore price, 1999 to 2018




Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Cat 3101, Table 2 and Department of Mines, Industry Regulation and Safety, Government of Western Australia.

**Figure 16** Migration and iron ore price, 1999 to 2018 (continued)




Source: Bankwest Curtin Economics Centre | Authors calculations based on ABS Cat 3101, Table 2 and Department of Mines, Industry Regulation and Safety, Government of Western Australia.

The weaker growth in WA's population has been particularly felt in the regions.

Much of the population growth between 2011 and 2018 was seen in Perth (+11.5%), the South West (+11.7%) and Peel (+24.2%).

## Population growth by region

Table 7 shows that while the overall population in WA increased by over 10 per cent between 2011 and 2018, this increase was only 2 per cent between 2015 and 2018. The weaker growth in WA's population has been particularly felt in the regions, with negative growth for all regions outside of Perth, South West, Peel, and Great Southern between 2015 and 2018, with the latter being particularly weak.

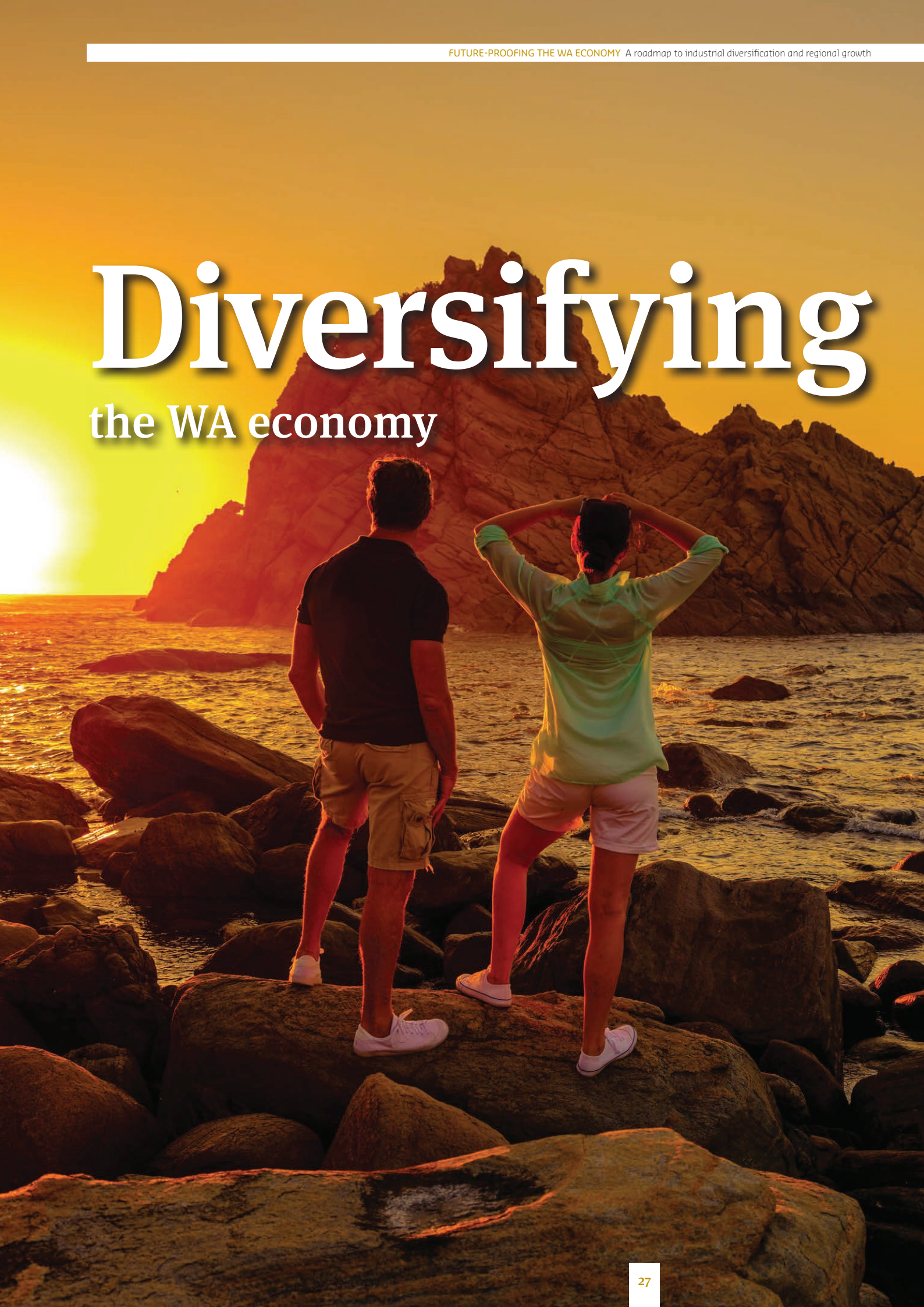
Much of the population growth between 2011 and 2018 was seen in Perth (+11.5%), the South West (+11.7%) and Peel (+24.2%). Even these regions have seen a weakening in population growth in the most recent 2015 to 2018 period.

**Table 7** **Population count and change in WA regions, 2011 to 2018**

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Percentage change | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ('000) | ('000) | ('000) | ('000) | ('000) | ('000) | ('000) | ('000) | 2011 to 2018 | 2015 to 2018 |
| Perth | 1,719 | 1,773 | 1,823 | 1,849 | 1,869 | 1,886 | 1,898 | 1,917 | +11.5 | +2.6 |
| South West | 160 | 165 | 170 | 173 | 175 | 176 | 177 | 178 | +11.7 | +2.0 |
| Peel | 113 | 118 | 124 | 127 | 131 | 134 | 137 | 140 | +24.2 | +7.0 |
| Wheatbelt | 84 | 86 | 87 | 88 | 87 | 86 | 86 | 86 | +1.7 | -1.6 |
| Pilbara | 62 | 64 | 65 | 64 | 63 | 61 | 61 | 62 | -0.2 | -2.1 |
| Great Southern | 57 | 58 | 60 | 60 | 60 | 60 | 61 | 61 | +6.2 | +0.7 |
| Goldfields - Esperance | 59 | 61 | 61 | 60 | 59 | 57 | 56 | 55 | -7.2 | -5.9 |
| Mid West | 55 | 56 | 57 | 57 | 56 | 55 | 54 | 54 | -3.0 | -4.4 |
| Kimberley | 34 | 35 | 36 | 35 | 35 | 34 | 34 | 34 | -2.5 | -3.2 |
| Gascoyne | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | -2.3 | -4.0 |
| **Western Australia** | **2,353** | **2,427** | **2,493** | **2,523** | **2,544** | **2,559** | **2,574** | **2,595** | **+10.3** | **+2.0** |

Note: Population is reported in thousands. Regions are ranked in order of population size in 2018.
Source: Bankwest Curtin Economics Centre | ABS Cat 3218.

# Diversifying
## the WA economy



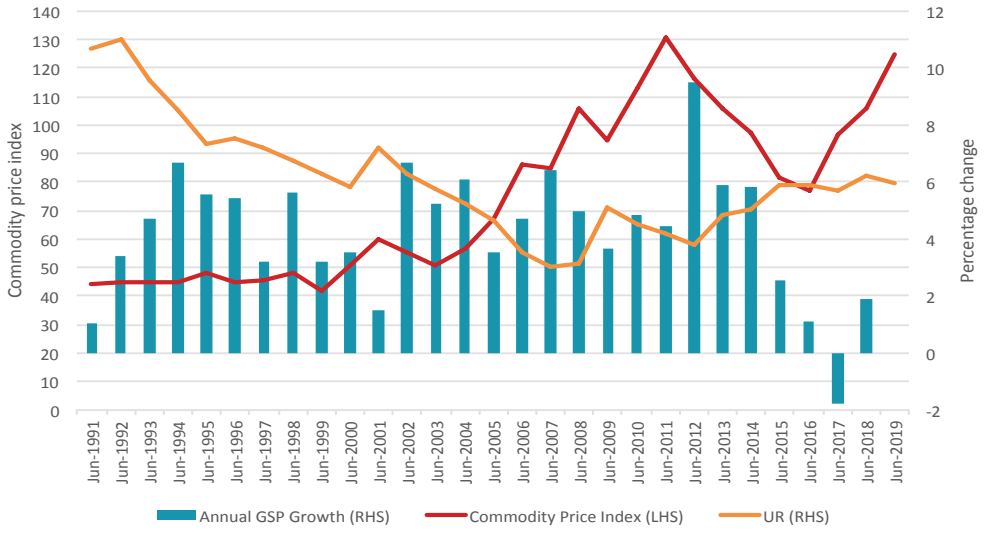
# Introduction

Any economy that is highly concentrated in a small range of closely related industries will be prone to greater economic fluctuations.

In 2017-18, fully one-third of WA's gross state product came from just two industries: Mining and Agriculture (ABS, 2018). Undoubtedly WA is very fortunate to be endowed with such vast riches of land and natural resources. Had WA been declared a country in 2018, it would have displaced Iceland as the ninth wealthiest country in the world on a GDP per capita basis. But is relying so heavily on primary industries and the exploitation of those natural resources a viable strategy for maintaining our standard of living? Or will WA be left behind if we fail to identify and diversify into the industries of the future?

WA's heavy reliance on primary production creates two main concerns. The first is that it exposes the State's economy to extreme volatility. Any economy that is highly concentrated in a small range of closely related industries will be prone to greater economic fluctuations than a highly diversified economy, just as a share market portfolio carries more risk if the investor holds shares in a small number of companies or sectors rather than a diversified portfolio. The issue of a lack of diversification is exacerbated for Western Australia, given the inherent volatility of primary commodity prices. As Figure 17 shows, the reality of this concern is readily borne out by recent experiences.

**Figure 17** Unemployment rate and commodity price index, WA, 1991 to 2019




Source: Bankwest Curtin Economics Centre | ABS 5220, Table 1; ABS, Labour Force, Australia, 6202.0; RBA.

The second concern is the widespread perception that the nature of economic production is shifting in a way that elevates the importance of knowledge and innovation as factors of production. It is the industries and associated jobs that make intensive use of knowledge and advanced technologies that will generate high returns. Jobs that rely on extraction and elementary processing of raw materials and routine manual tasks will not generate the same value as those based on knowledge and innovation, in part because those routine tasks face greater risk of being replaced by automation and artificial intelligence. WA workers could be left in low paying jobs in industries facing declining relative value of output.

It seems logical that government policy should play a role in helping to steer our economy towards a more diversified, secure and prosperous future. Indeed governments have a long history of proactive policy to promote both industry and regional development. In a sense, it is a role that government cannot avoid: as the provider of essential infrastructure, the decisions the government makes will inevitably shape population and industrial development. Over the years, however, governments have shown a willingness to take a far more proactive role of promoting selected industries in what is broadly termed 'strategic industry policy', with a somewhat chequered track record. This section traces a history of past policies in WA, and introduces a relatively new approach known as smart specialisation.

# Policy history

From the time of European settlement, the 'tyranny of distance' has been a constant force in shaping Western Australia's development as a market economy. The need for the remote Swan River colony to be largely self-sufficient led to concentration in agricultural production and wool emerging as the first viable export industry in the 1830s. Per unit of weight, wool could be anything from 10 to 20 times more valuable than wheat at that time (Department of Treasury and Finance (DTF), 2004). Freight costs, particularly for land transport, impacted on both industry and geographical diversification: Lourens (1979) estimated that in the 1830s it cost around €25 per ton to transport goods from York to Fremantle, compared to €3 per ton freight to ship goods from Fremantle to London. And unlike wheat, sheep grazing did not require labour-intensive land clearing, allowing pastoralism to expand from the coastal plains into the Avon Valley (Stratham, 1981). While sandalwood and whaling provided further export industries, the economy of the colony grew only very slowly in the initial years.

The 'tyranny of distance' has been a constant force in shaping WA's development as a market economy.

As the economy diversified through a growing number of merchants and the establishment of the Colony's first bank, the Bank of Western Australia in 1837, its sensitivity to commodity prices began. Declining prices for wool, livestock and grain, along with falls in immigration and its associated inflows of new capital and labour conspired to generate a depression in the early 1840s. In response to rapidly falling local prices and deteriorating trade balance, the Legislative Council and local press initiated a concerted campaign for people to refrain from purchasing non-essential imports and to encourage merchants to purchase local goods for export, a harbinger to 'Made in WA' policies to follow many years later.

In the recovery that followed from 1845, agricultural and timber production expanded and coal was discovered in the Murray district. Stratham (1979) credits the 'buy local' campaign with the promotion of import-substituting manufacturing, including expansion of viticulture and tanning. The 1850 decision to accept convicts brought much needed labour for public works and industry, plus expenditure in the form of upkeep paid from Britain. The government commenced development of a railway system financed from overseas loans in the 1880s, quickly extending from Geraldton to Albany and east across the Darling Ranges to service mining and agriculture. Economies of scale dictated that the Colony relied on imports for consumer durables and capital equipment during this time (Appleyard, 1981).

Things changed drastically with the discovery of gold.

Things changed drastically with the discovery of gold, first near Halls Creek in the late 1890s, then in the Murchison and Yilgarn; Coolgardie and, of course, Kalgoorlie. Men, railway tracks and investment funds quickly followed the discoveries. WA's first mining boom facilitated the construction, led by C.Y. O'Connor, of Fremantle Harbour and the Mundaring-Kalgoorlie pipeline providing the Goldfields with a permanent water supply. Gold replaced wool as the lead export and would henceforth remain a key export with inevitable fluctuations, but was surpassed by wheat in 1913. Writing in 1981, Appleyard observed that by this early point:

> *... an economic structure had been established in Western Australia which has not altered substantially to this day. Mineral and agricultural products then as now provide the bulk of export earnings which in turn are used to pay for imported manufacturing goods. (p. 231-33)*

Following Federation in 1901, the new State of Western Australia faced a tumultuous and challenging first 50 years. The World Wars of 1914-18 and 1939-45 placed a significant drain on labour and other resources, while the Great Depression commencing from 1929 and persisting for a decade sent commodity prices tumbling and capital flows drying up. A severe drought in 1914 also saw wheat output drop by 80 per cent from the previous year. Government grants of cheap land and credit to farmers and expansion of the railway system helped wheat and flour production and exports to expand. The manufacturing sector, now facing free trade between the States under Federation and greater competition from the East, remained limited. While the State's population grew steadily over this time, in contrast to the fluctuations of the gold rush, it is estimated that real income per capita fell after 1913 and did not recover to the same level until 1950 (Snooks, 1981).

Since Federation, industry development in WA has been subject to both state and Commonwealth policy, not always with beneficial or even the intended consequences. Snooks (1981) argues the State Government contributed to the stagnation of real incomes through an 'unbalanced' development policy of promoting the expansion of agricultural production into marginal areas supported by labour through immigration. Wartime had lasting effects on the operation of markets. Wool prospered during World War I because of the Imperial War Purchase Scheme. World War II saw the governments take greater control over production and prices of primary commodities through agencies such as the Australian Wheat Board and Australian Wool Board, with controls retained long after the war had ended. In WA, a Cooperative Wheat Board compulsorily purchased all wheat produced, but in fact acted to wind back some of the earlier 'grow more wheat' push by limiting the proportion of land farmers were permitted to crop (Snooks, 1981).

State government efforts to promote the manufacturing sector progressed from 'buy local' campaigns to direct state government involvement in establishing new industries, such as brickworks. Over the first half of the 20th century manufacturing activity shifted away from woodworking to metals and food and beverages, driven in part by the change from timber to brick as the preferred form of housing. At the Commonwealth level, early industry policy was synonymous with protection and the promotion of heavy- or high-technology manufacturing. The Tariff Board, established in 1921, was charged with "encouraging the development of 'economic and efficient' Australian industries" and pursued that end primarily by recommending tariffs on imported manufactures (Productivity Commission (PC), 2003). Protection in the form of tariffs, import quotas and local content rules was designed to allow fledgling industries to develop domestically, notably those deemed as critical to developed economies (Freedman and Stonecash, 1997), and achieve the economies of scale necessary to be competitive in their own right. These policies largely benefitted the more populous Eastern States while penalising WA's mining and agricultural sectors reliant on imported machinery and other manufactures.

The Commonwealth Government placed an embargo on iron ore exports in 1938 to preserve resources for domestic steel production.

In the belief that Australia's iron ore reserves were small, the Commonwealth Government placed an embargo on iron ore exports in 1938 to preserve resources for domestic steel production. The embargo remained in place throughout the 1940s and 1950s, and stymied incentives for further iron ore exploration (Pratt, 1993). This was just one of a number of export controls the Commonwealth imposed over varying years through its constitutional power over external trade, including on coal, bauxite, copper, alumina, petroleum, tin, salt and, of course, uranium, largely to ensure adequate supplies for domestic markets (Department of Trade and Resources, 1981).

Primary production, notably wool and wheat continued to underpin WA's prosperity in the post war years. Ghosh (1981) estimates that wool accounted for 55 per cent of the State's exports and 27 per cent of personal income in 1950-51. However, a concerted push for value added manufacturing came to fruition with the opening of the State's first major industrial complex, Kwinana, following the establishment of an oil refinery in 1952. A significant manufacturing sector based around minerals processing began to develop, including a steel bar plant (1954), alumina refinery (1961) and nickel refinery in 1970. Downstream processing was promoted through the WA government linking access to raw minerals to the establishment of refinery operations, commencing with bauxite, an alumina refinery and a policy that was soon followed by other States (Tomlinson, 2014).

Wool and wheat continued to underpin WA's prosperity in the post war years.

However, subsequent mining booms ensured the resource sector continued to underpin WA's growth and prosperity. With the removal of the embargo on iron ore exports in 1960, iron ore production in the Hamersley Range became the headline act for the 1960s minerals boom, fuelled by Japan's rapid post-war economic growth. However, DTF (2004) note that this mining boom was different to the previous gold rushes in an important respect: diversity. The following decades saw significant discoveries and development of nickel, petroleum and bauxite deposits and a major revival of the gold sector. The massive development of the North West shelf in the 1980s, at the time the largest engineering project in the world, set the stage for WAs most recent and protracted mining boom, commencing in the 1990s. Iron ore now dominates the State's exports, representing around 50 per cent by value and double the next largest category of natural gas, while wheat, as the largest agricultural export, is roughly matched in export value by service sectors such as tourism and education.

Throughout Australia's history, industry policy has concerned itself with both the industrial composition and the regional distribution of the economy, although the motivations for both have shifted substantially over time. In early years of colonisation, regional development was promoted in efforts to discover and develop resources, with residential settlement a co-requisite for resource access and development. With greater mobility and new forms of working, such as FIFO, the need for geographical coexistence between settlement and production is much weaker, and regional development is pursued against its own set of objectives. Much of past policy aimed at shaping industrial structure can be interpreted from the view point of efforts to gain greater self-sufficiency. In today's more globalised world, governments worry less about self-sufficiency and more about identifying those industries offering high growth and high incomes, while maintaining adequate diversity.

Many policies had perverse and unintended effects. While flour became a key manufacture and export in the first half of the 20th Ccentury, the development of bulk grain handling and export facilities made it substantially more profitable to export wheat. From a peak of 60,000 tonnes in 1961, flour exports were negligible by 1990 while wheat exports soared (DTF, 2004). The embargo on iron ore exports needlessly delayed the development of iron ore mining costing Western Australia years of wealth generation. Other controls over price and production continued to detract from consumer welfare, perhaps most notoriously illustrated by the Potato Marketing Board. Established in 1946 to ensure supply and control prices after World War II, the Potato Marketing Board regulated the quantity, varieties and colour of potatoes that could be sold, and who could grow them, an arrangement estimated to

Many policies had perverse and unintended effects.

cost consumers dearly in higher prices, lower quality and restricted choice of variety (Economic Regulatory Authority, 2014). The Board survived years of calls for its disbanding until finally being dismantled 70 years later at the end of 2016, and after Spudshed proprietor Tony Gelati publicly goaded the government to make him the first person to be jailed for growing a potato.

From the 1970s there was also growing recognition of the failures of Commonwealth protectionist policies, including the high cost to consumers, raised input costs to the export sector and harbouring inefficiency within sheltered manufacturing sectors. The Tariff Board, renamed the Industries Assistance Commission from 1973, led the charge to dismantle protection. Partly in response to high inflation, the Whitlam government enacted an across-the-board cut in import tariffs in 1973. The Hawke government, elected in 1983, initiated a further lengthy reform package to lower protection and assist with associated structural adjustment, including specific packages for the highly protected car industry and textiles, clothing and footwear manufacturing (Freedman and Stonecash, 1997; Jones, 2016). Nationally, the effective rate of import protection to the manufacturing sector is estimated to have fallen from 35 per cent in 1970-71 to below 2 per cent today (Productivity Commission, 2019). Even so the current-day incarnation of the IAC, the Productivity Commission, in its annual 'Trade and assistance review' estimates that the Commonwealth provided $14.4 billion in assistance to industry in 2017-18, covering tariffs, subsidies (including drought relief) and tax concessions (PC, 2019).

The growth and maturation of the WA economy in the post-WWII decades was assisted by a strongly pro-development stance of State governments. As noted, the WA government played an instrumental role in negotiating development of the first oil refinery in 1952 and subsequent development of the Kwinana industrial complex through provision of supporting infrastructure, including power, roads, rail and port access. Commonwealth support for construction of standard-gauge rail linking Kwinana and Kalgoorlie to iron ore deposits in Koolyanobbing, helped the State broker the establishment of a steel industry, with BHP's blast furnace commencing operation in Kwinana in 1968 (Black, 1981). The State government also underwrote the agreement to commence development of the North West Shelf natural gas reserves which, with the assistance of later renegotiation and Commonwealth royalty concessions, saw the first shipment of liquefied natural gas to Japan in 1989.

# Recent policy

Looking back on the policy history reveals an enviable record of successes in facilitating development opportunities in Western Australia on the back of natural resources in the form of mineral deposits, timber and farm land. That is, after all, a key function of government. The score-card on policies to promote diversification is much less impressive, with those policies often imposing significant welfare losses with limited evidence of compensating benefits.

With the WA economy still heavily reliant on primary production and lacking substantial diversification into manufacturing, the 1990s saw a concerted push for strategic industry policy that came on two fronts. At the state level, there was strong belief that the economy could benefit from greater engagement in 'downstream processing' or 'value added' activities that leveraged off mining or agricultural produce. At a national level there was a growing perception that Australia faced a gloomy future due to its structural characteristics as an 'old economy', that relied on mining and agriculture, when future prosperity for advanced nations lay in the 'new economy': the rapidly emerging knowledge economy linked to the internet, computers and telecommunications.

As set out in Box 1, those busily inscribing the words 'old economy' into the epitaph of the Australian economy in the 1990s could hardly have been more mistaken. The economy powered into an unprecedented boom on the back of what was supposed to be its Achilles heel: mining and soaring commodity prices. Belief in the logic of promoting downstream processing seems unwavering despite few success stories to point to and some notable failures. Interventions by the WA government sought to repeat the successful promotion of alumina refining, but resulted in major failures in the case of downstream processing of iron ore, with no processing of crude steel now taking place in WA (Tomlinson, 2014).

## Box 1: What's old becomes new again

Following a recession in the early 1990s Australia faced a widening current account deficit and unemployment rate of almost 11 per cent throughout 1993. While the economy began to recover from 1994, the value of the Australian dollar continued to fall throughout the decade, from over 80 US cents toward the end of 1990 to below 50 US cents in March of 2000. The narrative formed that Australia's woes stemmed from being an 'old economy'. The Economics editor for *The Australian* noted "In the 90s it became fashionable to paint Australia as an old economy, an embarrassing dinosaur in the high tech age." *The Economist* magazine's 'A survey of Australia' in 2000 summed up the critics view of Australia as "to this day, much of its wealth comes from raising plants and animals and digging stuff out of the ground, just as it has done for 200 years."

The state of Western Australia, of course, was the epitome of this antiquated economic structure.

Numerous analysts pointed to this perception of Australia as an old economy as discouraging foreign investment and contributing to the decline of the Australian dollar. Tim Harcourt, former Chief Economist with Austrade, recounts a visiting Hewlett-Packard executive claiming Australia needed to close down extractive industries and move into high-tech like Taiwan, and the Chief Scientist predicting the Australian dollar would fall to 30 US cents if action was not taken. Australian bureaucrats were regularly being admonished by visiting business leaders and at the 2000 World Economic forum for the country's failure to embrace IT and telecommunications.

As we now know, the 'tech boom' suddenly became a 'tech wreck' with the dot.com crash of 2000. At the same time the terms of trade, which had bottomed out at the end of 1993, began to turn sharply in Australia's favour, driven in large part by Chinese demand for iron ore. Australia has since gone a remarkable 25 years without a recession and with real GDP growth averaging almost 3 per cent from 2000 to 2019. The Reserve Bank of Australia argued at the time that the productivity benefits of new technology accrued from the application of those technologies, not necessarily to those who produced them, and Australia was at the forefront of innovation in the application of ICT.

In her 2017 Stan Kelly Lecture, Reserve Bank Assistant Governor Luci Ellis reflected on this debate:

> *"Then, as now, there were concerns that our prosperity might be based on too narrow a foundation. Even around the turn of this century, I remember foreign investors telling me that Australia was an 'old economy'. We should stop digging things out of the ground, they said, and start building microchip factories. Of course, this would have meant stopping the export of commodities in order to start the export of different commodities. And considering the relative price movements of iron ore versus microchips since then, we are better off for not having taken that path."*

(Sources: *The Economist, 2000;* Ellis, 2017; Grenville, 2001; Harcourt, 2007; Wood 2001; ABS.)

To meet the 'secondary processing obligations' associated with their Pilbara iron ore mining leases, CRA/Rio Tinto entered into a number of partnerships and joint ventures throughout the 1980s and 1990s to develop a 'HIsmelt' process to produce pig iron. Having completed a smaller scale proof of concept, construction of a full plant in Kwinana commenced in 2003 and was completed in 2006. Along the way, the State Government committed $30 million for land and upgraded port facilities, and the Commonwealth committed $125 million in infrastructure associated with the project. With an anticipated operating capacity of 800,000 tonnes per year, output never actually exceeded 115,000 tonnes. Describing the plant as 'deeply uneconomic' Rio Tinto announced a temporary closure of the plant in 2009 with the loss of 100 jobs, attributing this to low prices. Tomlinson (2014) is sceptical of this as the cause of the plant's troubles, since even with a doubling of pig iron prices by 2011, the plant did not reopen and was ultimately dismantled in 2013 and relocated to India, after an estimated total investment of around $1 trillion.  BHP's hot briquetted iron (HBI) plant provides another example of an expensive failure originating from secondary processing obligations (see Box 2).

## Box 2: Downstream processing: BHP's Boodarie hot briquetted iron (HBI) plant

Construction of the HBI plant at Boodarie, 20 kilometres to the south of Port Hedland, commenced in 1996 to fulfil BHP's secondary processing obligations associated with mining and shipping iron ore in the Pilbara, as agreed with the WA government and set out in the Iron Ore Processing Act (1994). Completed in 1999 with around three-quarters of construction expenditure spent in Western Australia, the plant processed iron ore fines transported from BHP's stockpile in Port Hedland via a 7.2 kilometre under-harbour tunnel and conveyor belt and was designed to produce 2.3 million tonnes of briquettes per year. The briquettes were returned by the same conveyor for shipping and export, with the first shipment loaded on 9 May, 1999.

Then WA Premier, Richard Court and Resources Development Minister, Colin Barnett, were on site to celebrate the official opening of the plant on 21 July, 1999, with the Premier proclaiming:

> *"This is one of the most important downstream mineral processing projects in the State's history ... While Western Australia has long been an important player in the world's iron ore industry, it is through downstream processing of the State's vast reserves of iron ore that the true potential of the industry will be achieved."*

In its media release from that day, the government confirmed that 'maximising further processing opportunities for the ongoing benefit of the Western Australian community' was one of its primary objectives, with Minister Barnett stating:

> *"The Government also maintains the vision of a sophisticated steel industry for Western Australia and to achieve this end, the Department of Resources Development is working with several international companies to investigate steel and other value added iron ore projects for the Pilbara and Mid-West regions."*

However, following a series of technical difficulties, cost over-runs and operational issues, BHP had written off the entire value of the $2.3 billion plant by May 2000. A further $46 million was spent on trials to determine the technical viability of the plant, leading to $20 million of changes and an announcement by BHP in December 2000 that it would continue to operate the troubled plant. The operation reached a maximum output of 1.7 million tonnes in 2004, but made financial losses in every year of operation. Operations were suspended after an explosion at the plant in May 2004 resulted in the death of one employee and serious injuries to two others. At the time Boodarie Iron had a workforce of 490 employees, and employed a similar number of contractors. In November that year BHP announced it was placing the plant on 'care and maintenance', and in August 2005 announced its permanent closure. It was finally demolished by explosives in 2011.

Tomlinson (2014) estimates that in total around $3.4 trillion was invested in the project, which ended up 3.5 times over budget. He notes that because BHP was able to write off the value of the plant and the annual operating losses against other tax liabilities, access to Pilbara iron ore under favourable conditions was expanded while: "the financial loss from the project was largely transferred to Commonwealth taxpayers through careful structuring that seemed to anticipate project failure. The benefits to the people of Western Australia were negligible, and possibly negative in the longer term".

Sources: Tomlinson, 2014; BHP Billiton, 2005; Government of Western Australia, 1999.

Diversifying the economy remains a stated priority of the WA government. Promoting tourism is typically one of the first ticket items listed against this goal. Forays into strategic industry policy continue. A Biotechnology Industry Development Strategy has come and gone, as have taxpayers' dollars invested in a failed wave energy project off Albany. Recent initiatives include support for a marine finfish nursery in Geraldton, a microscale LNG plant in Kwinana and a Future Battery Industry Strategy, among others. Many of the measures noted in Budget Papers as part of policies to achieve diversification of the economy also appear as regional development measures, reflecting that regional development has evolved as a policy end in itself, and no longer simply a by-product of the pursuit of the State's economic development.

Following Federation, Western Australia's population rapidly became concentrated in Perth, due to the absence of competing major urban areas (Snooks, 1981). Historical estimates show the proportion of the State's population living in the capital city steadily increase from 36.5 per cent in 1901, surpassing 50 per cent in 1942 and reaching 79 per cent in 2016 (ABS, 2019). The pursuit of regional development as a policy goal in its own right is reflected in the Royalties for Regions program, while the coupled goals of regional development and economic diversification are primarily managed through the State's Regional Development Commissions.

Commencing in 2008, Royalties for Regions diverts a proportion of the State's mining and on-shore petroleum royalties to spending in the regions, and is currently described by the Department of Industries and Regional Development as underpinning "... the State Government's long-term commitment to developing Western Australia's regional areas into strong and vibrant regional communities that are desirable places to live, work and invest." With current funding of around $1 billion per year, evaluations have delivered mixed reviews on the efficacy of the program. In a more directly interventionist approach, from 2011-12 a proportion of the Royalties for Regions funding was allocated to support nine towns identified as 'SuperTowns' to 'stimulate and sustain growth in their communities, Boddington, Collie, Esperance, Jurien Bay, Katanning, Manjimup, Margaret River, Morawa and Northam. Of these only Jurien Bay and Margaret River have experienced population growth above that of the State overall, and the populations of Boddington, Collie, Katanning, Manjimup and Morawa declined between 2011 and 2017. In the 2017-18 Budget a further $20 million was earmarked for a Collie Futures Fund to assist in transition away from the coal industry, and $60 million in 2019-20 budget for a Collie Industry Attraction and Development Fund redirected from previous plans for a biomass energy plant and a solar farm in Collie.

Lack of a rigorous methodology for determining comparative advantage and of consistency in methodologies used across the Regional Blueprints.

The formulation of the Regional Blueprints embodies detailed local knowledge and extensive consultation.

A feature of regional development policy in WA is the operation of nine Regional Development Commissions covering all of non-metropolitan WA: Gascoyne, Goldfields-Esperance, Great Southern, Kimberley, Mid West, Peel, Pilbara, South West and the Wheatbelt. The objectives of the Regional Development Commissions include broadening the economic base of the regions and identifying associated infrastructure requirements. From 2011, these functions have been guided by Regional Blueprints developed by each Commission, which include identification of areas of comparative advantage for each region and setting of strategic directions. A 2014 recent review and synthesis of the Blueprints undertaken by ACIL Allen highlighted a number of limitations:

- lack of a rigorous methodology for determining comparative advantage and of consistency in methodologies used across the blueprints
- a focus on physical and man-made features rather than on activities – in the modern economy skills, knowledge, networks and synergies embodied in activities are typically more important sources of comparative advantage than 'things'
- Blueprints tended to be inward looking, with few considering international competitors when assessing comparative advantage
- lack of a coherent framework to guide what actions government should take, in line with criticism of the lack of transparency and consistency governing the basis for Royalty for Regions funding allocations.

On the positive side, the formulation of the Blueprints embodies detailed local knowledge and extensive consultation.

# Smart specialisation framework

Looking back over the history of Commonwealth and State industry policy as it has impacted on Western Australia, three key pitfalls can be identified: the governments' misguided belief that it can 'pick winners' – to second guess which sectors or firms are likely to be successful; attempts to work against economic or market fundamentals; and decisions being captured by vested interests (notably in the case of protection and production controls). In this report we draw on insights and tools developed under the banner of 'smart specialisation', an emerging approach to industry and regional development policy that bypasses the key pitfalls of previous approaches to industry. The analysis is undertaken at a regional level corresponding to the Regional Development Commissions plus the Perth metropolitan area.

Smart specialisation evolved out of policies aimed to promote cohesion between countries within the European Union, and represents a 'place based' integration of industry and regional development policies (see Balland *et al*., 2018; Marinelli, Bertamino and Fernandez, 2019; OECD, 2013) that is well suited to application to the Development Commission regions. It explicitly addresses the challenge identified of the need for rigorous and transparent methodologies to identify regional comparative advantage.

At the heart of smart specialisation is the concept of an 'entrepreneurial discovery process'. In this process, the private sector and market forces are continually discovering and producing new information about activities and interacting to generate innovation. Universities and other research and development (R&D) centres are often integral partners to this innovation and discovery process. Smart specialisation seeks to interrogate and stimulate the process of entrepreneurial discovery to identify opportunities to exploit knowledge and innovative ideas that can be turned into marketable goods and services, leading to greater competitiveness. While this is most often described as a 'bottom up' approach, there is also recognition that it is a bi-directional process involving players at all levels, grounded in the conditions and actors within specific regions. This contrasts with 'one-size-fits-all' industry policies. Despite the name, the goal is not to make regions more specialised, but to build on existing regional strengths to promote high valued added activities (OECD, 2013; Sandu, 2012; Veldhuizen *et al.,* 2018).

Adding to the importance afforded to the entrepreneurial discovery process is the recognition of the role of technological networks and spill-overs in attempts to account for the gap in productivity between countries in the European Union and the US (McCann and Ortega-Argilés, 2015). And while specialisation is not the goal, neither is complete diversification. There are substantial benefits of scale associated with innovation- and knowledge-intensive activities, and in the ability to capture spillovers, which means that some degree of regional specialisation is desirable and inevitable (Foray and Goenega, 2013).

Recent directions in regional policy have promoted, neutral, or 'horizontal' measures as more desirable - those aimed at improving the general framework for entrepreneurship and innovation, such as competition policy, promoting education, quality institutions and intellectual capital rights. Foray and Goenega (2013) note that a distinguishing feature of smart specialisation is 'vertical' or 'non-neutral' intervention – the identification and support of particular areas for intervention. They are 'vertical' in the sense that smart specialisation considers linkages and networks at many levels. However, smart specialisation differs from what has previously been described as 'picking winners' because the areas of specialisation are generated through the entrepreneurial discovery process – the role of government is to help to foster that process rather than identify firms or industries to back.

Smart specialisation represents a 'place based' integration of industry and regional development policies.

Specialisation are generated through the entrepreneurial discovery process – the role of government is to help to foster that process.

In implementing smart specialisation, Foray and Goenaga (2013) argue that one of the key issues is the level of 'granularity', or the level at which opportunities are to be identified, assessed and supported. This needs to be low enough to reflect the unique characteristics of regions, but not so fine as to become a horizontal approach supporting micro-projects and ignoring important linkages and spill-overs. For WA, we argue that the Development Commission regions provide a practical level of granularity, providing sufficient regard to the needs for scale and critical mass. Given the vast distances between regions and their natural and social diversity within the State, it is important to consider the geographical, economic and social peculiarities of each region. Policies developed at a State-wide level will not be appropriate for all regions. A further principle is that the appropriate level for identifying priorities is at the level of 'activities'. Support should not be targeted at specific firms or sectors, but at activities likely to encompass groups of firms and research partners and exploring new technological and market opportunities. Foray and Goenaga (2013) provide the example of the plastics industry in the Basque region of Spain seeking to diversify from applications in the car industry to biomedical applications. The appropriate focus is not on a single firm or the plastics industry, but the activity of seeking out biomedical applications for plastics.

The European Commission identifies six practical steps for the implementation of smart specialisation strategies (Foray *et al.,* 2012):

1. analysis of the national/regional context and potential for innovation
2. set up of a sound and inclusive governance structure
3. production of a shared vision about the future of the country/region
4. selection of a limited number of priorities for national/regional development
5. establishment of suitable policy mixes
6. integration of monitoring and evaluation mechanisms.

In many ways the existing functions of the Regional Development Commissions are well aligned to principles of smart specialisation. They broker information on regional contexts and potential developments, identify barriers to development that may be addressed by policy and priorities for infrastructure, facilitate networks and the Blueprints seek to promote a shared vision for the region.

Of course, the critical question for smart specialisation is how to identify the priorities for regional activities. How can policy makers or analysts guide the existing entrepreneurial discovery process to reveal potential opportunities that are currently being overlooked? It is the methods and techniques that have been developed under smart specialisation to address that challenge that are applied here to the regions? In particular, the concepts of 'revealed comparative advantage', 'relatedness' and 'complexity' are used to highlight potential unexploited market opportunities in the regions. Revealed comparative advantage is a measure of what a region currently does well; relatedness provides an empirical measure of what other activities would be compatible with the existing industry structure of a region; and complexity provides an indicator of the level of knowledge embedded in the production of different goods and services, and thus an indication of their value added or wealth-generation potential. These concepts, introduced in detail in the following sections, can be applied to provide valuable information to support the entrepreneurial discovery process of the regions.

# Industry perspectives

# Introduction

Identifying and assessing opportunities for industry diversification across WA requires an in depth understanding of industries from a number of perspectives. These perspectives include:

- industry trends
- technological trends – new technologies, risks and opportunities
- international trade as an indicator of international linkages between WA and the world
- natural resource endowments such as climate, land or mineral deposits
- infrastructure status and requirements
- skills, education and human capital – stock of skilled workers, flows of newly trained workers and new skill requirements.

By understanding these perspectives this analysis identifies where an opportunity might require a policy response to address a particular need.

This chapter gives an overview of these perspectives and is used as a basis for assessing individual industries as opportunities for diversification.

# Industry trends

The state of play chapter outlined economic trends for the WA economy, with a focus on GSP, GVA and employment growth. The latter was presented at the broad industry level. At the aggregate industry level, it was shown that the top five employing industries in WA accounted for 46 per cent of total employment in the State. Nationally, the top five industries contributed 49 per cent to total employment. Here, more detailed employment data at the industry group level is presented.

Looking at employment at the industry group level shows some interesting trends (Figure 18). With the exception of the Construction and Manufacturing industries, and to a lesser extent, Professional, scientific and technical services, most industries have an industry group that dominates total employment within that industry.

For example, in the Health care and social assistance industry, WA's largest employer, hospitals account for 28.5 per cent of the 155,000 persons employed. This is followed by other social assistance services (18.5%), allied health services (15.1%) and residential care services (14.6%). Hospitals have seen a decline of 17.6 per cent of persons employed between 2018 and 2019, although this is on the back of 11 per cent and 14.4 per cent growth in 2017 and 2018, respectively. Other social assistance services meanwhile, have experienced growth of 10.6 per cent and 5.0 per cent in the number of persons employed over the last two years. The rollout of the NDIS is a likely factor at play here.

Within Retail trade, 25.2 per cent of the 131,000 employees are employed in supermarket and grocery stores, followed by pharmaceutical and other store-based retailing (18.6%), and clothing, footware and personal accessory retailing (10.2%). Pharmaceutical and other store-based retailing saw employment growth of 23.8 per cent in 2019, on the back of 11.9 per cent growth in 2018. Total employment in recreational goods retailing grew by a massive 39.9 per cent in 2019, while employment in hardware, building and garden supplies retailing (not reported in the chart below, as it is outside the top five groups), declined by 42 per cent between 2018 and 2019.

Building installation services contributes 22.6 per cent of total employment in the Construction industry, followed by building completion services (15.7%) and other construction services (12.3%). In GVA terms, the construction sector experienced significant declines from a peak of $31.0 billion in 2014 to $21.6 billion in 2018. The fruit of such declines are borne out in total employment, which declined from a peak of 146,900 in 2015 to now sit at 124,500 – a similar level to that reported in 2009.

WA's fourth largest employer is the Professional, scientific and technical services sector. This industry has seen employment growth in all of the top five industry groups in the last year, with total employment reaching an historic peak of 110,500 persons. Total employment in architectural, engineering and technical services grew by 31.5 per cent in 2019, bringing total employment back to the levels seen in 2015.

Earlier in this report, the importance of the Mining industry to WA was highlighted. In GVA terms, the Mining industry comprises over a third of the WA economy. For direct employment, the Mining industry employs over 104,000 persons, WA's fifth largest employment industry. Again here however, such employment is dominated by one sector – metal ore mining. This group makes up 60.6 per cent of persons employed

28.5% of the 155,000 persons employed in the Health care and social assistance industry are employed in hospitals.

There are 22,000 less persons employed in the Construction industry today relative to 2015.

Total employment in Architectural, engineering and technical services grew by 31.5% in 2019.

Metal ore mining contributes 61% of total employment in the Mining industry.

Cafes, restaurants and takeaway food services make up 79% of total employment in the Accommodation and food services industry.

Many groups within the Manufacturing industry display high employment volatility.

in the Mining sector, with 63,000 persons now employed in the sub-group. This is just below the previous peak of 66,800 persons employed in metal ore mining seen in 2012.

Oil and gas extraction is the second largest employer in the Mining sector, contributing 13,000 persons (12.6% share). Employment in mining exploration stood at 14,700 in 2016, but saw declines of almost 29 per cent in both 2017 and 2018, before an increase of 8.3 per cent in 2019, with employed persons now standing at 9,700.

Employment in the Education industry is dominated by school education, which is to be expected. Interestingly, total employment in the tertiary education sector in WA now stands at 18,200, down 33.5 per cent from the 27,400 persons employed in 2009. However, total employment in adult, community and other education grew by 110 per cent over the same period, to now stand at 20,400 persons.

Cafes, restaurants and takeaway food services make up 79 per cent of total employment in the Accommodation and food services industry. This industry group saw annual increase in total employment averaging 4.7 per cent since 2012, despite a blip of -5.1 per cent in 2018. In BCEC's *Falling through the net* report (Bond-Smith *et al.*, 2018), which investigated the digital divide in WA, the authors showed that there was a large increase in the number of businesses accessing the internet in WA with the launch of AirBnB in 2012-13 and Uber Eats in 2015-16. It appears that the latter has contributed also to employment growth in the cafes, restaurants and takeaway food services group. The accommodation grouping also saw employment growth, peaking at 13,900 in 2018. However, this declined by 43.3 per cent in 2019, bringing total employment back to 2012 levels.

The Manufacturing industry currently employs over 88,000 persons in WA, almost 10,000 persons below that seen ten years previously. At the industry group level, of which there are sixty nine for manufacturing, there is much volatility in total employment growth. For example, in the meat and meat product manufacturing group, with the largest employment share for the industry (6.8%), total employment declined by 57 per cent in 2017, but increased by 43.2 per cent in 2019. Similar trends are seen in this group's historical data. Furniture manufacturing displays similar traits, with total employment growth of 33.7 per cent in 2016, followed by a decline of 25 per cent in 2017. Employment in structural metal product manufacturing reached a height of 5,300 persons in 2018, up 123 per cent on that reported just two years earlier. However, a decline of 22.2 per cent was seen in 2019.

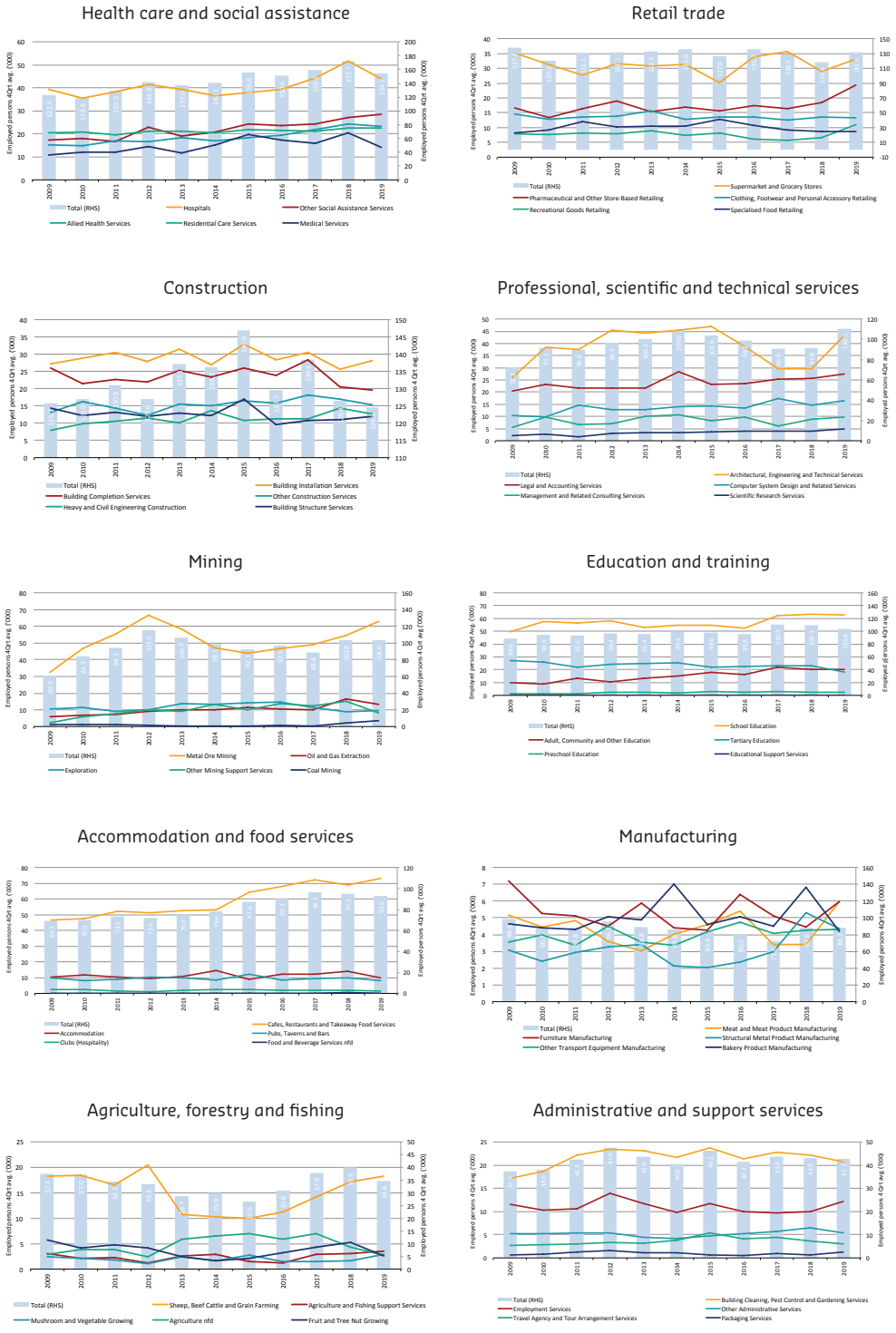
The Agriculture, forestry and fishing industry in WA now employs 34,800 persons, above the annual average of 33,700 over the past ten years. Employment in this industry is dominated by the sheep, beef, cattle and grain farming industry group, with an employment share of 52.7 per cent. In absolute terms, this translates to 18,300 persons, up 8,000 from that reported in 2014, but on par with that reported in 2009.

While contributing low levels of employment in absolute terms, the agriculture and fishing support services and mushroom and vegetable growing sectors have seen strong employment growth in over the last number of years, with for example, the former growing by 57 per cent in 2017 and the latter by 43.5 per cent in 2019.

Finally in Figure 18, total employment in the Administrative and support services industry are reported. Total employment in this industry has remained relatively stable, and now sits at 42,700 persons, down 5,000 persons on the 2012 peak for the period reported here. By industry group, building cleaning, pest control and gardening services accounts for 48.7 per cent of total employment, but has experienced declines in absolute employment terms in recent years. The employment services group grew by 19.1 per cent in 2019, and now contributes 28.7 per cent of the industry's employment. There is a mixed bag to report for the remaining groups, with particular mention to the travel agency and tour arrangement services, which has declined from a total employment of 5,400 in 2015 to 3,000 in 2019.

The Agriculture, forestry and fishing industry in WA now employs 34,800 persons, above the annual average of 33,700 over the past 10 years.

**Figure 18** Total employment by industry and industry group, WA, 2009 to 2019




Note: Average total employment over the previous four quarters are reported, to November of each year. For 2019, the average of the last two quarters are used, to May, 2019. Selection of Industries.

Source: Bankwest Curtin Economics Centre | BCEC analysis using ABS cat no. 6291.0.

# New technologies

This section summarises and reviews a range of forward-looking technology trends. There are of course many 'mega trends' that affect the economy, but these are some of the key trends affecting WA.

## Clean technologies


The clean tech trend is broader than renewable energy. There is a wave of new technology innovators in finance, agriculture, energy, education and construction who provide transformative potential for clean technologies.

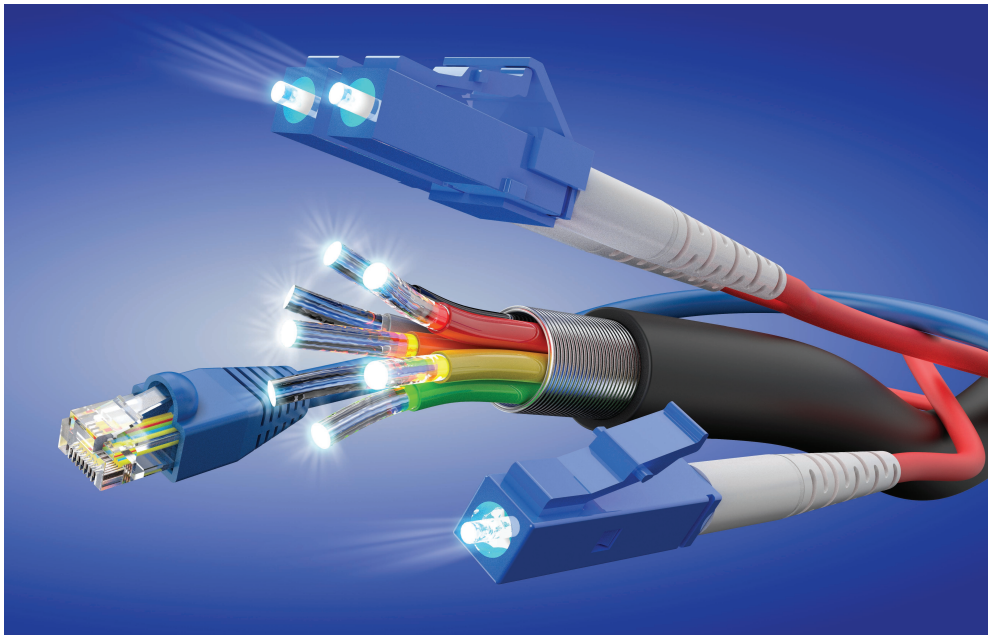
The growing global use of renewable energy generation and an increasing focus on energy efficiency could create a long-term downward trend for WA's coal mining and fossil fuel industries. Indeed these trends are already seen globally with many countries shutting down coal generation and expanding the use of renewables. Constantly improving energy efficiency and economic shifts mean that the link between economic growth and energy use has weakened substantially.[3] These trends are likely to contribute to declining demand for Australian coal. Coal surpassed iron ore as Australia's most valuable export in the 2018 financial year,[4] which may exacerbate the potential impact in Australia of a global divergence away from thermal coal.

The increasing use of lithium battery technology globally may alleviate some of the expected decline in the fossil fuel and mining industries in WA. Lightweight, fast-charging and high-capacity batteries are essential for electric vehicles to displace conventional fossil fuels. Batteries also moderate the intermittent nature of renewable generation and support grid reliability by providing inertia. Western Australia has large endowments of lithium which is used in the production of lithium ion batteries. In WA, lithium comes from the hard rock mining of spodumene deposits that also contain other rare earth metals. It may be possible to repurpose much of the

3 Energy use per capita in Australia has been declining since 2006 despite continued economic growth. See Cassells *et al.*, 2017
4 Sydney Morning Herald, 2018.

existing mining infrastructures and capabilities in WA to expand spodumene mining and support many of the existing mining regions through a technological transition. In particular, much of WA's lithium is in the Pilbara, and could take advantage of existing rail and the export facilities at Port Hedland. Exports of lithium are expected to rise to $1.1 billion by 2020[5]. The Future Batteries Industries Cooperative Research Centre (FBICRC) located at Curtin University is poised to assist Australia, and WA in particular, to expand its role in the global battery value chain. The industry is expected to deliver an estimated $2.5 billion benefit to the Australian economy in the next 15 years[6]. Nonetheless, as with other mining industries, there is also a continued technological risk such as if batteries become less reliant on lithium in future. WA should not rely on another mining boom for its continued prosperity. Instead, the opportunities around lithium may be more in downstream value added activities such as the processing of precursors. Similarly, WA can trade on being an ethical source for battery components.

## Connectivity



Modern economies are characterised by connectedness. Having a website, social media account or sourcing inputs online has become an essential business activity. Equipment, tasks, sales, recruitment, meetings and machines are also increasingly connected. Data is now an asset or the price paid for otherwise free services. Connectivity is transforming the way the world does business and also transforming where the world does business. The ability to work from home or undertake remote office tasks is a significant opportunity for regional WA.

However, alongside connectivity, value added production is increasingly knowledge based. So while many tasks can now be undertaken remotely, many elements of knowledge-based work also involve trust or the exchange of tacit ideas, often

5 Curtin University, 2019.
6 Curtin University, 2019.

requiring frequent face to face contact. As a result, the world is not flat, but increasingly spiky[7] because the places that are the most connected have access to the largest markets and are better at facilitating face to face contact. While connectivity makes business possible almost anywhere, the gains are greatest in the largest globally connected cities. In response, WA is able to take on a greater share of remote work, but must maintain and support connectivity in all forms[8] to compensate for the other factors that are most affected by WA's isolation. In this way, industries that require some local factor of production are more likely to flourish. In regional centres this has always been natural endowments such as minerals for the mining industries or climate for agriculture or tourism. But other local and human endowments can also be developed. The difficulty for regional areas is that people are more mobile than natural resources and their expertise follow when they leave regional areas. A smart specialisation approach enables local expertise in specific areas to overcome factors such as distance and mobility, because these industries can remain even when people move.

The internet of things enables remote consumption and operations to be continually optimised in response to real time conditions. Remote operations is an element of the connectivity trend that enables the operator to work in another location than the equipment. The major mining companies in WA typically have remote operations centres in Perth for their mine sites across the State. WA's expertise in mining may now also extend to expertise in remote operations in Perth. The internet of things will also transform other businesses, with farmers now able to continuously monitor farm activities from their home, or even from the city. Farmers can optimise irrigation systems in response to natural rainfall and pasture conditions to use water more efficiently. Similarly farmers can tailor nutrients across the farm to make better use of fertilisers.

7 Florida, 2005.
8 Including transportation of people and goods as well as broadband, particularly in regional areas.

## Automation

Automation is not only recent, but a long-term and ongoing trend. Many tasks have become automated over time and for the most part, it is the menial routine tasks, or dangerous tasks that are automated. Automation allows people to shift away from repetitive, physical, isolated, and dangerous work and toward more variable, mental, interactive, and less hazardous work. This can be particularly helpful in a resource based economy such as WA to improve the work lives of resource-based workers. It also makes these industries more attractive for people that are otherwise averse to such work.

Autonomous vehicles have the potential to revolutionise both public transport and commuting behaviour. People may be able to commute for longer, as work can begin using wireless connectivity while riding in autonomous, on-demand (possibly public) transport. Furthermore, autonomous vehicles combined with wireless connectivity enable greater use of existing infrastructure because these vehicles can travel closer together more safely than person-controlled vehicles, enabling faster commutes and saving the cost of expanding roads. It is a delicate balance for funding infrastructure between waiting for the widespread use of autonomous vehicles and expanding capacity on existing transport routes. A focus on existing public transport technologies might be a cautious approach to avoid any stranded investments in excessive road infrastructure.

Continued automation in manufacturing plants has the potential to overcome pressures to outsource manufacturing overseas. As a result, some manufacturing could return to Australia, particularly in niche, high-value industries where a significant knowledge and design component requires close oversight. These trends have been seen elsewhere in the world, such as the United States, where manufacturing output has increased, even though overall job numbers in manufacturing continue to decline[9]. On this basis, while the manufacturing industry has strong prospects, it is also likely to continue to reduce its ability to provide jobs.

9 Pew Research Centre, 2017.

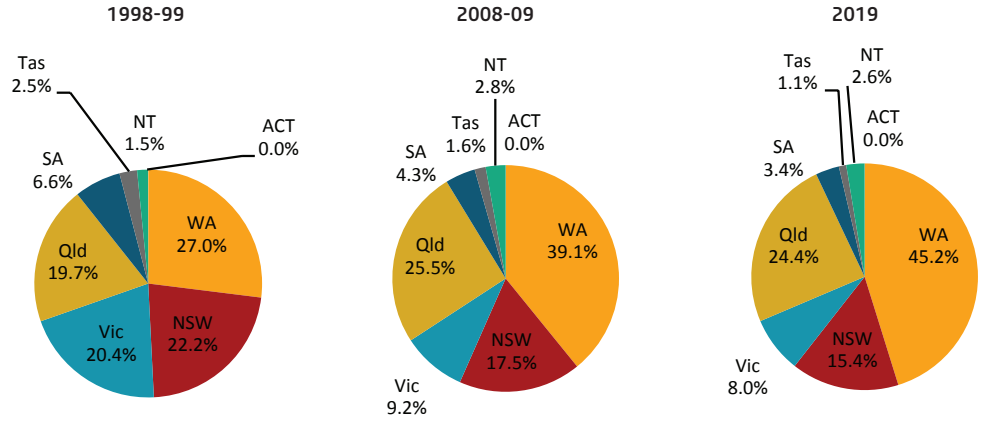
# Trade

An effective industry diversification strategy takes account of international links. Trading relationships facilitate the exchange of knowledge, ideas and technology. In this way trade indicates the ability for WA to benefit from knowledge and capabilities developed internationally. These linkages provide the channels for WA to learn from overseas markets and collaborate internationally in order to expand or create new local industries. A greater export market also indicates the ability for the industry to generate wealth for Australia. This section considers WA's international relationships by analysing the industries and destinations for WA's exports and imports.

WA accounts for 45% of Australia's exports.

Based on trade data, WA has strong international links compared to other states in Australia, with a far greater and growing share of Australia's exports (Figure 19). These links have been maintained despite the end of the mining boom, with WA accounting for 45.2 per cent of Australia's exports in the 12 months to the end of May 2019. Strong international trade indicators for WA show the potential for Perth to be considered a globally connected city and for WA's regional economies to be globally connected. WA is not the most isolated place in Australia when trade indicators imply that WA is the largest state for exports by such a considerable margin.

**Figure 19** Australian international export share by state/territories, selection of years




Note: 2019 is the year to April.
Source: Bankwest Curtin Economics Centre | Authors' calculations using ABS Cat No. 5368 Table 15a.

WA's exports are dominated by iron ore.

Western Australia's international trade indicates industries where WA is likely to have on going relationships with international partners. Figure 20 shows the shares of WA's merchandise exports and imports by industry at the Standard International Trade Classification (SITC) 4 digit level.

At 43.1 per cent or $62.5 million in 2018, WA's exports are dominated by iron ore. Other main exports include commodities and unprocessed fuels. Very few of these industries are highly knowledge intensive, as will be shown in the next chapter, but trade represents the channels by which WA can benefit from international links with its customers in those particular industries.

**Figure 20** WA international merchandise trade shares, by product, 2018


Source: Bankwest Curtin Economics Centre | Authors' calculations using Merchandise data from DFAT (2018) Australia's trade by state and territory.

At 30.4 per cent or $10.3 billion in 2018, WA's imports are dominated by machinery and equipment. Fuels are the other main component of WA's imports. These exports and imports are summarised at the aggregate SITC 1 digit level in Table 8. It is notable that WA's imports are quite different products than exports. This can be unusual for developed countries which often trade in very similar goods (for example, France both imports and exports machines to and from Germany). Expanding intra-industry trade in similar goods increases the scope for specialisation and could represent a wide range of opportunities for diversification. WA benefits from advances elsewhere in these industries and products by applying new machinery and equipment to local production. In this way, international trade in related industries implies an opportunity for international collaboration with WA.

**Table 8** **Value of merchandise international exports from and imports to WA, by SITC commodity group, 2014 to 2018**

| WA merchandise exports ($'m) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | |
| Food and live animals | 5,030 | 4% | 5,222 | 5% | 4,901 | 5% | 4,702 | 4% | 5,509 | 4% |
| Beverages and tobacco | 37 | 0% | 43 | 0% | 48 | 0% | 54 | 0% | 57 | 0% |
| Crude materials, inedible, except fuels | 70,632 | 57% | 54,492 | 53% | 58,985 | 55% | 69,568 | 57% | 70,068 | 48% |
| Mineral fuels, lubricants and related materials | 15,521 | 12% | 7,780 | 8% | 4,745 | 4% | 4,783 | 4% | 6,663 | 5% |
| Animal and vegetable oils, fats and waxes | 57 | 0% | 44 | 0% | 46 | 0% | 41 | 0% | 44 | 0% |
| Chemicals and related products, n.e.s. | 1,219 | 1% | 1,305 | 1% | 1,133 | 1% | 1,316 | 1% | 1,487 | 1% |
| Manufactured goods classified chiefly by material | 1,704 | 1% | 1,187 | 1% | 990 | 1% | 1,377 | 1% | 1,369 | 1% |
| Machinery and transport equipment | 975 | 1% | 994 | 1% | 902 | 1% | 982 | 1% | 1,207 | 1% |
| Miscellaneous manufactured articles | 174 | 0% | 202 | 0% | 184 | 0% | 207 | 0% | 264 | 0% |
| Commodities and transactions not classified elsewhere in the SITC | 29,100 | 23% | 31,458 | 31% | 34,560 | 32% | 40,062 | 33% | 58,430 | 40% |
| **Total** | **124,448** | | **102,728** | | **106,494** | | **123,093** | | **145,098** | |
| WA merchandise imports ($'m) | | | | | | | | | | |
| Group | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | |
| Food and live animals | 588 | 2% | 632 | 2% | 648 | 2% | 638 | 1% | 652 | 2% |
| Beverages and tobacco | 146 | 0% | 159 | 0% | 151 | 0% | 137 | 0% | 140 | 0% |
| Crude materials, inedible, except fuels | 301 | 1% | 279 | 1% | 232 | 1% | 234 | 0% | 238 | 1% |
| Mineral fuels, lubricants and related materials | 9,263 | 25% | 6,244 | 17% | 4,975 | 16% | 6,231 | 13% | 8,099 | 24% |
| Animal and vegetable oils, fats and waxes | 24 | 0% | 24 | 0% | 29 | 0% | 29 | 0% | 31 | 0% |
| Chemicals and related products, n.e.s. | 1,759 | 5% | 1,733 | 5% | 1,504 | 5% | 1,536 | 3% | 1,834 | 5% |
| Manufactured goods classified chiefly by material | 5,348 | 15% | 4,974 | 14% | 3,759 | 12% | 3,129 | 7% | 3,579 | 11% |
| Machinery and transport equipment | 12,121 | 33% | 14,078 | 39% | 10,350 | 32% | 26,691 | 56% | 10,331 | 30% |
| Miscellaneous manufactured articles | 1,953 | 5% | 2,118 | 6% | 1,936 | 6% | 1,932 | 4% | 2,124 | 6% |
| Commodities and transactions not classified elsewhere in the SITC | 5,175 | 14% | 6,151 | 17% | 8,282 | 26% | 7,334 | 15% | 6,923 | 20% |
| **Total** | **36,678** | | **36,392** | | **31,868** | | **47,892** | | **33,951** | |

**Source:** Bankwest Curtin Economics Centre | Authors' calculations using Merchandise data from DFAT (2018) Australia's trade by state and territory.

Exporting services may be more difficult in Australia, and WA in particular, since most services typically require an element of face-to-face contact and export markets are a significant distance away. This may partly explain why services are a relatively small share of WA's trade. But services are also typically more knowledge intensive than merchandise or commodities so trade in these industries may be more representative of international commercial relationships and the potential for collaboration. Figure 21 shows the shares of service exports and imports by industry and the groups are summarised in Table 9. In particular, travel and transport are the largest components of both WA's exports and imports of services. Notably, WA's exports are more concentrated in these two categories than imports.

**Figure 21** WA international merchandise trade shares, by product, 2018


Source: Bankwest Curtin Economics Centre | Authors' calculations using Merchandise data from DFAT (2018) Australia's trade by state and territory.

**Table 9** Value of international service exports from and imports to WA, by group, 2014 to 2018

| WA merchandise exports ($'m) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | |
| Manufacturing services on physical inputs owned by others | 18 | 0.3% | 26 | 0.4% | 42 | 0.6% | 24 | 0.4% | 4 | 0.1% |
| Maintenance and repair services n.i.e | 1 | 0.0% | 2 | 0.0% | 2 | 0.0% | 8 | 0.1% | 6 | 0.1% |
| Transport | 1,063 | 16.0% | 1,043 | 15.0% | 1,047 | 15.1% | 946 | 14.0% | 928 | 13.8% |
| Travel | 4,150 | 62.5% | 4,494 | 64.5% | 4,741 | 68.2% | 4,490 | 66.6% | 4,496 | 67.1% |
| Construction | 34 | 0.5% | 36 | 0.5% | 22 | 0.3% | 34 | 0.5% | - | 0.0% |
| Insurance and Pension services | 85 | 1.3% | 70 | 1.0% | 66 | 0.9% | 68 | 1.0% | 82 | 1.2% |
| Insurance | 23 | 0.3% | 25 | 0.4% | 25 | 0.4% | 23 | 0.3% | 24 | 0.4% |
| Financial Services | 2 | 0.0% | 3 | 0.0% | 10 | 0.1% | 14 | 0.2% | 3 | 0.0% |
| Charges for the use of intellectual property n.i.e | 24 | 0.4% | 48 | 0.7% | 46 | 0.7% | 34 | 0.5% | 37 | 0.6% |
| Telecommunications, computer and information services | 131 | 2.0% | 125 | 1.8% | 98 | 1.4% | 278 | 4.1% | 187 | 2.8% |
| Other business services | 575 | 8.7% | 591 | 8.5% | 397 | 5.7% | 399 | 5.9% | 461 | 6.9% |
| Personal, cultural, and recreational services | 58 | 0.9% | 61 | 0.9% | 55 | 0.8% | 54 | 0.8% | - | 0.0% |
| Government goods and services n.i.e | 350 | 5.3% | 704 | 10.1% | 716 | 10.3% | 730 | 10.8% | 744 | 11.1% |
| **Total service exports** | **6,642** | | **6,966** | | **6,952** | | **6,743** | | **6,704** | |
| WA merchandise imports ($'m) | | | | | | | | | | |
| Group | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | |
| Manufacturing services on physical inputs owned by others | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% |
| Maintenance and repair services n.i.e | 28 | 0.2% | 109 | 0.9% | 60 | 0.6% | 34 | 0.3% | 37 | 0.3% |
| Transport | 2,640 | 22.4% | 2,775 | 22.0% | 2,274 | 21.0% | 1,946 | 19.3% | 2,167 | 19.8% |
| Travel | 5,811 | 49.3% | 5,726 | 45.4% | 5,884 | 54.4% | 5,940 | 59.0% | 6,303 | 57.7% |
| Construction | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% | - | 0.0% |
| Insurance and Pension services | 49 | 0.4% | 51 | 0.4% | 44 | 0.4% | 41 | 0.4% | 46 | 0.4% |
| Insurance | 61 | 0.5% | 62 | 0.5% | 57 | 0.5% | 53 | 0.5% | 54 | 0.5% |
| Financial Services | 6 | 0.1% | 10 | 0.1% | 32 | 0.3% | 16 | 0.2% | 11 | 0.1% |
| Charges for the use of intellectual property n.i.e | 104 | 0.9% | 112 | 0.9% | 100 | 0.9% | 240 | 2.4% | 247 | 2.3% |
| Telecommunications, computer and information services | 182 | 1.5% | 287 | 2.3% | 194 | 1.8% | 373 | 3.7% | 367 | 3.4% |
| Other business services | 2,573 | 21.8% | 2,815 | 22.3% | 1,934 | 17.9% | 1,225 | 12.2% | 1,506 | 13.8% |
| Personal, cultural, and recreational services | 11 | 0.1% | 13 | 0.1% | 31 | 0.3% | 23 | 0.2% | 25 | 0.2% |
| Government goods and services n.i.e | 16 | 0.1% | 17 | 0.1% | 19 | 0.2% | 20 | 0.2% | 21 | 0.2% |
| **Total service exports** | **11,783** | | **12,614** | | **10,809** | | **10,061** | | **10,923** | |

Source: Bankwest Curtin Economics Centre | Authors' calculations using ABS Cat No. 5368.0.55.004 Table 3 and Table 4.

# Infrastructure

This section considers WA's infrastructure as both a crucial component of production in WA and to facilitate connectivity and distribution around the State or internationally. We take a broad view of infrastructure, to consider any man-made endowment that facilitates business activity. Ports facilitate international trade and coastal shipping. Railways and roads transport goods to or from cities and ports. Universities and research institutes facilitate research and development. Central business districts pool a range of services that support many types of businesses.

## Sea ports

Figure 22 shows the location of ports across WA and its regions. Fremantle has the most diverse range of traded cargoes of ports in WA. Fremantle is also the only port with container shipping in WA. The government is currently considering options at Fremantle, Kwinana and Bunbury for various combinations of freight modes. Notably, other ports in WA are significantly dominated by exports, rather than imports. The largest export from WA is iron ore, and at 495 million tonnes in 2016-17, the vast majority of this is exported through Port Hedland.

While individual port authorities in the Kimberley and Pilbara each support single local regional development areas, other port authorities support multiple regions. The Mid West supports the Gascoyne and Mid West regions. Fremantle supports Perth and a number of surrounding regions. The Southern Ports Authority borders the coast of Peel, South West, Great Southern and Goldfields-Esperance regions. Table 10 details the throughput of different cargoes at ports across WA.

**Figure 22** Ports in WA


Source: Bankwest Curtin Economics Centre | The Government of Western Australia Department of Transport.

**Table 10** Throughput at WA ports, by cargo, 2016-17

| Cargo | Fremantle | Kimberley | Mid West Ports | Port Hedland | Dampier / Ashburton | Port of Albany | Port of Bunbury | Port of Esperance |
|---|---|---|---|---|---|---|---|---|
| Coal | - | - | - | - | - | - | - | - |
| Iron ore | 4,302 | - | 11,837 | 494,607 | - | - | - | 11,247 |
| Steel | 6 | - | - | - | - | - | - | - |
| Grain | 7,325 | - | 3,223 | - | - | 2,912 | 274 | 2,962 |
| Sugar | 0 | - | - | - | - | - | - | - |
| Cotton | - | - | - | - | - | - | - | - |
| Wool | 64 | - | - | - | - | - | - | - |
| Livestock | 127 | 24 | 6 | - | - | - | - | - |
| Motor vehicles | 5 | - | - | - | - | - | - | - |
| Oil and petroleum | 1,811 | 40 | - | - | - | - | 13 | - |
| Gas | 36 | - | - | - | - | - | - | - |
| Silica sands | 144 | - | - | - | - | 228 | 273 | - |
| Mineral sands | 143 | - | 645 | - | - | - | 961 | - |
| Manganese | - | - | - | 462 | - | - | - | - |
| Nickel | 21 | - | - | - | - | - | - | 100 |
| Aluminium – bauxite | 332 | - | - | - | - | - | - | - |
| Aluminium – alumina | 3,149 | - | - | - | - | - | 10,933 | - |
| Aluminium – aluminium | - | - | - | - | - | - | - | - |
| Timber – logs | 24 | - | - | - | - | 49 | - | - |
| Timber – products | 1 | - | - | - | - | - | 26 | - |
| Timber – woodchips | - | - | - | - | - | 1,753 | 1,544 | 205 |
| Zinc – ore | - | - | - | - | - | - | - | - |
| Zinc – concentrate | - | - | 155 | - | - | - | - | - |
| Zinc – refined | - | - | - | - | - | - | - | - |
| Copper – ore | - | - | - | - | - | - | - | - |
| Copper – concentrate | - | - | 230 | - | - | - | 263 | 6 |
| Copper - refined | - | - | - | - | - | - | - | - |
| Lead – ore | - | - | - | - | - | - | - | - |
| Lead – concentrate | 1 | - | 13 | - | - | - | - | - |
| Lead - refined | - | - | - | - | - | - | - | - |
| Salt | - | - | - | 2,996 | - | - | - | - |
| Anhydrous ammonia | - | - | - | - | 669 | - | - | - |
| General | - | - | - | 73 | 254 | - | - | - |
| Spodumene | - | - | - | 714 | - | - | - | - |
| Copper – concentrate | - | - | - | 439 | - | - | - | - |
| Import throughput (mass tonnes) | | | | | | | | |
| Oil and petroleum | 6,849 | 119 | 244 | 1,444 | 794 | 42 | 12 | 297 |
| Motor vehicles | 154 | - | - | - | - | - | - | - |
| Electronics & telecommunication equipment/parts | - | - | - | - | - | - | - | - |
| Chemical compound (ammonium nitrate) | - | - | - | 43 | - | - | - | - |
| General cargo | - | - | - | 131 | 243 | - | - | - |

Source: Bankwest Curtin Economics Centre | Authors' calculations using data from Ports Australia; www.portsaustralia.com.au.

## Airports

Air transport is crucial to WA because our cities are far apart and far away from other major cities in Australia. WA also has a significant level of fly-in-fly-out (FIFO) employment. Figure 23 shows the airports with regular public transport (RPT) in WA. In addition to these airports, Perth International Airport provides an international gateway to WA and Australia and Jandakot airport is the base for many essential service organisations, pilot training facilities, freight and private air services.

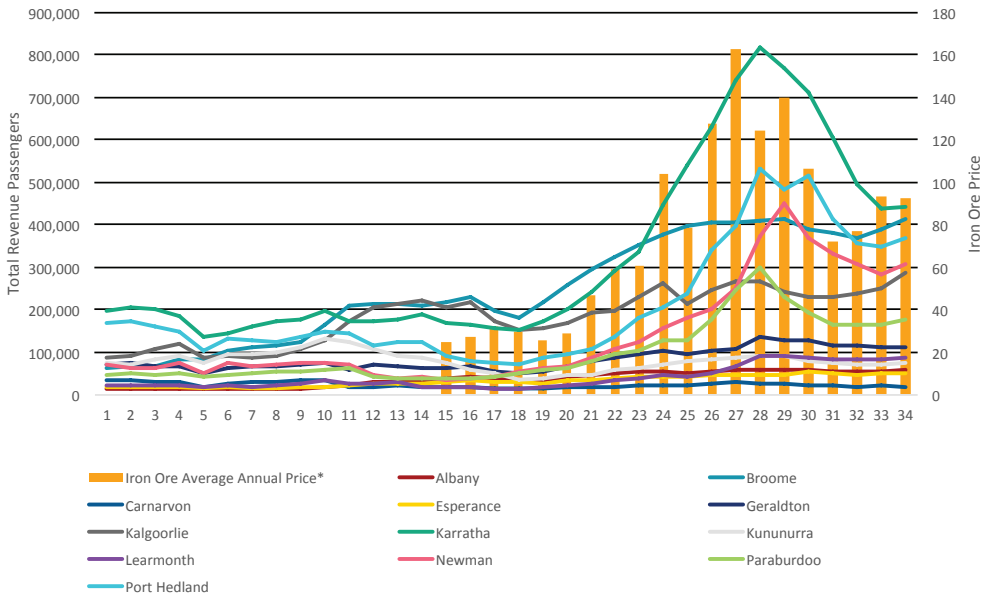
**Figure 23** Regional airports in WA


Source: Bankwest Curtin Economics Centre | The Government of Western Australia Department of Transport (2019) Air services in Western Australia https://www.transport.wa.gov.au/aviation/air-services-in-western-australia.asp

As part of the Regional Airports Development Scheme, $2.6 million in additional funding has been recently announced. These grants fund specific infrastructure projects at regional airports. Such a grant scheme could target specific upgrades that are directly linked to an industry diversification strategy to support new opportunities in the regional development areas.

Figure 24 shows domestic passenger numbers for public transport operations at selected regional airports in WA, with iron ore price superimposed. For airports in WA in major iron ore mining regions, passenger numbers are strongly driven by the iron ore price and associated mining activity.

**Figure 24** WA airports (excluding Perth) domestic passenger numbers 1999 to 2019 and iron ore prices




Note: Regular Public Transport (RPT) operations only. *Historic annual average iron ore price prior to 2011 is the average realised price per tonne received by Western Australian producers. After January 2011, it is the average benchmark 62% CFR China spot price in AUD.

Source: Bankwest Curtin Economics Centre | Authors' calculations using Bureau of Infrastructure, Transport and Regional Economics (2019) Airport traffic data; and WA Department of Mines, Industry Regulation and Safety (2019) 2018 Major Commodities Resources File.

Table 11 shows flight activity for top domestic flight routes to or from Perth. The most connected and utilised routes are from Perth to Melbourne or Sydney with 2.1 million and 1.7 million passengers respectively. Within WA, the most flown route is Karratha to Perth with almost 6,000 annual aircraft trips and 441,000 passengers. There is also significant spare capacity on a number of these routes within WA.

**Table 11** Flight activity on major domestic routes to or from Perth, 2018

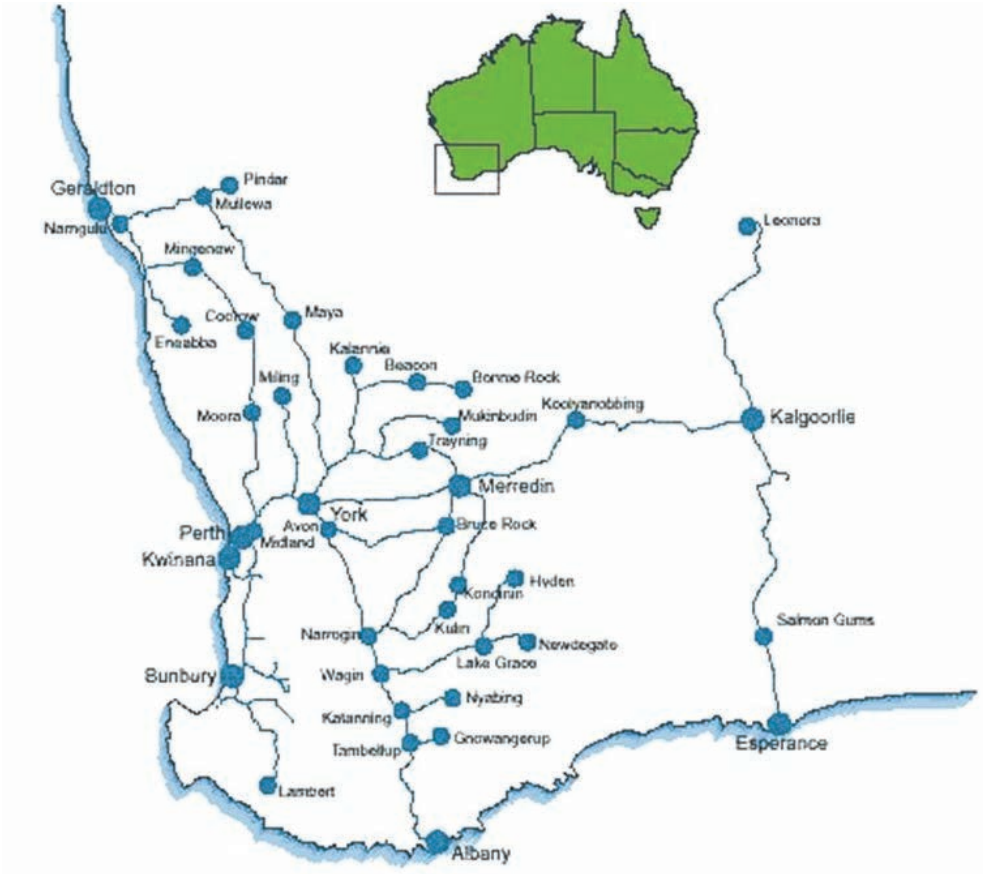
| City pair route | Aircraft trips | Revenue passenger load factor (%) | Revenue passenger kilometers (million) | Available passenger kilometres (million | Revenue passengers ('000) | Seats ('000) |
|---|---|---|---|---|---|---|
| Routes within WA | | | | | | |
| Broome - Perth | 3,759 | 79 | 568 | 717 | 339 | 428 |
| Geraldton - Perth | 2,245 | 51 | 42 | 83 | 113 | 223 |
| Kalgoorlie - Perth | 3,665 | 60 | 150 | 249 | 279 | 464 |
| Karratha - Perth | 5,965 | 65 | 551 | 853 | 441 | 683 |
| Perth - Port Hedland | 4,415 | 67 | 475 | 709 | 362 | 540 |
| Newman - Perth | 4,020 | 57 | 312 | 551 | 306 | 541 |
| Interstate routes | | | | | | |
| Adelaide - Perth | 5,513 | 77 | 1,346 | 1,758 | 635 | 829 |
| Brisbane - Perth | 6,022 | 84 | 3,459 | 4,121 | 957 | 1,140 |
| Darwin - Perth | 1,578 | 73 | 515 | 704 | 194 | 265 |
| Melbourne - Perth | 11,731 | 85 | 5,718 | 6,699 | 2,113 | 2,476 |
| Perth - Sydney | 9,085 | 84 | 5,637 | 6,719 | 1,717 | 2,046 |

Source: Bankwest Curtin Economics Centre | Authors' calculations using Bureau of Infrastructure, Transport and Regional Economics (2019) Australian Domestic Airline Activity – time series; Domestic Totals & Top Routes July 2004-April 2019.

## Road and rail

Rail in the southern half of WA is operated by ARC Infrastructure who hold a lease until 2049 on 5,500 km of track. This network connects Geraldton in the north to Leonora and Kalgoorlie in the east, and south to Esperance, Albany and Bunbury. This southern network is shown in Figure 25. The railway line east from Kalgoorlie is owned by the Commonwealth Government.

**Figure 25** Non-urban rail routes covered by the WA rail access regime




Source: Bankwest Curtin Economics Centre | Image from the Economic Regulation Authority.

There are other rail lines in the State not connected to a wider network. There is a rail line operated by Pilbara Infrastructure Pty Ltd that links Fortescue's mines in the eastern Pilbara to port facilities in Port Hedland. Roy Hill Infrastructure operates a rail line from its mine in the Pilbara to Port Headland. BHP-Billiton and Rio Tinto each also operate railway lines between mines and ports in the Pilbara.

The State road network in WA is shown in Figure 26. While Perth and its surrounding regions are highly interconnected by road over relatively short distances, other distant regions in WA may be more dependent on air transport or coastal shipping.

**Figure 26** State road network in WA


Source: Bankwest Curtin Economics Centre | Image captured from mainroads.wa.gov.au

# Education, training and skills

Education and training are inalienably linked to diversification and innovation, as both a cause and requirement. Diversification means engaging in the production of new products and services, which will typically require workers to acquire new knowledge and new skills. Education, research and development, and innovation are linked together in what has been termed the 'knowledge triangle' and recognised as key drivers of productivity gains and economic growth. Innovation creates new technologies, products and services, and completely new jobs. To embrace these trends, diversification from existing economic structures is needed.

In 2016, 22% of West Australians aged 30 years and over had a university level qualification.

One of Western Australia's comparative advantages is its highly educated population. Based on 2016 Census data, 22 per cent of West Australians aged 30 and over had a university level qualification. A further 28 per cent held trade and technical qualifications ranging from Certificates III or IV to a diploma or advanced diploma. This compares to 15 per cent of the population with a university degree and 24 per cent of the population with trade and technical qualifications ten years earlier, indicating a growing level of education attainment, particularly at the tertiary level. WA's educated workforce is a result of both the domestic education system and Australia's skilled migration system that preferences more educated applicants. The quality of the State's education system is evidenced by education ranking second behind tourism as our major services export.

28% held trade and technical qualifications.

There remain, however, a number challenges to the education and training system in terms of how effectively it can support diversification and innovation in the regions, stemming largely from WA's geography.

## Universities, TAFEs and research institutes

WA universities and research institutes are concentrated in Perth, with the main campus of each of the five WA based universities located in the metropolitan area. A number of satellite campuses are located in regional centres, including Curtin University's WA School of Mines in Kalgoorlie, the University of Notre Dame Australia's campus in Broome, Murdoch University's satellite in Mandurah, Edith Cowan University's satellite campus in Bunbury and the University of Western Australia's Albany Centre.

Linked to the university sector are a number of significant research centres, which are typically established as consortia of universities, industry and government and aligned with areas of innovation identified as strategic priorities for the State These include the recently established Future Batteries Industries Cooperative Research Centre, the Australian Export Grains Innovation Centre, Telethon Kids Institute and the Pawsey Supercomputing Centre which is supporting the Square Kilometre Array project and the International Centre for Radio Astronomy Research. Existing evidence shows that strong links between industry and research and education infrastructure contribute to regional capacity to innovate and diversify. However, the literature also demonstrates the existence of significant network and scale economies in R&D activities. With its vast distances and just the one urban centre of significant scale (Perth), the economies of scale and innovation work against R&D led regional diversification strategies in WA.

Strong links between industry and research and education infrastructure contribute to a regions capacity to innovate and diversify.

Vocational education and training is delivered through VET in schools, State managed tertiary and further education (TAFE) colleges and a wide range of accredited private training providers. Regionally the delivery of TAFE is structured around two metropolitan areas, North Regional TAFE, with 11 campuses or training centres in towns in the Pilbara and Kimberley, Central Regional TAFE, with campuses in 9 towns, and Southern Regional TAFE with 12 campuses across the South West, Greater Southern and Esperance.

Continuing education and lifelong learning are important for innovation and diversification.

## Challenges for the regions

Despite this network of university campuses and VET providers, there remains a strong divide in access to education and educational attainment between those living in the metropolitan area and those in regional and remote Western Australia. Looking at 20 to 24 year olds in 2016, the proportion who had completed secondary school (or the equivalent of Year 12) was 74 per cent for youth living in the metropolitan area, around 55 per cent in inner regional, outer regional and remote WA, and just 43 per cent in very remote WA. This is of particular significance to Aboriginal and Torres Strait Islander West Australians, who disproportionately reside in the more remote parts of the State. Again using 2016 Census data, 76 per cent non-Indigenous 20 to 24 year olds had completed the equivalent of Year 12, compared to 41 per cent of Aboriginal and Torres Strait Islander 20 to 24 year olds. The probability of school completion stood at 48 per cent for Indigenous persons living in Perth, compared to 35 per cent outside the metropolitan area.

In addition to a workforce's educational attainment at a point in time, continuing or lifelong learning is important for innovation and diversification. This may involve upskilling associated with the introduction of new technologies, for example, or acquisition of new sets of skills and qualifications to enable workers to transition into new industries and occupations. In 2016, just over 9 per cent of workers in WA were studying towards a post-school qualification. Again participation declines with remoteness. In Perth, 10 per cent of employed persons were studying towards a post-school qualification, with about one-third of these studying through the TAFE or VET sector. Only around 5 per cent of workers living in the regions were studying towards a qualification, but with over half doing so through the VET system rather than through universities.

## Policy implications

Compared to those in the metropolitan area, young people in the regions have much lower initial human capital formation, and workers are about half as likely to be in further training and education. This adds to the problems of churn associated with WA's boom and bust cycles in the regions. To meet sudden upturns in demand for skilled workers, employers need to rely on fly-in fly-out workforces or other transitory adjustments. Those skills and accumulated experience flow out again when demand falls, with that activity failing to add to the local stock of human capital. A proactive strategy to increase investment in education in the regions, both in the VET sector and expanding regional university campuses, should be aligned with any regional diversification strategy.

Young people in the regions have much lower initial human capital formation.

A proactive strategy to increase investment in education in the regions should be aligned with any regional diversification strategy.

Taking together a number of facts: Indigenous peoples comprise half or more of the population in many of the remote regions of the State; the lower educational attainment of Indigenous West Australians; the general decline in education attainment with remoteness; and the acknowledged potential diversification based on Indigenous tourism and Indigenous cultural knowledge, we believe there is a case for a redoubling of existing efforts to increase Indigenous educational attainment in WA. This should be integrated with and focussed on jobs and sectors Indigenous people most often secure employment. It may require a fundamental shift away from current approaches to education, to ensure delivery is appropriate and conducive to Indigenous persons and with strong input from local Indigenous peoples in the design of courses, their delivery and accreditation.

Efforts to establish research centres and promote R&D activities in the regions need to be based on substantive natural advantages and strong linkages with outside partners and institutions to counter the challenges of scale.

# Regional
## industry analysis

# Introduction

In this chapter, we present the analysis and methodology used to develop a number of new indicators for the feasibility and value of new industries in WA. Our strategy takes into account the capabilities of existing sectors and the relative comparative advantages of WA. Each industry relates to many others because they share similar capabilities and conditions to operate. It is difficult to diversify into unrelated industries that do not require WA's existing capabilities, but it is much easier to diversify into industries that repurpose or build upon WA's existing capabilities. Think of the industrial portfolio as a tree in which branches represent the different sectors or industries of a country. New branches build upon the existing trunk of the economy's capabilities. In particular, some branches lead to many more opportunities, and these may also be a desirable diversification strategy because they expand future diversification opportunities.

The European Union describes the smart specialisation strategy as aiming to diversify regions in order to limit the risk associated with the hyper-specialisation to only few activities[10]. For this report, we use many of the methods related to the smart specialisation framework in order to draw a pathway for the diversification of the WA economy. Our method also requires a sound analysis of regional assets, industry, and technology. The key principle of this approach is that a region should not specialise in any random activity but in industries it is already good at or industries that are closely related. It is also essential the different regions of WA strengthen cooperation and avoid specialisation in the same activities. This will prevent competition between regions that could be otherwise detrimental to their regional development and the State's overall diversification.

10 https://ec.europa.eu/jrc/en/research-topic/smart-specialisation

# Revealed comparative advantage

Comparative advantage is one of the pillars of trade economics: with trade, countries specialise in products in which they have a relative comparative advantage compared to other countries. Comparative advantage indicates the industries that a country or region is good at, such that by directing effort towards those industries the country or region's output and wealth increases.

However, as we have seen in WA, extreme specialisation brings a lot of risk, especially when specialising in primary goods. In response, smart specialisation aims for a limited degree of specialisation by also diversifying countries and regions into areas that relate to their comparative advantages.

Our analysis reveals comparative advantages by comparing the industrial portfolios of regions across Australia. In order to estimate the relative comparative advantage of each region, we analyse employment data by SA3 Australia-wide and by Regional Development Commissions (RDCs) in WA from the 2016 Census. We look at the distribution of employment per industry in the different 'places of work (POW)' and we calculate whether the different RDCs have a higher share of employees in the region in a particular industry relative to the rest of Australia. If this is the case then the region has a revealed comparative advantage at providing employment in that industry relative to the rest of Australia. A revealed comparative advantage (RCA) equal to one means that the region has on average the same number of employees in this particular industry as anywhere else in Australia. Likewise, an RCA equal to two implies twice as many employees work on the specific industry relative to the Australian average. The higher the magnitude of the RCA, the larger the comparative advantage of the region.

The RCA indicator indicates how prolific an industry in a given region is. This ultimately tell us what a region is good at right now. The advantage of the RCA is that it could signal the maturity or the stage of development of an industry for a given region.

**Table 12 Higher relative comparative advantage by SA3 regions, Australia, 2016**

| Wine and other alcoholic beverage manufacturing | | Iron ore | |
|---|---|---|---|
| Barossa (SA) | 109.9 | Pilbara (WA) | 102.8 |
| Griffith - Murrumbidgee (NSW) | 27.0 | West Coast (Tas) | 15.5 |
| Lower North (SA) | 25.9 | Gascoyne (WA) | 13.2 |
| Murray and Mallee (SA) | 17.2 | Mid West (WA) | 7.9 |
| Onkaparinga (SA) | 16.4 | Eyre Peninsula and South West (SA) | 7.1 |
| Wangaratta - Benalla (VIC) | 15.1 | Outback - North and East (SA) | 5.6 |
| Barwon - West (VIC) | 14.1 | Wheat belt (WA) | 3.9 |
| Lower Hunter (NSW) | 13.8 | Perth (WA) | 3.3 |
| Lower Murray (NSW) | 13.4 | Goldfield-Esperance (WA) | 2.6 |
| Maryborough - Pyrenees (VIC) | 12.9 | Christmas Island | 2.1 |
| South East Coast (TAS) | 11.5 | Kimberly (WA) | 2.1 |
| Adelaide Hills (SA) | 11.0 | Burnie - Ulverstone (TAS) | 1.8 |
| Burnside (SA) | 9.9 | Outback - North (QLD) | 1.4 |
| Limestone Coast (SA) | 9.9 | Peel (WA) | 1.2 |
| Mildura (VIC) | 9.4 | East Arnhem (NT) | 1.2 |
| Fleurieu - Kangaroo Island (SA) | 9.0 | Broken Hill and Far West (NSW) | 1.0 |
| Yarra Ranges (VIC) | 8.9 | Daly - Tiwi - West Arnhem (NT) | 0.8 |
| Gold Coast Hinterland (QLD) | 8.6 | Brisbane Inner (QLD) | 0.5 |
| South West (WA) | 8.5 | South West (WA) | 0.4 |

Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016

# Revealed relatedness

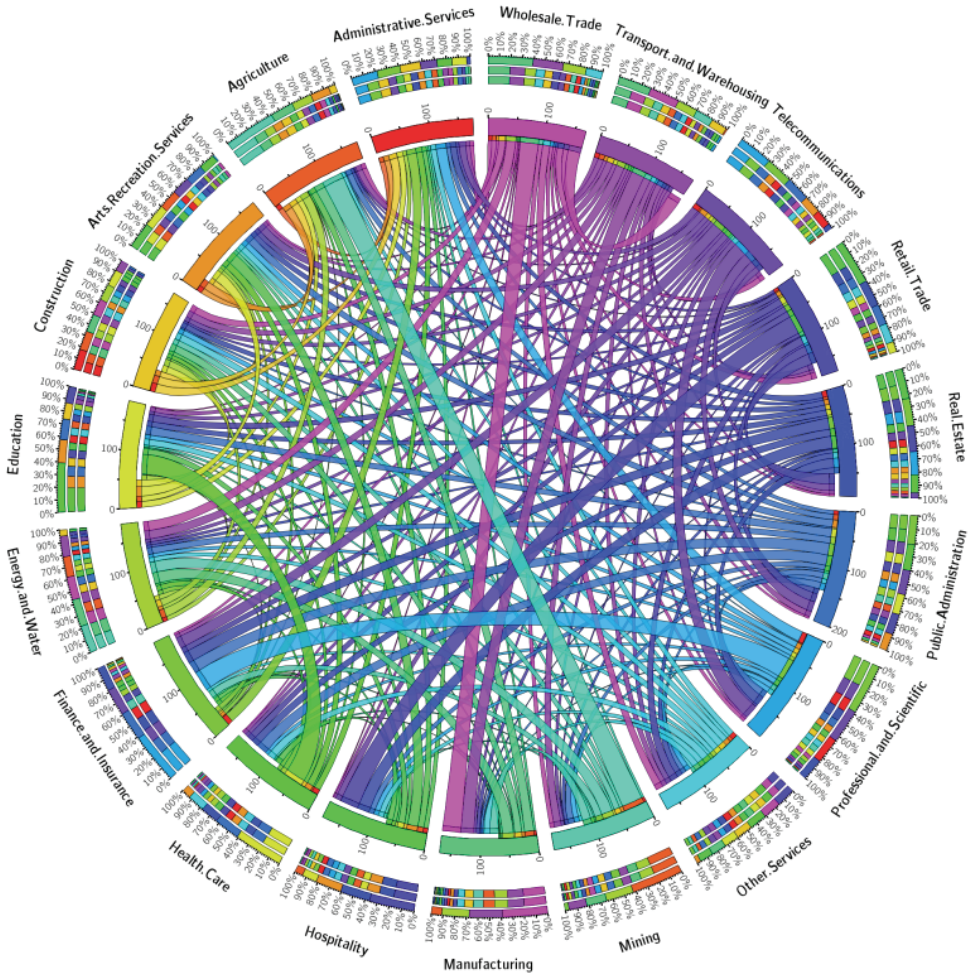
The set up of any new industry involves risk, but risk can be minimised by building on WA's existing capabilities. Western Australia needs to promote new industries that would bring sustained growth while reducing risks related to industry creation. To do so, we need to know what opportunities are most feasible given the current capabilities of our regions. The concept of relatedness helps us to do that by revealing the closest related industries or technologies to existing comparative advantages. Relatedness shows how closely related two industries are to each other. For instance, an industry such as sheep farming relates to both cereal and meat production as sheep eat grains and are primarily intended for meat consumption. Similarly, sheep farming is related to clothing manufacturing and organic fertilizers as wool is used for clothes and sheep manure for crop fertilizers. Our relatedness index reveals all the different connections between industries and the strength of these relationships.

One clear way that reveals how industries relate is to look at how often these sectors appear together. In Australia, for instance, we would like to know how often sheep farming capabilities are located close to factories manufacturing textiles. If we often observe these types of capabilities together across Australia then it is very likely that these industries relate in some way. We use the number of employees per industry at the class level from the 2016 Census. The Census contains detailed information that tells us where people work. We are able to track down the people's location of employment to the destination zone level (DNZ), which can be as little as one block for some parts of Perth CBD[11]. This information allows us to investigate how often a pair of industries appear together by destination zone. If two industries appear together more often than the average pair of industries in Australia, that means they are more likely to be related. Across thousands of destination zones in Australia, this reveals an accurate index that indicates industry relatedness. The strength of the link is given by the magnitude of this relatedness index.

The estimation of the relatedness index for the broader 19 industrial classification divisions is presented in Figure 27. This chord diagram represents how closely related industries are to each other, the thicker the chord between two industries, the stronger the relationship. Since we have very broad categories in this Figure, we can see that all of the divisions are slightly related to each other. However, there are some relationships that stand out, Manufacturing is highly related to Transportation, postal and warehousing as well as to Wholesale trade and Electricity, gas, water and waste services. A complex industry such as the Financial and insurance services is mostly related to Professional, scientific and technical services but also to Information media and telecommunications, Public administration and to a lesser extent Real estate services. Information media and telecommunications is itself related to Finance and insurance services and to Professional, scientific and technical services. Our analysis also reveal a strong relationship between the Health care sector and Education and between Retail trade and Hospitality.

11 Please refer to ABS map for DNZ division. https://itt.abs.gov.au/itt/r.jsp?ABSMaps

**Figure 27** Industry relatedness, Australia, 2016




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016

Since Figure 27 only looks at the broader industry classification, we observe that the relatedness index can induce some noisy relationships as evidenced by the relatedness between the Agriculture and Mining industry in our chord diagram. This is explained by the fact that most of the regions with mining industries are also agricultural regions, so these two industries are often found together. However, this link disappears once we look at a more granular classification of industries. In our case, we have used the industry classification at the class level and therefore we estimate the relatedness index for the 717 industries at the 9,137 destination zones.

Now that we know what the regions are good at, and what industries are most related to those. It would be enough for the WA diversification strategy to target those industries that relate to existing sectors but are not yet established in the region. However, as explained above, the industries that are more likely to be successful,

relate to more existing local industries. In order to account for this, we use the concept of relatedness density. The relatedness density index (RD) of a given industry in each region looks first at all the industries related to it and then assesses how many of the related industries already exist in the region. Relatedness density uses the relatedness of each industry and examines it in the region, indicating how feasible it would be for a region to diversify in this industry. This decreases risk and lowers the cost of diversification by targeting industries that are based on the existing capabilities of the region.

To illustrate this concept, imagine you would like to learn a new language like Portuguese. Since Portuguese is a Latin language, Portuguese is related to French, Spanish, Italian and Romanian (the other most spoken Latin languages[12]). Therefore, it would be easier to learn Portuguese if you already speak French and it would be even easier if you already speak both French and Spanish. The more Latin languages you already know, the easier it gets to learn Portuguese. In this example, there are four languages related to Portuguese, if you speak two, the relatedness index would be 0.5 or 50 per cent, if you speak three, it would be 0.75 or 75 per cent. The relatedness density gives us the feasibility of learning Portuguese conditional to existing languages capabilities, in this case, we have 50 per cent or 75 per cent of the capabilities required to learn Portuguese. This concept applies to industry diversification: the relatedness density index tells us how easy it is for a region to diversify into a new industry given the portfolio of industries already present within the region.

12 For simplification purposes, we are excluding Catalan, Occitan and Aromanian of this list even though they are of Latin descent.

# Economic complexity

The last principle that we shed light on is what economists call economic complexity (EC). A complex commodity is one that needs a lot of knowledge and networks to be produced. For instance, artificial intelligence requires the combined knowledge of automation, robotics, engineers, programmers, IT, statistics and linguists among many others while banana production only requires the skills of farmers and agronomists. At the same time, a complex economy is one that produces many complex goods and hence enjoys a higher level of embedded knowledge. Complex economies are able to produce more complex and diverse goods as their stock of knowledge is high, this will, in turn, increase growth and generate wealth. The scrabble analogy put forward by the Harvard team at the Center of International Development[13] is probably the best way to look at complexity. A scrabble player with a large number of letters is more likely to produce more complex and longer words than a player with only a few letters. Economic complexity enables sustainable growth, this is why the level of economic complexity and the level of wealth are highly correlated. This correlation is so strong that EC is better at forecasting future growth than education or governance levels for instance. Therefore, complexity is necessary if we would aim to achieve a successful diversification strategy.

In order to build a complexity index, we need to identify how complex each industry is. We could imagine that a product that is extremely complex is only produced by few regions as not many places in the world have enough knowledge stock to build complex goods. Only a few places in the world in the world are able to build artificial intelligence but a lot of places can produce bananas, provided an advantageous climate. Therefore, we can identify complex goods by their ubiquitousness: the rarer the commodity (the less countries/regions produce it), the more complex the commodity is. Nevertheless, there are some exceptions to the rule, goods produced by a few but that are not complex, these are known as rare raw materials.

13 Atlas of Economic complexity, Center of International Development, Harvard University.

Greater Sydney and Greater Melbourne are the regions with the highest strategic advantages of Australia.

In WA, the strategic advantage of most regions is relatively low. Greater Perth, Peel and the South West are the regions with the highest strategic gain.

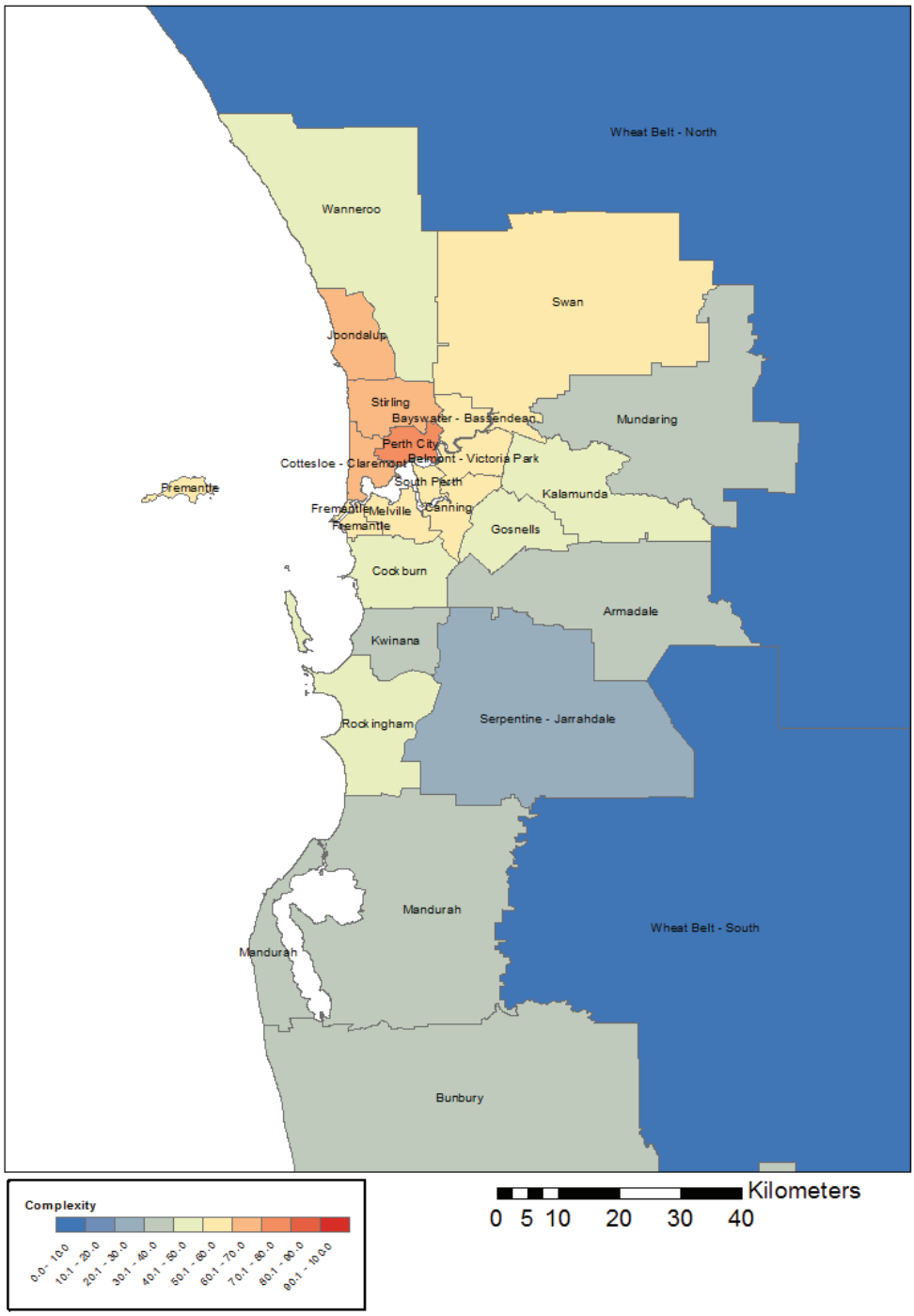
There are some natural resources such as oil, gas, gold, diamonds, etc., that are only exploited in a few places on Earth, not because they are complex, but because we can only find them in a handful of regions. To account for this phenomena, we look not only at the ubiquity of an industry but also at the overall complexity of the region. Complex goods can only be produced by complex economies, this is why complex goods are only exported by a few countries but this handful of countries tend to export a wide variety of products. On the other hand, a country who only exports raw materials such as petrol tends to only export petrol. Therefore, there is a link between the complexity of an economy, the number of goods and services produced by a region and the complexity of these products. Hence, the economic complexity of a sector can only be assessed by taking into account both the ubiquity of an industry as well as the economic complexity of the region where the industry sits. By doing so, we will revise the ranking of rare non-complex sectors so that they are not mistakenly classified as complex industries.

Consequently, the methodology that we use in this report uses employment data by SA3 nationally and by Regional Development Commissions in WA to create a measure of economic complexity (ECI) that incorporates an industry ubiquity index (UI). Once we calculate the ubiquity index, we can calculate the economic complexity measure and once we calculate the ECI we can revise our UI (as complex goods are only the product of complex regions) and with it calculate once again the ECI and so on and so forth. This iteration process is repeated multiple times in order to refine our economic complexity measure.

Regions can improve their local economic complexity, which may help to increase long-run growth, by targeting industries that rate higher on the ECI index. We refer to this as the 'strategic gain' of diversifying into those industries. However, when we will refer to the existing capabilities and industries already present in a region we will call it 'strategic advantage'.

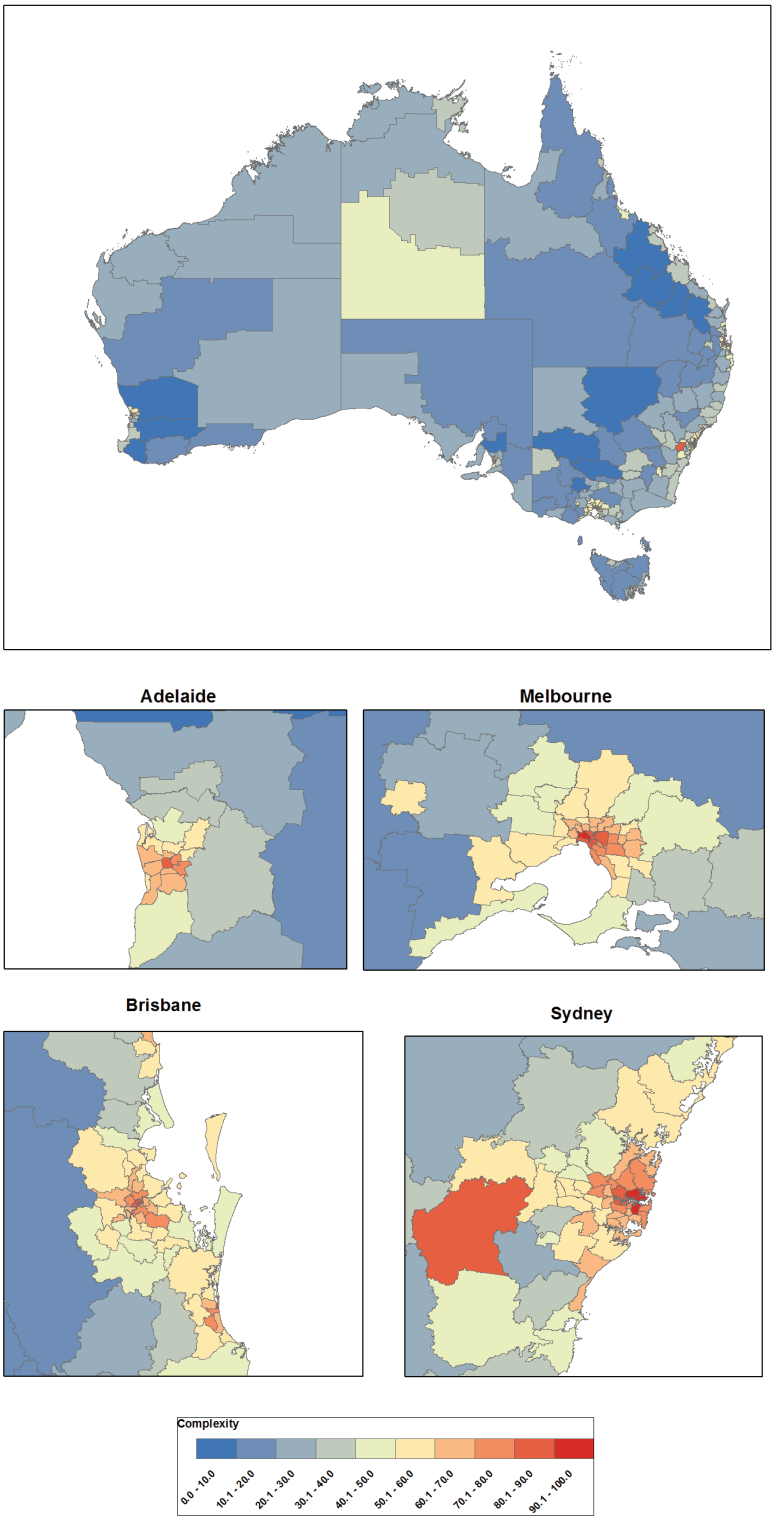
The strategic advantage of Australian regions and Greater Perth is showed in Figure 28 and Figure 29 respectively. As expected, Greater Sydney and Greater Melbourne are the regions with the highest strategic advantages of Australia, followed by Adelaide and Brisbane. The strategic advantage is higher in the inner cities and in industrial zones and lower in regional Australia and remote regions. In the case of WA, we observe that the strategic advantage of most regions is relatively low, especially in the Wheatbelt and the SA3 region of Manjimup. Greater Perth, Peel and the South West are the regions with the highest strategic gain of the WA economy, with Perth CBD having the highest strategic advantage in all the State. The western suburbs located north of the river have also a high strategic advantage relative to the rest of Australia as well as some industrial zones such as the Rockingham industry zone and the Cockburn area which includes the Cockburn Commercial Park, the Phoenix Business Park, the Australian Marine Complex and Latitude 32 industrial hub.

**Figure 28** Strategic advantage of Greater Perth, 2016




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

**Figure 29** Strategic advantage of Australian regions, 2016




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Regional embeddedness

The previous concepts of relative comparative advantage, relatedness and complexity will help us identify potential industries that would not only easily settle in a region, but it would also expand the complexity of the region's economy. However, it is important to develop industries that would remain in the region and would not move elsewhere once the industry is developed. In other words, we should focus on helping industries that are likely to stay in the region even when the public subsidies are removed. This is what we call regional embeddedness; an industry highly embedded in the region's economy is less likely to move elsewhere as it needs the regions, capabilities to operate. Embeddedness can come from multiple reasons, the most obvious is that an industry uses a particular resource in the region; this is the case of the mining and timber industries for example. The second most important reason is that, an industry requires the capabilities of other industries already present in the region; this is the case for the Silicon Valley where most of the high-tech companies need the skills and technology of other related high-tech companies is to achieve higher growth. The embeddedness of an industry would determine how likely a company to remain in the region in the long-run. In our case, we will examine the regional embeddedness by calculating the relative relatedness density of each industry per region. A company with a high embeddedness to the region implies that there is a high number of related industries in the territory and therefore it would have no incentive to delocalise to another region. If we take the example of the sheep cattle industry, a farmer in close proximity to food processing plants, textile factories, fertilizer processing and cereal farms is very likely to remain in the region relative to a farmer isolated from these industries. The regional embeddedness of this sheep farmer is significantly high.

# Evaluation

In order to evaluate the variety of opportunities in different regions across the range of metrics, these indicators are used to judge each opportunity on a regional and industry basis. Each indicator is awarded a score from zero to four with zero being the lowest score and four the highest. The smart specialisation approach sustains support for existing strengths and addresses the issues faced by the new activities being targeted. As we focus on these potential new industries for diversification, we only target industries that are not significant strengths already[14].

**Table 13** Evaluation of indicators

| Main group | Index sub-categories | Questions we aim to address |
|---|---|---|
| Regional viability | Feasibility index | Does the region have the capabilities to develop this industry? |
| Industry perspectives | Strategic gain<br>Ubiquity | Would this industry increase the region capabilities to create more jobs?<br>How unique is this industry in Australia? |
| Long run regional perspectives | Potential embeddedness<br>Potential job growth | What are the chances the industry would remain in the region?<br>What is the potential job creation of this industry within the region? |

Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

The feasibility indicator is built on the relatedness analysis because a new industry is more likely to become established in a region with many existing related industries. Therefore relatedness is a suitable proxy for existing regional capabilities that make it feasible for an industry to become established. The feasibility indicator draws from the relatedness density concept explained above and is evaluated with a local score from zero to five based on how well placed the region is to enter the industry.

The second indicator is the strategic gain indicator that represents the opportunities for the region to improve and expand its capabilities based on the economic complexity.

Third, we include a ubiquity index that accounts for the uniqueness of each industry. More unique industries are less competitive and are likely to present opportunities for local regions to differentiate their economic activity from the rest of Australia.

The fourth indicator aims to evaluate the potential of embeddedness of each industry to the region's market and actual capabilities. This indicator is calculated as the relative relatedness density of an industry, such that if the magnitude of relatedness density is uniquely local, then we expect the industry is more likely to develop a number of local networks and supply chains, such that it remains in the region in the long term.

14 Industries with an RCA smaller than two in each region, which implies less than double the capacity of the Australian average.

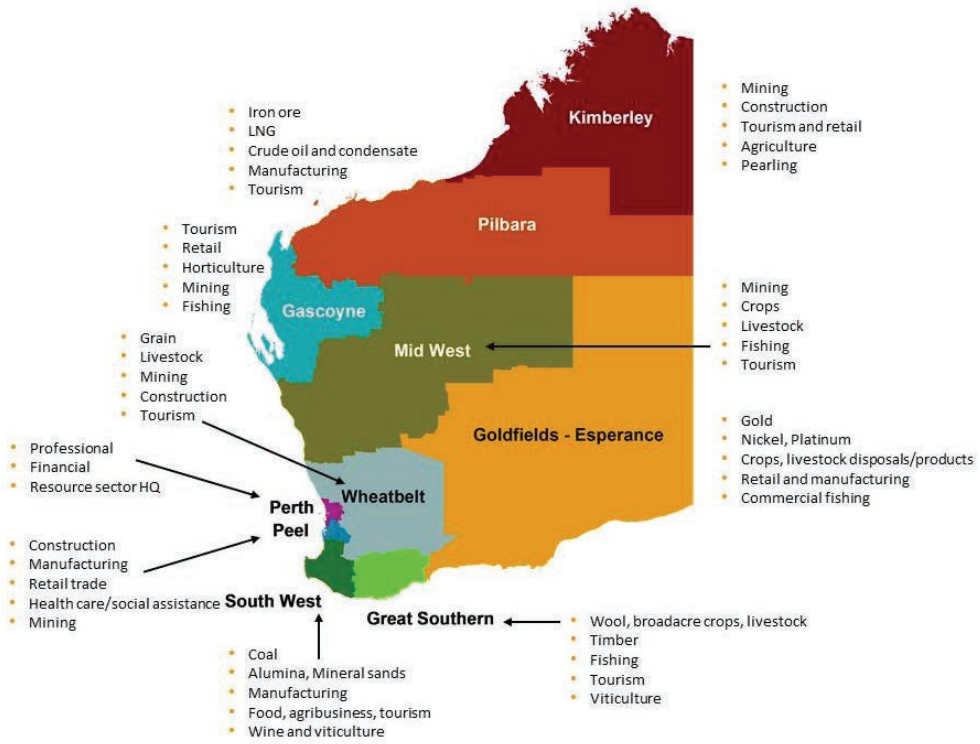
# Regional profiles

# WA regions

Western Australia is not only a vast state – in terms of area, it is by far the largest in Australia – but its regions vary in terms of industry, communities, population density, climate and natural resource endowments. On this basis, a successful diversification strategy for WA takes into account these regional characteristics as well as the local mix of capabilities and the range of capabilities across the State. Regions tend to specialise in different industries. The local resource endowment has determined some of these specialisations while other industrial specialisations have developed around local expertise. A successful industry policy for WA takes account of these regional specialisations and expertise, as well as the industry portfolios of the rest of the State.

There are nine regions in Western Australia as delineated by the Regional Development Commissions Act (1993). Figure 30 shows their boundaries and predominant industries. In this section we treat Perth as the tenth region of WA and identify new opportunities for each region to diversify into a wider range of industries by building on local capabilities.

**Figure 30** The regions of WA and principal industries




Note: Principal industry identification from the Regional Development Commissions.
Source: Bankwest Curtin Economics Centre | BCEC, Regional Development Commissions.

# Industries

This section reviews key industry themes that appear as recommended options for diversification in multiple regions across Western Australia.

## Defence industry in Northern Australia and Western Australia

The defence industry comes through in this report as a strong option for diversification in the Mid West, Gascoyne and Kimberley regions. The Federal Government's Northern Australia[15] agenda also seeks to invest in the defence industry as a key part of both growing and diversifying these regional economies. The agenda currently includes a $930 million investment to upgrade facilities and infrastructure in northern Western Australia[16]. While the Defence industry already has a presence in these regions and is targeted for investment by the Federal Government, this report finds that it is likely to be feasible to expand its presence in these regional economies by building on many other existing local industries, helping to diversify these regional economies.

Similarly, there is a strong defence presence in Perth. WA is currently campaigning for full-cycle docking of submarines to be shifted to Henderson in the Perth region. Submarine maintenance by civilians is included in the shipbuilding and repair services industry class, in which Perth already has a strong comparative advantage. As a result, this isn't a 'new' industry for the purpose of the industry opportunities identified in this report, because it is already one of Perth's existing strengths. But it is indeed an important industry for Perth to maintain as an existing strength under a smart specialisation policy approach.

## Scientific testing and analysis services

Scientific testing and analysis services appears as an option for diversification in many regions. Professional services are often difficult to enter in regional areas because these businesses often benefit from access to a significant skilled labour market in large cities. However, industry classes in both the Agriculture and Mining industry divisions are typically tied to regional resource endowments and these industries both require and are related to Scientific testing and analysis services. As a result this industry emerges as a key option for diversification into professional services in regional economies. Once established, scientific testing and analysis services is likely to become highly embedded in local economies, because a large portion of their customers are local. But there are also opportunities to export these services to other regions and internationally. Given WA's prominence in industries related to scientific testing, the industry is likely to scale up relatively easily.

15 Northern Australia' spans northern regions from Shark Bay in the Gascoyne on the WA coast, through parts of the Mid West region, all of the NT, and across to Gladstone in Queensland. For more details on the relevant regions, see Office of Northern Australia (2019) Developing Northern Australia Map https://www.industry.gov.au/sites/default/files/2019-07/developing-northern-australia-map.pdf

16 Office of Northern Australia, 2015 and Department of Defence, 2016

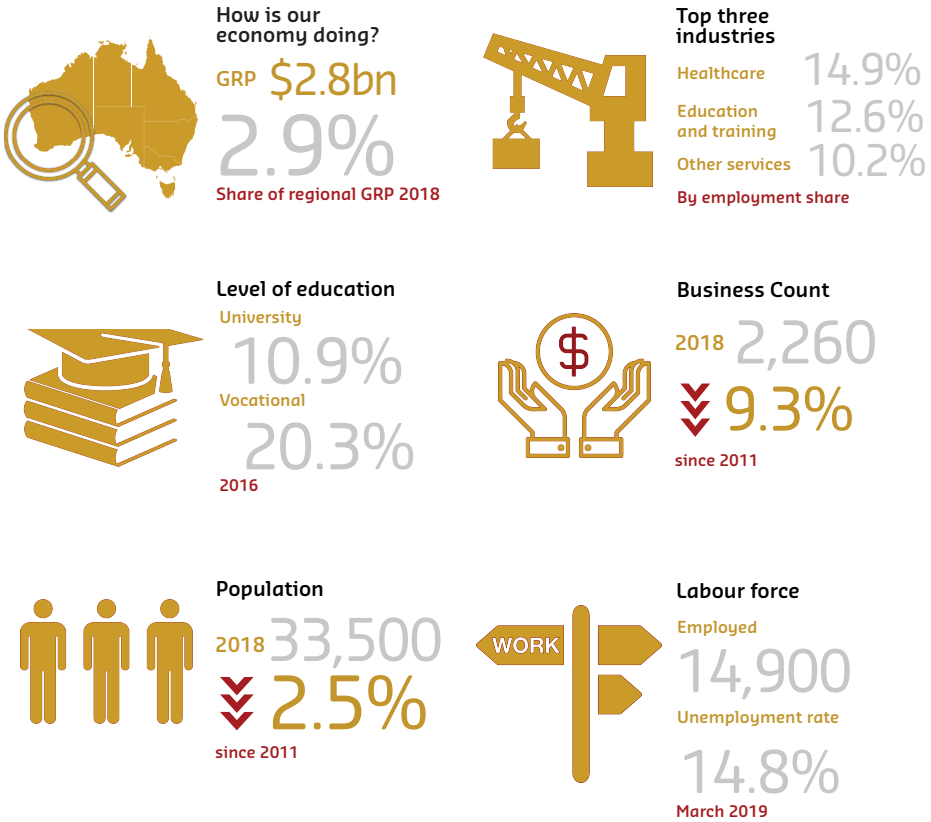
# Kimberley

## Background

The Kimberley is the northern-most region of Western Australia. While it is isolated from Perth, it is also connected with the Northern Territory. As a result of its tropical climate and local resource endowment, the Kimberley economy is remarkably diversified including tourism, local services, agriculture, forestry, mining and oil and gas. This diversity for a regional economy offers a number of branching points to expand development in the region into new industries.

Despite the wealth of opportunities in the Kimberley, unemployment levels are substantially higher than in the rest of Western Australia particularly in smaller or more isolated communities. The Kimberley's Regional Blueprint aspires for the Kimberley to achieve labour market outcomes that reflect the norms across WA and Australia. A regional economic development strategy would transform the Kimberley and help to meet this aspiration.

**Figure 31** A snapshot of the Kimberley




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Kimberley

Table 14 describes the ten largest employing industries in the Kimberley. These industries represent the largest scale industries providing local jobs. Broome is already well known as a holiday destination due to its attractive climate. This is reflected in the high share of employment in the Accommodation industry. Other areas for which the Kimberley is well known also appear as industries of high employment including beef and Mining.

Industries in which the Kimberley is uniquely capable are those that generate a greater share of employment in the Kimberley than would be expected based on population alone. These are industries in which the Kimberley can be considered an expert, but may not represent the largest employing industries or industries with the highest value.

**Table 14** Top ten industry classes in the Kimberley

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Accommodation | 821 | 6.0% | 57.9 | 5.2 |
| Hospitals except psychiatric hospitals | 716 | 5.2% | 58.7 | 1.2 |
| Secondary education | 472 | 3.4% | 37.9 | 1.9 |
| Primary education | 466 | 3.4% | 18.7 | 1.4 |
| Combined primary and secondary education | 372 | 2.7% | 26.9 | 2.2 |
| Other interest group services nec | 364 | 2.6% | 20.1 | 8.8 |
| Local government administration | 341 | 2.5% | (a) | 1.7 |
| Other non metallic mineral mining and quarrying | 334 | 2.4% | 74.1 | 90 |
| Beef cattle farming specialised | 316 | 2.3% | 20.1 | 5.1 |
| Supermarket and grocery stores | 311 | 2.3% | 17.7 | 0.9 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Other non metallic mineral mining and quarrying | 90.1 | 74.1 | 334 | 2.4% |
| Forestry | 17.2 | 9.5 | 66 | 0.5% |
| Offshore longline and rack aquaculture | 16.4 | 2.7 | 31 | 0.2% |
| Scenic and sightseeing transport | 10.2 | 20.1 | 80 | 0.6% |
| Other interest group services nec | 8.8 | 20.1 | 364 | 2.6% |
| Nature reserves and conservation parks operation | 8.0 | 7.1 | 101 | 0.7% |
| Accommodation | 5.2 | 57.9 | 821 | 6.0% |
| Beef cattle farming specialised | 5.1 | 20.1 | 316 | 2.3% |
| Air and space transport | 4.1 | 55.4 | 258 | 1.9% |
| Adult community and other education nec | 3.6 | 7.4 | 183 | 1.3% |

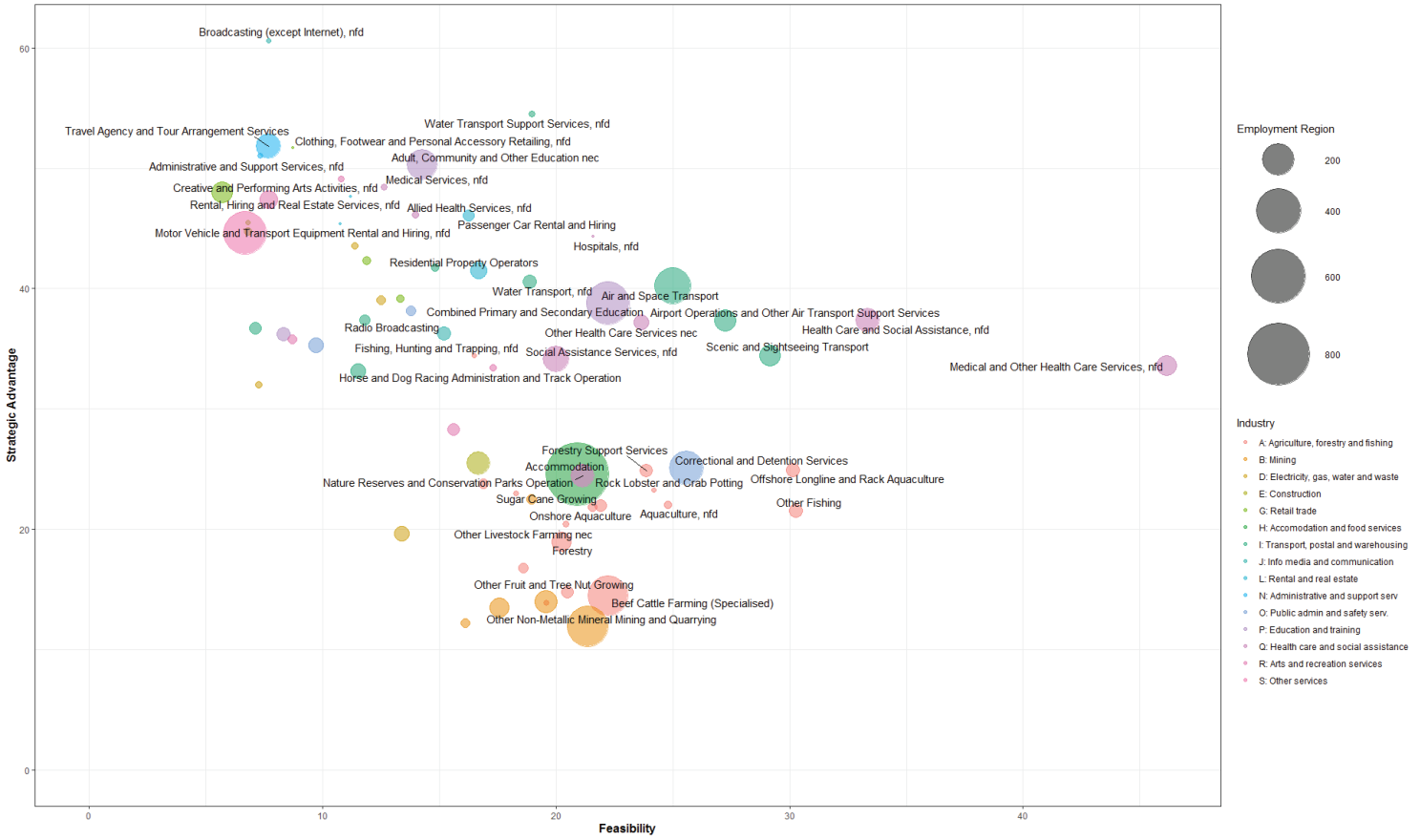
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Some industries may be very small, but if the Kimberley is uniquely represented in that industry then it is also one of the region's strengths. Table 14 lists the industries in which the Kimberley has a comparative advantage, measured according to the size of the industry class in employment terms. This represents the industries where the Kimberley can be considered an expert, because it has a substantially larger share of employment in that particular industry class than elsewhere.

Figure 32 describes the Kimberley's existing industry strengths in terms of our analysis on the feasibility and strategic advantage of industries in the Kimberley. These are all industries in which the Kimberley has twice the expected number of employees compared to all of Australia. The size of each bubble represents the number of local jobs in that industry class.

The main industry strengths and larger employers in the Kimberley tend to be industries that are considered more feasible. Notably, the chart is more scattered for the Kimberley than for other regions, indicating the greater degree of existing diversification already in the Kimberley. Some industries, particularly some services, are less reliant on the feasibility index for their presence in the Kimberley.

**Figure 32** Feasibility, strategic advantage and size of local industry strengths in the Kimberley




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Kimberley region?

The smart specialisation approach to diversifying the Kimberley aims to sustain what the Kimberley is already good at, as shown above, and diversify into industries that build on these expertise. There are many opportunities for diversification in the Kimberley because the Kimberley is already relatively diversified. The Kimberley's expertise in mining, agriculture and tourism offer a wide range of new opportunities.

If the Kimberley is not yet strong in a particular industry, the feasibility measure indicates the likelihood of the Kimberley diversifying into that industry. Similarly, the strategic gain index implies industries that would be strategically useful to boost incomes, resilience, long-term growth and diversify the Kimberley economy. The range of measures show the potential new or expansion opportunities in the Kimberley that should be investigated further.

Table 15 describes possible new opportunities for diversification in the Kimberley that rank well on other indicators. The data reveals a number of interesting potential opportunities for the Kimberley across a range of industries. Strategic gains that build on the existing industries are more difficult in the Kimberley and other regional economies. As a result, it is not advisable for the Kimberley to attempt to enter highly strategic industries that are unlikely to be successful. Instead, the industries targeted here predominantly focus on their feasibility, potential embeddedness and low levels of ubiquity across Australia. These are industries that are not found widely across Australia and in which the Kimberley possesses a uniquely high feasibility indicator, suggesting that they are more likely to remain in the Kimberley if they are able to become established.

**Table 15** Possible new or expansion opportunities for the Kimberley

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Defence | 3 | 3 | 3 | 4 | 4 | 1,075 | N/A |
| Hydro electricity generation | 3 | 2 | 4 | 3 | 4 | 65 | 41.5 |
| Offshore caged aquaculture | 3 | 2 | 4 | 3 | 4 | 130 | 11.3 |
| Water passenger transport | 3 | 3 | 3 | 3 | 3 | 45 | 6.6 |
| Copper ore mining | 3 | 1 | 4 | 3 | 4 | 390 | 401.5 |
| Other transport nec | 2 | 2 | 4 | 2 | 4 | 75 | 18.3 |
| Silver lead zinc ore mining | 3 | 1 | 4 | 3 | 4 | 165 | 168.2 |
| Oil and gas extraction | 2 | 1 | 4 | 2 | 4 | 190 | 378.5 |
| Fishing nfd | 4 | 1 | 1 | 3 | 2 | 15 | 1.9 |
| Scientific testing and analysis services | 2 | 3 | 1 | 2 | 3 | 40 | 4.4 |
| Other metal ore mining | 2 | 1 | 3 | 2 | 4 | 160 | 166.6 |
| Other heavy and civil engineering construction | 2 | 2 | 1 | 2 | 4 | 120 | 13.6 |
| Boatbuilding and repair services | 3 | 2 | 1 | 3 | 2 | 15 | 1.9 |
| Agriculture nfd | 3 | 1 | 0 | 2 | 4 | 125 | 7.8 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Specialist medical services | 4 | 4 | 1 | 4 | 4 |
| Pathology and diagnostic imaging services | 4 | 3 | 1 | 4 | 4 |
| Psychiatric hospitals | 3 | 4 | 2 | 3 | 3 |
| Special school education | 4 | 3 | 0 | 3 | 4 |
| State government administration | 2 | 3 | 2 | 2 | 4 |
| Fire protection and other emergency services | 4 | 3 | 1 | 2 | 3 |
| Justice | 2 | 3 | 3 | 2 | 3 |
| Residential care services nfd | 3 | 3 | 1 | 2 | 1 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

- The Federal government could consider a *defence* role for the Kimberley region because potential embeddedness indicates a uniquely high degree of related industries already in the region. This could imply that a defence capability in the Kimberley region could be more cost effective than elsewhere by building on existing industries. An increased defence capability in the Kimberley would also create significant employment opportunities.
- *Prawn fishing, offshore caged aquaculture* and *fishing* all build on the Kimberley's existing strengths in other *fishing* and *offshore longline and rack aquaculture* and *aquaculture*, already indicated as three of the Kimberley's existing strengths.
- The Kimberley is already strongly represented in the aquaculture industry and existing *offshore caged aquaculture* is likely to already be included in aquaculture, which is also already a strength in the Kimberley. These businesses are also in other types of aquaculture, so do not fit neatly into the lower class level of offshore caged aquaculture. Nonetheless, the analysis also indicates the potential for stand-alone offshore caged aquaculture businesses in the Kimberley region.
- *Fishing not further defined* refers to fishing businesses that do not fit neatly into a specific industry class. Instead this refers to businesses that are diversified beyond a single industry class. It indicates that existing fishing businesses in the Kimberley have an opportunity to diversify into a wider range of species and other industries related to their primary fishing activities. Such diversified businesses create additional value and jobs beyond employment in standard industry classes. Fishing businesses may consider diversifying into multiple species, fisheries or levels within the supply chain.
- *Hydro-electricity generation* already appears in the Kimberley at Lake Argyle, but the Census employment data did not reveal any local employment in this industry class so these facilities may be managed remotely or the employment data may reflect the current electricity system in the Kimberley where Horizon Power is fully integrated across generation, networks and retail. If there is potential to exploit further hydro resources for electricity generation in the Kimberley, these could also provide local employment opportunities.
- *Scientific testing and analysis services* offers the Kimberley a professional service industry that is closely related to the Kimberley's existing strengths in Agriculture and Mining. Such a highly-skilled industry is important to attract or retain highly skilled workers in the Kimberley and also offers further diversification opportunities in the future. This industry, if established, is also likely to remain in the region because a significant share of its customers are local and tied to regional resource endowments. Similarly, a strong local scientific testing industry may help to reduce costs for local agricultural and mining businesses. Expansion of the scientific testing industry also offers an opportunity to expand international service sector exports from the Kimberley and WA.

Figure 33 shows the strategic gain and feasibility indexes for industries in which the Kimberley is not currently strong[17]. The size of the bubbles now indicates nationwide employment in those industries. Many industry classes are difficult for the Kimberley to enter because none of the related industries appear in the Kimberley. These are the industries represented by bubbles on the far left of the chart.

17 Indicated by a Comparative Advantage of 2 or less.

**Figure 33** Feasibility, strategic gain and relative industry employment opportunities in the Kimberley


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Pilbara

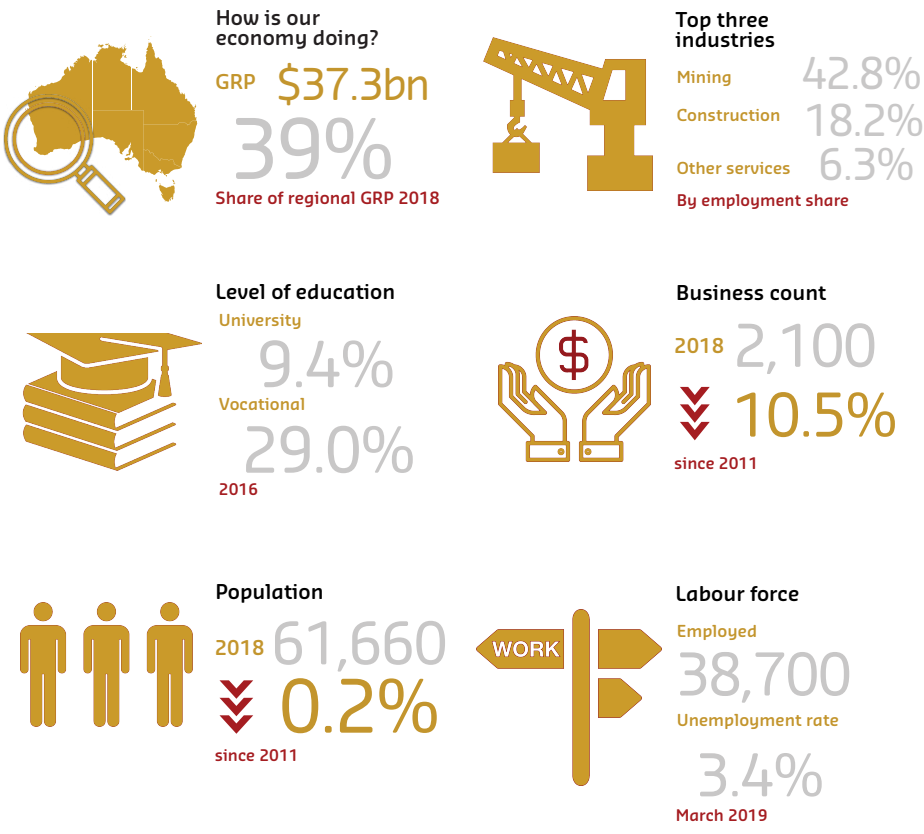
## Background

Stretching from Onslow on the north-west coast right to the Northern Territory border, the Pilbara covers over 500,000 square kilometres. The region is the backbone of the State's mining industry and home to the State's liquefied natural gas sector through the North West Shelf and Pluto ventures. The Pilbara has a resident population of around 60,000 persons, or just 2.5 per cent of the State population, but it is estimated that around a further 50,000 people work in the region on a fly-in-fly-out basis. One-third of all WA mining jobs are based in the Pilbara, and mining accounts for around 40 per cent of employment in the region.

The export sector is supported by several ports located around Port Hedland and Karratha. Those coastal towns are also the main population centres, with around 15,000 residents each. A number of smaller iron ore mining towns are located inland, including Newman, Tom Price, Paraburdoo and the notoriously hot Marble Bar.

The major occupational categories are Technician and trades workers, and Machinery operators and drivers, and the population is disproportionately male (57%). The unemployment rate is typically several percentage points below the overall rate for WA. In the 2016 Census, 15.7 per cent of the population identified as being of Aboriginal or Torres Strait Islander descent.

**Figure 34** A snapshot of the Pilbara




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Pilbara

Table 16 presents the largest employing industries in the Pilbara ranked by employment. As foreshadowed, Mining is the Pilbara's largest employing industry. Iron ore is the key commodity, and accounted for an estimated 97 per cent by value of mining output in the region in 2018, or $63 billion, representing more than half of Australia's iron ore production. Output of off-shore petroleum was valued at $34 billion in 2018 (WA Department of Mines, 2018). Industries associated with the mining and the oil and gas sectors round out the top 10 industries for the region, both in absolute terms and in terms of comparative strengths.

The appearance of primary school education as the ninth largest employer at the 4-digit industry class level is the one exception. This can be attributed to the relatively young population, with the Pilbara having a higher proportion of persons aged 5 to 9 (7.9%) compared to the rest of WA (6.6%), plus a relatively dispersed population. Employment in engineering construction, design and consulting, and in catering services and road freight transport can be directly linked to their roles as inputs to the mining and oil and gas extraction sectors.

**Table 16** Top ten industry classes in the Pilbara

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Iron ore mining | 18,892 | 33.0% | 19,390.2 | 102.8 |
| Other heavy and civil engineering construction | 4,063 | 7.1% | 458.4 | 15.6 |
| Oil and gas extraction | 2,716 | 4.7% | 5,393.2 | 26.4 |
| Engineering design and engineering consulting services | 1,992 | 3.5% | 219.7 | 4.5 |
| Gold ore mining | 1,327 | 2.3% | 1,362.0 | 11.9 |
| Catering services | 1,296 | 2.3% | 48.4 | 6.7 |
| Construction nfd | 1,139 | 2.0% | (a) | 5.3 |
| Road freight transport | 1,088 | 1.9% | 98.0 | 2 |
| Primary education | 799 | 1.4% | 32.1 | 0.6 |
| Other mining support services | 768 | 1.3% | 61.3 | 15.1 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Iron ore mining | 102.8 | 19,390.2 | 18,892 | 33.0% |
| Metal ore mining nfd | 38.1 | 314.1 | 306 | 0.5% |
| Other non metallic mineral mining and quarrying | 33.3 | 114.0 | 514 | 0.9% |
| Oil and gas extraction | 26.4 | 5,393.2 | 2,716 | 4.7% |
| Heavy and civil engineering construction nfd | 16.2 | 49.1 | 293 | 0.5% |
| Other heavy and civil engineering construction | 15.6 | 458.4 | 4,063 | 7.1% |
| Other mining support services | 15.1 | 61.3 | 768 | 1.3% |
| Hire of construction machinery with operator | 14.3 | 28.0 | 298 | 0.5% |
| Gold ore mining | 11.9 | 1,362.0 | 1,327 | 2.3% |
| Industrial gas manufacturing | 11.3 | 35.3 | 172 | 0.3% |

Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016

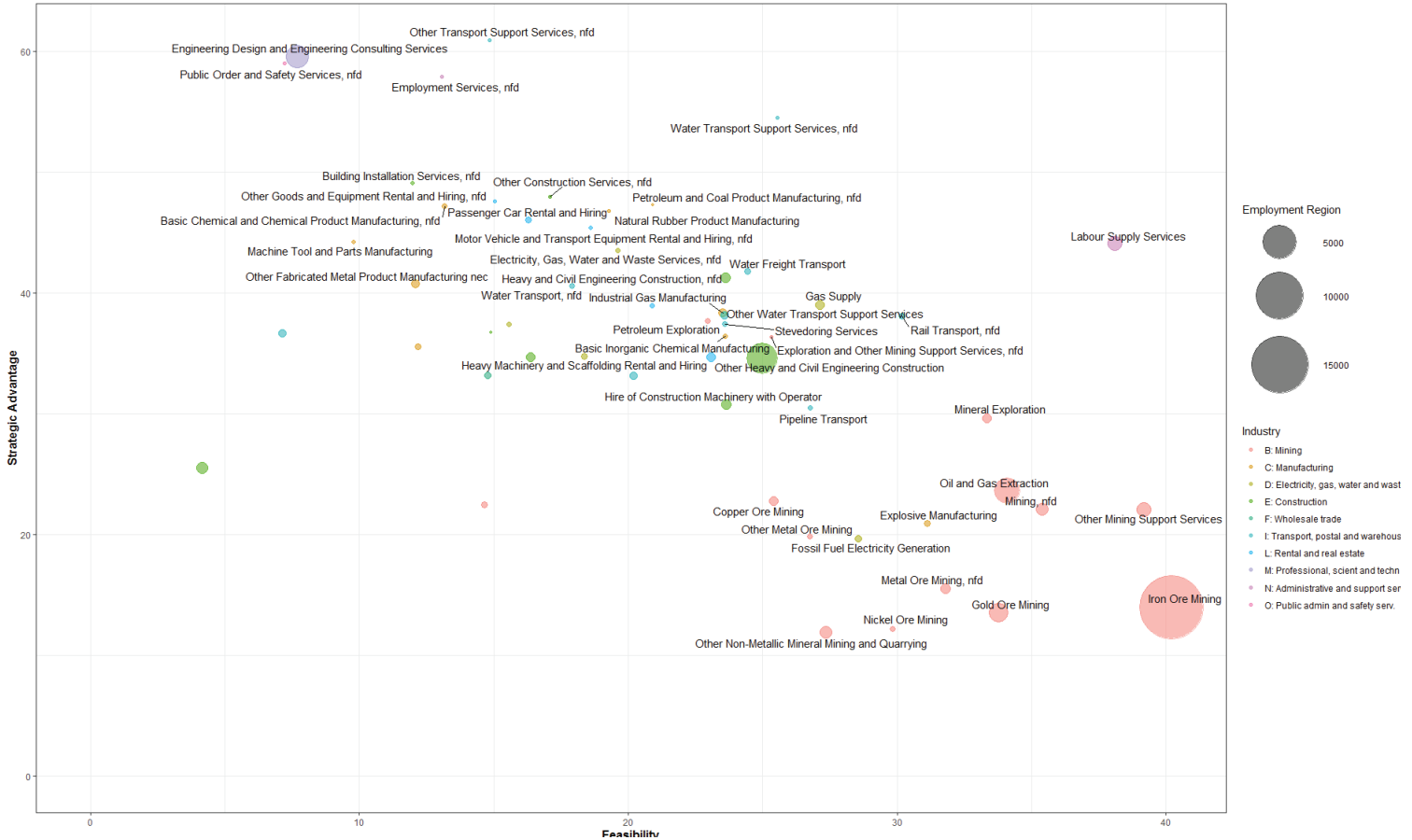
In the case of the Pilbara, there is little to be gained from differentiating between the main industries in terms of absolute employment (Table 16a, panel) and those in terms of relative employment (Table 16b, panel). The activities the Pilbara undertakes in spades, so to speak, are also the activities of comparative specialisation. Relative to total employment, the RCA measure for *iron ore mining* reveals there are over 100 times as many workers in that industry in the Pilbara when compared to the proportion for Australia as a whole. All other areas of comparative advantage similarly relate to employment in the extraction of other minerals/oil and gas, mining support activities, or associated construction and contracting.

This makes the Pilbara one of the least diversified regional economies in Australia. Though dwarfed by the mining and oil and gas sectors, the Pilbara does have substantive agricultural and tourism sectors. Agriculture is predominantly in the form of cattle stations. Pilbara contains the acclaimed Karijini National Park and a number of coastal attractions. The Pilbara Development Commission has identified aquaculture, renewable energy and tourism based upon Indigenous culture as industries with strong growth potential.

The existing industry strengths of the Pilbara are shown graphically in Figure 35 using our concepts of feasibility and strategic advantage. The bubbles represent industries with a comparative advantage of greater than 2, indicating the share of employment in the Pilbara is at least twice that industry's share nationally. The size of the bubbles are proportionate to the number of persons employed in that industry in the Pilbara. Mining dominates the bubbles to the lower right of the chart, indicating a cluster of industries that are commonly co-located, but generally these demonstrate low complexity. There is evidence of existing strengths in labour supply services, which demonstrates both high feasibility and strategic advantage. Various categories of *engineering design and construction* and of *equipment and vehicle hire services* and *transport support services* also feature.

In terms of Manufacturing, strengths are apparent in some sectors aligned with mining activities as both inputs and initial downstream processing, albeit each are quite small industries as measured by the number of persons employed. Manufacturing activities serving as inputs to mining include *explosives manufacturing* and *machine tools and parts*. Downstream manufacturing includes *industrial gas manufacturing, fabricated metal manufacturing, petroleum and coal product manufacturing* and *rubber manufacturing*. Basic chemical manufacturing is likely to be undertaken as both an input to the mining and oil and gas sectors, and as initial processing of outputs.

**Figure 35** Feasibility, strategic advantage and size of local industry strengths in the Pilbara




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Pilbara?

Based on a weighting of the criteria of feasibility, strategic gain, uniqueness, embeddedness and potential for employment growth, Table 17 lists the fifteen industries revealed by our analysis as having the greatest potential for diversification within the Pilbara. These are industries offering relatively high potential value added and employment and which are strongly related to other industries within the region, but which the Pilbara does not currently specialise in.

Five of the potential industries identified relate to Transport and related services: *air and space transport; freight forwarding services; rail freight transport; other transport support services not elsewhere classified (NEC); and other transport NEC*. The industry classification of air and space transport includes air freight and passenger transport and aircraft charter and lease with crew. Several of these transport related industries are ranked quite highly on uniqueness and embeddedness, indicating that once established they are industries that are unlikely to shift out of the region because they generally do not feature prominently in many other regions, and are closely related to existing activities of the Pilbara.

Other diversification opportunities revealed by the analysis are, predictably, closely aligned with mining, including *other potential minerals to be mined, downstream processing* and the support activities of *scientific testing and analysis services* and *exploration*. A wider set of potential diversification opportunities for the Pilbara can be seen in Table 17, which shows the strategic gain and feasibility indices for industries that are not currently a major focus within the Pilbara (a relative comparative advantage of less than 2).

**Table 17 Possible new or expansion opportunities for the Pilbara**

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Air and space transport | 3 | 3 | 4 | 3 | 4 | 1,470 | 315.3 |
| Scientific testing and analysis services | 4 | 3 | 1 | 4 | 1 | 25 | 3.0 |
| Copper silver lead and zinc smelting and refining | 2 | 2 | 4 | 1 | 4 | 530 | 135.1 |
| On selling electricity & electricity market operation | 1 | 4 | 4 | 2 | 3 | 145 | 92.5 |
| Petroleum refining & petroleum fuel manufacturing | 2 | 3 | 4 | 2 | 3 | 95 | 39.4 |
| Freight forwarding services | 1 | 3 | 3 | 1 | 4 | 295 | 53.9 |
| Rail freight transport | 2 | 2 | 2 | 3 | 4 | 220 | 44.5 |
| Silver lead zinc ore mining | 2 | 1 | 4 | 2 | 4 | 555 | 570.3 |
| Cement and lime manufacturing | 2 | 2 | 3 | 2 | 3 | 125 | 20.6 |
| Other transport support services nec | 1 | 3 | 2 | 1 | 3 | 160 | 29.0 |
| Other transport nec | 1 | 2 | 4 | 1 | 4 | 255 | 64.5 |
| Other specialised industrial machinery wholesaling | 1 | 3 | 2 | 1 | 2 | 70 | 9.3 |
| Other basic non ferrous metal manufacturing | 2 | 2 | 4 | 1 | 2 | 50 | 12.1 |
| Exploration nfd | 1 | 2 | 4 | 2 | 2 | 50 | 42.3 |
| Mining and construction machinery manufacturing | 1 | 2 | 2 | 2 | 2 | 65 | 8.7 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Foreign government representation | 1 | 4 | 4 | 1 | 3 |
| Domestic government representation | 1 | 4 | 4 | 1 | 1 |
| Corporate head office management services | 1 | 4 | 4 | 1 | 3 |
| Airport operations and other air support services | 3 | 2 | 3 | 3 | 4 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Taking these results together, we expand on some of the key potential opportunities arising from the analysis:

- The extensive use of FIFO workforce, offshore oil and gas operations and the Pilbara's vast distances all contribute to the *air and space transport* sector's economic embeddedness and feasibility in the region. Further specialisation into this industry would require expanding servicing activities outside of the region, such as through charter services, and into other industries, possible new tourism products based around air transport. There may also be some alignment with the State Government's investment in developing a space industry for WA, which builds on natural advantages of sparsely populated and geologically stable areas and capabilities of automated remote operations that are increasingly being used in the mining industry.

- *Scientific testing and analysis services* employs a highly qualified workforce and offers significant strategic gain as a complex industry, and hence likely to exhibit solid future growth in value added growth (ranked a 3 of a maximum possible 4). In the Pilbara, this industry is highly feasible and embedded (ranked 4 on both criteria), due to extensive assay and other testing associated with exploration and mining. As a diversification strategy, the critical question is whether there are prospects for the sector beyond simply supporting the local mining and oil and gas sectors. To assess this potential requires investment in networks between local industry players and strategic education and R&D partners, and to explore both 'horizontal' and 'vertical' value chains for opportunities for applications of the industry's technology and knowledge, including internationally. If wider market opportunities can be identified, there are synergies with WA's relatively highly educated population and significant recent R&D investment, including the State Government's investments in the WA Chemistry Centre. However, a very substantial specialisation in this industry would be required to translate into significant increases in employment.

- *On selling electricity and electricity market operations* is identified as offering potential for strategic gain, uniqueness and potential job growth. This can build on the abundance of natural gas but also the need for power generation for remote resource developments and communities which are not connected to a major grid.

- The analysis suggests the key opportunity for downstream processing is further *petroleum refining and petroleum fuel manufacturing*. With the Burrup Strategic Industrial Area already identified as a hub for downstream processing and hosting operations by Woodside, BP, Shell and others, there is strong potential to promote innovation and R&D networks based around this industry and further cement local comparative advantage.

- *Silver-lead-zinc ore mining* and *copper, silver, lead and zinc smelting and refining* are both identified as potential industries for diversification. While iron ore dominates mining output, the Pilbara does produce significant quantities of gold, silver and copper.

The bubble plot in Figure 36 shows there are a range of service industries offering high strategic gain (complexity), such as Public administration, Finance, superannuation and insurance, but generally these display low feasibility due to the lack of co-located industries that are typically present in more diverse regional economies. The appearance of a number of other Mining industries as highly feasible indicates these often coincide geographically with the minerals currently mined in the Pilbara, but exploitable deposits may not have actually been discovered in the region.

**Figure 36** Feasibility, strategic gain and relative industry employment opportunities in the Pilbara


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

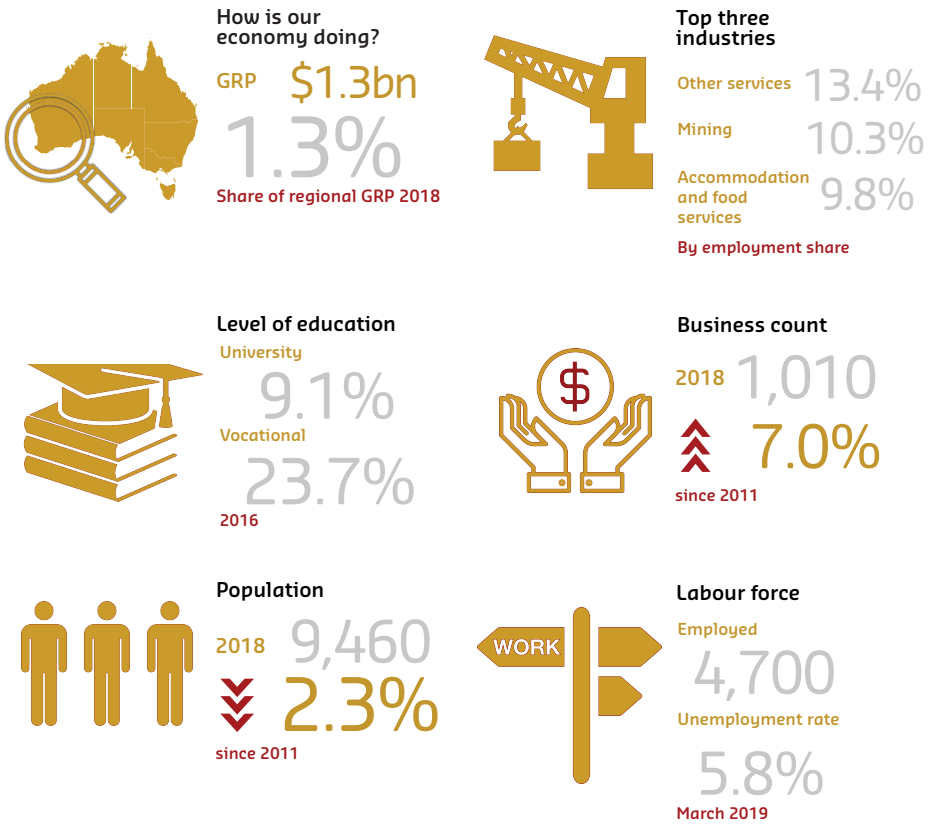
# Gascoyne

## Background

Comprised of the Shires of Carnarvon, Exmouth, Shark Bay and Upper Gascoyne, the Gascoyne region spans the coast from just north of Kalbarri to Exmouth on the North West Cape, and stretches around 500 kilometres inland to the desert regions. With a population of just under 10,000, the economy is actually quite diversified. At the level of the nineteen major industry categories, Agriculture, forestry and fishing was the largest employing industry in 2016 with just 11.3 per cent of total employment in the region, and a further six industries had shares greater than 7 per cent. The Gascoyne is a significant tourist destination, with attractions including the internationally renowned Ningaloo Reef and Shark Bay World Heritage Area. The bulk of the region's population live on the coast. The town of Carnarvon is the main population centre, with an estimated resident population of 4,400 in 2016, and around twice that of the next largest town, Exmouth.

At 13.5 per cent, the region has a relatively high proportion of Aboriginal and Torres Strait Islander persons compared to WA overall. This is particularly so in the sparsely populated and inland Upper Gascoyne, where Indigenous persons represent over half the population. As of the 2016 Census, the Gascoyne had a very similarly participation rate to the State overall, but a significantly lower unemployment rate at 5.8 per cent compared to 7.8 per cent for WA.

**Figure 37** A snapshot of the Gascoyne




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Gascoyne

At the more detailed industry class level, *accommodation* is the Gascoyne's main industry, with a workforce of 327 persons as recorded by the 2016 Census. This is attributable to the strong tourism sector. The Gascoyne has around 337,400 visitors and 2.5 million visitor-nights per annum, with international visitors accounting for around 15 per cent of visitors and 18 per cent of visitor nights[18]. Strong employment in *supermarkets and grocery stores* and *cafes and restaurants* can also be attributable to demand generated by tourism. The agricultural sector is well diversified, with *vegetables growing outdoors* the seven largest industry class by employment, despite Agriculture overall being the largest employer at the major industry level. *Other non-metallic mineral mining and quarrying* is the second largest employer by industry class, and WA Department of Mines figures show $75 million of salt was mined in the region in 2018. This is also the industry in which the region has the strongest comparative advantage. *Iron ore mining* features as the third largest employer and ninth in terms of comparative advantage, but much of this will be related to mining operations outside of the region.

The comparative advantage measures show that the Gascoyne has a relatively high share of employment in *prawn fishing* and, to a lesser extent, *seafood processing*, although both these industries are quite small employers in terms of the absolute number of employees (19 and 23 workers in 2016, respectively). Supporting the tourism sector, *scenic and sightseeing transport* is another area of comparative advantage, along with *accommodation*.

**Table 18 Top ten industry classes in the Gascoyne**

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Accommodation | 327 | 7.5% | 23.1 | 6.5 |
| Other non metallic mineral mining and quarrying | 281 | 6.5% | 62.3 | 240.6 |
| Iron ore mining | 184 | 4.2% | 188.9 | 13.2 |
| Supermarket and grocery stores | 173 | 4.0% | 9.8 | 1.5 |
| Local government administration | 171 | 3.9% | (a) | 2.7 |
| Hospitals except psychiatric hospitals | 157 | 3.6% | 12.9 | 0.9 |
| Vegetable growing outdoors | 117 | 2.7% | (a) | 18.1 |
| Primary education | 108 | 2.5% | 4.3 | 1 |
| Cafes and restaurants | 90 | 2.1% | 3.4 | 0.8 |
| Engineering design and engineering consulting services | 87 | 2.0% | 9.6 | 2.6 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Other non metallic mineral mining and quarrying | 240.6 | 62.3 | 281 | 6.5% |
| Prawn fishing | 183.2 | 2.0 | 19 | 0.4% |
| Seafood processing | 35.8 | 2.2 | 23 | 0.5% |
| Scenic and sightseeing transport | 25.6 | 15.9 | 63 | 1.5% |
| Fruit and tree nut growing nfd | 20.3 | 2.9 | 45 | 1.0% |
| Vegetable growing outdoors | 18.1 | 7.4 | 117 | 2.7% |
| Other fruit and tree nut growing | 17.6 | 3.1 | 49 | 1.1% |
| Nature reserves and conservation parks operation | 17.1 | 4.8 | 68 | 1.6% |
| Iron ore mining | 13.2 | 188.9 | 184 | 4.2% |
| Accommodation | 6.5 | 23.1 | 327 | 7.5% |

Note: (a) Estimated GVA cannot be calculated for government administration, justice and defence.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

18 Based on estimates averaged for 2016, 2017 and 2018 from *The Gascoyne 2018 Visitor Fact Sheet*, Tourism WA.

The Gascoyne Regional Development Blueprint identifies tourism, food production, resource project support, and lifestyle and natural amenity as areas of strategic regional comparative advantage. Carnarvon's potential as a resource project logistics and support hub is focussed around the town's location midway between Perth and the mining intensive Pilbara region. Table 18 (panel b) indicates that current areas of strength in Agriculture include various products classified as *fruit and tree nut growing*, along with *vegetable growing*. Along with *prawn fishing and seafood processing*, the comparative advantage measures are consistent with the recognition of food production as a strategic strength, reinforced by export opportunities to nearby Asian consumers. Although the region has relatively low rainfall, there is significant irrigated horticulture along the Gascoyne River, with major crops by value including tomatoes, vegetables, table grapes and bananas[19].

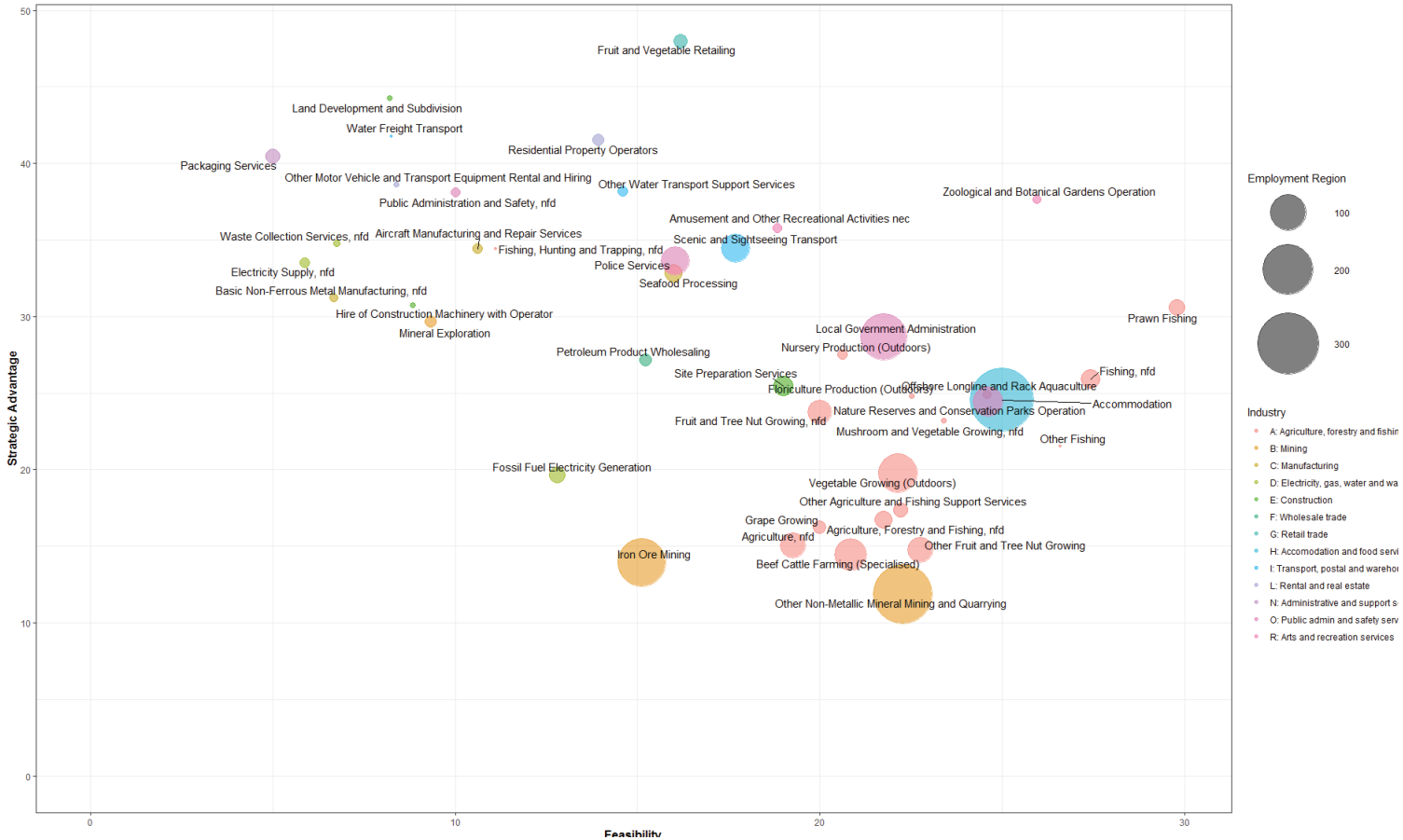
Scale is an issue for the Gascoyne region. The benefits of innovation networks are known to display significant agglomeration economies. With the Gascoyne's small population and limited employment in the industries of existing strengths, it would be difficult for activities based on innovation and research and development to gain critical mass in the region. Accordingly, areas of comparative advantage build primarily on local natural resources and amenity. Further exploration of existing strengths and opportunity for the Gascoyne can be seen in the bubble plot in Figure 38. There is a clear cluster toward the bottom right quadrant of the graph with an array of activities relating to Agriculture, forestry and fishing. These include several categories of *fruit and nut growing; beef cattle farming (specialised), grape growing, other agriculture and fishing support services*, several categories of *agriculture and fishing 'not further defined' (nfd), prawn fishing, vegetable growing (outdoors), mushroom and vegetable growing nfd*, and *nursery growing (outdoors)*. Clearly there is strong feasibility within this cluster because of the high degree of relatedness of these industries, however, they score relatively low in terms of strategic advantage. The lack of complexity of these industries points to low potential for future value growth. The exceptions are *prawn fishing* and *nursery growing (outdoors)*, with strategic advantage scores close to 0.3.

Industry strengths associated with tourism are evident in the light blue bubbles representing *accommodation* and *scenic and sightseeing transport*, with the larger scale evident for accommodation. While very small in scale, *zoological and botanical gardens operations*, has high relatedness with other regional industries and relatively high strategic advantage. This also falls under the broader industry category of Arts and recreational services. *Amusement and other recreational activities nec*, falling in the same broad industry, is assessed as having a similar level of strategic advantage, but not the same degree of relatedness.

The existing industry that stands out for its high degree of complexity is *fruit and vegetable retailing*, and this scores quite well on the feasibility scale. The region is conspicuous in its almost complete absence of any comparative strengths in Manufacturing. *Seafood processing*, in which the Gascoyne has a strong revealed comparative advantage, does qualify as a Manufacturing industry. The only other Manufacturing sector to appear as a relative strength is *basic non-ferrous metal manufacturing nfd*.

19 WA Department of Agriculture and Food (no date), Investment opportunities in Western Australia's northern horticultural industry.

**Figure 38** Feasibility, strategic advantage and size of local industry strengths in the Gascoyne




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Gascoyne?

To explore opportunities for diversification in the Gascoyne we restrict attention to those industries in which the Gascoyne has a revealed comparative advantage of less than 2. By construction, this omits tourism-related and agricultural industries which are already relative strengths for the Gascoyne. The aim is to identify industries aligned with existing strengths of the Gascoyne and offering strategic advantage in terms of growth potential, but that the region does not currently specialise in.

Table 19 reports the top fifteen industries for potential expansion based on a weighting of our five criteria for assessing diversification opportunity. All the identified industries offer good potential for employment growth. The three industries offering the highest potential increase in gross value added by 2025 from diversification are, in order, *gold ore mining, oil and gas extraction* and *silver-lead-zinc ore mining*. The existence of associated industries (feasibility and embeddedness) in the region and their uniqueness contributes to their selection in the top fifteen. However, diversification into these activities requires the presence of economically viable deposits of those natural resources, which is not known to be the case.

Many of the opportunities receive a 'red light' rating of zero on the uniqueness dimension and also have low embeddedness. These are industries which are very commonly found in other regions, such as *real estate services, other automotive repair and maintenance* and a number of retailing industries. Because these industries are commonly found throughout all regions of Australia, there is no strong reason to believe that any additional activity supported in those industries would not simply shift elsewhere if they are not built on some form of local advantage. The low embeddedness rating suggests they are generally not particularly reliant on other local industry sectors as suppliers or markets.

**Table 19** Possible new or expansion opportunities for the Gascoyne

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Defence | 3 | 3 | 3 | 4 | 4 | 300 | N/A |
| Gold ore mining | 3 | 1 | 3 | 3 | 4 | 125 | 129.2 |
| Air and space transport | 3 | 3 | 4 | 4 | 4 | 105 | 22.3 |
| Real estate services | 2 | 3 | 0 | 1 | 4 | 60 | 12.4 |
| Oil and gas extraction | 2 | 1 | 4 | 3 | 4 | 55 | 106.8 |
| Silver lead zinc ore mining | 3 | 1 | 4 | 3 | 4 | 50 | 53.6 |
| Non residential building construction | 1 | 4 | 1 | 0 | 4 | 45 | 6.5 |
| Airport operations & other air support services | 2 | 2 | 3 | 3 | 4 | 35 | 6.2 |
| Pharmaceutical cosmetic & toiletry goods retailing | 1 | 3 | 0 | 0 | 4 | 35 | 1.8 |
| Other store based retailing nec | 2 | 2 | 0 | 1 | 4 | 25 | 1.3 |
| Hydro electricity generation | 3 | 2 | 4 | 3 | 4 | 20 | 13.2 |
| Concreting services | 2 | 2 | 0 | 0 | 4 | 20 | 1.8 |
| Other automotive repair and maintenance | 1 | 2 | 0 | 1 | 4 | 20 | 1.5 |
| Other specialised food retailing | 1 | 3 | 0 | 0 | 3 | 15 | 0.7 |
| Fresh meat fish and poultry retailing | 3 | 2 | 0 | 1 | 3 | 10 | 0.5 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Correctional and detention services | 2 | 1 | 2 | 4 | 4 |
| Ambulance services | 3 | 2 | 0 | 3 | 3 |
| Gardening services | 3 | 2 | 0 | 1 | 3 |
| Religious services | 1 | 3 | 0 | 0 | 4 |
| Veterinary services | 2 | 2 | 0 | 0 | 3 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

- The Gascoyne region could consider positioning itself to take on a larger role in *defence* associated activities. The region contains the RAAF air base co-located with Exmouth's Learmonth airport and the Harold E Holt Naval Communication Station just north of Exmouth on the North West Cape. Currently there are no RAAF units based in Learmonth and the communication facility is operated by a civilian contractor rather than naval personnel, so diversification potential is likely be contingent on a substantial Government-led defence initiative in the local area. However, with the WA Government recently identifying defence related industries as a priority with the release of the *Defence and Defence Industries Strategic Plan* and rising political tensions in the region, opportunities may arise for an elevated role in the Gascoyne.

- *Air and space transpor*t and *airport operations and other air transport support services* appear as further potential industries for diversification. For *air and space transport* there are other supporting industries in the region (strong embeddedness), industries typically co-located (feasibility) and potential for strategic gain. The scorecard is not quite as positive for *air transport support services*, but synergies will exist between the Learmonth airport and tourism, both for transport and scenic flights. The region is also serviced by the smaller Carnarvon airport and charter operators. Expanded activity in these industries aligns with the potential identified in the Regional Blueprint for the Gascoyne to act as a resource project logistics and support hub servicing mining operations in the Pilbara.

- Several retail activities feature among the list of diversification opportunities, primarily on the basis of potential job growth and strategic gain. There may be the potential for niche retail opportunities targeted at the tourist dollar and based on marketing and branding of the region's produce and natural amenity.

- *Hydro electricity generation* has high ratings for potential jobs growth and uniqueness (both the maximum rating of 4), and for embeddedness and feasibility (both a rating of 3). The latter two indicators show the Gascoyne has industries that are often co-located with hydro electricity generation and found within the same value-chains. This likely arises due to activities along the Gascoyne River that coincide with hydro electricity operators in other regions of the country. We are not aware of such hydro-electric prospects for the Gascoyne region, although the Gascoyne Regional Blueprint does acknowledge a lack of investment in renewable energy in the region as one of its major challenges.

Figure 39 shows the strategic gain and feasibility indices for industries in which the Gascoyne does not currently display a comparative advantage[20]. There is an obvious absence of potential industries of scale lying in the top right quadrant and representing both high strategic gain and high feasibility. There is cluster of industries based on various Agriculture, forestry and fishing activities with high feasibility but low strategic gain. *Pubs, taverns and bars* stands out as one large potential industry that would typically be found alongside the Gascoyne's areas of strength, namely agriculture, seafood and tourism. As with retail, there may be niche opportunities in this industry based on stronger local marketing and branding. A diversification strategy for the region should consider the possibility that coordination failures currently exist in regards to tailoring the region's products and services as a coordinated tourist experience package.

20 Indicated by a Comparative Advantage of 2 or less.

**Figure 39** Feasibility, strategic gain and relative industry employment opportunities in the Gascoyne


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Mid West

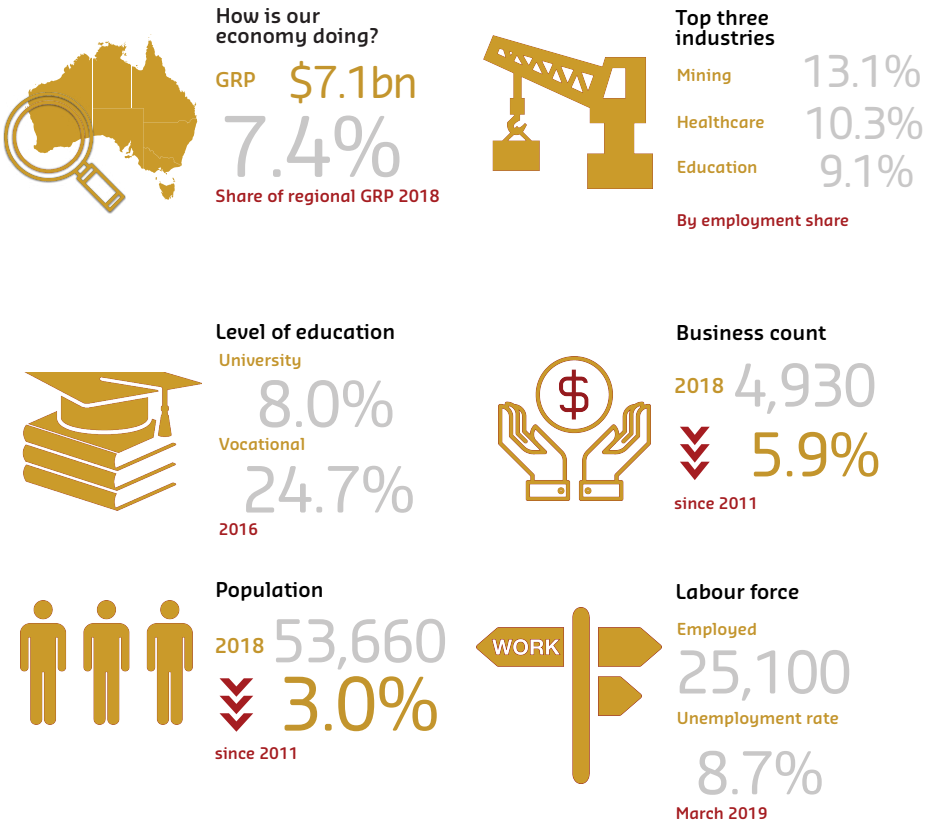
## Background

The Mid West region is located between the Perth metropolitan area and the resource rich regions of Pilbara and the Kimberley. In terms of population size, the Mid West is the third smallest WA region, behind the Gascoyne and Kimberley, with 53,660 people living in the region. The Mid West has also experienced a 3 per cent decline in population since 2011.

The Gross Regional Product (GRP) of the Mid West reached $7.1 billion in 2018, equating to 7.4 per cent of total GRP for regional WA. The Mid West is a resource rich economy with mining and agriculture central to the region. The biggest employer in the region is the Mining industry (13.1%), followed by the services provided by Health care (10.3%) and education (9.1%).

About a half of the population in the Mid West are in employment, with an unemployment rate of 8.7 per cent, amongst the highest for the state. The total business count has experienced a 6 per cent decline since 2011, and there are currently close to 4,900 businesses in the region.

**Figure 40** A snapshot of the Mid West




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Mid West

The industry class division provides a greater insight to the current strengths of the Mid West region. As expected, gold ore and iron ore mining are amongst the biggest employers in the region, accounting for 4.4 per cent and 2.5 per cent of the region's employment, respectively. Primary and secondary education provide 6 per cent of the total employment in the region and hospitals account for another 3.6 per cent.

The agricultural and agribusiness sectors are major players of the Mid West economy, with other grain growing directly providing 2.8 per cent of the jobs in the region. This category includes wheat and lupins grains production.

Other interesting figures come across when we look at the share of local employment. Road freight transport is one such industry, providing 2.3 per cent of the region's total employment and an estimated GVA of $47 million. Finally, 2.1 per cent of employment in the Mid West comes from the Accommodation industry. The Tourism sector is a growth industry for the region, which has potential to grow further – a point which will be returned to later below.

**Table 20** Top ten industry classes in the Mid West

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Gold ore mining | 1,019 | 4.4% | 1,045.9 | 22.7 |
| Hospitals except psychiatric hospitals | 833 | 3.6% | 68.3 | 0.9 |
| Primary education | 769 | 3.3% | 30.9 | 1.4 |
| Other grain growing | 648 | 2.8% | 41.2 | 14.7 |
| Supermarket and grocery stores | 648 | 2.8% | 36.9 | 1.1 |
| Secondary education | 595 | 2.6% | 47.8 | 1.4 |
| Iron ore mining | 585 | 2.5% | (a) | 7.9 |
| Local government administration | 585 | 2.5% | (a) | 2 |
| Road freight transport | 522 | 2.3% | 47.0 | 1.8 |
| Accommodation | 481 | 2.1% | 33.9 | 1.8 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Rock lobster and crab potting | 108.6 | 21.4 | 201 | 0.9% |
| Other basic non ferrous metal manufacturing | 77.5 | 43.1 | 169 | 0.7% |
| Nickel ore mining | 30.2 | 124.2 | 121 | 0.5% |
| Gold ore mining | 22.7 | 1,045.9 | 1,019 | 4.4% |
| Mineral sand mining | 21.4 | 128.3 | 125 | 0.5% |
| Other mining support services | 17.8 | 29.2 | 366 | 1.6% |
| Mineral exploration | 17.4 | 46.8 | 254 | 1.1% |
| Other grain growing | 14.7 | 41.2 | 648 | 2.8% |
| Copper ore mining | 14.5 | 233.0 | 227 | 1.0% |
| Silver lead zinc ore mining | 14.1 | 104.7 | 102 | 0.4% |

Note: (a) Estimated GVA cannot be calculated for government administration, justice and defence.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Other strengths of the Mid West can also be observed in panel b of Table 14. The items on this list represent the industries in which the region has an RCA compared to the average Australian regions, but they are not necessarily the largest employers in the Mid West.

*Rock lobster and crab potting* is the industry with the highest RCA in the region, with the Mid West boasting an RCA of over 100 times that of the average Australian region. However, this sector currently provides jobs for (only) 200 people, with an estimated GVA of $21.4 million.

The Mid West also has an RCA in other basic *non-ferrous metal manufacturing*, an industry that employs less people than rock lobster and crab potting but produces twice as much in terms of estimated GVA.

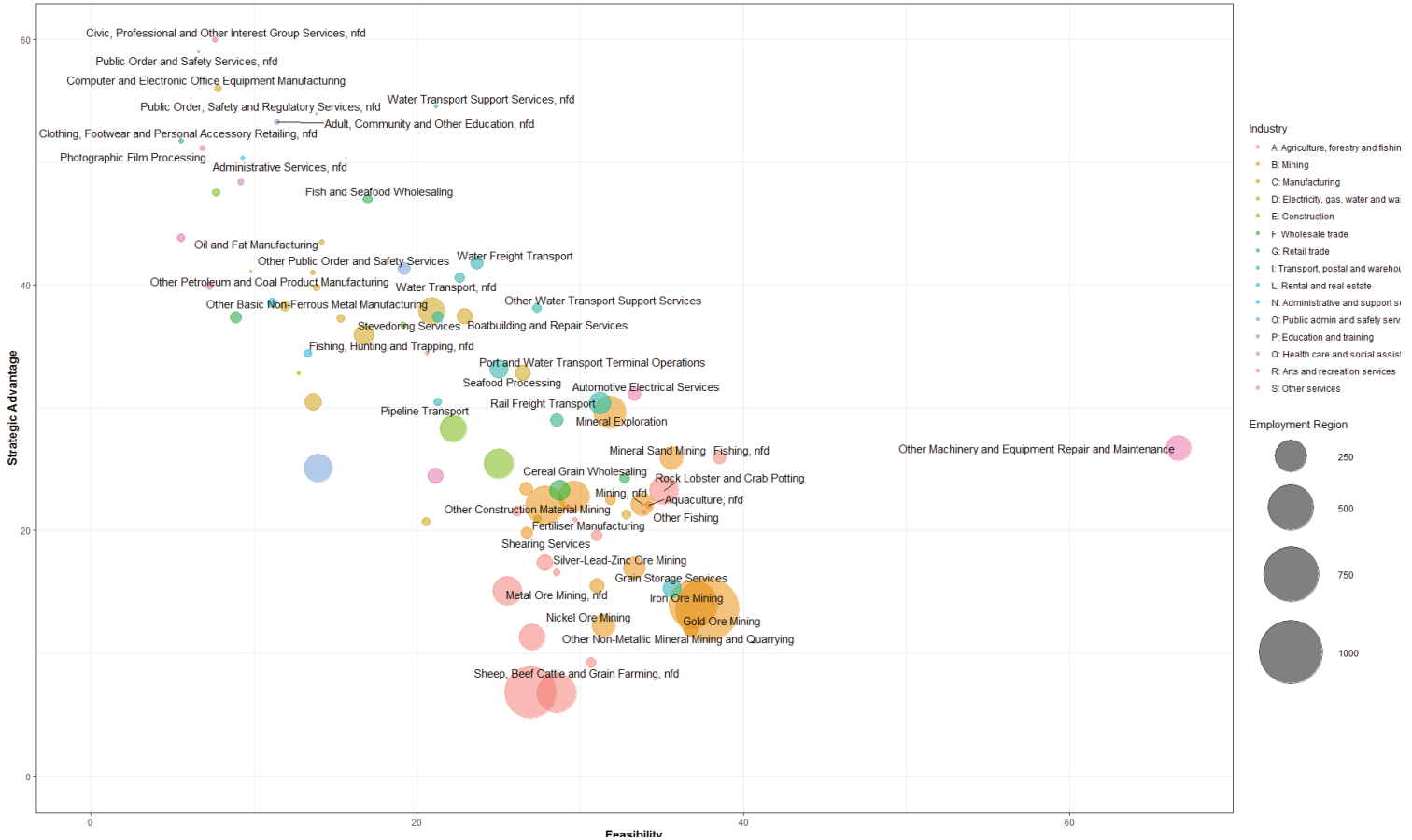
Other industries that have both a high RCA and a high employment rate in the region include *gold ore mining* and *other grain growing*. Mining is not only the major employer in the region, but it also has a high RCA in the Mid West. In particular, nickel ore, mineral sand, copper ore and silver lead zinc ore are all mining industries in the top ten RCAs. All these mining industries combined account for an estimated $590 million GVA, with 570 people employed.

Other related industries to Mining have an important RCA in the region, this is the case of *mineral exploration* and *other mining support services* with, respectively, RCAs 17 and 18 times higher than the average Australian region.

Another way to look at the strengths of the region is presented in the bubble chart of Figure 40. Here we present the industries that are already mature and developed in the Mid West (RCA>2) in terms of the strategic advantage they provide and how related they are to the other industries in the region, termed here as feasibility. There are some interesting industries with a high strategic advantage even if they only employ a low percentage of the population (size of the bubble). *Computer and electronic office manufacturing* is one of them, along with *fishing and seafood wholesaling* and *seafood processing*. *Water transportation* also floats up, as does *water freight transport*, and *other water support services*. *Boatbuilding and repair services* and *port and water transport terminal operations* also appear as industries that are already well developed in the region and have a high strategic advantage.

Mining and Agriculture, represented by the red and orange bubbles, employ a large number of people in the region but they do not bring a high strategic advantage as we can see in the bottom right of Figure 41. There are a cluster of Mining and Agriculture industries that are highly related to the other industries in the region but do not bring high degrees of strategic advantage to the economy.

**Figure 41** Feasibility, strategic advantage and size of local industry strengths in the Mid West




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Mid West?

Table 21 and Figure 42 present some of the opportunities for diversification of the Mid West economy. The non-exhaustive list presented in Table 17 looks at five main characteristics for each industry: feasibility, strategic gain, uniqueness, embeddedness and potential job growth, with the last two columns representing the potential extra jobs and the potential added GVA by 2025 if such industries develop in the Mid West.

- *Defence:* Another interesting opportunity for the Mid West is the development of defence activities in the region. This is also an opportunity that has been pointed out by the Mid West Development Commission's Blueprint, with the region having the business and operation capacity to reinforce defence operations further. The main advantage of this industry is the potential job creation by 2025 (1,750). Defence often brings a large amount of jobs in the regions it develops.
- *Scientific testing and analysis services:* This industry is highly feasible in the region as more than 35 per cent of the industries necessary to develop scientific testing and analysis services are already present in the region. The main industries related to scientific testing and analysis services are mining industry classes and agriculture, both of which are current strengths in the region.
- *Air and space transport:* Due to the mining industry and related FIFO work, the Mid West has established capacity in air transportation. There is a base therefore from which tourism related transport can expand. Such findings support some of the infrastructure initiatives of the region's Blueprint such as the expansion of the airport to international capacity and the development of a larger interconnectivity with regional aerodromes.
- *Offshore caged aquaculture and offshore longline and rack aquaculture:* The Mid West already has an RCA in some of the industries related to offshore caged and longline aquaculture such as in *fishing nfd, onshore aquaculture, other fishing and rock lobster and crab potting*. On top of that, the Mid West also possesses an advantage in *seafood processing and fish and seafood wholesaling* which can potentially increase the value added of offshore caged, longline and rack aquaculture. These are downstream industries of aquaculture and they can further enhance the feasibility and prospects of the offshore aquaculture industry.

**Table 21 Possible new or expansion opportunities for the Mid West**

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Oil and gas extraction | 4 | 1 | 4 | 4 | 4 | 315 | 622.6 |
| Scientific testing and analysis services | 4 | 3 | 1 | 4 | 3 | 40 | 4.5 |
| Defence | 2 | 3 | 3 | 3 | 4 | 1,750 | N/A |
| Air and space transport | 2 | 3 | 4 | 3 | 4 | 710 | 153.0 |
| Water passenger transport | 3 | 3 | 3 | 3 | 4 | 80 | 11.8 |
| Offshore caged aquaculture | 3 | 2 | 4 | 2 | 4 | 215 | 18.2 |
| Hydro electricity generation | 3 | 2 | 4 | 2 | 4 | 105 | 67.0 |
| Offshore longline and rack aquaculture | 3 | 1 | 3 | 2 | 4 | 105 | 9.1 |
| Scenic and sightseeing transport | 3 | 2 | 1 | 3 | 3 | 70 | 17.2 |
| Fossil fuel electricity generation | 3 | 1 | 3 | 3 | 4 | 200 | 126.4 |
| Cotton growing | 3 | 0 | 4 | 2 | 4 | 115 | 7.2 |
| Other heavy and civil engineering construction | 2 | 2 | 1 | 2 | 4 | 155 | 17.3 |
| Cotton ginning | 3 | 0 | 4 | 2 | 3 | 65 | 3.9 |
| Petroleum exploration | 2 | 2 | 3 | 3 | 2 | 30 | 2.7 |
| Grain mill product manufacturing | 2 | 2 | 3 | 2 | 3 | 50 | 4.6 |
| Beef cattle farming specialised | 3 | 1 | 1 | 2 | 4 | 510 | 32.5 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Other health care services nec | 2 | 2 | 2 | 2 | 4 |
| Labour supply services | 4 | 3 | 1 | 4 | 4 |
| Passenger car rental and hiring | 2 | 3 | 2 | 2 | 3 |
| Airport operations and other air support services | 3 | 2 | 3 | 4 | 4 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

- *Water passenger transport:* Water passenger transport is closely linked to *water support services, water freight transport, port and water operations* as well as *boatbuilding and repair services*. All these industries have an RCA higher than four in the region, which indicates that water passenger transport is quite feasible to develop in the Mid West. This opportunity is reinforced by the construction of the Oakajee deepwater port and the further expansion of the Geraldton port. Both of these infrastructure projects are a part of the Mid West's Blueprint.

- *Other heavy and civil engineering construction* is an interesting option for the Mid West. This category includes construction of major projects such a dams and canal constructions, railway permanent way and irrigation systems. A lot of the sub-classes of mining are highly related to this industry, which explains the elevated index of embeddedness of this industry. Looking at the two right columns of Figure 41, key advantages of this industry are the potential job creation by 2025 (estimated to be 150 jobs) as well as the non-negligible potential GVA of $17.3 million.

Figure 42 shows the strategic gain and feasibility indexes for industries in which the Mid West is currently underdeveloped[21].

- *Beef cattle farming, cotton growing and cotton graining* have a high feasibility in the region as most of the industries necessary for their development are already present in the region. However, their strategic gain is relatively small. Some other industries align with the Mid West Development Commission's Blueprint. This is the case of *rail transport* nfd, which is both feasible and has a high strategic gain for the region. The PortLink inland freight corridor could potentially enhance the development of rail transport in the region and increase the movement of goods from inland areas of the Mid West to the ports of Geraldton, Oakajee and Port Hedland.

- Another opportunity that is worth mentioning is *iron and steel forging*. Certainly the amount of jobs provided by this industry in Australia is low but the strategic gain from this activity is high. Mainly for this reason, it could be a strategic development, especially given the fact that the Mid West, the Pilbara and the Kimberley are all important producers of iron ore. This, combined with the freight and port developments planned for this region, mean they provide potentially high opportunities for the region.

- We have seen in Table 17 that *hydro and fossil fuel electricity generation* are possible candidates for diversification in the Mid West. However, even if these industries might not be viable because of environmental concerns or because of resource scarcity reasons, they highlight the fact that the Mid West has some capacity for electricity generation that can come from solar, wind or wave power, among others. The biggest challenge in this industry is the grid infrastructure as exporting electricity requires more connectivity (at least internationally) but because the Mid West is located between Perth and the Pilbara it also offers great opportunities for this sector.

21 Indicated by a Comparative Advantage of 2 or less.

**Figure 42** Feasibility, strategic gain and relative industry employment opportunities in the Mid West


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Goldfields-Esperance

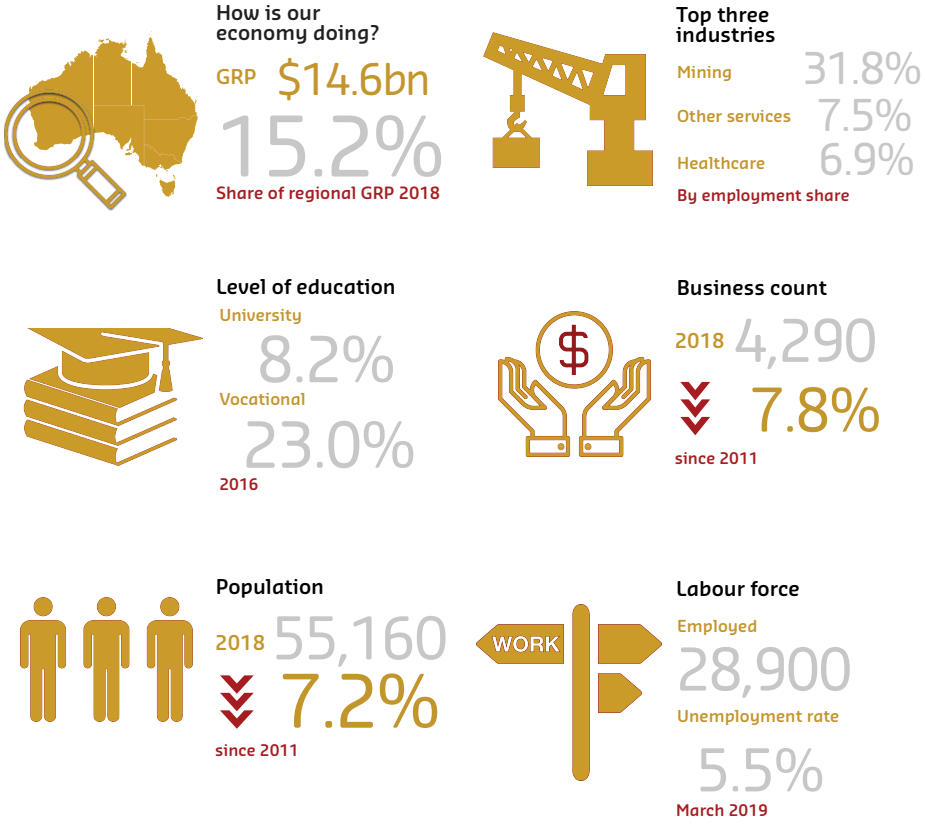
## Background

The Goldfields-Esperance region is located in the south-east of WA, with a land area of over 771,000 square kilometres making it the largest of the ten regions in the State. It borders four other regions – Pilbara to the north, the Mid West and Wheatbelt to the west, and the Great Southern to the south west. It has a vast coastal line facing the great Southern Ocean. This vast coast line provides commercial fishing and aquaculture opportunities, with the large land mass offering diverse opportunities in agriculture. Inland, Kalgoorlie-Boulder is a well-established mining zone, with valuable commodities such as gold, nickel and platinum, amongst others. Together with vast national parks, and forestry, the region has an attractive tourism offering.

The Goldfields-Esperance region has an estimated Gross Regional Product (GRP) of $14.6 billion, which makes up a 15.2 per cent share of regional WA's overall GRP. Key employment industries include Mining (32%) and Healthcare (7%). Over 8 per cent of the estimated 55,200 resident population have a university qualification, with a further 23 per cent having a vocational level qualification. This implies that approximately 69 per cent of the population have a level of qualification equivalent to secondary level or below. The latter is on par with the Kimberley, implying one of the lowest rates of tertiary education across the State. Of course, the latter does not account for age distribution.

Coupled with a 7.2 per cent decline in population between 2011 and 2018, the count of businesses (all sizes) has declined by 7.8 per cent over the same time period. Employment now stands close to 29,000, with an unemployment rate of 5.5 per cent.

**Figure 43** A snapshot of the Goldfields-Esperance




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Goldfields-Esperance

In 1892, gold was discovered in Coolgardie, and with the vision of the great Irish engineer, C.Y. O'Connor, the Goldfields Water Supply Scheme brought the required water to the miners in 1903. Furthermore, agriculture in Esperance and pastoral lands in the Goldfields opened up, and the 1960s saw the emergence of nickel as a major player for the region.

Panel a of the table below presents the ten largest employing industries in the Goldfields-Esperance region currently. These industries represent the largest scale industries providing local jobs.

As outlined earlier, Mining is critical to the region, with *gold ore mining* employing over 5,700 persons, and a further 900 in *nickel ore mining*. Together with *mining support services*, these three comprise almost 8,000 workers (27% share of the region's employment) alone. Critical support services including Transport, Education and training and Public administration also feature.

**Table 22** Top ten industry classes in the Goldfields-Esperance

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Gold ore mining | 5,763 | 19.9% | 5,915.0 | 102.5 |
| Other mining support services | 1,165 | 4.0% | 93.0 | 45.3 |
| Nickel ore mining | 901 | 3.1% | 924.8 | 179.7 |
| Primary education | 788 | 2.7% | 31.6 | 1.2 |
| Road freight transport | 696 | 2.4% | 62.7 | 1.9 |
| Supermarket and grocery stores | 648 | 2.2% | 36.9 | 0.9 |
| Hospitals except psychiatric hospitals | 607 | 2.1% | (a) | 0.5 |
| Local government administration | 598 | 2.1% | (a) | 1 |
| Mineral exploration | 524 | 1.8% | 96.6 | 28.6 |
| Secondary education | 520 | 1.8% | 41.7 | 1.0 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Nickel ore mining | 179.7 | 924.8 | 901 | 3.1% |
| Other basic non ferrous metal manufacturing | 108.7 | 75.7 | 297 | 1.0% |
| Gold ore mining | 102.5 | 5,915.0 | 5,763 | 19.9% |
| Other mining support services | 45.3 | 93.0 | 1,165 | 4.0% |
| Mineral exploration | 28.6 | 96.6 | 524 | 1.8% |
| Explosive manufacturing | 16.3 | 18.9 | 92 | 0.3% |
| Mining nfd | 13.6 | 287.0 | 324 | 1.1% |
| Other non metallic mineral mining and quarrying | 12.7 | 22.0 | 99 | 0.3% |
| Grain storage services | 9.6 | 10.3 | 73 | 0.3% |
| Other grain growing | 8.3 | 29.2 | 460 | 1.6% |

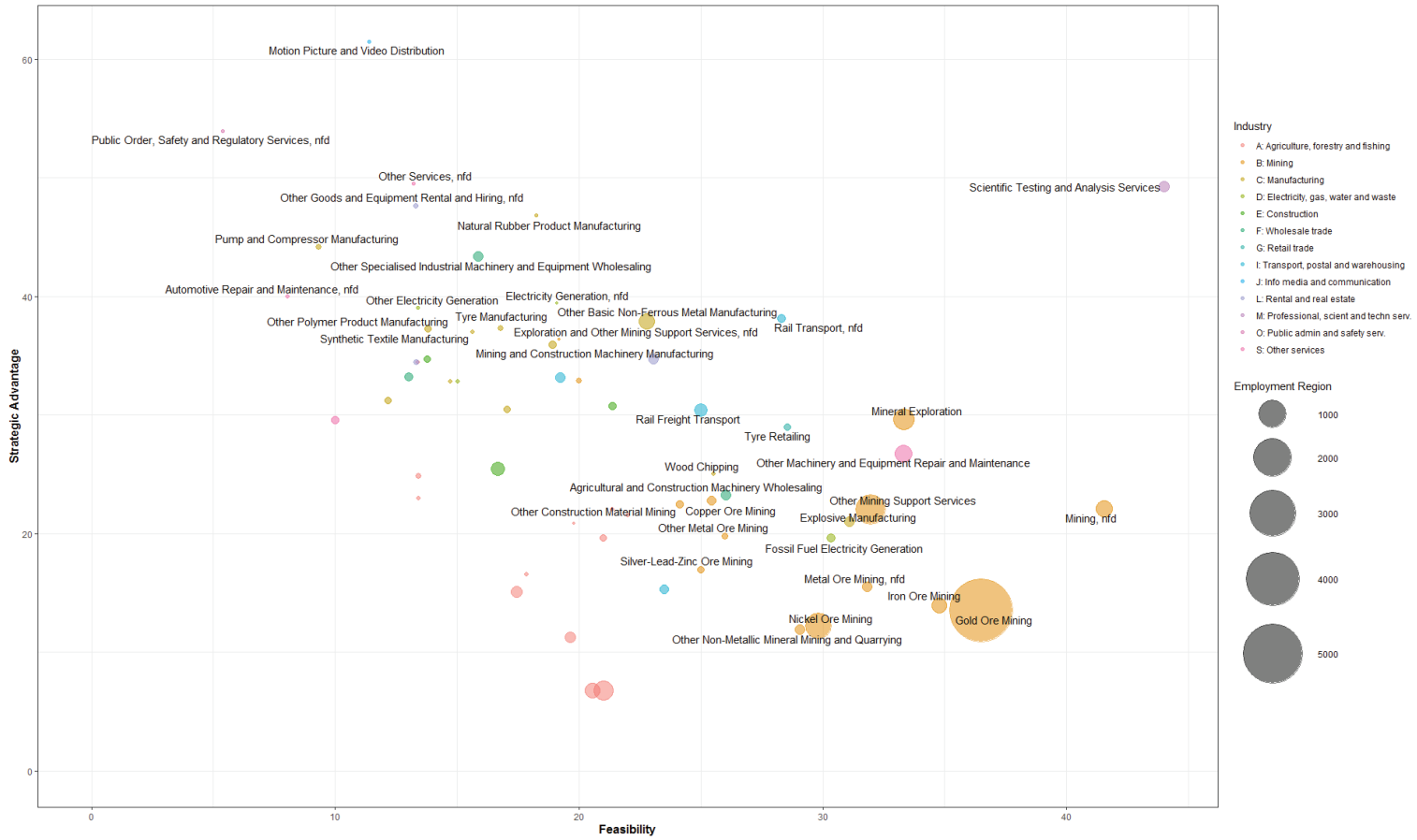
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Industries in which the Goldfields-Esperance is uniquely capable (has an RCA) are those that generate a greater share of employment in the Goldfields-Esperance than would be expected based on population alone. These are industries in which the Goldfields-Esperance can be considered an expert, but do not necessarily represent the largest employing industries or industries with the highest value. Mining again features heavily here for the region, with *mining related manufacturing* also highlighted (Table 22, panel b).

Our analysis on the feasibility and strategic advantage of industries in the Goldfields-Esperance are described in Figure 44. These are all industries in which the Goldfields-Esperance has twice the expected number of employees compared to all of Australia. The size of each bubble represents the number of local jobs in that industry class.

The main industry strengths and largest employers in the Goldfields-Esperance tend to be industries that are considered more feasible, many mining related, with some agriculture also coming to the fore. The dominance of gold ore mining is again highlighted. There is also demonstration here that many services supporting the mining industry are less reliant on the feasibility index in the Goldfields-Esperance region, instead playing a critical supply chain role.

**Figure 44** Feasibility, strategic advantage and size of local industry strengths in the Goldfields-Esperance




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Goldfields-Esperance?

The smart specialisation approach to diversifying the Goldfields-Esperance aims to sustain what the Goldfields-Esperance is already good at, as shown above, and diversify into industries that build on these expertise. Many of the opportunities for diversification in the Goldfields-Esperance lay around existing mining strengths. The Goldfields-Esperance's expertise in gold and nickel mining can be translated to other commodities where natural resources and scale are available.

If the Goldfields-Esperance is not yet strong in a particular industry, the feasibility measure indicates the likelihood of the Goldfields-Esperance diversifying into that industry. Similarly, the strategic gain index implies industries that would be strategically useful to boost incomes, resilience, long-term growth and diversify the Goldfields-Esperance economy. The range of measures show the potential new or expansion opportunities in the Goldfields-Esperance that should be investigated further.

Table 23 describes possible new opportunities for diversification in the Goldfields-Esperance that rank well on other indicators. The data reveals a number of interesting potential opportunities for the Goldfields-Esperance across a range of industries. Strategic gains that build on the existing industries are more difficult in the Goldfields-Esperance and other regional economies. As a result, it is not advisable for the Goldfields-Esperance to attempt to enter highly strategic industries that are unlikely to be successful. Instead, the industries targeted here predominantly focus on their feasibility, potential embeddedness and low levels of ubiquity across Australia. These are industries that are not found widely across Australia and in which the Goldfields-Esperance possesses a uniquely high feasibility indicator, suggesting that they are more likely to remain in the Goldfields-Esperance if they are able to become established.

**Table 23** Possible new or expansion opportunities for the Goldfields-Esperance

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Coal mining | 4 | 1 | 3 | 4 | 4 | 240 | 254.0 |
| Airport operations and other air support services | 3 | 2 | 3 | 2 | 4 | 210 | 38.3 |
| Copper silver lead and zinc smelting and refining | 2 | 2 | 4 | 2 | 4 | 275 | 70.5 |
| Hydro electricity generation | 3 | 2 | 4 | 2 | 4 | 120 | 76.6 |
| Air and space transport | 1 | 3 | 4 | 2 | 4 | 835 | 179.4 |
| Petroleum refining & petroleum fuel manufacturing | 2 | 3 | 4 | 2 | 3 | 60 | 25.0 |
| Rail passenger transport | 1 | 3 | 3 | 1 | 4 | 115 | 23.7 |
| Stevedoring services | 2 | 2 | 3 | 2 | 3 | 50 | 8.8 |
| Cement and lime manufacturing | 2 | 2 | 3 | 2 | 3 | 60 | 9.6 |
| Railway rolling stock manufacturing & repair services | 2 | 2 | 3 | 2 | 3 | 50 | 5.8 |
| Other heavy and civil engineering construction | 3 | 2 | 1 | 2 | 3 | 65 | 7.3 |
| Pipeline transport | 3 | 2 | 3 | 2 | 2 | 20 | 4.9 |
| Basic inorganic chemical manufacturing | 2 | 2 | 3 | 2 | 2 | 35 | 7.2 |
| Mineral sand mining | 3 | 1 | 2 | 2 | 3 | 45 | 47.9 |
| Industrial gas manufacturing | 2 | 2 | 3 | 2 | 2 | 25 | 4.9 |
| Water transport | 2 | 3 | 2 | 2 | 2 | 55 | 8.5 |
| Electricity supply nfd | 2 | 2 | 1 | 2 | 2 | 35 | 21.9 |
| Agriculture forestry and fishing nfd | 2 | 1 | 0 | 1 | 2 | 35 | 2.4 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Labour supply services | 4 | 3 | 1 | 4 | 2 |
| Correctional and detention services | 2 | 1 | 2 | 2 | 4 |
| Local government administration | 4 | 2 | 0 | 1 | 4 |
| Passenger car rental and hiring | 2 | 3 | 2 | 2 | 3 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

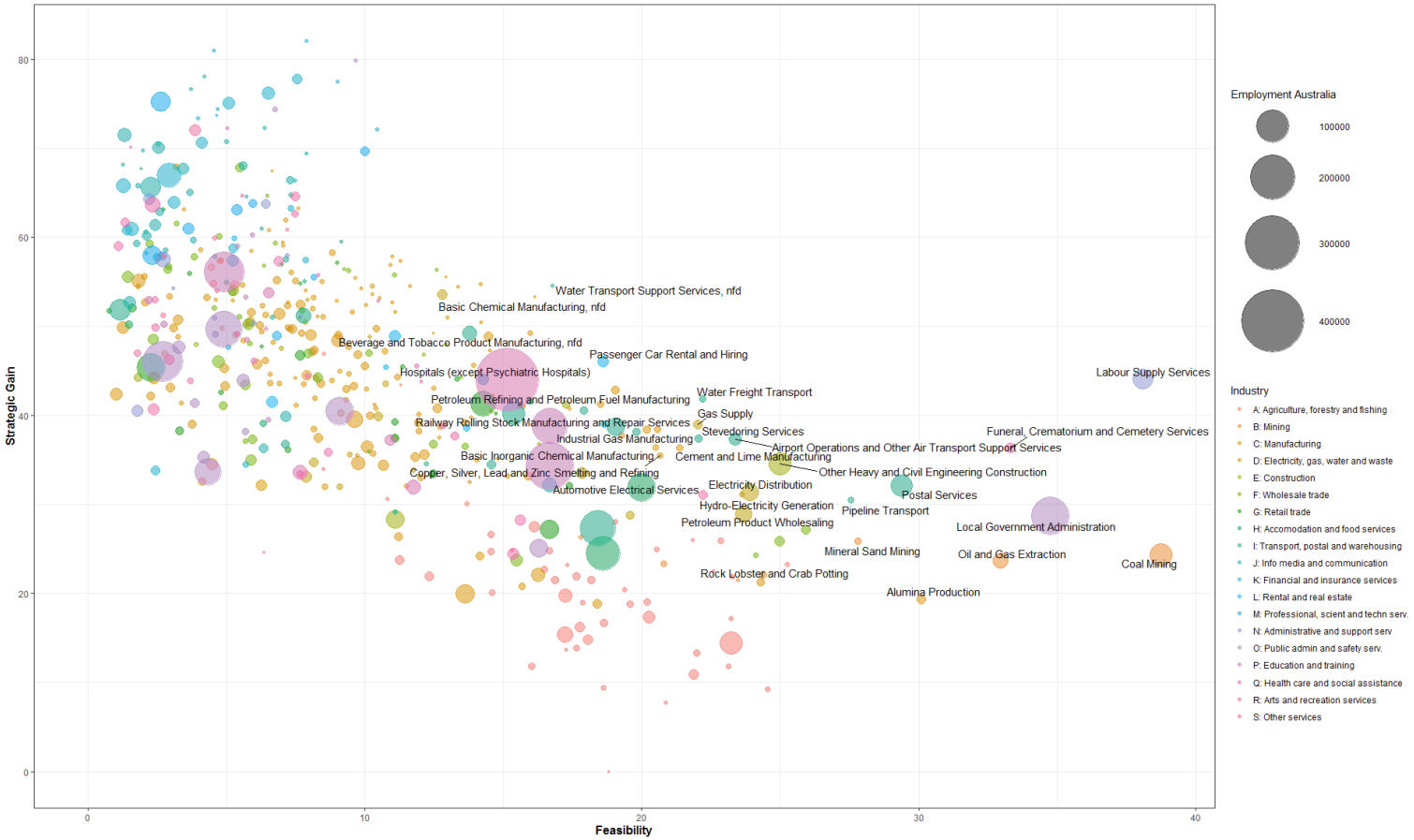
Of course, mining has been the lifeblood of the Goldfields-Esperance for over 120 years now, and, it is likely that the region will build on those existing strengths. In fact, in more recent times, the Goldfields-Esperance has expanded its mining portfolio beyond gold and nickel, with a number of iron ore, copper, zinc, silver, and lithium projects and exploration initiatives across the region. Therefore, it must be re-emphasised that the smart specialisation approach to diversifying the Goldfields-Esperance aims to sustain and continue to build on these strengths, and to investigate further opportunities to diversify into industries that build on these capabilities. Such industries include:

- Together with meeting the FIFO labour requirements of mining, *airport operations and other air support services* also show up as potential growth opportunities, using the method applied in this section of the report. Other 'related services' such as *car rental and hiring services* and *labour employment services* also show potential for growth. The latter had emerged as a sector which experienced growth across WA in more recent years.
- *Air and space transport* is a further industry with suggested capability for the region. Building on the existence of numerous telescopes in the Goldfields-Esperance region, as part of the national Desert Fireball Network, there may be potential for the region, particularly with the Federal Government's investment of $6 million in WA's space industry, which was established to support the State in playing a significant role in the broader national expansion plan. Further support for such developments can be seen in a 2018 report by ACIL Allen to the Department of Jobs, Tourism, Science, and Innovation (ACIL Allen Consulting, 2018), which suggested that "there is a possibility of a future Satellite Laser Ranging (SLR) ground station in Laverton Western Australia".
- Various *manufacturing, smelting and refining activities* also emerge as potential candidates for growth in the region, many of which again build on the existing strengths from mining in the Goldfields-Esperance region.

Figure 45 shows the strategic gain and feasibility indexes for industries in which the Goldfields-Esperance is currently underdeveloped[22]. The size of the bubbles indicates nationwide employment in those industries currently. The numerous bubbles on the far left of the chart below indicate industry classes that are difficult for the Goldfields-Esperance to enter, since none of the related industries appear in the Goldfields-Esperance region.

22 Indicated by a comparative advantage of 2 or less.

**Figure 45** Feasibility, strategic gain and relative industry employment opportunities in the Goldfields-Esperance




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Wheatbelt

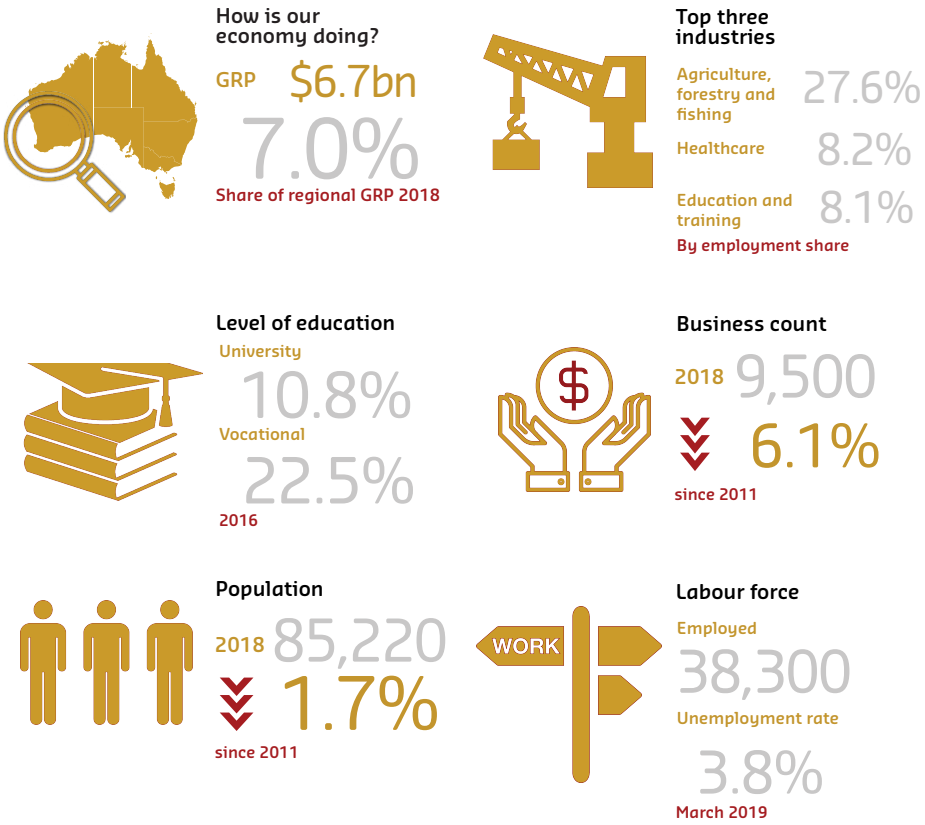
## Background

The Wheatbelt borders greater Perth on its north and eastern side and, population wise, is the third largest region of WA, with more than 85,000 people. The gross regional product of the Wheatbelt stands at $6.7 billion and represents 7 per cent of WA's regional GRP. The Wheatbelt has one of the highest number of businesses in WA, standing at 9,500, with a larger number of businesses only seen in Perth and the South West. Nevertheless, the number of businesses has decreased by 6.1 per cent since 2011.

The top three industries by employment share are Agriculture, forestry and fishing (27.6%), Healthcare services (8.2%) and Education and training (8.1%). However, in terms of GRP, Mining contributes up to 21 per cent to the region's GRP[23]. The Tourism sector is also an important asset as the Wheatbelt attracts nearly 700,000 tourist annually[24], only second after the South West in regional WA.

There are around 38,300 people employed in the region (45% of the total population) as of March 2019. The unemployment rate of the Wheatbelt is one of the lowest in the State, only 3.8 per cent of people actively seeking work do not have a job in the region. The Wheatbelt has a relatively high skilled population, with 10.8 per cent of the region's population holding a university level qualification. Only Perth does better than the Wheatbelt on this metric.

**Figure 46** A snapshot of the Wheatbelt




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

23 Wheatbelt fast facts (2018), Wheatbelt Development Commission.
24 Growing Wheatbelt Tourism 2017-2020 (2017), Wheatbelt Development Commission.

## Current industry strengths in the Wheatbelt

The Wheatbelt economy is mainly driven by Agriculture and especially grain growing. Table 24 gives us a more detailed insight of the region's strengths in terms of local employment (panel a) and of RCA (panel b). Let us first have a look at the highest industry employers by industry class. As expected, a big proportion of employment comes from Agriculture. *Grain sheep or grain beef cattle farming* is the largest employer in the region, accounting for 8.6 per cent of the total employment (almost 2,500 people) and an estimated GVA of $155 million. *Other grain growing* adds an additional 2,000 workers. *Sheep farming specialised* provides around 3 per cent of the region's jobs, ranking seventh in the region.

The large development of the cattle and agricultural sectors also bring some secondary jobs, with for example, *road freight transport* playing a critical role in the regions, supply chain. Almost 500 people are employed in this industry, which represents a non-negligible 1.8 per cent of jobs in the region.

Educational and Health care services are also significant employers in the Wheatbelt region. Together, *hospitals, and primary and secondary education* add over 2,600 jobs. A further 1,150 jobs are generated by local government administration.

**Table 24** Top ten industry classes in the Wheatbelt

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Grain sheep or grain beef cattle farming | 2,434 | 8.6% | 154.7 | 56.6 |
| Other grain growing | 1,981 | 7.0% | 125.9 | 36.6 |
| Local government administration | 1,144 | 4.0% | (a) | 2.8 |
| Hospitals except psychiatric hospitals | 941 | 3.3% | 77.2 | 0.8 |
| Primary education | 843 | 3.0% | 33.8 | 1.3 |
| Secondary education | 835 | 2.9% | 67.0 | 1.6 |
| Sheep farming specialised | 833 | 2.9% | (a) | 16.5 |
| Agriculture nfd | 795 | 2.8% | 50.5 | 12 |
| Supermarket and grocery stores | 659 | 2.3% | 37.5 | 0.9 |
| Road freight transport | 497 | 1.8% | 44.8 | 1.4 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Grain sheep or grain beef cattle farming | 56.6 | 154.7 | 2,434 | 8.6% |
| Other grain growing | 36.6 | 125.9 | 1,981 | 7.0% |
| Rock lobster and crab potting | 35.6 | 8.6 | 81 | 0.3% |
| Nickel ore mining | 30.7 | 155.0 | 151 | 0.5% |
| Shearing services | 29.3 | 9.0 | 149 | 0.5% |
| Sheep beef cattle and grain farming nfd | 28.7 | 6.4 | 100 | 0.4% |
| Olive growing | 26.3 | 2.3 | 36 | 0.1% |
| Grain storage services | 20.4 | 21.6 | 153 | 0.5% |
| Pig farming | 17.5 | 7.9 | 124 | 0.4% |
| Sheep farming specialised | 16.5 | 52.9 | 833 | 2.9% |

Note: (a) Estimated GVA cannot be calculated for government administration, justice and defence.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

In terms of RCA, *grain sheep or grain beef cattle farming* is again comes to the fore, as one would expect for the region. The Wheatbelt has an RCA which is 57 times higher relative to the average Australian region in grain sheep or grain beef cattle farming. *Other grain growing* is also an industry with a high RCA (37), and together these provide a significant number of jobs to the region.

There are three other industries related to animal farming in which the Wheatbelt region has an RCA: *sheep beef cattle and grain farming nfd* (29), *pig farming* (17) and *sheep farming specialised* (16). Among the three, the latter employs the highest percentage of people, around 830 persons, and is estimated to be the largest contributor to region GVA. The remaining two, employ close to 0.8 per cent of the total population. Linked to the region's strengths, *grain storage and shearing services* also present with a strong comparative advantage.

*Nickel ore mining* is also a key industry in terms of comparative advantage for the Wheatbelt. *Nickel ore mining* employs close to 150 people in the Wheatbelt but the estimated GVA exceeds that of *grain sheep and grain beef cattle farming* that employs sixteen times as many people. Lastly, it is worth pointing out that *rock lobster and crab potting* also have a high comparative advantage, as is the case in the Mid West region.

Figure 47 describes the Wheatbelt's existing industry strengths in terms of our analysis on the feasibility and strategic advantage of industries in the region. These are all industries in which the Wheatbelt has twice the expected number of employees compared to all of Australia. The size of each bubble represents the number of local jobs in that industry class.

In the bottom centre of the chart we observe a cluster of agriculture industry classes that employ a large percentage of the Wheatbelt population. Most of the industries with the highest strategic advantage belong to the manufacturing class: *transport equipment, motor vehicle and motor vehicle parts, iron and steel casting, other fabricated metal product and other polymer products*, but these rely less on feasibility for their presence, with a likely reason being their role in the agricultural supply chain. The Wheatbelt region also has a significant comparative advantage in *agricultural machinery and equipment manufacturing*, and *other machinery and equipment manufacturing nec.*

Wholesaling is also a big strength in the Wheatbelt, more specifically, *agricultural product wholesaling, industrial and agricultural chemical product wholesaling and basic material wholesaling*. These industries are all linked to the two main division industries of Agriculture and Mining. Interestingly, the highest strategic advantage of the Wheatbelt is in *financial assets investing.* The industry employs almost 200 people in the region and is a highly skilled service. The RCA is seven times higher than the average in Australia.

**Figure 47** Feasibility, strategic advantage and size of local industry strengths in the Wheatbelt


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Wheatbelt?

Industries with diversification opportunities for the Wheatbelt region are displayed in Table 25. The different industries are rated regarding their feasibility to develop in the region, the strategic gain they bring, the uniqueness of the industry, the embeddedness to the region's capabilities and the potential job growth. Some of the most interesting options are discussed below.

- Since the Wheatbelt is mainly an agricultural region, the most feasible options are related to this industry. *Apple and pear growing, grape growing, mushroom growing*, *other fruit and tree nut growing* are some of the easiest diversification options within the agriculture industry but unfortunately the strategic gain for these industries is relatively low. Among them, *other fruit and tree nut growing* has the highest potential job growth (a potential 200 extra jobs). An interesting example of this development is the Roleystone area of the Perth region. The diversification to other fruit trees such as avocado, mangos, persimmons, and passionfruits, amongst others, has diversified not only the agriculture of the region but it has also boosted the tourism coming from the Perth area as the spring and autumn seasons bring an increasing number of visitors to the orchards of the area.

- *Wine and other alcoholic beverage manufacturing* also displays potential, with *alcoholic beverage manufacturing* having the potential to generate 300 jobs in the region and an extra GVA of $60 million by 2025. The Wheatbelt already produces the cereals required for beer manufacturing and developing such an industry in the region will increase the value added of this product. More importantly, *wine and other alcoholic beverage manufacturing* is related to the tourism industry and *accommodation* services. Developing a diversification strategy that mirrors the Swan Valley case could enhance the growth of Agriculture, Manufacturing and Tourism industries. In addition, the proximity of the Wheatbelt region to Perth offers a great avenue for commercialisation of these industries.

**Table 25 Possible new or expansion opportunities for the Wheatbelt**

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Dairy cattle farming | 3 | 1 | 2 | 4 | 4 | 550 | 35.0 |
| Apple and pear growing | 3 | 1 | 3 | 4 | 4 | 90 | 5.7 |
| Wine and other alcoholic beverage manufacturing | 2 | 1 | 2 | 3 | 4 | 325 | 59.5 |
| Grape growing | 3 | 1 | 2 | 4 | 4 | 155 | 9.7 |
| Mushroom growing | 3 | 1 | 3 | 3 | 4 | 90 | 5.8 |
| Accommodation | 3 | 1 | 0 | 4 | 4 | 440 | 31.1 |
| Other fruit and tree nut growing | 3 | 1 | 3 | 4 | 4 | 190 | 12.1 |
| Offshore longline and rack aquaculture | 2 | 1 | 3 | 3 | 4 | 115 | 9.6 |
| Cotton growing | 3 | 0 | 4 | 4 | 4 | 120 | 7.6 |
| Cotton ginning | 3 | 0 | 4 | 4 | 3 | 70 | 4.1 |
| Meat processing | 2 | 1 | 2 | 3 | 4 | 385 | 36.6 |
| Log sawmilling | 3 | 1 | 2 | 4 | 4 | 140 | 15.0 |
| Copper ore mining | 1 | 1 | 4 | 3 | 4 | 665 | 682.6 |
| Silver lead zinc ore mining | 1 | 1 | 4 | 3 | 4 | 275 | 282.0 |
| Logging | 2 | 1 | 2 | 3 | 3 | 50 | 7.2 |
| Poultry farming | 2 | 1 | 2 | 4 | 3 | 65 | 4.1 |
| Forestry | 3 | 1 | 1 | 4 | 3 | 40 | 5.4 |
| Fishing nfd | 2 | 1 | 1 | 3 | 2 | 30 | 3.4 |
| Explosive manufacturing | 1 | 1 | 3 | 3 | 3 | 45 | 9.4 |
| Mining nfd | 1 | 1 | 1 | 3 | 3 | 45 | 40.9 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Combined primary and secondary education | 2 | 2 | 0 | 3 | 4 |
| Zoological and botanical gardens operation | 2 | 2 | 2 | 3 | 4 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

- *Offshore longline and rack aquaculture* builds on the Wheatbelt's existing strengths in *rock lobster and crab potting, agriculture and fishing support services, and onshore aquaculture and other fishing*. The capabilities of these industries could easily be used to develop offshore aquaculture in the Wheatbelt and create extra jobs.

- *Meat processing* is an interesting opportunity for the Wheatbelt as the region has a strong RCA in two of the related industries, *grain sheep or grain beef cattle farming* (57) and *beef cattle feedlots specialised* (8).

Figure 48 shows the range of interesting diversification industries for the Wheatbelt, showing those industries in which the strategic gain and feasibility indexes are not currently strong[25]. Here, the size of the bubbles indicates nationwide employment in those industries. Further possibilities for expansion worth noting include:

- Given the current strength in *cattle farming and grain crops*, along with *meat processing, other food product manufacturing nec, offer* options for diversification. *Other food product manufacturing nec* includes pre-prepared meals, frozen meals, food flavouring manufacturing, and colouring.

- The *mining industry* also offers an alternative to diversify assuming that the region's natural endowments follow. *Cooper ore mining, silver lead zinc ore mining* are ideal candidates as they are highly related to *nickel ore mining, mineral sand mining and metal ore mining*.

A key challenge for the Wheatbelt region is the availability of and assurance of water supply, as highlighted in the Wheatbelt Development Commission's Blueprint. This is even more important as the region looks to increase intensive agriculture, and given climatic changes occurring. The Blueprints also emphasises the need to improve soil health and the promotion of technologies that would mitigate climate impact. More specifically, the development of dry and frost tolerant cultures can attenuate the shocks linked to climate change. Native cereals cultures such as perennial native rice and wheat alike cereals have already been developed in Queensland for example[26], with further research being developed across Australia[27]. These native crops are highly resilient to dry weather and require low quantities of water[28].

The digital initiatives such as the 'growing the digital Wheatbelt' strategy and the 'Wheatbelt digital plan' will improve the mobile connectivity and the broadband capacity of the region. These initiatives would improve the agricultural businesses and develop other types of industries that are reliant on digital services, such as tourism.

25 Indicated by a Comparative Advantage of 2 or less.
26 Pascoe, 2018.
27 American Society of Cereal Chemists,, 2009.
28 Pascoe, 2018.

**Figure 48** Feasibility, strategic gain and relative industry employment opportunities in the Wheatbelt


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Perth

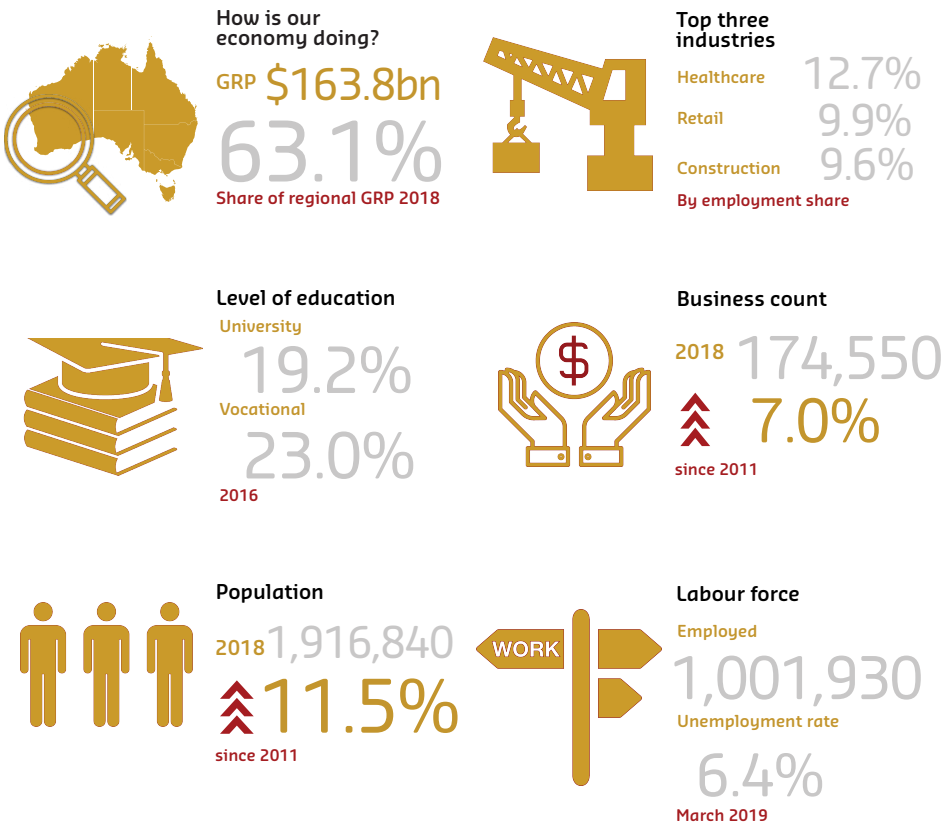
## Background

As the State's capital, Perth already has a highly diversified and complex economy. In value terms, Perth's businesses are estimated to generate nearly two-thirds (63.1%) of WA's Gross State Product (GSP), some $163.8 billion in 2018. The Perth metropolitan area is home to a growing population of over 1.9 million people. This figure has grown by 11.5 per cent since 2011, with Perth residents representing around three quarters of the State's total population. There are also nearly 175,000 businesses in Perth (up 7% since 2011).

The economic prosperity of the State's capital derives much from the business activities of globally leading Perth-based companies in the resources sector – particularly in *iron and gold ore mining*, and *oil and gas extraction*. The *banking and insurance services* industry also make a substantial value contribution to the State's economy, as does Perth's higher education sector.

Future jobs growth is very much a centrepiece of the state's economic strategy, with the McGowan government setting a target of 150,000 new jobs over the next five years. After a period of fragility, WA's labour market has shown signs of recovery according to *BCEC's Monthly Labour Market Update* (MLMU) series. Just over 1 million of Perth's population are currently in paid work, with an unemployment rate of around 6.4 per cent.

**Figure 49** A snapshot of Greater Perth




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in Perth

The top three employing industry sectors when aggregated into broad industry division (Figure 49) are in Healthcare (providing 12.7% of the State's total employment share), followed by Retail (9.9% of total employment) and Construction (at 9.6%).

The first panel in Table 26 breaks down employment shares further into industry classes, and shows just how extensive is the reliance on the services sectors for jobs – especially in health, education and residential aged care. Perth's hospitals collectively provide jobs for over 34,000 people, with a further 15,800 jobs in residential aged care services. The primary, secondary and higher education sectors are among the largest employers in the State's capital, accounting collectively for nearly 60,300 jobs.

The Retail and Hospitality industries also feature strongly as major employers, with nearly 22,000 jobs in cafes and restaurants, 20,500 supermarket and grocery store workers, and around 16,750 people working in takeaway food services.

**Table 26** Top industry classes in Perth

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Hospitals except psychiatric hospitals | 34,105 | 4.4% | 2,797.9 | 1.0 |
| Cafes and restaurants | 21,675 | 2.8% | 809.5 | 1.1 |
| Primary education | 20,962 | 2.7% | 841.5 | 1.1 |
| Supermarket and grocery stores | 20,544 | 2.6% | 1,168.6 | 1.0 |
| Takeaway food services | 16,754 | 2.1% | 625.7 | 1.1 |
| Aged care residential services | 15,811 | 2.0% | 943.4 | 1.0 |
| State government administration | 15,412 | 2.0% | (a) | 1.2 |
| Secondary education | 14,235 | 1.8% | 1,142.9 | 1 |
| Higher education | 13,777 | 1.8% | 2,324.7 | 1.1 |
| Combined primary and secondary education | 11,322 | 1.4% | 818.1 | 1.2 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Mineral exploration | 4.4 | 396.0 | 2,148 | 0.3% |
| Petroleum exploration | 4.3 | 54.7 | 579 | 0.1% |
| Clay brick manufacturing | 4.3 | 94.9 | 581 | 0.1% |
| Oil and gas extraction | 3.8 | 10,697.0 | 5,387 | 0.7% |
| Other mining support services | 3.6 | 201.7 | 2,527 | 0.3% |
| Iron ore mining | 3.3 | 8,373.2 | 8,158 | 1.0% |
| Other basic non ferrous metal manufacturing | 3.1 | 58.9 | 231 | 0.0% |
| Nickel ore mining | 3.0 | 412.6 | 402 | 0.1% |
| Corporate head office management services | 3.0 | 145.8 | 1,322 | 0.2% |
| Shipbuilding and repair services | 2.9 | 153.9 | 1,297 | 0.2% |
| Mining and construction machinery manufacturing | 2.8 | 153.3 | 1,177 | 0.2% |
| Gas supply | 2.8 | 934.2 | 1,183 | 0.2% |
| Mining nfd | 2.5 | 1,411.1 | 1,593 | 0.2% |

Note: (a) Estimated GVA cannot be calculated for government administration, justice and defence.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

But in which industries does Perth have a comparative advantage, when benchmarked according to employment?

The second panel in Table 26 ranks industry classes in Perth according to their employment shares relative to the same industries in other parts of the country. Those industry classes that feature at the top of this revealed comparative advantage (RCA) ranking have a substantially larger share of employment than the same industry class in other localities in Australia.

Not surprisingly, the list is dominated by industry classes within the resources sector – in *oil and gas extraction, iron and nickel ore mining* and *non-ferrous metals manufacturing* – all with at least three times the RCA employment shares relative to industry classes in comparable areas of the country. Perth also has a strong comparative advantage in *minerals and petroleum exploration*, as well as in *mining machinery manufacturing* and *other mining support services*.

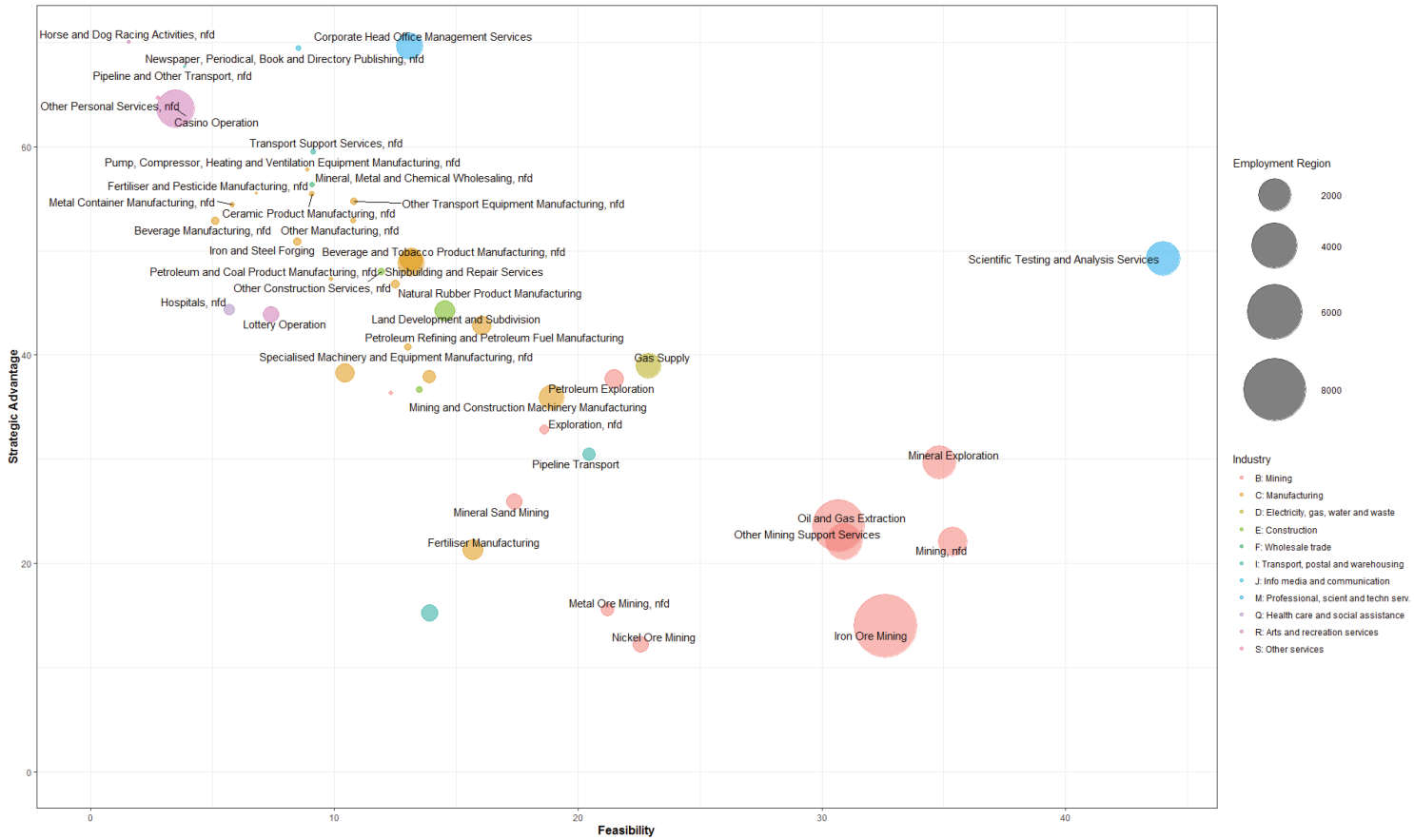
Business leadership also features as one of Perth's strengths, with *corporate head office services* ranking highly in terms of comparative advantage.

A comprehensive visual mapping of the economic sustainability of Perth's current industry strengths is shown in Figure 50. The chart presents two indicators of strategic advantage (which represents the complexity of networks to support the industry class) and feasibility (which captures the presence of related or supporting industries). The area of each bubble represents the relative employment share for each industry class.

The chart serves to highlight some of the key industry strengths and advantages:

- Perth's mining and resource industry strengths are highlighted in the bottom right quadrant of Figure 50, particularly in *iron ore mining, oil and gas extraction, minerals exploration* and *mining support services*. Each of these industry classes is shown to be highly feasible, and most benefit from strong resource endowments that create a natural advantage.
- The *scientific testing and analysis* industry class is shown to be highly feasible, given the presence of highly innovative related industries and *research-intensive universities* in Perth. This industry class also draws a strategic advantage from the complexity of supporting knowledge networks.
- Perth enjoys a significant strategic advantage in *shipbuilding and repair services*, with the Australian Marine Complex in Henderson acknowledged as one of the largest shipbuilding facilities in Australia.
- The strengths of Perth's metal and minerals mining industries, and minerals exploration, provide strong support for the manufacture of *mining and construction machinery* and *specialist machinery and equipment.*

**Figure 50** Feasibility, strategic advantage and size of local industry strengths in Perth




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in Perth?

Perth, like most other large state capital cities, is home to an already complex and highly diversified economy. This means that a large part of the economic development narrative in the capital will be concerned with building on existing strengths.

The smart specialisation analysis in this report nevertheless provides some important empirical support in identifying those industries in Perth that are well placed to take advantage of the presence and strength of related industry sectors, and that have the potential to expand further.

Table 27 lists some possible industry classes that have the potential to develop or expand further, according to their feasibility (indicating whether related industries are in place to support their expansion) and strategic gain (showing industries that would be resilient, strategically beneficial and drive long-term incomes growth).

Industries are also ranked according to their uniqueness (showing the prevalence in other localities across the country), their embeddedness (as a marker of the need for, and presence of, industry networks and knowledge bases), and the potential for jobs growth (by looking at employment shares for comparable industry classes in other localities).

The analysis presented in Table 27 extends further to highlight those service industries that could, or should, expand further expansion to support Perth's diversification and future economic growth.

**Table 27** Possible new or expansion opportunities for Perth

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Residential building construction | 4 | 4 | 0 | 0 | 4 | 1,815 | 270.0 |
| Engineering design & engineering consulting services | 3 | 4 | 3 | 2 | 4 | 1,760 | 193.9 |
| Electronic & precision equipment repair & maintenance | 4 | 3 | 1 | 1 | 3 | 340 | 26.8 |
| Carpentry services | 4 | 3 | 0 | 1 | 4 | 770 | 72.6 |
| General insurance | 1 | 4 | 3 | 1 | 4 | 1,650 | 1097.5 |
| Building construction nfd | 4 | 3 | 0 | 1 | 4 | 780 | 116.3 |
| Non-residential building construction | 3 | 4 | 1 | 1 | 4 | 1,100 | 163.4 |
| Plumbing services | 4 | 2 | 0 | 1 | 4 | 530 | 50.1 |
| Professional scientific and technical services | 1 | 4 | 3 | 1 | 4 | 405 | 44.9 |
| Freight forwarding services | 1 | 3 | 3 | 1 | 4 | 1,135 | 206.5 |
| Other grocery wholesaling | 1 | 4 | 2 | 1 | 4 | 450 | 52.8 |
| Rail transport servicing | 2 | 2 | 2 | 3 | 3 | 180 | 35.9 |
| Specialised food retailing | 3 | 3 | 0 | 1 | 3 | 195 | 11.2 |
| Coal mining administration services | 2 | 1 | 3 | 2 | 4 | 495 | 524.7 |
| Transport support services nec | 1 | 3 | 2 | 1 | 3 | 170 | 30.6 |
| Water freight transport | 2 | 3 | 2 | 2 | 3 | 105 | 16.4 |
| Railway rolling stock manufacturing & repair services | 1 | 2 | 3 | 2 | 3 | 170 | 20.1 |
| Bakery product manufacturing (non factory based) | 2 | 2 | 0 | 1 | 3 | 335 | 31.7 |
| Interurban and rural bus transport | 2 | 2 | 1 | 2 | 3 | 270 | 24.3 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Employment placement and recruitment services | 1 | 3 | 1 | 1 | 4 |
| Child care services | 2 | 3 | 0 | 1 | 4 |
| Preschool education | 3 | 2 | 0 | 1 | 4 |
| Funeral crematorium and cemetery services | 4 | 2 | 0 | 3 | 2 |
| Religious services | 3 | 3 | 0 | 1 | 4 |
| Sports and physical recreation instruction | 2 | 3 | 0 | 1 | 3 |
| General practice medical services | 2 | 3 | 0 | 1 | 3 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Our analysis highlights a number of industries that offer the potential for either expansion or diversification in Perth:

- *Residential* and *non-residential building construction* and associated *plumbing and carpentry construction services* are highlighted as potential expansion sectors in Perth, despite the national slowdown in the housing market. These sectors score low on uniqueness, unsurprisingly, but rate strongly on feasibility, strategic gain and jobs growth. Construction sector industries such as these are critical to support the growing pipeline of infrastructure and construction projects in the State. However, concerns have been expressed of a deepening shortage of skilled construction and related trades workers, which emphasises the importance of VET training and apprenticeships to address these workforce and skills challenges.
- *Transport manufacturing and servicing* is shown as an expansion opportunity, particularly *railway rolling stock manufacturing and repair, rail transport servicing and transport support services*. These industries rank highly in terms of strategic gain and jobs growth for Perth, and would be strongly aligned with major transport infrastructure initiatives such as Metronet. They could also prepare the ground for the future manufacture of trackless trams. This analysis provides empirical support for the recent announcement that train manufacturing and assembly is to be developed in Midland.
- The *Professional, scientific and technical services* industry is highly related to *data processing, scientific analysis and testing, digital services and information analysis*, and provides technical and support services to the resources, finance and telecommunications sectors. This relatedness underscores the importance of this expansion opportunity for Perth, in support of the State's digital and STEM strategies.
- The *engineering design and engineering consulting services* sector is shown as a feasible opportunity for expansion in Perth, and would offer both strategic benefit and significant jobs growth. This would provide the public and commercial sectors of the Perth economy with access to an expanded range of specialised expertise. This will help to support a diversified portfolio of capital infrastructure projects, as well as servicing Perth's existing strengths in the mining and resources sector, defence, construction and in the manufacture of specialised equipment and machinery.
- *Child care services* and *pre-school education* have both been identified as services in Perth that may see further expansion. The child care market is complex. Recent data from the MyChild website shows considerable variation by suburb in the supply of places at centres across Perth's suburbs, with demand for home-based or flexible child care options coming from small business owners, FIFO workers and those working shifts.
- Along with labour supply agencies, *employment placement services* have become progressively more important in matching workers to jobs, meeting labour demands from industry, and servicing an increasing trend towards shorter term, casual or flexible contracts.

Figure 51 shows the strategic gain and feasibility indexes for all industries in which Perth is currently under-represented[29].

29 Indicated by a comparative advantage of 2 or less.

**Figure 51** Feasibility, strategic gain and relative industry employment opportunities in Perth


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Peel

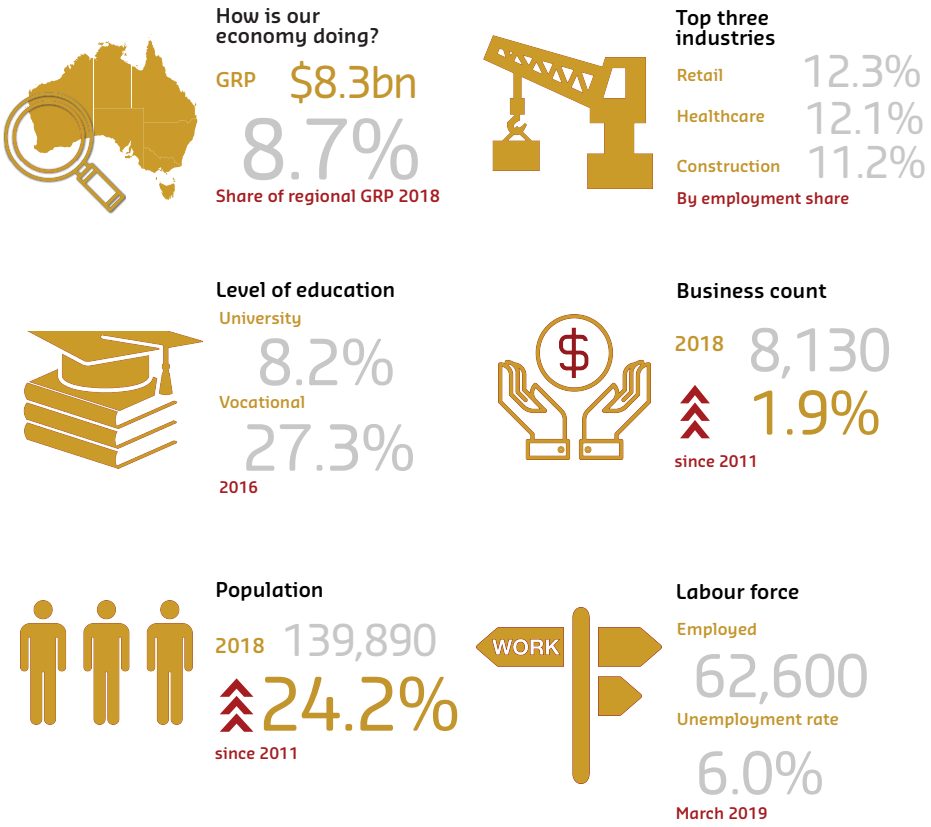
## Background

As the second largest WA non-metropolitan region by population, and given its geographical proximity to the Perth metropolitan area, Peel is an important region for WA. With five local government areas, it's coastal location provides many opportunities. Despite the fact that it is the smallest geographic region, with a land size of 5,648 square kilometres, it has a diverse landscape suitable for agriculture, horticulture and forestry, and both coastal and inland waters.

Established in the early 1870s, the Jarrahdale timber mill developed into the State's largest timber operation. While the industry has since declined, the diverse landscape has allowed for diversification, with alumina refineries, and gold and bauxite mines, amongst others, now driving growth in the region. The region's three largest industries by employment share include Retail (12.3%), Health care (12.1%) and Construction (11.2%).

The population stands at approximately 140,000, which is almost a 24 per cent increase on 2011. There are 63,000 people employed. While the unemployment rate sits at 6.0 per cent, it is lower than the 6.4 per cent reported for Perth. In regards to educational qualifications, 8.2 per cent hold a university qualification, with above 27 per cent of people having a VET qualification. There are over 8,100 businesses in the region, an increase of almost 2 per cent since 2011.

**Figure 52** A snapshot of Peel




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in Peel

Peel's alumina and bauxite industries are among the region's large scale employers, collectively accounting for around 2,600 jobs in the area. Alcoa's Kwinana alumina refinery is located in Peel, and is one of the biggest integrated alumina refining, aluminium smelting and bauxite mining sites in the country. *Gold ore mining* provides nearly 1,200 jobs in the region. The result of these industry strengths and population growth has led to benefits too for the retail and hospitality outlets, which also contribute strongly to employment in the region (Table 28, panel a). Service sector jobs are also to the fore in Peel in terms of employment, with primary and secondary schools employing around 2,300 people.

The largest industry in Peel by value is *gold ore mining*, at almost $1.2 billion. The region's Boddington gold and copper mine is the largest producing single gold mine site in Australia. Although not in the top 10 current industry classes by employment or revealed comparative advantage, *livestock and meat preparation* are also critical industries. There is a mix of agricultural produce in the region, with a climate supportive of cut turf, grain crops and hay, vegetables, and some fruits – oranges, mandarins and lemons, amongst others.

**Table 28** Top industry classes in Peel

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Alumina production | 1,617 | 4.8% | 412.0 | 98.2 |
| Primary education | 1,456 | 4.3% | 58.4 | 1.8 |
| Supermarket and grocery stores | 1,272 | 3.7% | 72.4 | 1.4 |
| Gold ore mining | 1,155 | 3.4% | 1,185.5 | 17.5 |
| Aged care residential services | 1,118 | 3.3% | 66.7 | 1.6 |
| Takeaway food services | 988 | 2.9% | 36.9 | 1.5 |
| Cafes and restaurants | 982 | 2.9% | (a) | 1.1 |
| Bauxite mining | 958 | 2.8% | 983.3 | 85 |
| Secondary education | 861 | 2.5% | 69.1 | 1.4 |
| Local government administration | 826 | 2.4% | (a) | 1.7 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Alumina production | 98.2 | 412.0 | 1,617 | 4.8% |
| Bauxite mining | 85.5 | 983.3 | 958 | 2.8% |
| Gold ore mining | 17.5 | 1,185.5 | 1,155 | 3.4% |
| Aluminium rolling drawing extruding | 12.8 | 21.4 | 84 | 0.2% |
| Land development and subdivision | 5.6 | 7.1 | 75 | 0.2% |
| Horse farming | 5.3 | 3.9 | 62 | 0.2% |
| Site preparation services | 4.1 | 41.3 | 439 | 1.3% |
| Bricklaying services | 3.9 | 11.8 | 125 | 0.4% |
| Structural steel fabricating | 2.6 | 5.7 | 60 | 0.2% |
| Nursery production outdoors | 2.5 | 4.3 | 67 | 0.2% |

Note: (a) Estimated GVA cannot be calculated for government administration, justice and defence.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

So, what are the industries in which Peel has a comparative advantage, when benchmarked according to employment? The second panel in Table 28 ranks industry classes in Peel according to their employment shares relative to the same industries in other parts of the country. Those industry classes that feature at the top of this *revealed comparative advantage* (RCA) ranking have a substantially larger share of employment than the same industry class in other localities in Australia.

It is not surprisingly, that the mining sectors discussed earlier dominate the industry class list. Other sectors related to the mining supply chain also feature, such as steel fabrication. The love for horses in the region also comes to the fore, albeit small in employment and GVA terms relative to other industries, with expertise and facilities to support a thriving racing and non-racing equine industry.

Figure 53 provides a comprehensive visual mapping of the economic sustainability of Peel's current industry strengths. The chart presents two indicators of strategic advantage (which represents the complexity of networks to support the industry class) and feasibility (which captures the presence of related or supporting industries). The area of each bubble represents the relative employment share for each industry class.

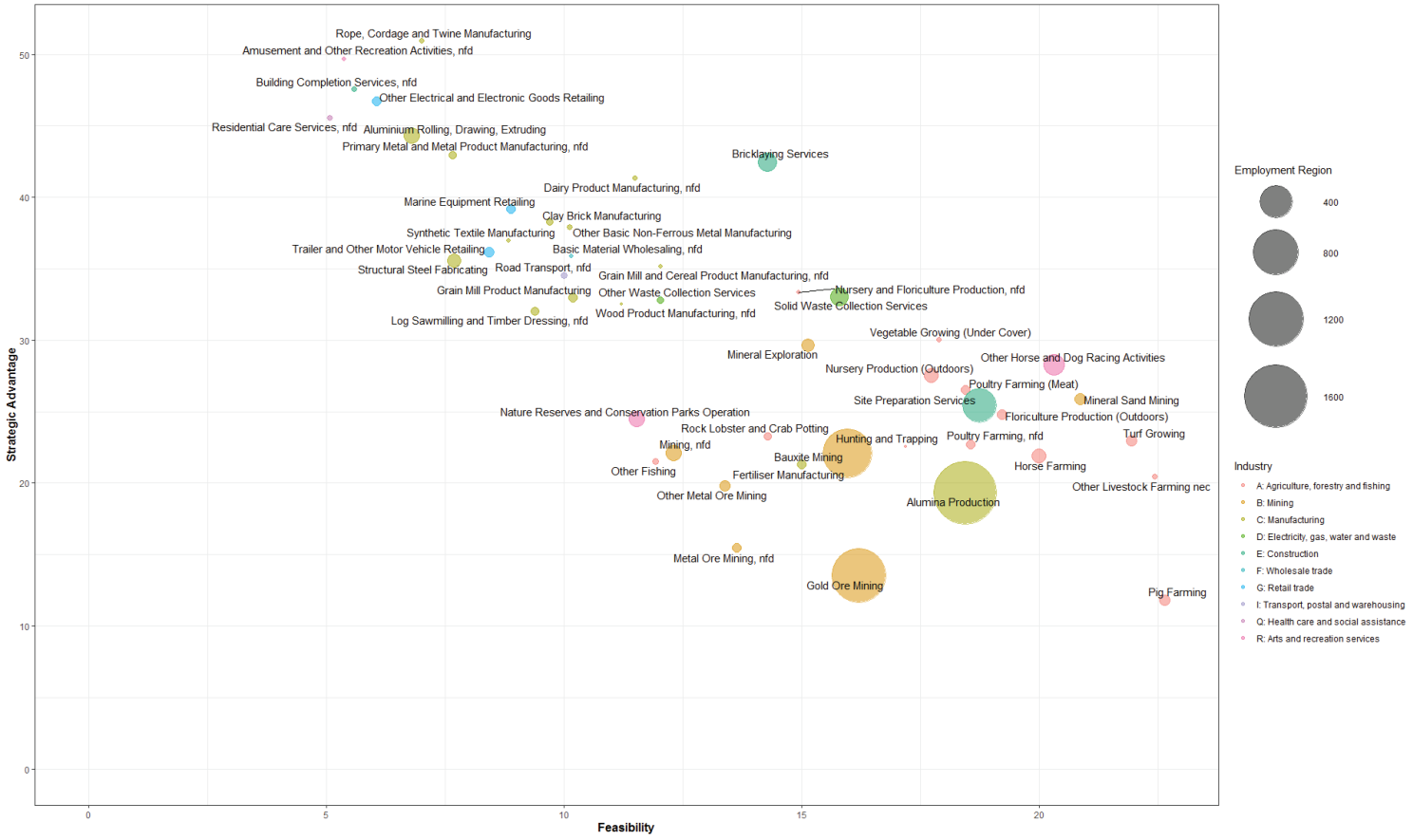
In addition to those industries already discussed here, the chart highlights some of the other key industry strengths and advantages. Sub-industry classes of the Agriculture, forestry and fishing grouping particularly come to the fore. For example, *nursery production, floriculture and turf growing*, along with *vegetable growing* emerge as industries with high feasibility. Other agricultural produce with strengths include *pig farming* and *livestock farming*, along with *poultry farming*.

*Parks and conservation nature reserves* also feature, and provide ample opportunities for the tourism industry.There are also scatterings of *fishing and rock lobster and crab potting*.

Looking north along the strategic advantage, vertical axis of Figure 53, it is evident that the manufacturing sector has strength in its complexity of networks. There is much diversity in the types of manufacturing carried out in the region too, spanning from *primary metals manufacturing* to *synthetic textile manufacturing, grain mill product manufacturing* and *non-ferrous metal manufacturing*.

With strong population growth, *land development and subdivision* came to the fore under in terms of the comparative advantages table presented above. The bubble chart also displays strengths in Construction-related industries, with for example *bricklaying services* displaying strength in both feasibility and strategic advantage. This aligns too with the great demand for housing given the population growth seen over the last decade.

**Figure 53** Feasibility, strategic advantage and size of local industry strengths in Peel




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in Peel?

Peel is one of the largest regional areas in Western Australia, with a growing population. Its proximity and connectedness to Perth means that the economic opportunities available to the region's residents take in the State's capital as well as the Peel locality.

The resources sector drives much of the economic prosperity of Peel, and alongside services also provides the greatest share of employment – particularly in the mining, refining and processing of alumina, bauxite and gold as well as in construction and agriculture.

Table 29 shows that Peel has the potential to diversify into, or expand, a number of industry sectors related to existing strengths. These potential industry opportunities are again identified using a weighted combination of indicators that represent feasibility, strategic gain, uniqueness, embeddedness and potential jobs growth.

In broad terms, Table 29 highlights some clear opportunities to grow the agriculture industry in Peel through the expansion of boutique or high value food production, as well as in downstream food processing. While building construction is already one of Peel's strongest industry sectors, the region is also well-positioned to expand its construction services and materials industries to capitalise on new infrastructure projects across the State.

**Table 29 Possible new or expansion opportunities for Peel**

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Citrus fruit growing | 3 | 0 | 3 | 3 | 4 | 250 | 15.9 |
| Scientific testing and analysis services | 2 | 3 | 1 | 3 | 3 | 125 | 14.0 |
| Cheese and other dairy product manufacturing | 2 | 2 | 3 | 3 | 4 | 420 | 39.5 |
| Rail freight transport | 2 | 2 | 2 | 4 | 4 | 215 | 43.4 |
| Vegetable growing outdoors | 3 | 1 | 1 | 3 | 4 | 385 | 24.5 |
| Other grain growing | 3 | 0 | 3 | 3 | 4 | 1,265 | 80.5 |
| Sheep farming specialised | 3 | 0 | 2 | 3 | 4 | 1,105 | 70.2 |
| Sheep beef cattle farming | 3 | 0 | 2 | 3 | 4 | 385 | 24.3 |
| Meat processing | 2 | 1 | 2 | 2 | 4 | 1,045 | 98.9 |
| Log sawmilling | 3 | 1 | 2 | 3 | 4 | 215 | 23.5 |
| Grain sheep or grain beef cattle farming | 2 | 0 | 3 | 3 | 4 | 940 | 59.7 |
| Other mining support services | 2 | 1 | 2 | 3 | 4 | 175 | 13.8 |
| Agriculture nfd | 2 | 1 | 0 | 2 | 4 | 540 | 34.5 |
| Other agriculture and fishing support services | 3 | 1 | 0 | 3 | 3 | 150 | 9.1 |
| Forestry | 3 | 1 | 1 | 3 | 3 | 95 | 13.5 |
| Boatbuilding and repair services | 2 | 2 | 1 | 3 | 2 | 45 | 5.6 |
| Onshore aquaculture | 2 | 1 | 2 | 3 | 2 | 50 | 4.4 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Labour supply services | 2 | 3 | 1 | 4 | 3 |
| Waste collection services nfd | 2 | 2 | 0 | 3 | 1 |
| Garden supplies retailing | 3 | 2 | 0 | 4 | 1 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

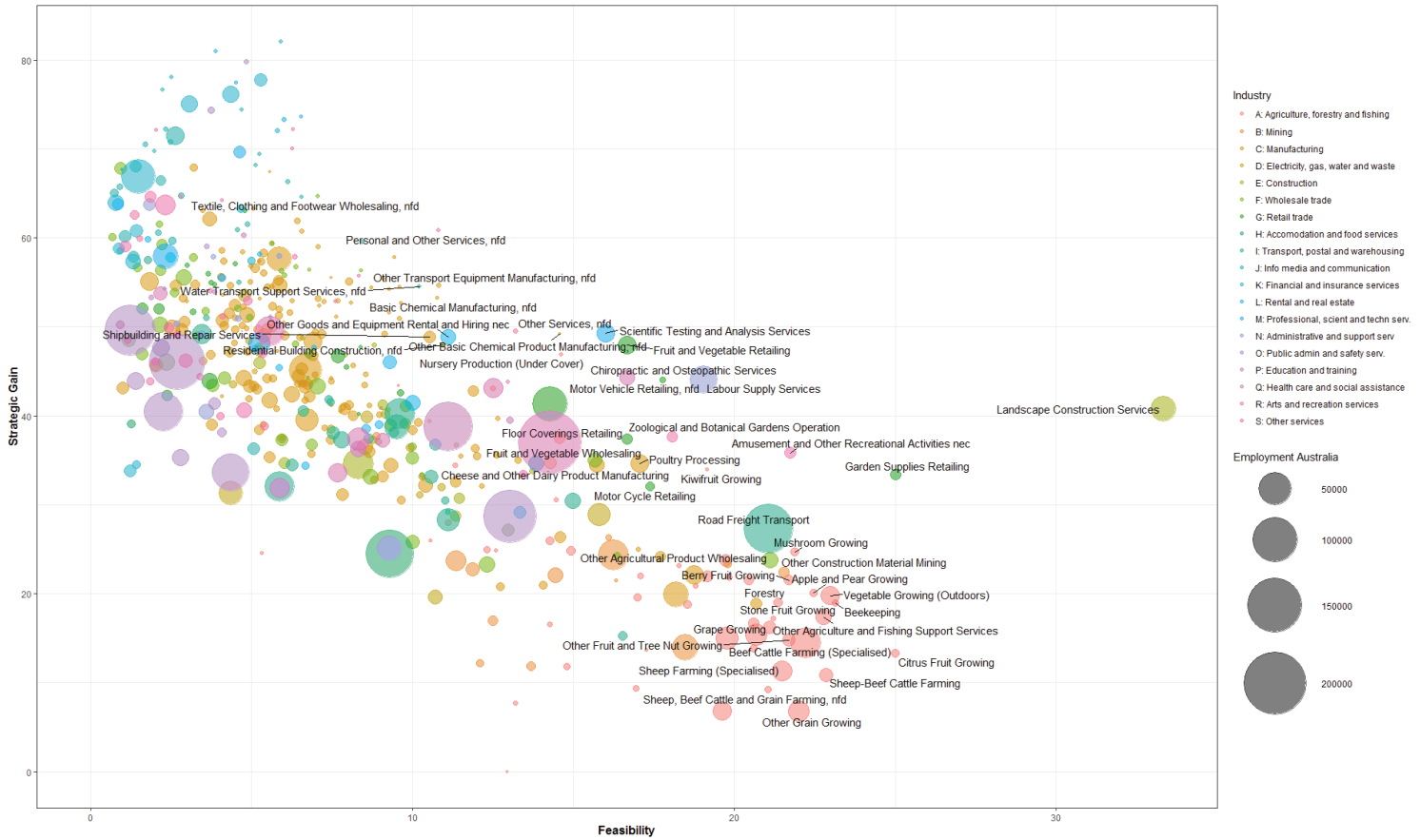
The diversification potential of Peel capitalises on a number of feasible opportunities, supported by relatively unique endowments, which could develop alongside the further expansion and refinement of existing industry strengths:

- *Vegetable growing* and *grain growing* has the potential to develop further in the Peel region. *Citrus fruit production* is feasible, with the climate and land conditions in Serpentine-Jarrahdale able to support the production of oranges, mandarins, lemons and limes. The diversification opportunity is further supported by the presence of industries that are highly related to citrus fruit production both in Peel and in the neighbouring South West region.
- Alongside the region's existing strengths in pig and poultry farming, there is potential to develop the *specialised sheep and beef farming* industry to be capitalise on the growing demand from China and South East Asia for high quality meat products. The expansion of *onshore aquaculture* along with *agriculture and fishing support services* has the potential to deliver high value fresh food produce into the same export markets.
- There are opportunities for Peel to grow its tourism industry, but the challenge is to develop a differentiated tourism proposition in the region that is distinctive, and would complement the experiences offered by Perth and the South West. Peel's current industry strengths (Figure 53) and expansion opportunities (Figure 54) provide support for distinctive tourism experiences, especially industry tourism, agri-tourism and cultural tourism.
- The history of Jarrahdale is founded on the development of a timber industry, with wood from the Jarrah forest. Although the timber industry is now more established in the South West region than in Peel, the analysis in this report suggests that the conditions are in place to support an expansion in the region's *forestry* and *wood sawmilling* industries. The opportunity to expand the production, preparation and sale of high value indigenous hardwoods such as Jarrah, Tuart and Marri, as well as wood preparation and higher value, downstream wood product and component manufacturing, would be supported by the presence of related industries, as well as natural resources and a conducive environment.
- Construction is strong in the region, but Peel has a comparative advantage in meeting the growing demand for construction materials and services both locally, and (at least) across the State. *Mineral sand production, gravel and sand quarrying, construction materials mining, site preparation* and *land development services* emerge from the analysis as opportunities for diversification or expansion in the region. So too do *basic materials supply and bricklaying services*.
- The smart specialisation framework offers support for an expansion of the *Scientific testing and analysis services* industry class in Peel, driven by strategic gain and the co-location of high technology industries in the resource sector, as well as established connections and networks into Perth. Further development of this industry creates the potential to attract and retain highly skilled workers into Peel, as well as supporting prospective emerging industries in *defence, boatbuilding and repair, and freight and rail transport manufacture*.

Figure 54 shows the strategic gain and feasibility indexes for industries in Peel that are currently relatively small, but which are revealed to have diversification or expansion potential based on their feasibility, strategic advantage and jobs potential[30].

30 Indicated by a comparative advantage of 2 or less.

**Figure 54** Feasibility, strategic gain and relative industry employment opportunities in Peel




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

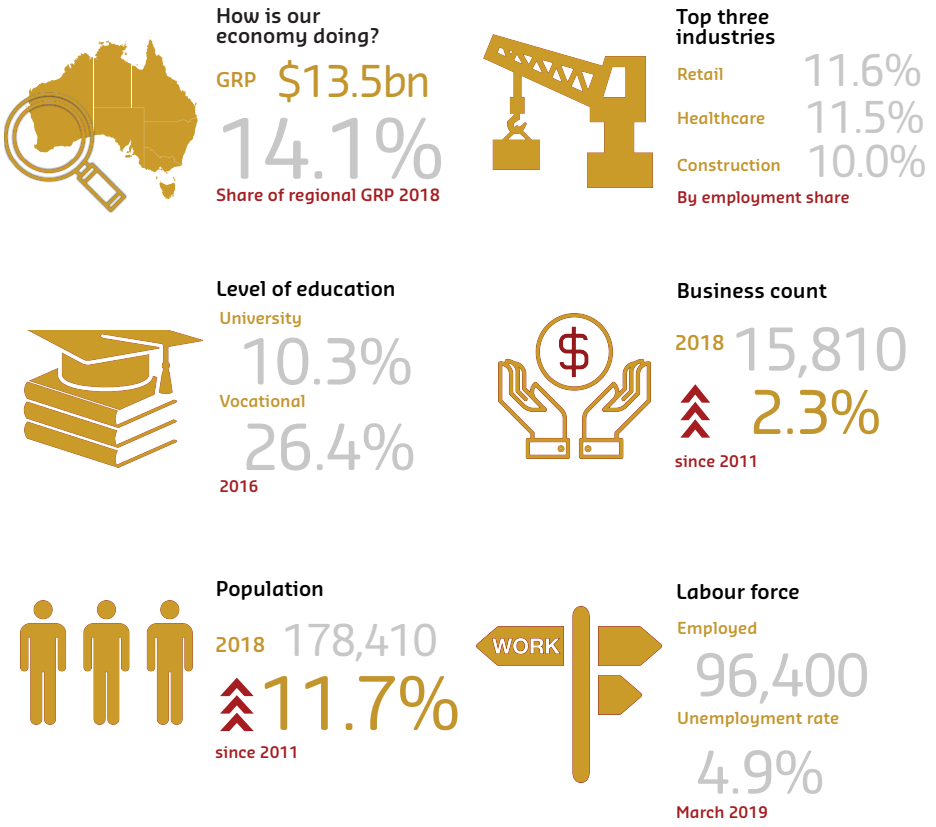
# South West

## Background

The South West region of WA is a much loved tourist destination for WA families, along with interstate and overseas tourists. As per the region's name, it is located in the south-western corner of the region, and covers 24,000 square kilometres. Its vast and beautiful coastline, biodiversity and natural landscapes, beaches and forests all provide for a tourist paradise. It is a world-renowned wine region, with fertile soils and a conducive climate enabling for a strong agriculture industry. Mining and Manufacturing also play critical roles, as does fishing and aquaculture. Such industries are supported by good road, rail and port infrastructure, and its proximity to the Peel and Perth regions is also a positive attribute.

The South West contributes $13.5 billion to the WA economy, which accounts for over 14 per cent of regional GRP. The population has increased by 12 per cent since 2011, and is now close to 180,000 people. There are 96,400 people in employment, with an unemployment rate of 4.9 per cent. It is one of the few regions that saw business count increase between 2011 and 2018, with the count now at 15,800. In regards to education, 10 per cent of the population hold a university qualification, with 26 per cent having VET qualifications. The top three industries by employment share are Retail (11.6%), Healthcare (11.5%) and Construction (10.0%).

**Figure 55** A snapshot of the South West




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the South West

Table 30 gives us a more detailed insight of the region's strengths in terms of local employment (a) and of RCA (b). Let us first have a look at the highest industry employers by industry class. As expected a big proportion of employment comes from tourist related activities.

The South West economy has a strong tourism presence, which is highlighted by the high levels of employment across the Accommodation, food and café and restaurants sectors, as shown in Table 30. Together these industry classes provide 4,700 jobs.

Education and Health services, including *aged care residential services* are also critical employers. Education alone comprises over 6,500 jobs for the region, with *hospitals and aged care* adding another 3,600 jobs.

Given the level of Agricultural and Mining activities in the region, *road freight transport* is also a key employer. *Local government* is also a critical employer in the South West region.

**Table 30** Top ten industry classes in the South West

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Primary education | 2,412 | 3.7% | 96.8 | 1.6 |
| Supermarket and grocery stores | 2,280 | 3.5% | 129.7 | 1.3 |
| Hospitals except psychiatric hospitals | 2,135 | 3.3% | 175.1 | 0.8 |
| Secondary education | 1,749 | 2.7% | 140.4 | 1.5 |
| Cafes and restaurants | 1,720 | 2.6% | 64.2 | 1.0 |
| Accommodation | 1,617 | 2.5% | 114.0 | 2.1 |
| Aged care residential services | 1,487 | 2.3% | (a) | 1.1 |
| Takeaway food services | 1,379 | 2.1% | 51.5 | 1 |
| Local government administration | 1,327 | 2.0% | (a) | 1.4 |
| Road freight transport | 1,057 | 1.6% | 95.2 | 1.3 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Wood chipping | 30.8 | 7.1 | 65 | 0.1% |
| Alumina production | 24.7 | 199.3 | 782 | 1.2% |
| Basic inorganic chemical manufacturing | 23.7 | 62.2 | 303 | 0.5% |
| Bauxite mining | 20.7 | 458.8 | 447 | 0.7% |
| Mineral sand mining | 20.1 | 340.8 | 332 | 0.5% |
| Reconstituted wood product manufacturing | 14.0 | 19.6 | 179 | 0.3% |
| Timber resawing and dressing | 13.0 | 10.4 | 95 | 0.1% |
| Apple and pear growing | 11.9 | 7.1 | 112 | 0.2% |
| Logging | 11.1 | 21.9 | 153 | 0.2% |
| Other non metallic mineral mining and quarrying | 10.4 | 40.6 | 183 | 0.3% |

Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

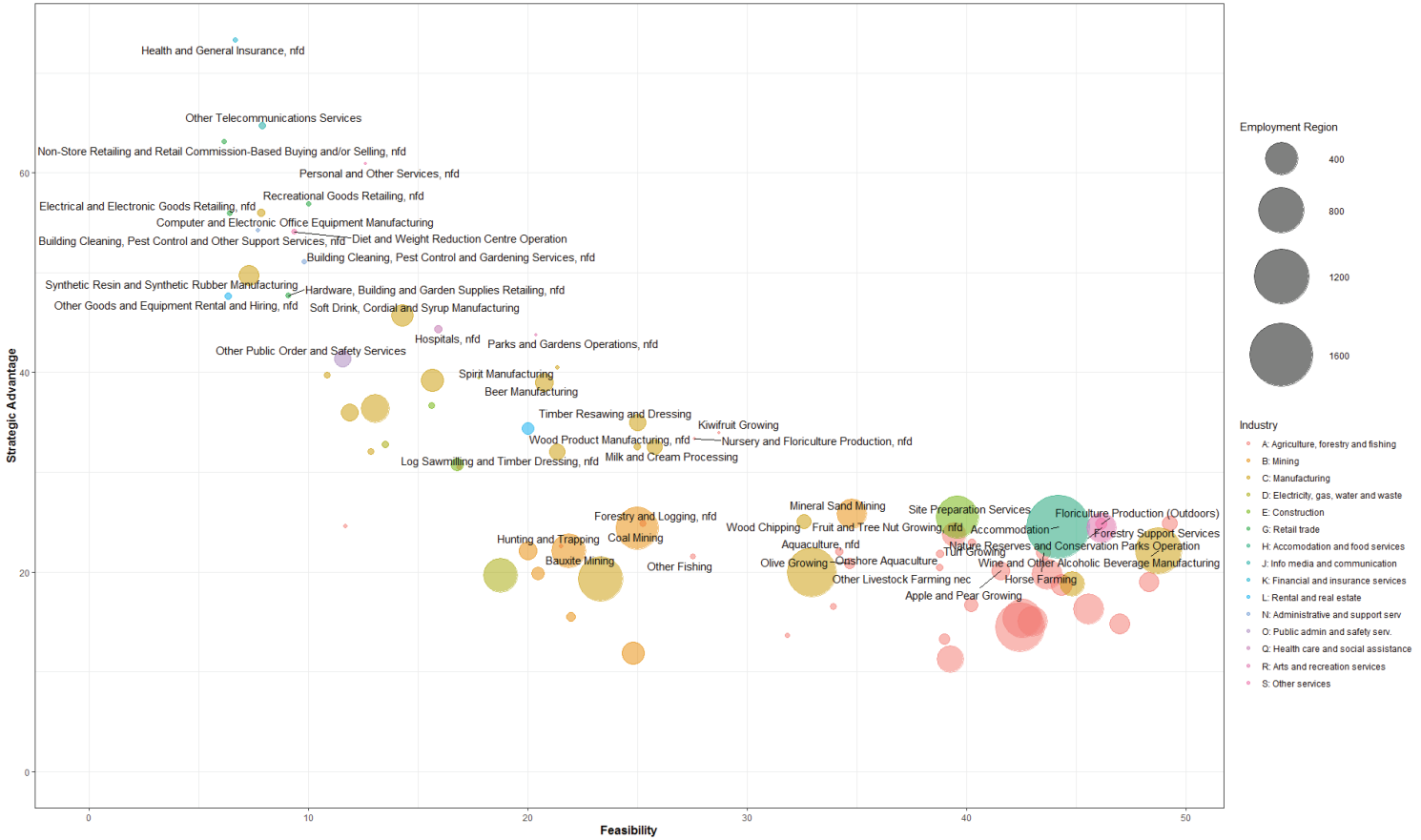
In terms of RCA, as denoted in the second part of Table 30, *wood chipping* features highly, albeit with a low estimated GVA. Related industries such as *logging, timber resawing and dressing*, and *reconstructed wood product manufacturing* also feature as having both strong comparative advantage, and estimated GVA.

*Mining* features heavily here, across *alumina, bauxite* and *non-metallic mineral mining and quarrying*. Manufacturing and agricultural related industries also feature key employers.

Figure 56 describes the South West's existing industry strengths in terms of our analysis on the feasibility and strategic advantage of industries in the region. These are all industries in which the South West has twice the expected number of employees compared to all of Australia. The size of each bubble represents the number of local jobs in that industry class.

What comes out strongly for the South West is the level of diversity and high levels of feasibility for a variety of industry classes, as denoted by the clustering of bubbles in the bottom left of Figure 56. Many of these relate to the Agriculture, forestry and fishing industry, but with significant levels of diversification within that. These include *horticulture, pastoral and broadacre crops*. However, mining activities, alcohol and beverage manufacturing and fishing and aquaculture also feature.

**Figure 56** Feasibility, strategic advantage and size of local industry strengths in the South West




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the South West?

The South West region is one of the State's most visited areas, with existing strengths in tourism, food and hospitality, agriculture, viticulture and mining. The South West is also home to the Wellington Dam Hydro Power station, one of only two hydroelectricity power generation facilities in Western Australia, alongside the Ord River Hydro station.

With such a unique proposition, the economic development options for the region will inevitably feature the further growth in these existing strengths as a priority. The diversification potential for the South West appears to come more from a refinement in the activities and outputs of existing industry sectors, capitalising on the unique endowments in the region:

- With the global market for lithium, one of the most important new opportunities in the South West is in *minerals exploration*. This would capitalise and build on the establishment of lithium mining at Greenbushes and offers tremendous potential to comparative advantage in high value bauxite and minerals mining.
- While horticulture is already well established in the South West, the diversification options for the region feature the further development of the sector, specifically in *berry growing, nursery production* and *stone fruit growing*. All of these industries are highly feasible and would capitalise on the local conditions and related industry sectors. Favourable conditions also support *beekeeping* as a diversification opportunity.

**Table 31** Possible new or expansion opportunities for the South West

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Offshore longline and rack aquaculture | 2 | 1 | 3 | 3 | 4 | 325 | 27.7 |
| Berry fruit growing | 3 | 1 | 3 | 3 | 4 | 275 | 17.4 |
| Offshore caged aquaculture | 2 | 2 | 4 | 2 | 4 | 645 | 55.3 |
| Nursery production outdoors | 3 | 2 | 0 | 3 | 3 | 145 | 9.4 |
| Sheep beef cattle farming | 3 | 0 | 2 | 3 | 4 | 485 | 30.8 |
| Other grain growing | 2 | 0 | 3 | 3 | 4 | 1,720 | 109.4 |
| Grain sheep or grain beef cattle farming | 2 | 0 | 3 | 3 | 4 | 1,345 | 85.4 |
| Stone fruit growing | 3 | 1 | 3 | 3 | 3 | 105 | 6.7 |
| Pig farming | 2 | 0 | 2 | 3 | 4 | 245 | 15.5 |
| Poultry farming eggs | 3 | 1 | 1 | 3 | 3 | 160 | 10.3 |
| Flower retailing | 2 | 3 | 0 | 3 | 2 | 40 | 2.1 |
| Veterinary services | 3 | 2 | 0 | 2 | 2 | 55 | 6.3 |
| Other agriculture and fishing support services | 3 | 1 | 0 | 3 | 3 | 155 | 9.5 |
| Rock lobster and crab potting | 2 | 1 | 3 | 3 | 2 | 75 | 7.8 |
| Mineral exploration | 1 | 2 | 2 | 3 | 3 | 145 | 26.8 |
| Other agricultural product wholesaling | 2 | 1 | 0 | 3 | 3 | 130 | 18.3 |
| Seafood processing | 1 | 2 | 2 | 2 | 3 | 105 | 9.7 |
| Gravel and sand quarrying | 3 | 1 | 0 | 3 | 2 | 60 | 12.8 |
| Shearing services | 2 | 1 | 1 | 3 | 3 | 100 | 5.9 |
| Beef cattle feedlots specialised | 2 | 0 | 3 | 3 | 3 | 85 | 5.6 |
| Beekeeping | 3 | 1 | 1 | 3 | 2 | 45 | 3.0 |
| Fertiliser manufacturing | 2 | 1 | 2 | 3 | 2 | 80 | 16.1 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Labour supply services | 2 | 3 | 1 | 3 | 4 |
| Landscape construction services | 4 | 3 | 0 | 2 | 3 |
| Ambulance services | 2 | 2 | 0 | 3 | 3 |
| Funeral crematorium and cemetery services | 3 | 2 | 0 | 2 | 1 |
| Special school education | 2 | 3 | 0 | 3 | 2 |
| Automotive electrical services | 3 | 2 | 0 | 3 | 0 |
| Residential care services nfd | 1 | 3 | 1 | 3 | 0 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

- *Specialised sheep and beef cattle farming* and *beef cattle feedlots* are identified as opportunities for breeding and finishing livestock, and supporting high value beef production.
- *Offshore longline, caged and rack aquaculture, fishing* and *seafood processing* are shown as opportunities for further development in the South West region, particularly high value marron and crab fishing. These expansion opportunities would be supported through further infrastructure development at the Bunbury port facility.
- With tourism featuring as one of the South West region's signature industries, the smart specialisation analysis highlights diversification opportunities in recreational retail, specifically in *sports and camping retail, garden supplies, horse breeding and racing*, and *sports, amusements and other recreational activities*. These enhancements would both provide for the resident population and develop the region's attractiveness to those seeking to move to the area for lifestyle regions, as well as serving the tourism sector.

Figure 57 shows the strategic gain and feasibility indexes for those industries in the South West with relatively low employment, as a means to identify those which offer diversification or growth potential[31] .

31 Indicated by a comparative advantage of 2 or less.

**Figure 57** Feasibility, strategic gain and relative industry employment opportunities in the South West


Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# Great Southern

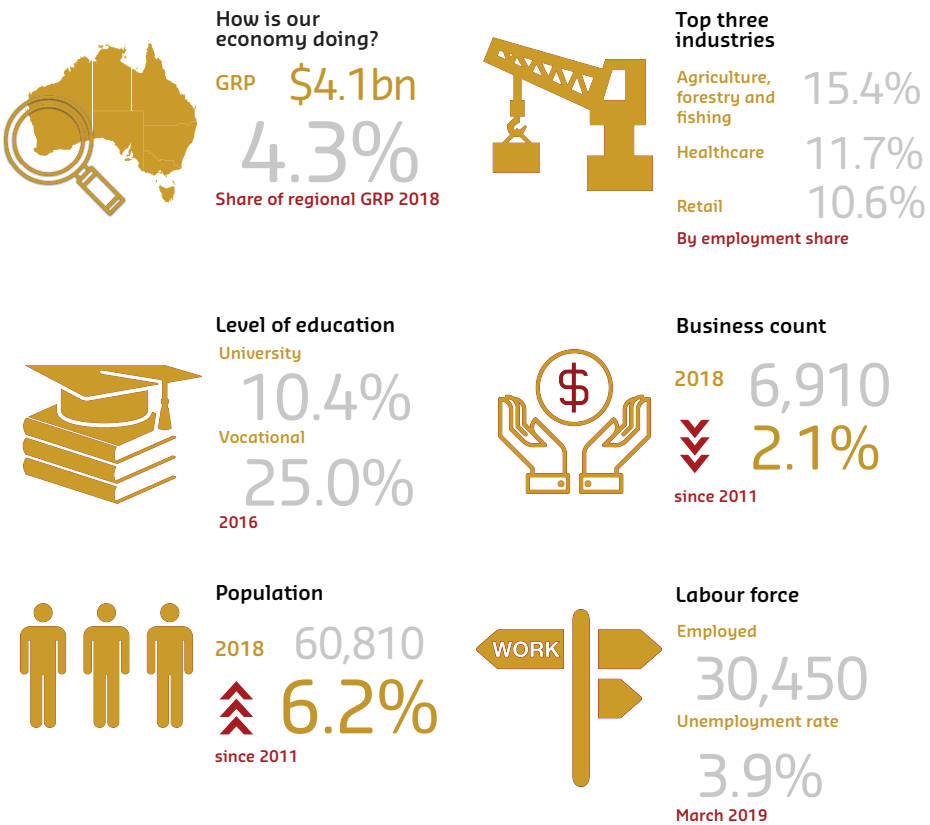
## Background

The Great Southern region is located on the south coast of WA, to the east of the South West region, to the south of the Wheatbelt, and with the western side bordering the Goldfields-Esperance. In terms of land mass, it is one of the smaller WA regions, standing at 39,000 square kilometres (1.5% of the State's total area). Despite its size, it has over eleven local authorities. Agriculture, forestry and fishing, along with viticulture and tourism are the critical industries for the region.

The Great Southern region has an estimated gross regional product (GRP) of $4.1 billion implying a 4.3 per cent share of regional GRP. Of the nine regional areas, this is the seventh largest contributor to GRP, with only the Gascoyne and Kimberley contributing less. Nonetheless, it has the fifth largest population across the nine regions, with a population currently standing at 60,800. This is a 6.2 per cent increase on 2011 Census figures. Over 35 per cent of the population have a tertiary level qualification – 25 per cent in VET and 10.4 per cent with a university qualification.

The top three employing industries are Agriculture, forestry and fishing at 15.4 per cent followed by Healthcare (11.7%), and Retail (10.6%). Almost exactly 50 per cent of the overall population are employed, with only the Pilbara and Wheatbelt boasting a lower unemployment rate than the 3.9 per cent reported. While not to the same extent as that expressed in many of the other regions, the number of businesses has declined since 2011 (-2.1%), with the count now standing at approximately 6,900 businesses.

**Figure 58** A snapshot of the Great Southern




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016, ABS Cat. 5220; ABS Cat 8625; and Department of Jobs, Tourism, Science and Innovation.

## Current industry strengths in the Great Southern

Panel (a) of the table below presents the ten largest employing industries in the Great Southern region. These industries represent the largest scale industries providing local jobs.

As outlined above, Agriculture is a critical sector for the economy, comprising over 15.4 per cent of total employment for the region. With a resident population of over 60,800, Education and Health services are also major employers, including the aged care residential services. Accommodation and food services also present as critical employers for the Great Southern region.

**Table 32** Top ten industry classes in the Great Southern

*(a) by share of local employment*

| | Employment | Employment (% of total) | Estimated GVA ($m) | Comparative advantage |
|---|---|---|---|---|
| Grain sheep or grain beef cattle farming | 806 | 3.5% | 51.2 | 23.2 |
| Primary education | 759 | 3.3% | 30.5 | 1.4 |
| Hospitals except psychiatric hospitals | 751 | 3.3% | 61.6 | 0.8 |
| Supermarket and grocery stores | 715 | 3.1% | 40.7 | 1.2 |
| Local government administration | 646 | 2.8% | (a) | 2.0 |
| Sheep farming specialised | 584 | 2.5% | 37.1 | 14.4 |
| Aged care residential services | 577 | 2.5% | (a) | 1.2 |
| Secondary education | 576 | 2.5% | 46.2 | 1 |
| Cafes and restaurants | 538 | 2.3% | 20.1 | 0.9 |
| Accommodation | 517 | 2.3% | 36.5 | 2.0 |

*(b) by comparative advantage*

| | Comparative advantage | Estimated GVA ($m) | Employment | Employment (% of total) |
|---|---|---|---|---|
| Grain sheep or grain beef cattle farming | 23.2 | 51.2 | 806 | 3.5% |
| Shearing services | 20.7 | 5.1 | 85 | 0.4% |
| Forestry | 16.4 | 15.1 | 105 | 0.5% |
| Sheep farming specialised | 14.4 | 37.1 | 584 | 2.5% |
| Meat poultry and smallgoods wholesaling | 13.7 | 22.3 | 201 | 0.9% |
| Other grain growing | 10.7 | 29.8 | 469 | 2.0% |
| Pig farming | 10.3 | 3.7 | 59 | 0.3% |
| Forestry support services | 8.1 | 2.7 | 45 | 0.2% |
| Sheep beef cattle farming | 6.3 | 6.2 | 98 | 0.4% |
| Meat processing | 6.3 | 40.1 | 424 | 1.9% |

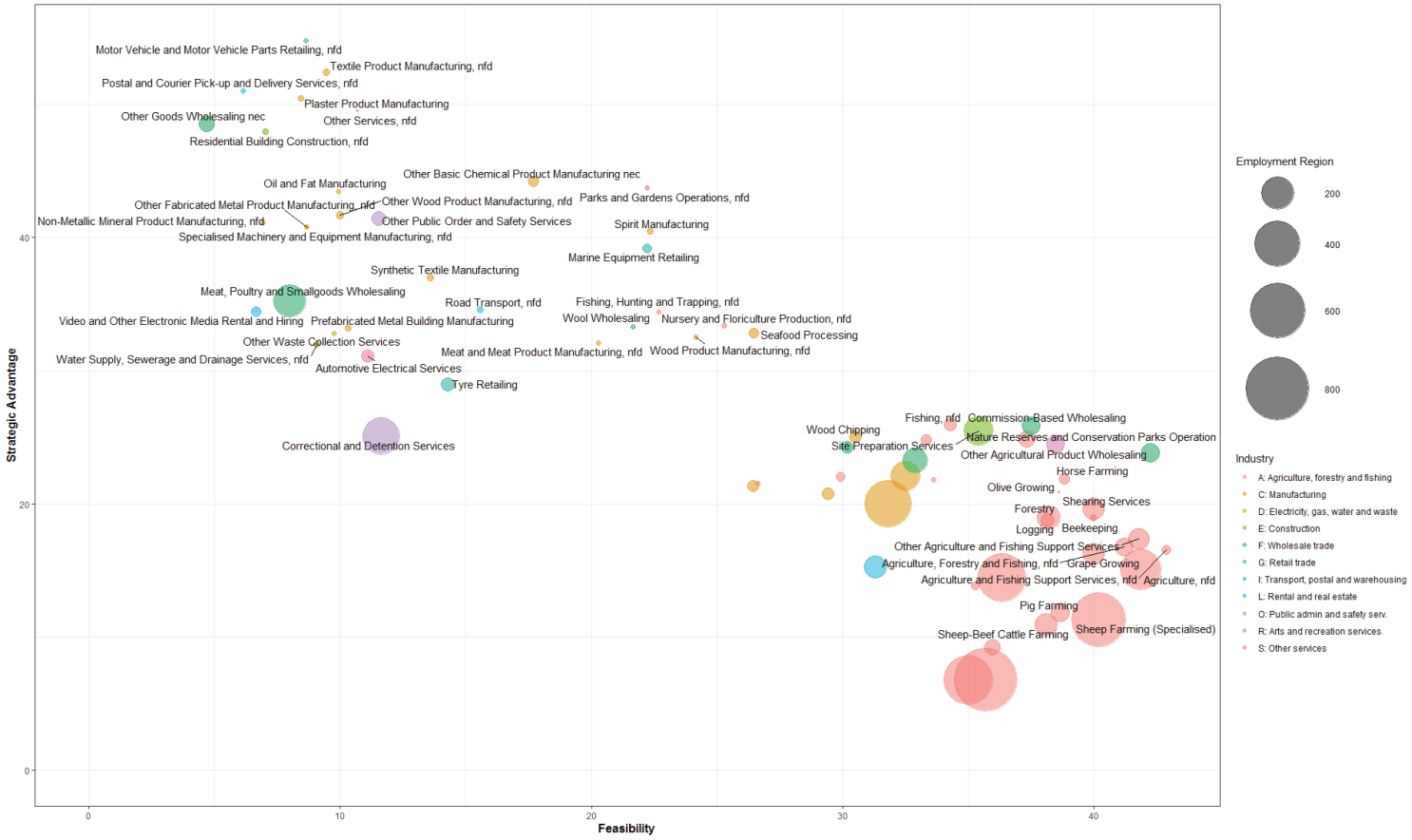
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

Industries in which the Great Southern is uniquely capable (has an RCA) are those that generate a greater share of employment in the Great Southern than would be expected based on population alone. These are industries in which the Great Southern can be considered an expert, but do not necessarily represent the largest employing industries or industries with the highest value. Agriculture and forestry related manufacturing and services again feature heavily here for the region (Table 32, panel b).

Our analysis on the feasibility and strategic advantage of industries in the Great Southern is described in Figure 59. These are all industries in which the Great Southern has at least twice the expected number of employees compared to all of Australia. The size of each bubble represents the number of local jobs in that industry class.

The main industry strengths and larger employers in the Great Southern tend to be industries that are considered more feasible, with a high representation of agriculture, particularly agricultural services. *Sheep farming and related services* are of particular dominance, with *pig and cattle farming* also featuring strongly from a feasibility perspective.

**Figure 59** Feasibility, strategic advantage and size of local industry strengths in the Great Southern




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

## What are the diversification opportunities in the Great Southern?

The smart specialisation approach to diversifying the Great Southern aims to sustain what the Great Southern is already good at, as shown above, and diversify into industries that build on such expertise. Many of the opportunities for diversification in the Great Southern lay around existing Agriculture, forestry and fishing and Tourism strengths. The Great Southern's existing expertise in agricultural areas such as wool, broadacre cropping and livestock, provides a strong foundation from which the region can grow. The latter particularly through an increasing demand for high quality agricultural produce both domestically and overseas. Greater efficiencies too can be made through implementation of best practice management and technological advancements.

If the Great Southern is not yet strong in a particular industry, the feasibility measure (Table 33) indicates the likelihood of the Great Southern diversifying into that industry. Similarly, the strategic gain index implies industries that would be strategically useful to boost incomes, resilience, long-term growth and diversify the Great Southern economy. The range of measures show the potential new or expansion opportunities in the Great Southern that should be investigated further.

Table 33 describes possible new opportunities for diversification in the Great Southern that rank well on other indicators. The data reveals a number of interesting potential opportunities for the Great Southern. However, many relate to sub-industries within Agriculture, forestry and fishing, and tourism, which is not surprising given existing strengths in this broad industry grouping. That is, diversification within such dominant industries is more feasible. Strategic gains that build on the existing industries are more difficult in the Great Southern and many other regional economies. As a result, it is not advisable for the Great Southern to attempt to enter highly strategic industries that are unlikely to be successful. Instead, the industries targeted here predominantly focus on their feasibility, potential embeddedness and low levels of ubiquity across Australia. These are industries that are not found widely across Australia and in which the Great Southern possesses a uniquely high feasibility indicator, suggesting that they are more likely to remain in the Great Southern if they are able to become more established.

**Table 33** Possible new or expansion opportunities for the Great Southern

| Industries | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth | Potential extra jobs by 2025 | Potential extra GVA by 2025 ($m p.a) |
|---|---|---|---|---|---|---|---|
| Accommodation | 3 | 1 | 0 | 4 | 4 | 230 | 16.1 |
| Offshore longline and rack aquaculture | 2 | 1 | 3 | 4 | 4 | 95 | 8.3 |
| Apple and pear growing | 2 | 1 | 3 | 4 | 4 | 80 | 5.1 |
| Offshore caged aquaculture | 1 | 2 | 4 | 3 | 4 | 200 | 17.2 |
| Mushroom growing | 2 | 1 | 3 | 4 | 4 | 80 | 5.2 |
| Dairy cattle farming | 3 | 1 | 2 | 4 | 4 | 425 | 27.1 |
| Berry fruit growing | 2 | 1 | 3 | 4 | 4 | 70 | 4.6 |
| Vegetable growing outdoors | 3 | 1 | 1 | 4 | 4 | 140 | 8.9 |
| Other fruit and tree nut growing | 2 | 1 | 3 | 4 | 4 | 180 | 11.5 |
| Citrus fruit growing | 2 | 0 | 3 | 4 | 4 | 105 | 6.7 |
| Log sawmilling | 3 | 1 | 2 | 4 | 4 | 85 | 9.4 |
| Poultry farming eggs | 3 | 1 | 1 | 4 | 3 | 85 | 5.4 |
| Nursery production outdoors | 3 | 2 | 0 | 3 | 3 | 60 | 3.7 |
| Timber resawing and dressing | 1 | 2 | 3 | 3 | 3 | 40 | 4.5 |
| Rock lobster and crab potting | 2 | 1 | 3 | 4 | 2 | 25 | 2.8 |
| Cotton growing | 2 | 0 | 4 | 3 | 4 | 105 | 6.8 |
| Stone fruit growing | 2 | 1 | 3 | 4 | 3 | 90 | 5.9 |
| Natural textile manufacturing | 1 | 2 | 4 | 3 | 2 | 15 | 1.3 |
| Grain mill product manufacturing | 1 | 2 | 3 | 3 | 3 | 45 | 4.3 |
| Turf growing | 2 | 1 | 2 | 4 | 2 | 25 | 1.6 |
| Prepared animal and bird feed manufacturing | 2 | 1 | 1 | 3 | 3 | 55 | 5.1 |
| Deer farming | 2 | 1 | 4 | 3 | 1 | 10 | 0.5 |
| Leather tanning & product manufacturing fur dressing | 1 | 2 | 1 | 3 | 2 | 15 | 1.0 |
| Gravel and sand quarrying | 2 | 1 | 0 | 4 | 2 | 20 | 4.4 |

| Related services | Feasibility | Strategic gain | Uniqueness | Embeddedness | Potential job growth |
|---|---|---|---|---|---|
| Urban bus transport including tramway | 3 | 2 | 0 | 4 | 3 |
| Water supply | 3 | 2 | 1 | 4 | 4 |

Note: GVA data not available for defence, government administration or justice.
Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

BCEC's from *Paddock to Plate* report (Bond-Smith *et al*., 2016) on agriculture and agribusiness in WA outlined the growth opportunities from an expanding middle class in China and a rising population in South-East Asia, with opportunities too for investors and the government looking for new sources of growth and prosperity. There is increasing demand domestically too, with changing lifestyle choices and related food consumption.

Of course, the analysis here is driven by the economic modelling and the data available, and potential industries require additional analysis, consultation with local and industry experts, as for example, in the case of agriculture and aquaculture, soil quality and climatic factors (land and sea temperatures) may rule such opportunities out. Keeping this in mind, industries with potential include:

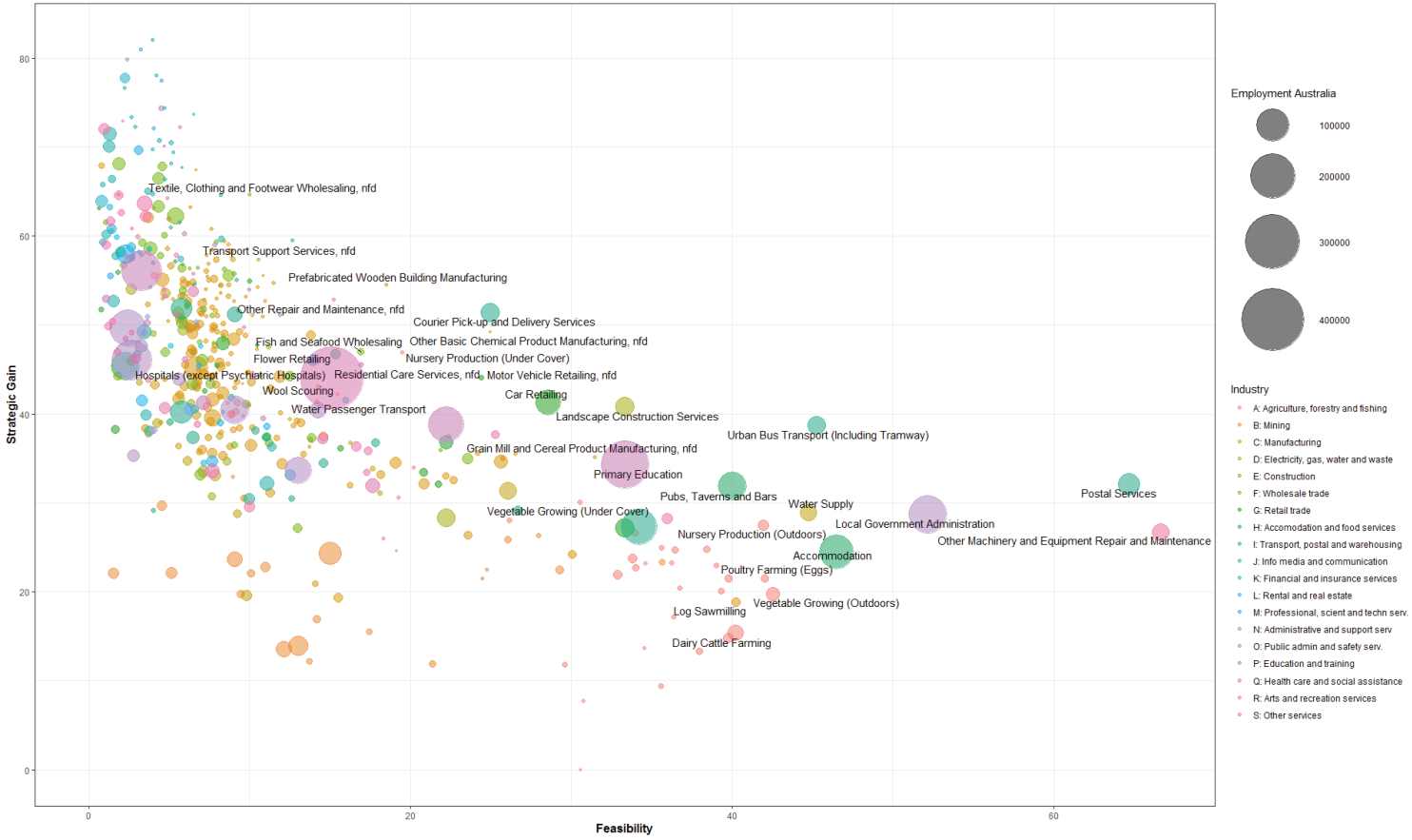
- The *horticulture* space, which emerges strongly in the analysis here (Table 33) for the Great Southern region. In line with the methodology applied, such opportunities also align with the existing viticulture and tourism strengths in the region.
- For example, *berry fruit growing, apple and pear growing, citrus fruit growing* and *stone fruit* and *other fruit and nut growing* all emerge as potential growth opportunities which are worth further investigation in for the region. In terms of the current scale of employment in the region, together, such opportunities present good employment opportunities. *Vegetable and mushroom growing* also feature along with *nursery growing* and *cotton growing*.
- While cattle farming is an existing strength in the region, *dairy cattle farming* emerges as an area with potential for expansion. Developments in farming technology have potential for significant technological and productivity gain, which together can lead to enhanced employment for the Great Southern.
- The *aquaculture industry* is not seen as an existing strength for the Great Southern, but *offshore caged aquaculture* along with *offshore longline and rack aquaculture* and *rock lobster and crab potting* all emerge as potential opportunities for the region. The feasibility of such activities are increased with supply chains and networks in the broader agricultural sector that could be drawn upon.

- While wave energy does not come to the fore in the table above, UWA's Wave Energy Research Centre, which is based in Albany, also provides opportunities. Wave energy is in its infancy globally, with potential for further and sizeable growth.
- *Accommodation* to support the many festivals and tourist related activities that take place in the Great Southern also emerges as a candidate with potential growth opportunities and related employment, to build on existing tourism strengths.
- This will transfer to other tourist related services too, including *food and restaurants* and *public houses*, the latter of which is displayed in Figure 60.

Figure 60 also shows the larger suite of strategic gain and feasibility indexes for industries in which the Great Southern is currently underdeveloped[32]. The size of the bubbles indicates nationwide employment in those industries currently. Many industry classes are difficult for the Great Southern to enter, since none of the related industries appear in the Great Southern. Such industries are represented by the bubbles on the far left of the following chart.

32 Indicated by a comparative advantage of 2 or less.

**Figure 60** Feasibility, strategic gain and relative industry employment opportunities in the Great Southern




Source: Bankwest Curtin Economics Centre | Authors' calculations from ABS Census 2016.

# How do we get there?

# Introduction

Just as change has been labelled the one constant in life, the one thing we can be certain about the future is that it will be different to today. Whether it is the gig economy, digital disruption and the share economy, international competition or sudden swings in commodity prices, the Western Australian economy and the regions will need to respond to changing environments. Making predictions or forecasts about economic trends has some value, such as in scenario planning exercises, but, as noted, even market investors and learned commentators have at times been hopelessly wrong in claiming to know what path the Australian economy should take. In the face of this uncertainty, the important thing is to set in place a framework conducive to recognising and responding to high-value opportunities as they arise rather than trying to predict the future.

Given the vastness and diversity of Western Australia, any such framework must emphasise place-based differences. Trade-offs are inherent in the degree of granularity at which to base such a framework, but we argue the Regional Development Commission regions reflect a reasonable structure to capture important 'bottom-up' elements of locality while also reflecting the importance of scale in innovation processes and networks. The OECD (2013) identifies three strategic capacities required for governance that allows regions to grasp opportunities:

- the capacity to identify local strengths
- the ability to align policy actions and to build critical mass
- the ability of regions to develop a vision and implement the strategy.

Each of these align with functions of the Regional Development Commissions, with the formulation of a shared regional vision currently embodied in regional development Blueprints. And while the nine regions offer an appropriate level of analysis, they are not the only level at which action needs to be taken to promote innovation and diversification. There is a role for agents at a more localised level, such as business and community groups of local towns and shires, Indigenous Land Councils and Traditional Owners, at higher levels, such as the State and Commonwealth governments and Chambers of Commerce and Industry and a role for 'horizontal linkages' that cut across these levels, such as growers cooperatives and representative industry bodies.

# Principles

Building on extensive experience of the implementation of smart specialisation strategies in regions throughout Europe as well as in other countries, the EU has developed a six-step approach or guide to developing a smart specialisation strategy for regional innovation. These are:

1. analysis of the regional context and potential for innovation
2. set up of a sound and inclusive governance structure
3. production of a shared vision about the future of the region
4. selection of a limited number of priorities for regional development
5. establishment of suitable policy mixes
6. integration of monitoring and evaluation mechanisms.

As noted, we are not attempting to develop or advocate for a smart specialisation strategy for the WA regions, but argue that many of the insights behind smart specialisation and the tools developed to support it can be usefully applied in the pursuit of regional opportunities for diversification and increasing productivity. In particular, the preceding chapters offer contributions to the first and fourth steps: the analysis of the regional context and identifying potential priorities for local development. The measures of relatedness provide an empirical basis for identifying activities which are complementary to existing activities, and therefore potentially build upon existing regional strengths. The measures of complexity provide one empirical indicator for assessing the value added potential of competing opportunities. Such an explicit theoretical framework and evidence base has largely been missing from the formulation of regional development and industry policy to date.

The main role of the analysis and regional profiles is as conversation starters – to provide information to stimulate the entrepreneurial discovery process and to help shape the creation of a shared vision within each region. In many cases the potential industries identified may not be feasible business concerns for specific local reasons – but that is for local entrepreneurs to decide. The role of this analysis is to start those dialogues. Lessons from the history of industry policy warn us against trying to pick winners or providing subsidies that will generate rent seeking behaviour. The information provided here is a public good, but acting on that information involves risk that should be borne privately by entrepreneurs and their associated partners. So, beyond injecting new talking points into the dialogue, what are the next steps and what is the role of government?

In principle, government should step in to support or fulfil any function that has a net social benefit, but where private agents will be unwilling to make those investments because they cannot capture the benefits. Examples of these include the production of public goods (including information), activities which have positive externalities or network effects (including investing in education and training) and the provision of infrastructure that has characteristics of a monopoly or where it is impracticable to exclude users (ACIL Allen, 2015). Where these conditions exist, suboptimal outcomes can arise due to coordination failure. Coordination failure occurs when a group of firms or agents could benefit by acting collectively, but that action is not taken either because the parties lack full information or because there is a high cost to any one party to initiate and manage the collective action. Seeking to identify and address coordination failures is a legitimate role for government. An example is the WA Government's proposal to create an overarching 'Brand WA' promoting a reputation of excellence across WA-produced goods and services and for the State as a tourist destination (Department of Premier & Cabinet, 2019). While this collective action offers pay-offs across many firms, no single firm would have had the incentive to initiate and coordinate such a marketing campaign.

# Policy steps

In response to the findings of this report, the key role of policy should be to build on those conversations through provision of ongoing information and the facilitation of networks necessary to realise regional opportunities. Identifying the key innovation networks and linkages to support is the starting point for the final three implementation steps of selecting priorities, establishing the right policy response and putting in place monitoring and evaluation mechanisms.

In terms of providing information, the analysis undertaken here has necessarily been based on employment data by industry from the 2016 Census, as the only current source to contain information at the required level of disaggregation by region and industry. However, BCEC is currently exploring the possibility of obtaining firm level data through Australian Tax Office records and the Commonwealth Government's Business Longitudinal Analysis Data Environment. This has the potential to generate additional and more timely information on regional linkages, and that could provide the basis for ongoing monitoring of emerging regional opportunities.

Drawing upon this report and any further analyses, priorities for potential activities to be promoted should be identified for each region through extensive local consultation, a role well suited to the Regional Development Commissions. A collaborative approach and development of a shared vision is important as there is less resistance to change when the governance process is seen to have legitimacy, and inclusion of a wide range of stakeholders and perspectives promotes more imaginative thinking about ways to create value (Foray and Goenaga, 2013; Veldhuizen *et al.,* 2018).

Having identified priorities to support, the government then has a coordination role in developing innovation networks around those activities: exploring the supply chains and final customers, R&D partners, relevant education and training institutions, and technology requirements, and to facilitate communication between key players. Government involvement at a higher level is likely to be important here, as research internationally (Veldhuizen *et al.*, 2018) and here in WA (ACIL Allen, 2015) has shown that regional businesses and other stakeholders are often internally focussed, and tend not to consider global trends, international business opportunities or to have international networks. The WA Government and agencies such as Austrade can help to make those connections, and to activate networks through targeted trade delegations and in other international trade dialogues, such as the Asia Pacific trade forums. In fostering these networks, the goal is not just to get the parties talking, but to get them focussing on the specific theme relating to the identified activity (Veldhuizen *et al.,* 2018).

Having carriage over the school system, much of the VET sector and universities, governments are also critical in shaping the education, training and R&D institutions and systems available to support innovation. Much of the focus of smart specialisation strategies in the EU has been on innovation originating from university-led R&D and on knowledge intensive and high-tech activities. Here we are assessing regional strengths more broadly and with a more general interpretation of innovation: not as the forefront of scientific knowledge, but as any change that increases value. Similarly, it has been argued in the literature that the smart specialisation approach has over-emphasised the university sector as a source of knowledge and innovation and underemphasised the role of firms and industry in generating regional innovation (Veldhuizen *et al.,* 2018).

So while an important role for government in supporting regional innovation is the provision of appropriate education and training and to incorporate those institutions in the process of building networks around prioritised activities, it is important that due consideration is afforded to the TAFE sector as well as the university sector. In a similar vein, we caution against a focus on knowledge intensive and high-tech sectors. In advanced economies, services typically feature among the fastest growing sectors and personal services among the fastest growing occupations. These sectors can often generate value by making innovative use of new technologies and knowledge, without having to be at the forefront of invention. Nationally, there has been a push to increase the science, technology, engineering and mathematics (STEM) capacity of the workforce, and the WA government recently released its own STEM strategy stressing the growing demand for STEM qualifications (Department of Jobs, Tourism, Science and Innovation, 2019). However, recent analysis by BCEC has shown that employment in many of the fastest growing occupations in Western Australia, notably in the health sector, make very little use of STEM qualifications. Moreover, much of the narrative around STEM has considered only qualifications at the university level (bachelor's degree or higher) to count as STEM qualifications. Using earnings by qualification level as a proxy for productivity, the BCEC analysis demonstrated that a substantial proportion of WA's STEM capacity resides with workers with vocational level qualifications, notably tradespersons and technical workers with diplomas and associated diplomas.

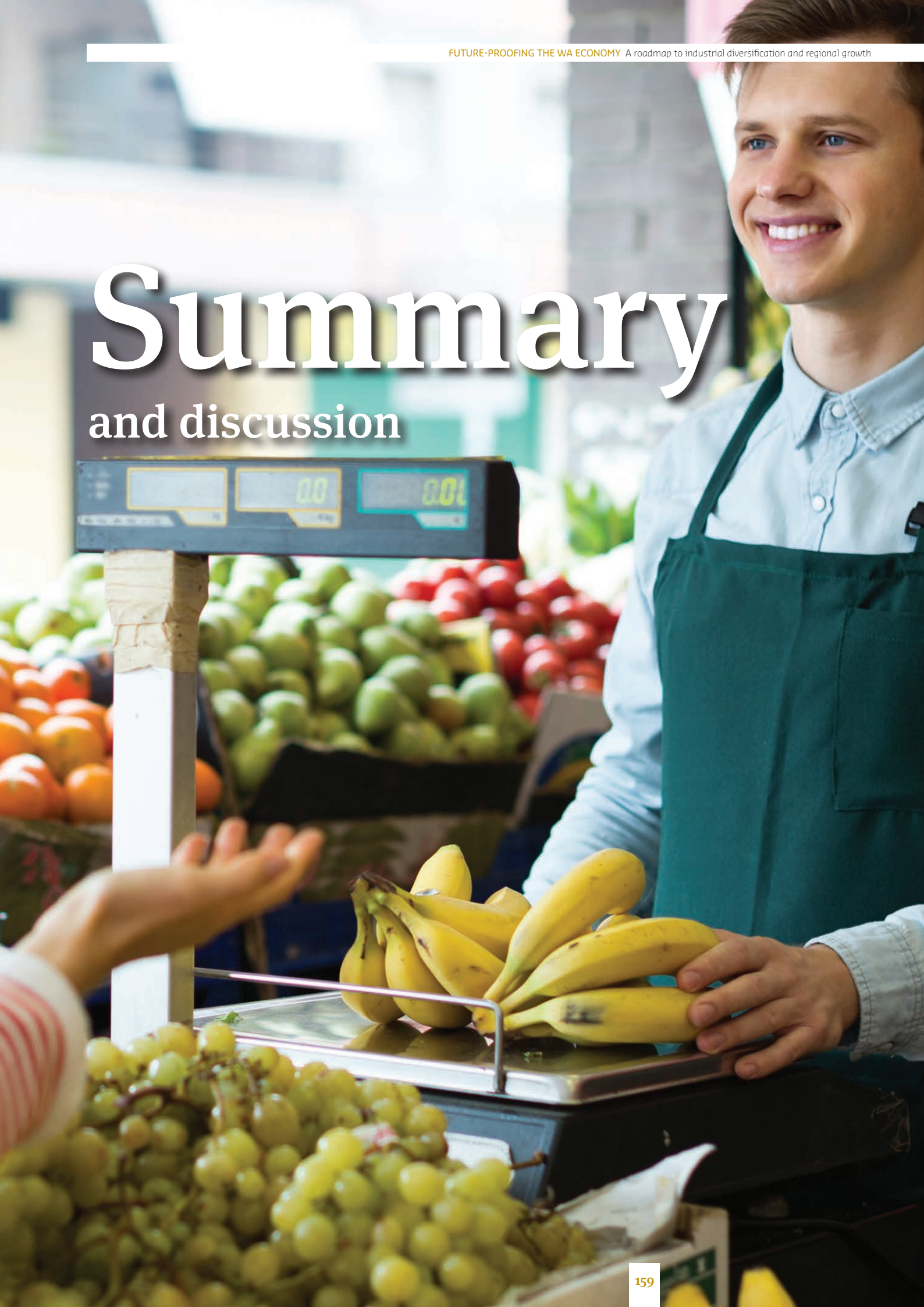
In response to regional innovation priorities identified, the government should assess the viability of expanding regional TAFEs with courses aligned with those activities, and continue to promote linkages between TAFE and the university sector. The recent State Government investment in the WA Applied Engineering and Shipbuilding Training Centre in Henderson is an example of such a response.

In addition to this, the established and ongoing roles of government infrastructure provision and good governance support regional initiatives. Public provision of infrastructure, such as roads, rail, ports, airports, utilities and telecommunications has been critical to development throughout the State's history. Information on potential development opportunities should be taken into consideration in regional planning for infrastructure, particularly where these relate to specific technologies. Good governance and quality government institutions ensure the proper incentives to parties to participate in the entrepreneurial discovery process and to avoid vested interests that potentially constrain it, and have been found to be important factors in explaining differences in innovative performance across regions (Marinelle *et al.,* 2019; Rodriquez-Pose, Di Cataldo & Rainoldi, 2014).

With Commonwealth, State and Local Government policies and regulations all likely to influence opportunities, a further obligation of government is to work to ensure the mix of policies are all appropriately aligned to support priorities. Regional innovation strategies should also incorporate an ongoing evaluation strategy with clear criteria for success and failure. This follows from the principles set out by Foray and Goenaga (2013) that an innovation strategy should be seen as a living document and an experimental approach – that the priorities that emerge today will not be supported forever. Moreover this process of continued refinement through experimentation and evaluation can lead to a learned capacity for innovating that maximises a region's potential to seize and maximize opportunities.

# Conclusion

In summary, future proofing the WA economy requires the development of capabilities within the regions to recognise and grasp opportunities based on local differences and local strengths, and generating from the 'bottom-up' a shared vision for regional development. Using emerging methodologies, this report generates a number of measures to contribute to the identification of regional development opportunities and highlights some of these for each region. The key role of government is to foster the entrepreneurial discovery process by addressing coordination failures: to provide 'public good' information relevant to the identification of regional priorities and to assist in building innovation networks and initiating dialogues focussed around specific identified themes or activities. The regional priorities should also be supported by government decisions relating to investment in infrastructure and in education and training, and the alignment of policy at different levels of government. This policy approach avoids the classic pitfalls of regional and industry policy of governments trying to 'pick winners', or trying to simply replicate high performing regions without adequate consideration of local context. Because it concentrates on supporting the discovery process through legitimate roles of government (provision of public goods and addressing coordination failures) rather than subsidising business activities, it requires entrepreneurs to put 'skin in the game' to realise those opportunities, and thus avoids rent seeking behaviour. The analysis presented here offers a starting point for those conversations, with significant opportunities to build on the approach through richer and ongoing analyses.



# Summary

## and discussion

# Summary and discussion

As outlined in the introduction of this report, the Australian and WA economies have shown impressive and consistently positive growth in GDP and GSP over recent decades, with much commentary around the nation's avoidance of a recession during and post-GFC.

In fact, in per capita terms, since 1992, the WA economy has, on average, grown at an even stronger pace than that displayed nationally. WA's GSP per capita stood at $98,725 in 2018, and despite a decline from a peak of almost $100,000 in 2016, it remains $25,850 above the GDP per capita reported for the nation.

## Why do we need to diversify?

As is often the case with resource-intensive economies, success is often accompanied by greater volatility. Over the course of the last quarter of a century, the level of economic volatility in WA (as measured by changes in GSP) peaked in 2017, when the gap between WA and Australia was also at its widest. Volatility is also evident in WA's employment trends. For example, employment in mining grew by almost 40 per cent in 2010, but fell by an average of 7.6 per cent in each of the following three years. This in turn causes employment volatility in related industries such as construction, with knock-on implications too for retail trade and the accommodation and food sectors.

This *Focus on Industry* report shows that the WA economy is now more concentrated (or less diversified) than at any other time over the last quarter of a century. The mining sector now accounts for over a third of the WA economy, with a similar share reported for the top four industries put together nationally. Furthermore, the economy has been slowing, with aggregate growth in GVA across all industries at its lowest in recent years.

These facts all point to the need for diversification to future-proof the WA economy against shocks, and to ensure that our high standard of living is maintained. In this report, we put forward a policy framework that draws upon the emerging smart specialisation approach to provide a guide to the appropriate role for government and policy in the face of inevitable uncertainty. Such a framework complements the existing roles of the Regional Development Commissions, and puts an important emphasis on local knowledge and place-based policy to support diversification.

## Think smart

Smart specialisation evolved out of policies to promote regional cohesion within the European Union, and represents a 'place based' integration of industry and regional development policies. Smart specialisation emphasises the role of entrepreneurship and networks in promoting innovation to increase regional value-added. Smart Specialisation emphasises the importance of local contexts and capacities and attempts to develop networks to build on regional strengths. Given the geographical scale and diversity of this State, it is imperative that any approach to regional policy is formulated from the ground up.

A common criticism of various approaches to regional and industrial development policies, including those in WA, has been the lack of an evidence-based and transparent methodology to identify what those local strengths are.

In this report we apply a data-driven methodology to identify current strengths and potential opportunities for diversification both in Perth and in each of WA's nine Regional Development Commission regions. The smart specialisation criteria used to identify diversification include concepts of feasibility, embeddedness, complexity and strategic gain. Each is calculated from detailed data on the existing industrial structure of the regions, and the inter-relationships between local industries.

A range of potential diversification options are put forward for each region, as a complement to those activities that the regions already do well.

It is important to stress that such policies are not a substitute for the continued support for existing industry strengths in each region. Rather, the purpose of this report is to raise awareness of emerging or potential opportunities for economic development, and to support conversations about how to foster economic growth, innovation and diversification.

## Profiling the regions – towards smart specialisation

So, which industries offer the greatest potential for diversification across WA's regions, and which justify further examination?

A number of WA's regions, particularly in the Pilbara, Goldfields-Esperance and South West, are well positioned to develop mining capabilities in lithium, rare earths and other non-ferrous metals, and to add value through refining and downstream processing technologies.

Many of WA's regions have the potential – and in some case the need – to expand both specialist and general medical services, childcare and education services and residential aged care to support growing populations both in Perth and regional WA.

One of the most significant areas for further industry diversification and jobs growth is in the Peel region, especially in boat and freight transport construction, scientific support, agriculture and food processing. The report also finds empirical support for rail transport construction services in Perth, as well as diversification opportunities into defence services and defence technology in the Gascoyne, Mid West and Kimberley regions, to complement current industry concentrations in Perth.

Many of the State's regions can further develop their tourism industries to capitalise on WA's industrial history and current strengths, its cultural richness and its natural endowments – for example through science tourism, cultural tourism, eco-tourism and adventure tourism. Industry tourism also presents as a niche diversification opportunity, especially related to the State's legacy, and current and future industrial strengths in gold, resources and agriculture.

And many regions are also well-place to develop capacities in scientific testing and analysis, and in data and information analytics – all key components of WA's main strengths in mining and agriculture. There are opportunities for regional economies to develop and export scientific and technical services and other knowledge-based industries, particularly air and space technologies given the 'line of sight' that exists with the strengths of related resources industries in remote operations, automated vehicles technologies and data analytics.

## What does this imply for the WA economy, including the regions?

If industry diversification in Western Australia followed the smart specialisation prospectus laid out in this report, it would result in more than **163,000 new jobs** across the State in 2025, more than **48,000** of which would be in **regional areas**, and add around **$19.5 billion** in annual value to the WA economy by 2025 over and above current growth expectations.

These are conservative estimates of the total employment gains from smart specialisation, with further growth likely to come from expanded service sector jobs.

In addition to previous BCEC reports, here we have again highlighted that the regions suffer particularly when economic growth is weak. The growth opportunities presented in this report will help to strengthen local economies, create local employment opportunities and relieve population decline in many regional areas.

## Recommendations

Targeting new sectors with a smart specialisation approach is not 'picking winners'. Instead, strategies for smart specialisation prioritise new industry opportunities based on their strength and potential, the strength and co-location of related industries, and the local conditions necessary to sustain themselves. This report is intended to support economic development across each of WA's region, and proposes a framework to ensure that diversification opportunities have the best chance of success.

A number of strategies and actions should be considered by regional development agencies in collaboration with state and governments and industries to build a long-term and sustainable vision for regional economic growth:

- Appropriate and proportionate regulation is good for investment, and builds confidence among investors. The regulatory environment in WA over the course of the mining boom evolved more to support investment in 'mega-projects'. It is important that the State's regulatory settings continue to evolve to support smaller scale investment projects.
- Regional Development Commissions should develop roadmaps for industry development and diversification, but should do so in collaboration with state agencies, local stakeholders and local industry.
- The case for diversification should be supported by measurable targets that assess the implementation, impacts and results of new ventures, as well as timelines.

- Networks and knowledge transfer are crucial factors in the success of new ventures and diversification opportunities. The state government and industry peak agencies have an important role to play in connecting local businesses with local, national and global best practice.
- The smart specialisation approach provides an evidence-based framework to target new diversification opportunities across regions, and to facilitate international business delegation visits to support and inspire local entrepreneurs.
- And the approach should be two-way, exposing international business investors to regional development opportunities and local entrepreneurs.
- There is also an important role for regional coordination in seizing opportunities, capitalising on complementarities across industries and regions, rather than competition between them.

Continuous evaluation and monitoring is a recognised principle of the smart specialisation framework. To this end, the Bankwest Curtin Economics Centre hopes the approach developed for this *Focus on Industry* report can build into an ongoing capacity for the assessment of regional economic development opportunities both in Western Australia, as well as nationally.

This smart specialisation capability should enhance our capacity to identify and seize diversification opportunities as they arise, supporting sustained and inclusive growth and a more resilient state economy.

# Glossary

## and technical notes

# Glossary and technical notes

## Relative comparative advantage (RCA)

The relative comparative advantage ($RC_{r,i}$) indicates the industries that a country or region is good at, such that by directing effort towards those industries the country or region's output and wealth increases.

$$\boldsymbol{RCA_{r,i}} = \frac{\boldsymbol{E_{ri}} / \sum_{i'} \boldsymbol{E_{ri'}}}{\sum_{r'} \boldsymbol{E_{r'i}} / \sum_{r'i'} \boldsymbol{E_{r'i'}}}$$

Where $E$ equals employment, $r$ the regions of Australia and $i$ the industry at class division. The RCA equals the proportion of the region's employment of the class industry under consideration, divided by the proportion of Australian employment of that industry class.

## Relatedness

Relatedness ($\varphi_{i,r}$) describes the extent that two industries require similar capabilities and conditions to operate. Relatedness is inferred by the frequency with which each pair of industries appears co-located in the same small statistical area (DNZ) across Australia.

To compute relatedness we use the standardization method (Steijn, 2017) based on Van Eck and Waltman (2009)[33].

## Relatedness density - feasibility

The relatedness density in an industry in a particular region describes the share of related industries that also appear in the region.

The relatedness density ($RD_{i,r}$) is calculated for a region $r$ and industry $i$ for all the industries in which the region has an RCA larger than 2, therefore:

$$RD_{i,r} = \frac{\sum_{j \in r, j \neq i} \varphi_{ij}}{\sum_{j \neq i} \varphi_{ij}} * 100$$

These estimation follow the procedure of Hidalgo *et al.* (2007) and Boschma *et al.* (2014) and is performed using the Econ Geo R package.

33 Relatedness is computed using the *Econ Geo R* package: Balland, P. A (2017). Econ Geo: Computing key indicators of the spatial distribution of economics activities, R package version 1.3.

## Diversity

The diversity index ($Div_r$) accounts for the number of industries $i$ that are developed in region $r$ for which the region has an RCA greater than 2.

$$Div_r = k_{r,0} = \sum_i M_{ri}$$

Where $M_{ri}$ is a matrix I if the region $r$ has industry $i$ with an RCA>2 and zero otherwise.

## Ubiquity

The ubiquity index ($Ubi_i$) indicates the degree of rarity of an industry $i$ in the regions $r$ in which the industry has an RCA greater than 2.

$$Ubi_i = k_{i,0} = \sum_r M_{ri}$$

Where $M_{ri}$ is a matrix I if the region $r$ has industry $i$ with an RCA>2 and zero otherwise.

## Economic complexity – Strategic gain

The economic complexity of an industry *i* describes the implicit capabilities requirement of the industry by considering the diversity of the region's capabilities (Escobari *et al.*, 2019).

The economic complexity of a region *r* describes the implicit capabilities of the region by considering the ubiquity of the industries that are established in the region.

The concept of industry and region economic complexity interact and correct each other to deliver the economic complexity index:

$$EC_i = \frac{\vec{Q} - \langle \vec{Q} \rangle}{Stdev(Q)}$$

Where $Q$ is the second eigenvector of the product matrix $(B)=(M^T * M)$ and $M$ is the binary adjacency matrix that contains *n=317* regions in rows and *k=717* industries in columns for which an RCA>1 exist. This procedure is based on Hausmann *et al.* (2014) and Balland *et al.* (2018) using the Econ Geo R package.

## Embeddedness

An industry *i* is considered embedded in a region *r* if there is an unlikely probability for the industry to exit the region. The regional embeddedness is calculated by the relative relatedness density ($RD_{i,r}$) of each industry *i* in region *r*.

# References

ACIL Allen (2015), *Collective review of Regional Blueprints and implications for a regional development strategy*, Final Report to the Regional Development Trust, ACIL Allen consulting Pty Ltd, June.

ACIL Allen Consulting, May, 2018, *Space Industry Capability in Western Australia*, report to The Department of Jobs, Tourism, Science, and Innovation May, 2018

Appleyard, RT. (1981), 'Western Australia: Economic and demographic growth 1850-1914', in in Stannage, CT, (ed) A new history of Western Australia, University of Western Australia Press, Nedlands, pp. 211-236.

Australian Bureau of Statistics (2019), *Australian Historical Population Statistics, 2019*, Catalogue No. 3105.0.65.001, ABS, Canberra.

Australian Bureau of Statistics (2019), Australian National Accounts: State Accounts, 2017-18, Cat. no. 5220.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics (2019), Australian System of National Accounts: State Accounts, 2017-18, Cat. no. 5204.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics (2019), Australian Demographic Statistics, Cat. no. 3101.0, Australian Bureau of Statistics, Canberra.

Black, D. (1981), 'Liberals triumphant: the politics of development 1947-1980', in Stannage, CT, (ed) A new history of Western Australia, University of Western Australia Press, Nedlands, pp. 441-470.

Bond-Smith S, Duncan AS, Nguyen H, Kiely D, and Leong K (2016), 'From paddock to plate: WA's potential in agriculture and agribusiness', Bankwest Curtin Economics Centre, Focus on Industry Series, Issue #1, September 2016

Department of Treasury and Finance (2004), An economic history of Western Australia since colonial settlement, Research Paper, Government of Western Australia, December.

Department of Jobs, Tourism, Science and Innovation (2019), *Future jobs, future skills: Driving STEM skills in Western Australia*, Government of Western Australia, May.

Department of Premier and Cabinet (2019), *Diversify WA: Strong economy, creating jobs, diverse industry*, Government of Western Australia.

Duncan A, Kiely D and Salazar S (2019), BCEC Quarterly Economic Commentary, Issue #7, Bankwest Curtin Economics Centre, June 2019.

Economic Regulatory Authority (2014), *Enquiry into microeconomic reform in Western Australia, Final Report*, ERA, June, Perth.

Foray, D., Goddard, J., Beldarrain, X.G., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C. and Ortega-Argilés, R. (2012), Guide to research and innovation strategies for Smart Specialization (RIS 3),: European Union, Luxembourg.

Foray, D. and Goenaga, X. (2013), *The goals of smart specialisation*, Policy Brief Series No. 01/2013, European Union, Luxembourg.

Freedman, C. and Stonecash, R. (1997), 'A survey of manufacturing industry policy: From the Tariff Board to the Productivity Commission', *Economic Record*, 73(221), pp. 169-183.

Ghoush, RN, (1981), 'Economic development and population growth in Western Australia since 1945, in Stannage, CT, (ed) A new history of Western Australia, University of Western Australia Press, Nedlands, pp. 267-293.

Herfindahl, O.C. (1950), Concentration in the Steel Industry, Doctoral dissertation, Columbia University.

Hirschman, A.O. (1980), National Power and the Structure of Foreign Trade, Vol. 105, University of California Press.

Jones, E. (2016), 'Australian trade liberalisation policy: the Industries Assistance Commission and the Productivity Commission, E*conomic and Labour Relations Review*, 27(2), pp. 181-198.

Lourens, R. (1979), '1829-1901', in P. Firkens (ed) A History of commerce and Industry in Western Australia, University of Western Australia Press, Nedlands, pp. 1-42.

Marinelli, E., Bertamino, F. and Fernandez, A. (2019), Layers, levels and coordination challenges: comparing S3 governance in Puglia and Extremadura, Joint Research Centre Technical Reports, European Union, Luxembourg.

McCann, P. and Ortega-Argilés, R. (2015), 'Smart specialisation, regional growth, and applications to European Union cohesion policy', *Regional Studies*, 49(8), 1291-1302.

Organisation of Economic Co-operation and Development (2013), Innovation-driven growth in regions: the role of smart specialisation, preliminary version, OECD, Paris.

Pratt, R. (1993), *Australian's iron ore resources*, Resource report, Bureau of Resource Sciences, Department of Primary industries and Energy, Australian Government Publishing Services, Canberra.

Productivity Commission (2003), *From industry assistance to productivity: 30 years of 'the Commission',* Productivity Commission, Canberra.

Productivity Commission (2019), *Trade and assistance review 2017-18*, Productivity Commission, Canberra.

Rodriguez-Pose, A., Di Cataldo, M. and Rainoldi, A. (2014), *The role of government institutions for smart specialisation and regional development*, S3 Policy Brief Series 04/2014, Joint Research Centre, European Union

Snooks, GD. (1981), 'Development in adversity 1913 to 1946', in Stannage, CT, (ed) A new history of Western Australia, University of Western Australia Press, Nedlands, pp. 237-265.

Stratham, P. (1981), 'Swan River colony 1829-1850', in Stannage, CT, (ed) A new history of Western Australia, University of Western Australia Press, Nedlands, pp. 181-210.

Tomlinson, A. (2014), *Understanding success and failure in innovative Australian resource processing projects*, PhD Thesis, University of Sydney, School of Chemical and Biomolecular Engineering. https://core.ac.uk/download/pdf/41239456.pdf

Veldhuizen, C, Wilson, B., Coenen, L., Goedegebuure, L. and Schoen, M. (2018), *State of the Art Review of Smart Specialisation in Europe*, Melbourne Sustainable Society Institute, University of Melbourne.

Western Australian Government (various years), Budget Papers Number 1 and 2, Department of Treasury.

WA Department of Mines and Petroleum (2019), Economic Indicators Resources Data, Government of Western Australia, available at http://www.dmp.wa.gov.au.

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