Australian Government

Productivity Commission

Transitioning
Regional Economies

Productivity Commission
Study Report

December 2017

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

Foreword

Over recent years, the mining investment boom provided substantial economic benefits to individuals, businesses and governments across Australia. As the investment phase has wound down, regional economies have generally transitioned well.

A large amount of discretionary spending is directed towards regional areas, by all levels of government. Much of this expenditure generally does little to facilitate adjustment and long term development. There remains ample opportunity for governments to coordinate better and evaluate this expenditure to improve its effectiveness in supporting development, improving living standards, and generating better value for money.

In conducting this study, I was assisted by Commissioner Ken Baxter, and the Commission's Special Adviser, Sean Innis. I was supported by a research team in the Commission's Melbourne and Canberra offices, led by John Salerian.

The Commission is grateful to everyone who has been involved in this study. Specific thanks are given to those people and organisations that provided written submissions, or who met with the Commission around the country to discuss this study.

Thanks are also given to experts who attended the Commission's technical workshop in Canberra on 11 July to discuss approaches to measuring regional adaptive capacity.

This study would not have been possible without the assistance of the Australian Bureau of Statistics, who provided timely access to high quality data from the 2016 Census of Population and Housing. This Census, which was collected after the end of the mining investment boom, provides a highly detailed picture of the people that live around Australia and was essential for measuring regional adaptive capacity. The Commission is particularly grateful to the Australian Bureau of Statistics and its staff for their strong support of this study.

Paul Lindwall
Presiding Commissioner

December 2017

Terms of reference

A study on the transition of regional economies following the resources boom

I, Scott Morrison, Treasurer, pursuant to Parts 2 and 4 of the Productivity Commission Act 1998, hereby request that the Productivity Commission undertake a study into the geographic impacts of the transition of the Australian economy following the resources investment boom.

Background

The transition from the mining investment boom to broader-based growth is underway. This transition is occurring at the same time as our economy is reconciling the impacts of globalization, technological and environmental change.

By its nature, the geography of our economic transition will not be consistent across the country.

The combination of forces driving the transition of our economy will unavoidably create friction points in specific regional areas and localities across the country, while being the source of considerable growth and prosperity in others.

The different impacts across the geographic regions of the Australian economy occur because of variable factors such as endowments of natural resources and demographics. Some regions may also have limited capacity to respond to changes in economic conditions; for example, due to different policy or institutional settings.

Scope of the research study

The purpose of this study is to examine the regional geography of Australia's economic transition, since the mining investment boom, to identify those regions and localities that face significant challenges in successfully transitioning to a more sustainable economic base and the factors which will influence their capacity to adapt to changes in economic circumstances.

The study should also draw on analyses of previous transitions that have occurred in the Australian economy and policy responses as reference and guide to analysing our current transition. The Commission should consult with statistical agencies and other experts.

In undertaking the study, the Commission should:

1. Identify regions which are likely, from an examination of economic and social data, to make a less successful transition from the resources boom than other parts of the country at a time when our economy is reconciling the impacts of globalization, technological and environmental change.

2. For each such region, identify the primary factors contributing to this performance. Identify distributional impacts as part of this analysis.

3. Establish an economic metric, combining a series of indicators to assess the degree of economic dislocation/engagement, transitional friction and local economic sustainability for regions across Australia and rank those regions to identify those most at risk of failing to adjust.

4. Devise an analytical framework for assessing the scope for economic and social development in regions which share similar economic characteristics, including dependency on interrelationships between regions.

5. Consider the relevance of geographic labour mobility including Fly-In/Fly-Out, Drive-In/Drive-Out and temporary migrant labour.

6. Examine the prospects for change to the structure of each region's economy and factors that may inhibit this or otherwise prevent a broad sharing of opportunity, consistent with the national growth outlook.

Process

The Commission is to undertake an appropriate public consultation process including consultation with Commonwealth, State and Territory governments, as well as local government where appropriate.

The final report should be provided within 12 months of the receipt of these terms of reference, with an initial report provided in April.

The Hon Scott Morrison MP
Treasurer

[Received 15 December 2016]

Contents

Abbreviations

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
APVMA	Australian Pesticides and Veterinary Medicines Authority
ASGS	Australian Statistical Geography Standard
ASIC	Australian Securities and Investments Commission
BLADE	Business Longitudinal Analysis Data Environment
CBD	central business district
COAG	Council of Australian Governments
CofFEE	Centre of Full Employment and Equity (University of Newcastle)
DEAL	Developing East Arnhem Limited
DIDO	drive-in, drive-out
FER	functional economic region
FIFO	fly-in, fly-out
GCCSA	Greater Capital City Statistical Area
GDP	gross domestic product
GRP	gross regional product
IAC	Industries Assistance Commission
IC	Industry Commission
LGA	local government area
NBN	National Broadband Network
OECD	Organisation for Economic Cooperation and Development
PC	Productivity Commission
PCA	principal components analysis
PHA	Public Health Area
PHIDU	Public Health Information Development Unit
RDA	Regional Development Australia
RfR	Royalties for Regions

RGF	Regional Growth Fund
SA2	Statistical Area Level 2
SA3	Statistical Area Level 3
SA4	Statistical Area Level 4
SAFSA	Structural Adjustment Fund for South Australia
SEIFA	Socio-Economic Indexes for Areas

OVERVIEW

Key points

- Overall, the Australian economy has shown considerable flexibility and resilience over the past 30 years, with a large majority of regions (77 per cent) experiencing positive employment growth over the past five years. Employment in mining remains more than double pre-boom levels.

- While the mining boom has caused transitional pressures, it has also made Australians substantially better off in the short term and over the long term.

  - A mobile workforce (including fly-in, fly-out) has spread the benefits of the boom across workers living in other regions, as well as reduced the cost of both the investment phase and the ongoing production phase.

  - Adjustment from the mining boom is generally not a source of significant disadvantage and does not justify special intervention from governments.

- Even though overall employment growth has been positive, all regions have variable growth in employment over time, with most experiencing falls at times.

  - Over the past five years, reductions in employment and population are more evident in some agricultural regions and a number of marginal mining regions.

  - Despite this, there is emerging evidence of rising incomes in agricultural regions.

- As requested, the Commission has constructed an index of relative adaptive capacity. This metric does not, by itself, provide a basis for policy making. There is unavoidable uncertainty about its estimated value for each region, and transitions in the real world also depend on the specific nature of the shock, the options available to people and the decisions they make.

- Using this metric, most major cities have relatively higher adaptive capacity, while some remote regions (including Indigenous communities) and many outer regional areas tend to have relatively lower adaptive capacity.

- Governments should avoid providing ad hoc financial assistance to regions because it is rarely effective. It does little to facilitate transition and long-term development. Governments should also better coordinate and evaluate their activities that affect Australia's regions.

- Specific adjustment assistance to individual regions should be reserved for extreme events that are likely to result in high levels of permanent disadvantage in a community. Even then it should be targeted at assisting the most vulnerable families and individuals, in particular to help them secure employment.

- There is unnecessary overlap in the regional development roles of all three tiers of government, contributing to concerns about the effectiveness and value for money from the large outlays on regional development programs.

- Central responsibility for regional development resides with State and Territory governments, supported by local governments. They should:

  - remove unnecessary planning and zoning regulations that are obstacles to regional development

  - adopt more rigorous and transparent assessment and implementation of their regional development planning strategies to improve the effectiveness and value for money from the large expenditures on regional development. This requires strong and effective local leadership

  - direct discretionary funding to priorities identified in regional strategic plans.

Overview

The recent mining investment boom (which ended around 2013) was a confluence of high commodity prices, increased demand, substantial construction of new mining capacity and a sustained increase in production levels. Although mining is naturally cyclical, the amplitude and duration of this commodity cycle was relatively large (box 1). It presented both opportunities and challenges for workers, businesses, communities and governments.

Box 1   The mining commodity and investment cycle was large

Western Australia

Annual economic growth peaked at 9.4 per cent in 2011-12 and business investment accounted for a significant share of the growth. Following the end of the investment phase, economic growth slowed, and gross state product declined by 2.7 per cent in 2016-17. Unemployment has also been trending up. There were 86 000 people unemployed (on average) in the year to October 2017 compared to about 37 000 people in 2008. The unemployment rate rose from about 3 per cent in 2008 to about 6 per cent in the year to October 2017.

Queensland

Construction expenditure in Queensland rose to unprecedented levels during the boom, peaking in 2013-14 at $36.6 billion, and subsequently fell by about 70 per cent. Unemployment in Queensland also fell to about 80 000 people in 2008, but has since almost doubled, reaching about 156 000 people in the year to September 2017.

Overall, Australia has benefited substantially (and will continue to benefit) from the resources boom. It has led to higher average incomes for individuals, larger profits, and increased revenues for the Australian, State and Territory governments. The slowing of the investment phase has caused transitional pressures. Perhaps because of the unusual duration of this resources cycle, many Australians and some governments assumed that the investment phase would stay stronger for longer and were unprepared for its winding down. Yet the winding down was inevitable, and Australia as a whole is better off because of the boom.

It is against this backdrop that the Australian Government asked the Commission to undertake a study into the geographic impacts of the transition of the Australian economy following the resources investment boom.

At the same time, there are other long-term transitions taking place in regions. There is increasing urbanisation driven partly by the long-term trend of productivity improvements in the agriculture sector and associated consolidation and growth of regional towns and

centres. The trend to urbanisation and the relative growth in services is not confined to Australia, with many OECD countries having a similar experience. In part, the trend reflects an increased preference by Australians and recent migrants to live in urban environments, which offer a broader and deeper range of services and employment opportunities compared with non-urban environments.

Australia's regions have enjoyed overall employment growth and improved social connections as technology is helping to bring people closer together (virtually if not physically) — this will only improve further in the future. This has provided new opportunities for many regional towns and helped to cement their long-term viability and vitality. However, some regions have been more directly affected by the pressures of changing economic circumstances and face substantial and perhaps insurmountable challenges in forging a sustainable future. Additionally, many smaller towns have seen falling population as people move to larger towns where there are a greater range of economic, cultural and social services.

What the Commission has been asked to do

The core tasks for this study are to:

- identify regions that face significant challenges in successfully transitioning to a more sustainable economic base

- establish a single economic metric to highlight regions most at risk of failing to adjust

- for regions considered at risk of failing to adjust, identify factors that influence their capacity to adapt to changes in economic circumstances

- devise an analytical framework for assessing the scope for economic and social development in regions, and examine prospects for, and inhibitors to, change to the structure of regional economies.

Approach to assessing adaptation and development

All regions are considered

All regions of Australia (both urban and non-urban) are considered in this study, not just those directly affected by mining. The mining investment boom (and its end) has had widespread effects on regions and to exclude capital cities would have skewed the analysis. As the Commission's work shows, some of the more seriously affected regions were capital cities (and adjacent regions), notably Perth. There are also regions that are subject to transitional pressures from other sources, such as environmental, energy, and trade policies. Assessment of their interests was consistent with the Commission's charter of taking a national perspective.

For this report, the Commission has chosen to use functional economic regions (FERs), which capture economic linkages and interdependencies between neighbouring areas (box 2). In practice, other factors such as community consultation are also important to take into account social and cultural dimensions that affect whether communities consider themselves more closely aligned with one region or another. As such, the definition used in this report is not the final word, but is fit-for-purpose. And common use of FERs would improve regional comparative analysis. Governments should use FERs as a standard for future regional analyses, such as assessing the scope for economic and social development in regions.

Box 2   What is a region?

'Regions' can be defined in many ways. For this study, regions are defined using functional economic regions (FERs). The design of FERs recognises that:

- people often travel between areas for work or to access services

- businesses hire workers, purchase services, and sell products and services across areas

- governments and people interact economically, socially and culturally across areas.

There is a higher degree of interaction between people and businesses within FERs and these are generally based around centres (such as relatively large towns and cities).

For policy purposes, FERs are preferred to local government areas or small statistical areas because they facilitate better evaluation and implementation of regional strategic plans and development policies. The use of FERs was advocated by some study participants, and FERs are increasingly being used by governments, albeit inconsistently.

Comparing FERs with ABS SA4 and SA2 regions

The FER regions are aggregations of ABS Statistical Area Level 2 (SA2) regions. However, the FERs are different to ABS Statistical Area Level 4 (SA4) regions (which are also aggregations of SA2 regions). In some cases (more remote regions) ABS SA4 regions are larger than FERs. In other regions (capital cities) FERs are larger than SA4s. Overall, the numbers of SA4s and FERs are similar.

	Greater capital city regions	Regions outside greater capital cities	Total
Functional economic regions	7	82	89
ABS Statistical Area Level 4 regions	45	43	88

Key elements of the approach

The study of the economic resilience and the adaptive capacity of regional economies has gained momentum since the 2007-08 global financial crisis. Despite this, there is no generally accepted way to measure economic resilience and adaptive capacity (or even common definitions of these terms). The Commission has constructed a metric of adaptive capacity which brings together a range of indicators using a widely accepted and robust

methodology. As with any metric that combines multiple indicators, there are limitations and caution is needed in interpreting the metric and applying it to policy questions.

The Commission's approach has three parts.

1. Assess regional economic performance over time.

2. Create a single economic metric of relative adaptive capacity.

3. Develop a framework for assessing the scope for economic and social development in regions.

Economic performance over time

Observing the economic performance of regions over time can yield insights about how regions have transitioned or are transitioning from economic disruptions (box 3).

In principle, examining economic growth over time could make it possible to identify regions that have experienced a significant disruptive event, and to determine whether they recovered (were resilient) or whether their growth path stagnated or deteriorated (were non-resilient). This could reveal factors associated with observed resilience, which could help in identifying policies that might facilitate resilience.

In practice, operationalising this concept has proved challenging with the data available. It has been difficult to observe events at a regional level that are out of the ordinary (using criteria such as the amplitude and duration of regional employment). This is not to say that at a personal level, workers and businesses have not experienced significant challenges from the relentless pressures of dynamic market forces.

Perhaps unsurprisingly, the analysis of employment data suggests that regions are continually experiencing ups and downs. There are also longer-term trends across classes of regions, including those that are predominantly based on mining or agriculture, or that are regional population centres (towns and cities). These observations help to paint a picture of changes taking place across classes of regions and to examine the common and differential factors shaping their development path.

Box 3   An illustration of the concept of economic resilience

The goal is to identify 'disruptive events' in regional economies by examining the path of economic growth over time. If a disruptive event is identified, then the growth experience following the event can be used to categorise the region as:

- resistant, whereby the event does not disrupt the growth path. The identification of this type of region is problematic unless the event is identified externally by means other than observing growth in the region

- resilient, whereby following the disruption the regional economy recovers and returns to a positive growth path

- non-resilient, whereby the region is unable to recover from the disruption.

It is challenging to distinguish genuine 'disruptive events' from the normal cycle of ups and downs and variability in performance. The stylised example here is for a disruptive event that has a negative impact on the growth path. It is also possible to have a short-term disruptive event that is positive, such as an investment boom.
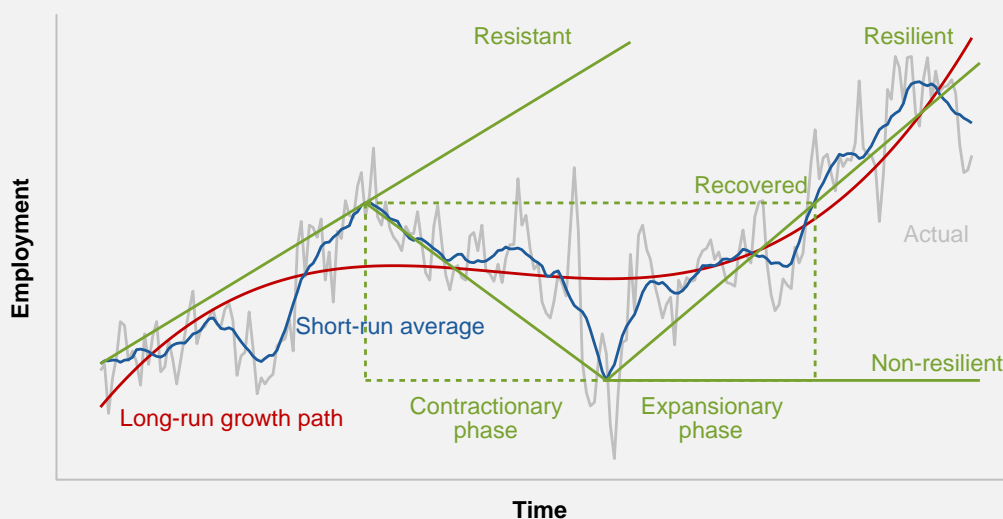
Single economic metric of relative adaptive capacity

As discussed above, the Commission developed a single economic metric that can be used to identify regions most at risk of failing to adjust successfully to economic disruptions. This is achieved by creating an index of the relative adaptive capacity (box 4) for each FER using data from the 2016 Census of Population and Housing, as well as other data sources.

Relative adaptive capacity

Relative adaptive capacity is an unobservable attribute of a region. It is not a guarantee of resilience to disruptive events. Rather, it is a summary of the complex set of factors considered to influence the capacity of regions to be resilient. These factors include the skills and education of regional workforces, access to infrastructure and services, availability of natural resources, financial resources available to businesses and individuals, and industry diversity. For this report, a relative measure of adaptive capacity has been derived from these factors across all regions, principally using Census data. Principal component analysis was used to construct the metric. This is a method applied to develop similar metrics, such as the ABS Socio-Economic Indexes for Areas (SEIFA). In general, regions with higher adaptive capacity have attributes that are likely to increase the potential to transition successfully following an economic disruption.

Obtaining consistent data for all factors and regions was not possible. Proxies have been used to measure some of the factors thought to shape adaptive capacity, particularly social factors and natural resources. Sensitivity analysis provides insights into the uncertainty about the estimated value of the index score for each region (and therefore its relative ranking). There are many regions where the value of the index would change substantially if different variables were included in the analysis, resulting in large ranges in the scores for some regions (figure 1).

Figure 1 **High uncertainty about the index scores of adaptive capacity**

Index values and their 90 per cent confidence intervals for each FER, sorted from lowest to highest
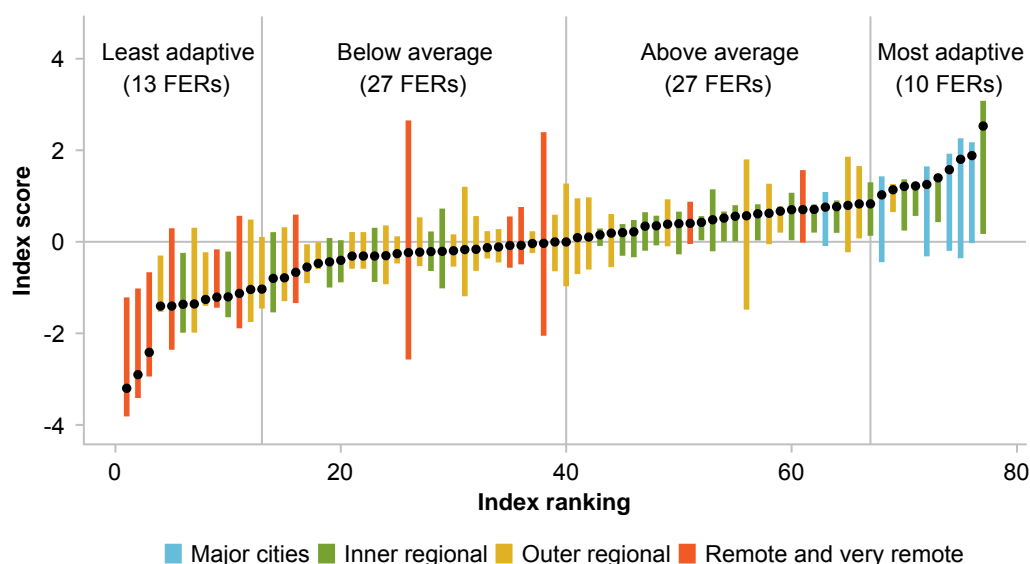
On its own, adaptive capacity does not identify whether regions would be successful in transitioning to a more sustainable economic base following a disruption. Realised outcomes depend on the sensitivity of a region to a particular disruption, the predictability, type and

magnitude of a shock (or shocks), the opportunities available to people in regional communities, and the decisions they make. This limits the suitability of the metric, by itself, as a guide for policy decisions. Nevertheless, the metric can be used to explore broad patterns of adaptive capacity across regions and as a 'litmus test' to identify regions that might be at risk of successfully transitioning if the region were exposed to a fundamental shock.

Assessing the scope for economic and social development

Within the Australian federation, the principal responsibility for developing any particular region lies with the State and Territory governments. The Commission has developed a framework to guide these governments (and also the Australian Government) in assessing the scope for economic and social development in regions.

Assessments should focus on enabling people in regional communities to adjust to changing economic circumstances. Governments should focus on the people who reside in regions, rather than the geographical areas themselves. The movement of people across regions can be important for their individual wellbeing, as well as for the performance of the Australian economy, especially if it reduces long-term unemployment. The assessments should be led by regional communities, be based on robust evidence and transparent processes and take into account:

- the views and local knowledge of regional communities

- the relative strengths (comparative advantage) of regions

- whether existing programs and strategies targeting economic and social development are effective and delivering value for money.

A snapshot of regional employment growth and adaptive capacity

Insights into the performance and adaptive capacity of Australia's regions have been gained using the first two elements of the Commission's approach, namely regions' employment growth over time and the single metric of relative adaptive capacity.

Recent trends in regional growth

The Commission attempted to identify regions that had experienced an out-of-the-ordinary economic disruption (cycles that are larger than usually observed) using time series data for employment at the Statistical Area Level 4 (SA4) level. Employment data is not disaggregated sufficiently to allow analysis at the FER level.

Most regions (about 77 per cent at the SA4 level) have experienced overall positive growth in employment over the past five years (figure 2). However, almost all regions have

displayed significant variability in growth rates and at times most have experienced negative growth rates.

Incomes in most regions are increasing, including in agricultural regions. Between 2012-13 and 2014-15, income growth in many agricultural regions in New South Wales and Victoria exceeded the Australian average rate. Income growth in the Wheatbelt region of Western Australia was even higher.

Figure 2   **Most regions have experienced positive employment growth**

Median employment growth and interquartile ranges for SA4 regions, October 2012 to October 2017, 12 month average data
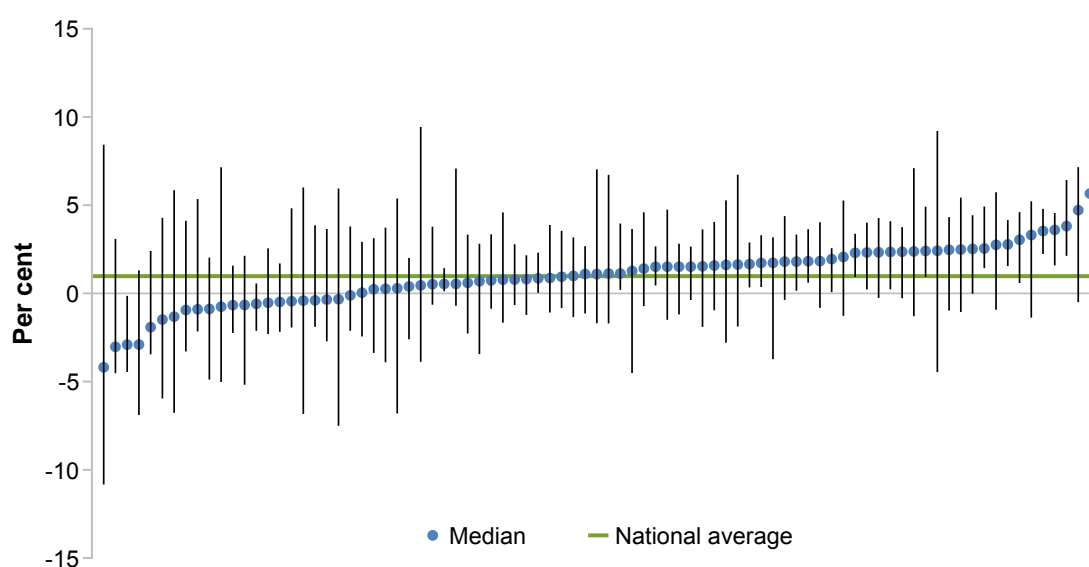
An overview of the adaptive capacity of Australia's regions

Unsurprisingly, Australia's regions vary in their adaptive capacity. Regions with the lowest relative adaptive capacity[1] (about 17 per cent of all FERs) are concentrated in outer regional and remote/very remote areas of Australia (figure 3). There is an association between lower adaptive capacity and remoteness (figure 4, top panel).

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[1]   Those regions classified as 'least adaptive' are those with a relative adaptive capacity value that is more than one standard deviation below the mean relative adaptive capacity for all regions. There are 13 regions in this category.

Figure 3   **The relative adaptive capacity of functional economic regions**
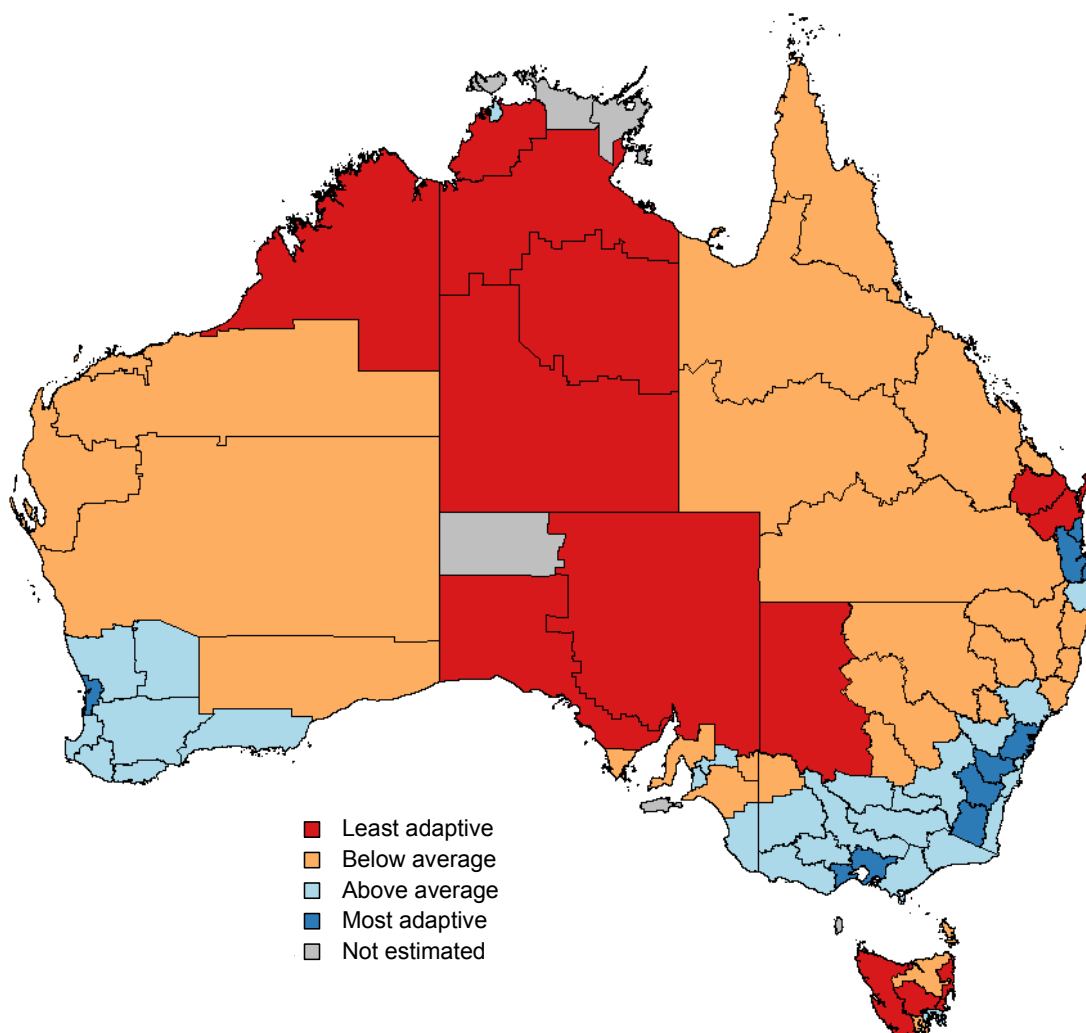
Although the regions with the lowest adaptive capacity cover large areas of Australia, they represent a small proportion of the total population (figure 4, bottom panel). About 659 000 Australians live in the regions with the lowest adaptive capacity, representing 3 per cent of the total population. In contrast, nearly 16 million people live in regions with the highest adaptive capacity, representing 66 per cent of the total population.

Overall, all major greater capital city FERs have relatively high adaptive capacity. However, this does not mean that these cities do not have clusters of disadvantaged people living within them that struggle to adapt to changing circumstances. These areas within cities often have similar challenges to those faced in more remote areas of Australia. Notwithstanding this, greater capital cities have a higher adaptive capacity to transition and develop relative to other regions, with greater employment opportunities found in proximity to large urban centres.

The values of the index of relative adaptive capacity are driven by differences between regions' levels of each factor used to construct the index (skills, incomes, access to infrastructure and services, natural resources and so on) and the different weights estimated for these factors. Factors relating to people (education, skills, employment and health) strongly influence adaptive capacity, particularly for communities in urban areas. For communities in remote areas, these and other factors associated with remoteness, such as accessibility to services and infrastructure, have the strongest influence on index results. It is unsurprising that the regions with the least adaptive capacity frequently have high levels of disadvantage.

Figure 4   **Regions and population by adaptive capacity and remoteness**

Remote and outer regional areas feature strongly in the least adaptive category...

... but very few people live in the least adaptive regions
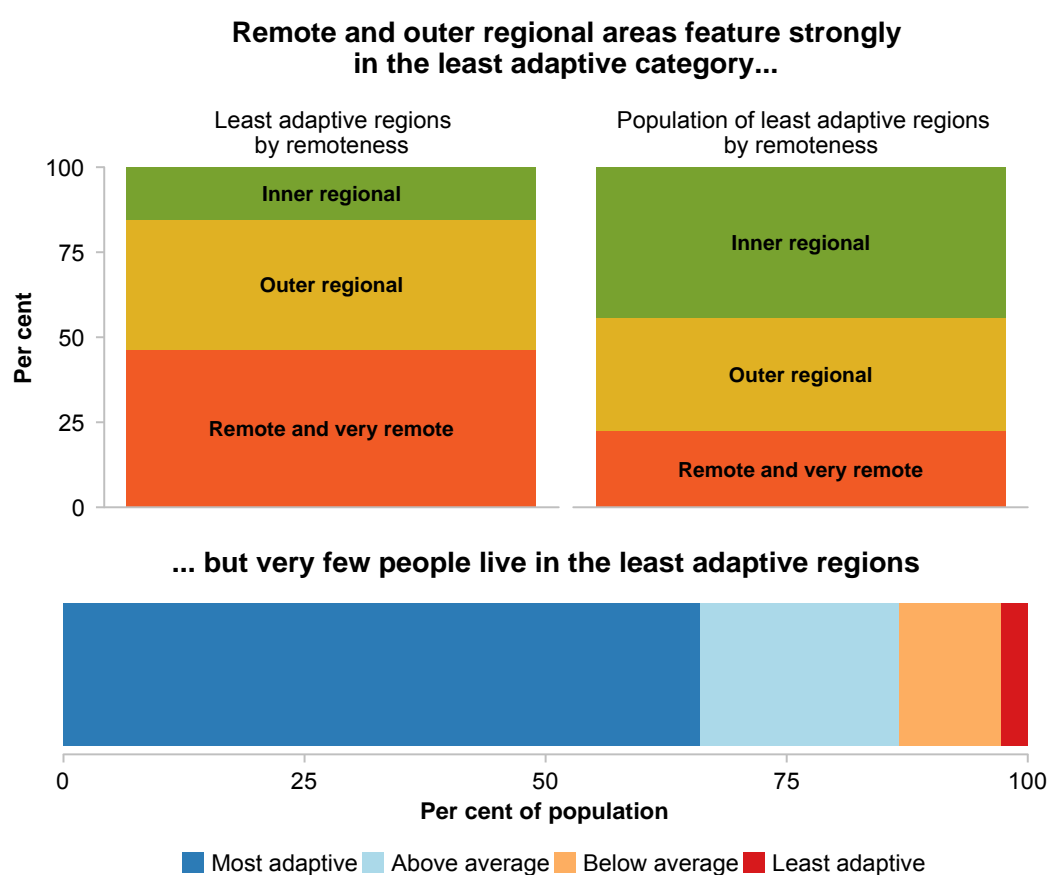
Themes of regional growth and adaptive capacity

Australia's regions are diverse, reflecting differences in their endowments of natural resources, economic geography, their history of settlement and development, and the mix and relative size of economic activities undertaken. Although this diversity has made it

difficult to classify regions based on either the trends in performance or the index of relative adaptive capacity, a number of general observations can be made.

- Regions with an economic base that is large-scale mining have generally had the highest rates of growth in employment since 2005, notwithstanding the end of the investment boom. But, not all mining areas are prospering and some are in decline. Incomes in mining regions are generally much higher than the national average, but growth in incomes were more subdued immediately following the end of the investment boom.

- Regions that are predominantly based on the agricultural and pastoral sectors, particularly broadacre cropping, tend to have lower rates of employment growth. Long-term improvements in the productivity of agriculture have enabled increased production with fewer workers. There is emerging evidence that incomes in some agricultural regions (particularly in the Wheatbelt of Western Australia) have increased faster than the national average following the end of the investment boom. Agricultural regions have also experienced consolidation of small towns into larger regional towns.

- Regions based predominantly around manufacturing tend to have relatively low rates of growth in manufacturing employment and low incomes, but these areas are mainly located in smaller sub-regions within FERs, particularly in greater capital cities.

- Regions with an economy predominantly based on services (cities, large regional centres) tend to have higher rates of growth.

These observations (elaborated on below) reflect longer-term trends in employment and the move away from manufacturing and agriculture towards services (a trend observed in other advanced economies) and resource industries (figure 5). The extent to which regions are affected depends on their industry mix and the concentration of employment in particular industries.

Trends in mining regions

Although commodity cycles are a common feature of the resources sector, the recent resources investment boom was one of the largest for Australia in recent generations. Its effects were widespread and felt to varying degrees across regions in Australia. The transition to the production phase has also had disparate effects, including on workers whose skills were highly valuable during the construction phase (and who therefore had high levels of pay) but who are no longer needed in the mining production phase. Regions where mines are no longer viable in the current environment of lower commodity prices have also had to adjust.

Figure 5 **National trends in employment and value added by industry**

Mining

Agriculture

Manufacturing

Services

— Employment   — Value added
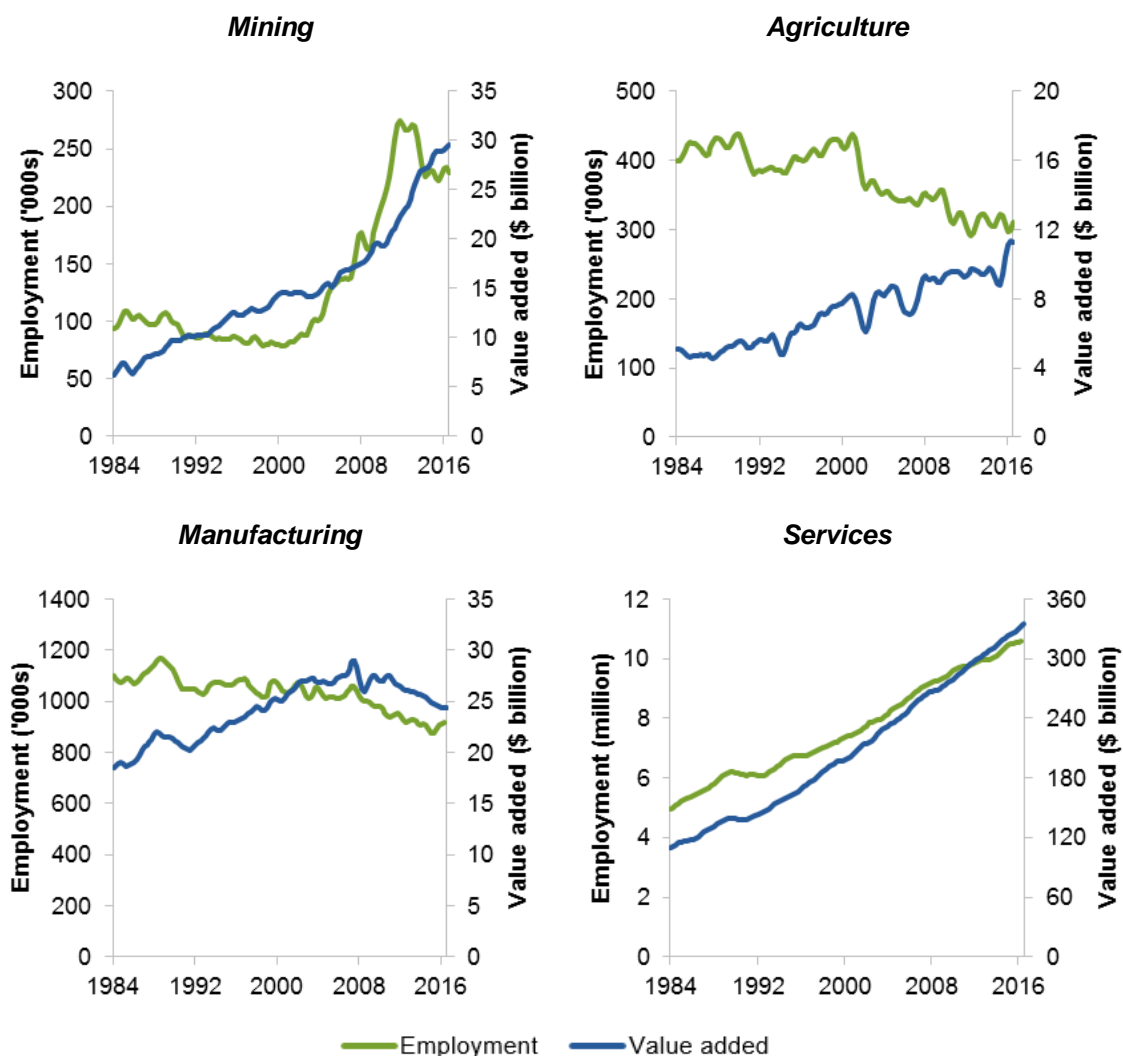
Most resource regions are continuing to grow

At the SA4 level, Mackay (Queensland) and the Western Australian Outback (right panel, figure 6) have a strong upward trend in employment, growing by about 8 per cent and 12 per cent respectively, in the past five years.

Figure 6 **Illustrative trends in employment in mining regions**
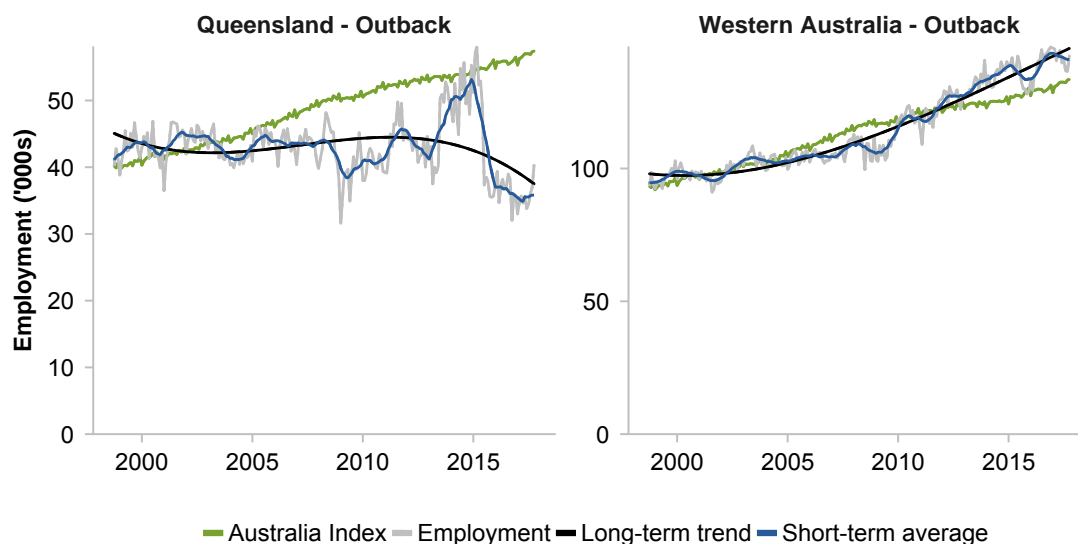
The resources boom was particularly transformative for the Pilbara region. High commodity prices and demand for the Pilbara's resources spurred many iron ore and gas investment projects aimed at a major expansion in the capacity of mining operations. Many people moved to the area to take advantage of lucrative employment opportunities, and income growth in the region was well above the national average (8.4 per cent per year compared with 5.4 per cent between 2005-06 and 2010-11). The benefits of the investment boom spread beyond the regions where mining activity was occurring. There was strong growth in mining-related employment in other areas, including in Perth and in the south-west regions of Western Australia (box 5). The rest of Australia benefited through additional taxation revenue, which in some cases was used to fund permanent increases in welfare payments or reductions in some taxes.

The influx of fly-in, fly-out workers using chartered flights and rapid population growth of a highly-paid workforce had a large impact on demand for goods and services in the Pilbara region, and widespread price increases occurred.

Box 5   The geographic spread across regional labour markets

During the height of the resources boom (in 2011), an estimated 50 000 people worked under fly-in, fly-out (FIFO) arrangements in the Pilbara. This was significant given the Pilbara's residential population of only 66 000 people. FIFO workers in the resources sector included those also working in construction (during the investment phase) and delivering other services to mining communities (for example, chefs, cleaners, personal trainers, and health professionals). Over two-thirds of FIFO workers in Western Australia were sourced from the Greater Perth region, with the remainder from elsewhere in Western Australia, interstate and overseas.

Employment of FIFO workers spread the impacts of the Pilbara's investment boom more widely throughout Western Australia. High incomes of many workers brought benefits to the local regions. FIFO arrangements also enabled families to avoid relocating to areas where local labour markets were temporary, allowing their partners to continue accessing the broader employment market and their families to access services and lifestyles in urban regions. The end of the investment phase saw a decrease in FIFO workers (particularly in construction) and a resulting increase in the unemployment rate in some regions, including Mandurah and Rockingham.

Not all mining sector workers in the Greater Perth region were employed in a FIFO capacity. A relatively large proportion of mining workers lived and worked in the Greater Perth region and the Perth CBD, a long way from the major mining activity in the Pilbara.
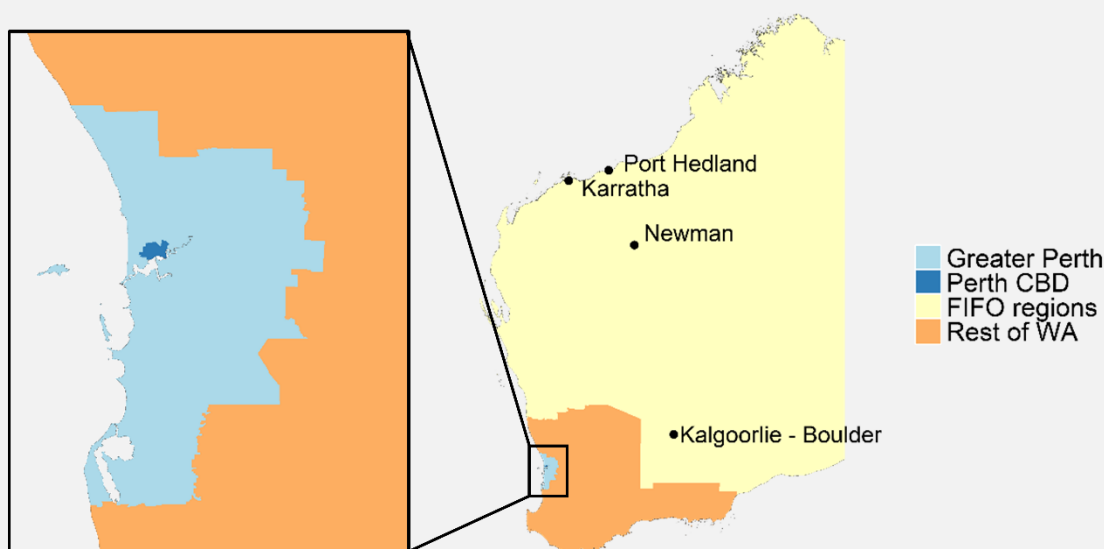
Employment in Western Australia in 2011, by location and industry

Location of work		All industries	Mining industry	Construction industry
Greater Perth	%	96.6	65.9	92.7
(Perth CBD)	%	(23.4)	(43.1)	(11.5)
FIFO regions	%	2.5	29.8	5.1
Rest of WA	%	0.9	4.3	2.2
Number	no.	759 702	34 766	60 058

Adjustment from the mining boom presents challenges for some regions

Just as the investment phase of the mining boom was large and fast, so too has been the transition to the production phase. Greater labour mobility means that both source and host regions for mining labour are subject to transitional forces. The cyclical nature of employment (demand for certain skills at particular points in time) does not diminish the effects of job loss (or lower wages) for people who expected continued employment and high wages.

During the boom, housing prices skyrocketed from a median of $200 000 in 2001 to $800 000 in Karratha and over $1 million in Port Hedland in 2012. The housing market then experienced a rapid re-adjustment following the end of the resources boom, falling significantly in a number of areas. Prices have returned to pre-boom levels, creating winners and losers in the process. Some people were provided finance to buy properties at peak prices with no deposit required. Mortgagee sales in regional centres have been large and some property investment groups have entered into liquidation.

Many mining regions are experiencing transition due to a re-adjustment to the production phase following the resources investment boom. But their large resource base and the expansion of capacity generated during the boom are likely to provide sound economic and employment opportunities for decades to come.

Some resource regions are in decline and many have below average adaptive capacity

A number of other mining areas are experiencing significant decline following the resources investment boom. For example, the Queensland Outback region (left panel, figure 6), which includes Mount Isa, has been adversely affected by lower metals prices, the closure of depleted mines, and declining ore quality. Current employment levels are significantly below those of the past. Mount Isa is one of Australia's largest mining towns, and is a significant regional centre for Queensland's vast north west. At the same time, other disruptions, such as drought, have had adverse impacts on agriculture (particularly cattle grazing) in the region. The future outlook for the region is likely to be significantly dependent on the identification of new commercial resource projects.

Most of Australia's mining regions were found to have below average adaptive capacity. Some common factors have been identified that have a negative impact on the adaptive capacity of mining regions. These relate primarily to natural assets, and the characteristics of the communities in the region as well as concentration of employers and activities.

Regions where mines have high cost structures that are only economically viable during periods of relatively high commodity prices also face challenges during cyclical downturns. For example, in the Kimberley region of Western Australia, three mines that previously accounted for 30 per cent of gross regional product are now in care and maintenance.

The availability of mineral resources in these regions presents both challenges and opportunities. It provides a source of employment. Indeed, some towns were developed solely to service the mining industry (such as Leinster and Goldsworthy) and are unlikely to have existed were it not for the natural mineral endowments in the area. At the same time, this lack of industry diversity leaves communities exposed to a loss of mining activity. This is reflected in the estimation of the metric — as a region's share of mining employment increased it had a larger negative effect on the index score. Notwithstanding the lack of industry diversity, many of the mining regions are not suited to other activities which at any rate would come at a cost to the principal mining activities.

Trends in agricultural regions

Falling employment in many agricultural regions (figure 7) does not necessarily equate to a decrease in the value or quantity of production or a fall in incomes. Employment is growing more slowly (or even decreasing) due to innovation and improvements in productivity. There are several sources of productivity growth, discussed below.

Figure 7   **Illustrative trends in employment in agricultural regions**
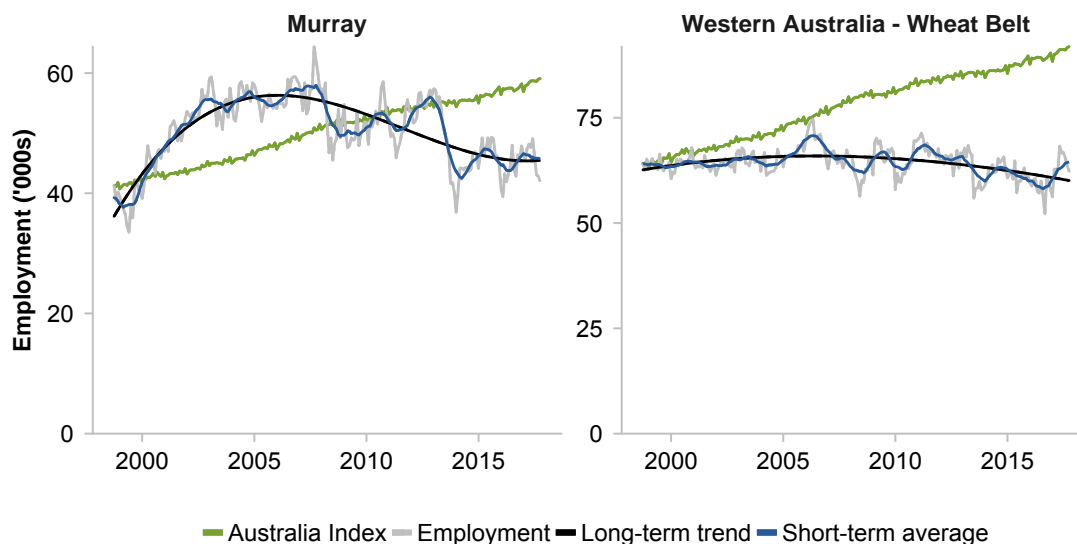
On-farm productivity improvements

Many agricultural products are sold on competitive international markets. The prices that primary producers have received for these products have often not kept pace with the increase in prices for the inputs used. These include wages paid to workers and the price and availability of water, fertiliser, seeds and chemicals. Partly in response to these pressures,

primary producers have lowered their cost of production through productivity and technological innovation. Farm sizes have increased significantly over time and more technologically advanced machinery and farm practices are being used.[2] These changes mean that over time, there are fewer farm owners, farm families and workers. Those remaining in the sector are operating larger-scale properties and more intensive operations to supply agricultural produce. Additionally, farmers are avid adopters of new technologies, including the use of drones and autonomous farm vehicles and sensors that can precisely measure the quantity of water and fertiliser that need to be applied.

Supply chain productivity improvements

Improvements in productivity have also taken place in the transport supply chain, from the farm gate to market. For example, larger trucks are used to move grain from farms to fewer and larger receival sites (or even direct to port), which are often located closer to main rail lines. This means more produce is moved using fewer workers, although, as recommended in the Commission's recently released *Regulation of Australian Agriculture* inquiry report, there remains much that governments could do to reduce the burden of transport regulations.

Trends in manufacturing impact on cities and towns

In 2016, the regions with the largest number of people employed in manufacturing were greater capital city regions, particularly Melbourne and Sydney. Over 160 000 people work in manufacturing in the Greater Melbourne region, representing 8.1 per cent of total employment. Manufacturing is also heavily concentrated within certain parts of capital cities, which tend to be outer-suburban areas which have more affordable land as well as significant pools of labour. At the SA4 level, Melbourne – South East, Sydney – South West, Adelaide – North, Logan – Beaudesert and Ipswich (Greater Brisbane) all have a high share of manufacturing employment (over 10 per cent).

The trends in manufacturing employment can have a significant impact on these areas, posing transitional challenges. Manufacturing pockets within cities are characterised by lower incomes relative to other locations of the city. However, overall, capital cities have a high relative adaptive capacity.

Consolidation of services from small towns to regional centres

The services provided by smaller towns, such as retail, banking and finance, machinery repairs, professional services, education, health, and cultural activities, have consolidated to larger regional towns and centres. Wagga Wagga in the Riverina (New South Wales) is an example of these changes (box 6). Again, these trends are driven by productivity, technological change,

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[2]   Although, as noted in the Commission's *Regulation of Australian Agriculture* report, the sugar industry has not followed this trend to increased economies of scale.

demography, personal choices and increasingly connected regions through trade in services. The ease of transport and the capacity to undertake transactions using the internet, mobile phones and satellite-based communications systems has facilitated this trend. There is also greater amenity associated with larger regional centres as well as access to a wider range of services (including schools, aged care services, hospitals and universities).

Box 6   Wagga Wagga and the Riverina region (New South Wales)

The Riverina is primarily a cropping region, with wheat (the major crop) grown along with rice, canola and barley. Over time, the region's population has increasingly centred on Wagga Wagga. The population of the region grew by about 11 500 people between 1991 and 2016, with Wagga Wagga growing by about 9500 (about 85 per cent of the Riverina's growth). Much of the remaining increase was in the next largest town (Griffith), while smaller towns remained stable or declined.

When initially settled, the population of the Riverina was more widely spread. A large number of small towns sprang up as service hubs to the surrounding farms. Wagga Wagga provided specialised services, and smaller towns offered machinery, fertiliser suppliers and marketing services for farm products.

The advent of better personal transport (and roads) increased competition and trade between service providers in previously less commercially-connected towns. Such providers had to 'get big or get out', creating pressure to consolidate into fewer, larger centres.

As a result of centralisation, many nearby smaller towns have experienced population decline. For example, in Boree Creek the population has steadily declined in recent times to 199 people in 2016. That said, the experience of towns in the Riverina has not been uniform. For example, Junee has a correctional centre, providing an alternative employment base from traditional agricultural activities, and has staved off population decline.

There are now fewer people living in some smaller regional towns — a familiar story in the history of Australia's regions. Over the past century, many previously thriving regional towns have shrunk (box 7). When people and businesses leave a regional community to take up opportunities elsewhere, this often generates greater value and so increases the overall wellbeing of the Australian population. However, such changes can have adverse effects on the people left behind, who are likely to be older. Individuals who depart the region are often those who played key roles in the community, such as leading local sporting clubs and similar organisations. A shrinking of the population can harm a community's social and cultural life, and reduce local leadership expertise and skills. However, this is not a uniquely Australian phenomenon, with many OECD countries experiencing similar trends. It is a trend that cannot (and should not) be thwarted.

The ebb and flow of towns has been a feature in the history of Australia's regions. Numerous localities that were classed as towns in both the 1911 and 1961 Censuses, with a population of at least 500 in either Census, had populations of less than 200 by the 2006 Census. Population decline impacts on the social fabric of regions. This is exemplified by the closure and merging of football teams in the Mallee region of Victoria between 1997 and 2015.
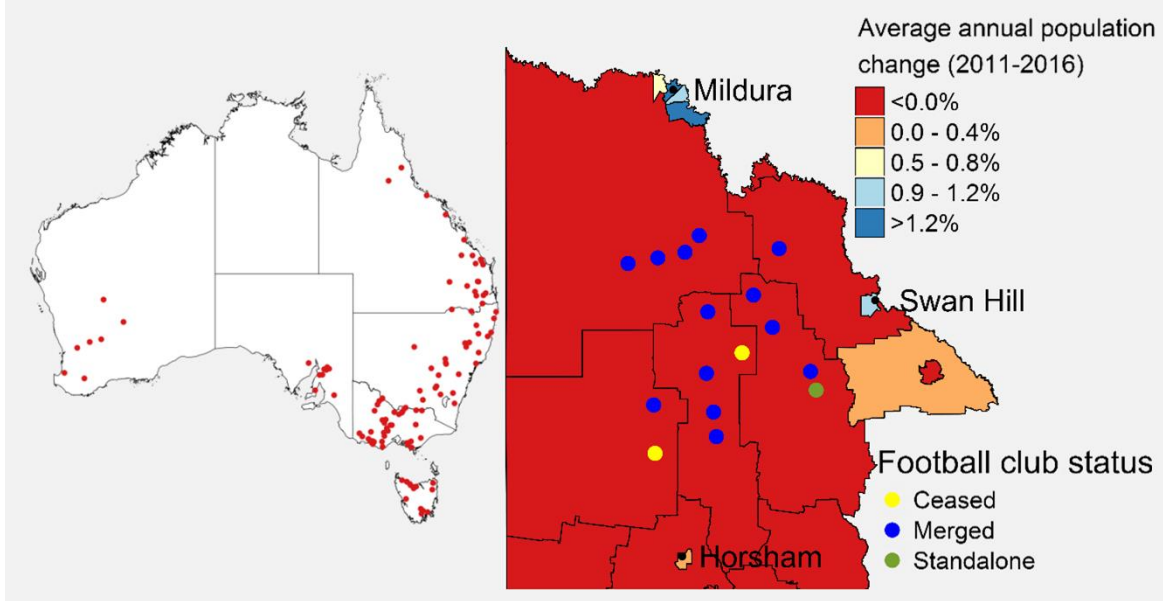
Strategies for successful transition and development

A framework is set out here to guide governments – especially State and Territory governments – in assessing the scope for economic and social development in regions in the face of changing circumstances.

Governments can (and in most cases do) seek to modify the circumstances of a region so that members of the community can have a higher standard of wellbeing than otherwise. For example, Australian Government Financial Assistance Grants are provided to local governing bodies, taking into account their financial capacity to provide residents with an equitable level of services. On a per-capita basis, local governments in regional and remote areas receive substantially more than those in capital cities. In 2014-15, the range was from about $21 per capita for some urban developed councils to about $3350 for extra small rural remote councils.

All levels of government support people living in regions through the provision of services such as health, education, and community services, as well as infrastructure services (including transport and the National Broadband Network).

In assessing the scope for economic and social development in regions, three points should be borne in mind. First, a regional community does not collectively 'decide' to develop or

transition but does so organically. Most people in communities make decisions in their best interests, given the circumstances and opportunities they face, both in the region and elsewhere.

Second, regional economies are continually transitioning and adapting to pressures for change and new opportunities, not just those arising from large disruptions. Intervening to shift development from one region to another risks depriving one, as it favours the other.

Finally, governments have a finite capacity to facilitate local growth, and must balance this with promoting conditions for transition and development among all regions. It is expensive and generally futile for governments to try to artificially create and maintain an advantage for a regional community where such an advantage does not inherently exist. Time and again, grand scale interventions, or even less grand but persistent favouring of perennial candidates for support, have not delivered measurable benefits. In addition, government support *always* comes at a cost to people in Australia, as taxpayers must find the money.

In the absence of a rigorous assessment framework there is a great risk that policies and programs targeting economic and social development of particular regions will be ineffective, costly, and reduce national prosperity. Policies should instead focus on creating a general environment that supports growth across all regions. These policies should enable people and businesses in regional communities to make the most of available economic opportunities and to adjust to changing circumstances.

Principles for guiding the assessment of the scope for economic and social development in regions are set out in box 8.

Box 8   **Principles for assessing the scope for economic and social development in regions**

Assessing the scope for development in regions should involve:

- incorporating the views and knowledge of regional communities

- identifying and supporting a region's relative strengths (comparative advantage)

- identifying any unnecessary regulatory impediments to people or businesses taking up economic opportunities, or relocating (either within, or to other regions)

- considering the capabilities of people in regional communities and the region's connections with other regions and markets

- evaluating whether existing programs and strategies aimed at regional development (or adjustment) are effective and provide value for money

- embedding robust evaluation and transparent processes for policy/project proposals, which include clear objectives, identification and assessment of options, and monitoring and evaluation of outcomes

- considering the scope for private economic activity that is not dependent on ongoing government financial support (other than payments made under general taxation, social security and welfare policies).

Improving the scope for economic and social development in regions

The Commission has identified a number of reforms that would facilitate the transition and development of regions. These are set out below.

Removing unnecessary impediments to doing business

All governments can facilitate regional transition and development by removing regulatory obstacles that reduce flexibility and discourage people and business owners from taking up opportunities. Doing so creates an environment conducive to employment and growth, and facilitates the movement of labour and other resources between regions.

Impediments include unnecessarily complex and costly regulatory processes and regulations that restrict what people and businesses can do. The Commission has previously made recommendations to reform regulations affecting regional communities, including in relation to planning, zoning and development processes, environmental regulations, and occupational licensing arrangements (box 9). Removing unnecessary regulatory barriers is a 'win-win' policy option — these reforms are justifiable in their own right and also open up opportunities for people in regional communities to adapt to change. They should be pursued by all governments as a matter of priority. Failure to do so will unnecessarily increase the pressures faced by regional communities and constrain their prospects.

Removing unnecessary impediments to pursuing new opportunities

There are many reasons why people might not take up job opportunities that require them to change occupations or locations. These include personal and social reasons, such as family commitments, lifestyle preferences, a region's social infrastructure and the costs of relocating. Changing occupations may also require workers to undertake education or training.

But there are also regulatory arrangements that can make it more difficult for people in regional communities to pursue employment or training opportunities and reduce the mobility of workers and their families, including:

- occupational licensing requirements
- land use planning restrictions (contributing to a lack of affordable housing)
- stamp duty (which contributes to the higher cost of buying homes).

Governments should carefully audit their programs to remove disincentives to mobility and/or the acquisition of new skills.

Box 9   **Removing unnecessary regulations to support regional development**

Regulatory impediments that prevent businesses from operating efficiently and taking up potentially profitable opportunities include:

- *planning, zoning and development processes* — complex and excessively prescriptive arrangements impose costs and delays on businesses seeking to expand or take up new opportunities in regions, including tourism-related developments. These problems were found in the Commission's study on the *Relative Costs of Doing Business in Australia: Retail Trade*, its review of *Australia's International Tourism Industry* and its inquiries into *Business Set-up, Transfer and Closure* and *Regulation of Australian Agriculture*, and were highlighted in the recent report, *Shifting the Dial: 5 Year Productivity Review*. Planning and zoning regulations also often fail to meet their objectives because they are not sufficiently adaptable for managing changing agricultural land uses. The quarantining of land for coal mining in the Latrobe Valley is another example of where planning regulation may be impeding development and adaptation in regional Victoria.

- *environmental regulations* — while essential to protect the environment, they can be unnecessarily onerous and complex, imposing excessive costs and discouraging regional development. In its inquiry into the *Regulation of Australian Agriculture*, the Commission found that native vegetation and biodiversity conservation regulations can have unnecessary costs on farm businesses and limit farmers' capacity to adapt and to improve productivity.

There are other regulatory impediments that act to reduce mobility, making it difficult for people in regional communities to pursue employment or training opportunities. These include occupational licensing requirements, particularly where there are different arrangements across jurisdictions. Inefficient land use planning (including delayed release of land for development) and stamp duty on property also contribute to distorted housing costs. These may impede people moving between regions to take up new job opportunities.

Improving the effectiveness of planning and expenditure

Discretionary expenditure in regions is often ill-targeted

At the aggregate level, governments have spent, and continue to spend, very large amounts of money on regional programs (box 10). The Commission has not assessed the benefits of, and is not endorsing, the overall amount of regional spending. However, there is evidence that raises questions about whether these programs have successfully met their objectives and achieved value for money, and whether there is scope for governments to use regional funding more effectively.

> **Box 10**   **Government expenditure on regional programs**
>
> **Australian Government**
>
> As at May 2017, the Australian Government has committed an estimated $20.9 billion in expenditure on regional programs. This is a conservative estimate, as it excludes concessional loan schemes and a number of programs with significant, but unspecified, regional components. Among these are the National Broadband Network (about $30 billion to date) and the Melbourne to Brisbane Inland Rail Project (about $8.4 billion).
>
> **State and Territory governments**
>
> Between 2008 and 2017, the WA Government's Royalties for Regions program directed over $6.9 billion into over 3700 infrastructure and community projects.
>
> The Queensland Government committed $10.7 billion to capital works in its 2016-17 budget, with almost half ($4.9 billion) being targeted at regional Queensland.
>
> As at 30 June 2017, the NSW Government had committed or reserved a total of $9.1 billion for regional programs and projects, consisting of $3.8 billion in committed funding and $5.3 billion in funding reserved for future projects.
>
> Between 2014 and 2017, the Victorian Government reported having spent over $8.5 billion on regional investment, and committed a further $4 billion to regional investment from 2017-18.

There is also evidence (box 11) that expenditure in regions has not been well planned or evaluated, is insufficiently transparent and often poorly implemented. Regional programs and projects have often suffered from:

- unclear and inconsistent objectives

- expenditure decisions not following good processes and rigorous evaluation

- a lack of coordination and cooperation between governments, made more challenging by three tiers of government operating in this space

- strategic planning processes failing to identify and plan for significant risks, such as the likely closure of a major employer

- a lack of local capacity (trained staff) for rigorous strategic planning and evaluation

- inadequate data to support regional planning

- lack of a regional focus in planning processes.

Box 11   Examples of inadequate project assessment and evaluation

Regional Growth Fund (Victoria)

In 2015, the Victorian Auditor-General found evidence of a lack of transparency and rigour, as well as inadequate monitoring, evaluation and performance reporting, in the Victorian Regional Growth Fund, which provided about $570 million in regional grants during 2011–2015. The audit found that the $295 million Economic Infrastructure Program kept no documentation of the pre-application process. In the context of a non-competing grant funding model, this absence of documentation contravened best practice guidelines and made it difficult to ascertain if Regional Development Victoria funded the best available projects.

Royalties for Regions (Western Australia)

In 2014, the WA Auditor-General reported a number of problems with Royalties for Regions project selection, monitoring, benchmarking and evaluation.

- Projects were submitted for Cabinet approval that did not clearly indicate outcomes to be delivered or demonstrate long-term sustainability.

- Since 2009, the Department of Regional Development (DRD) had been developing indicators to benchmark and measure the impact of projects against the six Royalties for Regions objectives, but these had still not been implemented.

- Not all Royalties for Regions projects were clearly aligned with one or more of the six Royalties for Regions objectives, and only half of project business cases reviewed complied with the DRD's requirement to include specific and measurable outcomes.

- At the time of audit, the DRD had completed only seven evaluations of Royalties for Regions projects, and these only reported on outputs delivered, rather than on whether they met their intended outcomes.

- The DRD had no monitoring system to oversee the progress of individual projects and of the overall program, despite over 3500 projects having been approved (at the time of audit).

Improve the effectiveness of planning and expenditure in regions

There is significant confusion, overlap and uncooperative rivalry between the Australian, State, Territory, and local governments in the pursuit of regional development. Over recent years the tendency for such confusion and rivalry has increased as the varying governments express concern that their expenditures are not sufficiently recognised by the populace. This is a worrying trend that should be addressed now. Political recognition is not a valid objective for good public policy. The Australian population expect and deserve good government at all levels, working cooperatively in the interests of the people of Australia.

Improvements to the way proposals for regions are identified and prioritised (and then linked to expenditure decisions) are essential for ensuring that funding to regions is directed in ways that achieve the greatest net benefit for the community.

The Australian Government should focus on national economic development

Although all tiers of government have a shared interest in regional development, State and Northern Territory governments are responsible for regional development and the establishment of local governments in their jurisdictions. Assessment of regional development strategies also need to recognise the unique circumstances of local regions and their communities. Central responsibility for regional development should reside with State and Territory governments, with support from local governments. For the Australian Government, to the extent that it has a role, it should be a supporting one.

Over recent years successive Australian governments have encroached more into regional policies that should remain with the states and territories. There appears to be little economic benefit from the Australian Government pursuing independent regional development strategies. By returning to its core business, the effectiveness of the State and Territory governments in delivering regional programs can more readily be assessed. This would also reduce the scope for blaming another jurisdiction for failures of policy development and implementation.

Instead, the Australian Government should focus on national economic development through policy settings that have broad application across regions. National policy settings in areas such as education, health, communications, defence and trade, as well as the 'built-in' distribution of funds across regions (such as Financial Assistance Grants for local governments' service delivery) have a significant impact on development in regions. As such, it is important that the Australian Government works effectively in collaboration with all tiers of government to ensure that services meet the needs of people living in regions.

Only in rare circumstances does there remain a case for the Australian Government to provide additional support. For example, to assist regions that have been affected by a severe negative economic shock and for which existing support mechanisms are demonstrably inadequate (discussed later). This happens rarely in Australia.

State and Territory governments should play a lead role in facilitating transition and development in regions

Improvements to the way proposals for regions are identified and prioritised and then linked to expenditure decisions of governments are essential for ensuring that funding to regions is directed in ways that achieve the greatest net benefit for the community. To achieve this, State and Territory governments should:

- develop definitions of regions based on FERs to be used for regional strategic planning purposes, and align relevant regional boundaries to these FERs

- ensure that a regional entity is responsible (and has sufficient capacity and funding) for developing and publishing a strategic regional plan that identifies priorities for development and transition in each FER

- direct any discretionary funding for regional development or transition to the priorities of regions identified in a regional strategic plan — all decisions to fund regional programs should be transparent, including prior publication of cost–benefit analyses

- enhance cooperation and collaboration, including by pooling of funding with local governments for regional projects.

Better targeting State and Territory government regional expenditure to the priorities identified through rigorous planning

It is important that any discretionary government expenditure for the development of regions is clearly linked to the priorities of regions as identified in a regional strategic plan, underpinned by rigorous public assessment, selection and evaluation processes. This includes expenditure from grant programs, such as regional growth funds, which are often administered on an ad hoc basis by the State or Territory government department or agency responsible for regional development. This would better align regional development expenditure by State and Territory governments with the priorities that deliver the highest benefit to regional communities.

Funding decisions by governments should be open and transparent, including prior publication of detailed cost–benefit assessments and explanation of the selection of projects across regions, as well as public evaluations of alternative proposals for achieving the same objectives.

It is also essential that local councils are aware of and have the capacity to fund any commitments to ongoing maintenance and operating costs associated with the project.

The selection of large regional development projects would be further improved by building on the work of Infrastructure Australia and state-based infrastructure advisory bodies. This would help governments prioritise infrastructure projects between regions and systematically embed transparent, rigorous infrastructure investment processes in governments' decision making.

Where governments choose to pursue regional projects or activities that are inconsistent with the priorities identified through rigorous regional planning processes or independent infrastructure advisory bodies, governments should provide a public justification for how and why the project was selected. Ultimately, expenditure decisions are the responsibility of governments and relevant Ministers. However, they can be made more accountable for their decisions through openness and transparency.

Specific national adjustment assistance

On rare occasions, the impact of economic changes and transitions may place a disproportionate burden on some groups of people. Some workers may become unemployed, some firms may go out of business and some towns may disappear or decrease significantly

in size (as has been the case throughout Australia's history). This can have significant social impacts on people in regional communities.

However, governments cannot, and should not, shield people in regional communities from all possible adverse events or ongoing pressures. There will always be some people who are disproportionately affected by change. Businesses may close and move elsewhere, and workers may become unemployed and relocate in search of work. Some people might find it difficult to obtain employment elsewhere because their skills are no longer in demand, or because there are limited job opportunities in the region in which they have chosen to live. And some regional communities face ongoing challenges due to disadvantage. The fairest and most equitable way to support the many thousands of Australians who experience involuntary job loss every year is through the social security, tax, training and job services systems.

On rare occasions, the existing social security, tax, training and job services systems are insufficient, and without further government interventions, the most vulnerable people in regional communities experience such severe, pervasive and persistent changes that there is a strong likelihood of them becoming permanently disadvantaged. In these circumstances there is a case for additional support for individuals. However, assistance should be targeted based on the principles in box 12.

Box 12   **Principles guiding the rare application of specific adjustment assistance**

The case for specific adjustment assistance is strongest when policy and market adjustments are unanticipated and impose a clear and sizable burden on a specific disadvantaged group, and the general safety net arrangements are demonstrably inadequate.

When assistance is provided, it should:

- facilitate change for affected individuals
- be targeted at those groups for whom adjustment pressures are the greatest
- be transparent, both in policy and administration
- be of limited duration
- be compatible with the general safety net arrangements.

Additional support could involve targeted and time-limited training assistance and provision of information on industry needs and employment opportunities. It is important that any targeted support facilitates change and helps people adapt, instead of preventing change from occurring. Past assistance to specific industries or firms in regions, to support investment in infrastructure and preserve jobs, has often been costly and ineffective. Such assistance can also give false hope to people and businesses by signalling the long-term health and prosperity of particular industries. This can discourage workers from acquiring new skills, thereby reducing their future employment prospects, and gives businesses less incentive to become more innovative and productive and to plan for the future.

There will be instances where regions face continued decline in employment and economic activity that cannot be feasibly reversed. In such cases, governments' efforts should be directed at managing family and labour mobility, facilitating movement and ensuring that residents who remain in a region have access to a minimum level of services. Inevitably this cannot mean that services will always be provided within all towns or at the same level as might be expected in major urban or regional centres. Like all sound policies, regional adjustment should not promise what it cannot deliver sustainably.

Findings and recommendations

FINDING 2.1

Australian, State and Territory governments already have a suite of existing arrangements aimed at redistributing resources across regions, achieving service delivery objectives and planning for regional transition and development.

There are also generally available measures provided to assist people and businesses across all regions when faced with economic disruptions, under the social security, tax, training and job services systems.

Assistance beyond these arrangements should be rare, occurring in response to extreme circumstances that strongly portend the development of permanent disadvantage in a regional community, and that cannot be addressed by existing arrangements. Additionally, such assistance should be designed carefully to ensure that it is only temporary.

FINDING 2.2

There is no single approach to assessing the scope for economic and social development in regions. However, assessments should be guided by the following principles.

- Incorporate the views and knowledge of regional communities.
- Consider a region's relative strengths and inherent advantages.
- Identify barriers to people or businesses relocating, either within the region, or to other regions.
- Identify unnecessary regulatory impediments to people or businesses taking up economic opportunities.
- Include robust and transparent evaluation of existing programs and policies.
- Include rigorous strategic regional planning and cost–benefit analysis of any proposed programs, policies or strategies.
- Consider the scope for private economic activity that is not dependent on ongoing government financial support (other than payments made under general taxation, social security and welfare laws).

FINDING 3.1

All Australian regions experience significant variation in their growth in employment, with many having occasional periods of negative growth. Even so, most regions (67 out of 87 SA4 regions) have seen net increases in the number of employed persons over the five years to October 2017. Many regions with low rates of employment growth have a large agricultural base.

FINDING 3.2

Almost all regions have experienced growth in average personal incomes over the four years to 2014-15.

Incomes in agricultural regions grew faster than in mining regions in the period immediately following the end of the mining construction boom (between 2012-13 and 2014-15).

But incomes in 2014-15 generally remained higher in mining regions compared with agricultural regions.

Income growth in greater capital city areas has varied across Australia, but income levels in capital cities are, on average, higher than in other regions. Across capital cities, growth in incomes between 2010-11 and 2014-15 was highest in Perth and Darwin. Perth and Darwin also had higher average incomes compared with other capital cities.

FINDING 3.3

Regions with an economic base concentrated in manufacturing tend to have declining employment in manufacturing consistent with the inexorable rise in service industries and desirable shifts in technologies. Many of these are sub-regions within greater metropolitan areas of capital cities and have demonstrated adaptability in adjusting to declining manufacturing employment.

FINDING 3.4

Mining regions continue to have high incomes and have substantially more people employed than prior to the boom. Many regions with a high concentration of activity based on mining have transitioned well from construction to production following large expansions in capacity during the mining investment boom.

However, mining operations in regions that are smaller in scale, are economically marginal or are approaching the end of their economic lives have been most affected by the end of the high-price cycle.

FINDING 3.5

Mobile labour (such as fly-in, fly-out workers) was instrumental in meeting the high demand for workers during the investment phase of the resources boom, and helped to spread the benefits of the boom to other regions.

Many of the workers employed in the investment phase lived in regions outside mining areas, such as capital cities and other regional centres, or temporarily lived in the region. In addition, many mining workers work in capital cities and their greater metropolitan areas.

The natural completion of the high mining investment phase has affected labour markets and economic conditions across the country, particularly in Western Australia but also in many regions outside of traditional resources areas.

FINDING 3.6

Efficiencies and technological innovation are generating higher levels of agricultural production using less labour. This is driving a long-term trend of lower employment in agricultural regions. There is also a pattern of consolidation from smaller towns to larger regional centres, which affects the social fabric of these communities.

FINDING 3.7

Capital cities have experienced high population growth over the past 25 years. Growing demand for services and large increases in knowledge-based service employment has resulted in demographic change in Australia's largest cities.

Many smaller cities and regional centres have also grown (in some cases more quickly than capital cities) due to movements of people from inland regions and the migration of families and retirees from capital cities. Connectivity to large cities and proximity to the coast are important drivers of the wellbeing of those living in smaller cities and regional centres.

FINDING 4.1

The Commission's index of relative adaptive capacity is based on a widely accepted methodology. The metric can be used as a litmus test to identify regions which may find it difficult to adjust to significant economic disruptions.

However, caution is required in interpreting the metric and using it as a basis for policy making. A single metric of relative adaptive capacity cannot fully capture the unique attributes of each regional community. Further, the metric does not predict the likely outcome of a region to a shock, which is based not only on the region's adaptive capacity but also the nature of shocks it faces, the options available to people affected, and the decisions that they make.

FINDING 4.2

The proportion of regions in the least adaptive category increases with the degree of remoteness. About 659 000 people (or 3 per cent of the population) live in the least adaptive regions. In contrast, nearly 16 million people (66 per cent of the population) live in the most adaptive regions, which are concentrated in major cities.

FINDING 4.3

The main factors shaping the index value of relative adaptive capacity for each region relate to:

- people-related factors (including educational achievement, employment rates, skill levels, personal incomes and community cohesion)
- the degree of remoteness and accessibility of infrastructure and services.

FINDING 5.1

Governments can primarily facilitate successful development by removing unjustified or excessively burdensome regulations that impede people and businesses from taking advantage of opportunities. Significant benefits would arise from expediting regulatory reforms in land use planning and development, environmental, agriculture-related regulation and occupational licensing.

These 'win-win' reforms benefit all regions but are particularly important to regions that do not have the advantages and range of opportunities found in capital cities and major regional centres.

FINDING 5.2

Substantial funding has been devoted to regional programs by successive Australian, State, Territory and local governments over many years. The effectiveness of these programs in facilitating development in regions is unclear, largely due to a lack of robust and transparent evaluation.

There is scope to achieve considerably improved outcomes for regional communities by changing the way regional programs are designed and delivered. Fundamental to this is applying rigorous and transparent processes for choosing, implementing, and evaluating regional spending.

Failure to set out clear objectives, build capacity and adequately plan for new spending risks regional communities missing out on opportunities and taxpayers' funds being squandered.

FINDING 5.3

Strong and effective local leadership is critical in developing and implementing regional development plans. There is a case for State and Territory governments to build capacity in leadership of regional institutions and community groups and to ensure these entities can attract skilled leaders.

FINDING 5.4

States and the Northern Territory are responsible for regional development and the establishment of local governments within their jurisdictions. Assessment of regional development strategies needs to consider the circumstances of local regions and communities. Although all tiers of government have a shared interest in regional development, central responsibility for regional development best resides with State and Territory governments, supported by local governments.

RECOMMENDATION 5.1

The Australian Government should abolish the Regional Development Australia program.

RECOMMENDATION 5.2

Current discretionary funding allocated by the Australian Government specifically to regional development (such as funding for regional grant programs, City Deals and the Northern Australia Infrastructure Facility) should be subject to independent, rigorous and transparent evaluation.

Where discretionary regional programs are found to have significant net benefits, the Australian Government should transfer responsibility to the relevant states and territories consistent with their primary roles in regional development. Where the programs do not have significant net benefits they should be abolished.

RECOMMENDATION 5.3

State and Territory governments, in consultation with local governments and communities, should develop a single consistent definition of Australia's regions to be used to inform regional development planning and policy.

Regions should be based on functional economic regions, so as to take into account the stronger linkages and interdependencies between neighbouring communities.

State, Territory and local governments should adopt these classifications for guiding regional policy and planning.

RECOMMENDATION 5.4

State and Territory governments should ensure that each functional economic region has a nominated entity that:

- is responsible for developing a credible regional strategic plan that identifies the capabilities and attributes of the region and, where relevant, identifies priority actions and projects for facilitating transition and development in the region

- is sufficiently resourced and capable of developing high-quality business cases for proposed regional initiatives

- has representation from the relevant State, Territory and local governments, businesses and the regional community

- utilises and incorporates past planning priorities where they have been soundly and rigorously developed.

RECOMMENDATION 5.5

State and Territory governments should direct discretionary expenditure for regional development (for example from regional growth funds) to areas that have been identified as priorities in a published regional strategic plan.

Decisions should be transparent, including publication of cost–benefit assessments. For major regional infrastructure projects, decisions should be informed by the work of Infrastructure Australia and state-based infrastructure advisory bodies.

Where governments choose to pursue projects that have not been assessed as a priority by infrastructure advisory bodies, or are inconsistent with the priorities of regions as identified in strategic plans, governments should provide a public justification for why these projects have been selected.

FINDING 5.5

Decentralising public sector agencies imposes costs and risks on governments, taxpayers and users of government services. These risks include a loss of efficiency and service quality, and difficulty sourcing specialised skills and expertise.

Although decentralisation has the potential to increase employment in target regions, in most cases it simply redistributes economic activity across regions. As a regional development strategy, decentralisation is unlikely to make a long-term, systemic difference to regional growth and resilience.

FINDING 5.6

Generally available welfare, training and employment measures promote fairness and equity and are usually the most effective means for facilitating transition. Assistance that creates false expectations about the future success of a particular business, industry or region can lead to confusion and reduce individuals' incentives to plan and adapt to changing circumstances.

Past assistance to industries and regions has often been costly, ineffective, counter-productive, wasteful, poorly targeted and inequitable.

RECOMMENDATION 5.6

Specific adjustment assistance (beyond generally available measures) should be reserved for extreme events that are likely to result in high levels of permanent disadvantage in a region. It should be targeted to the people who are least likely to make a successful transition and be focused on improving their employment prospects.

Assistance designed to sustain regions or industries (as distinct from individuals) should be avoided. Assistance should be designed to facilitate movement towards explicit and transparent adjustment goals, which might be a path of managed decline.

1   About this study

The Australian Government asked the Commission to undertake a study into the geographical impacts of the transition of the Australian economy following the resources investment boom.

The mining investment boom (from about 2005 to 2013) provided widespread benefits for the economy, workers, business owners, communities and governments. By 2013, it was estimated that the resources boom had raised average real wages by 6 per cent, raised real per capita household disposable income by 13 per cent and lowered the unemployment rate by about 1.25 percentage points (Downes, Hanslow and Tulip 2014, p. 1).

The mining investment boom was driven by a rapid increase in demand for commodities and a dramatic increase in the price of Australia's mining exports. This price rise is reflected in the non-rural commodity price index (figure 1.1). The index increased by over 300 per cent from the average of the early 2000s to the peak in 2011. As can be seen in figure 1.1, the terms of trade followed a similar pattern to commodity prices, rising dramatically from the mid-2000s and peaking in late 2011. The increase in the terms of trade enabled Australia to buy more imports for a given quantity of exports and thereby increased domestic real income. The resources sector responded to the price increase by expanding its production capacity. Investment in the mining industry increased from an average of about 2 per cent of GDP before the boom and peaked at just under 8 per cent in 2012.

Commodity prices fell considerably from the peak in 2011 but have since recovered from their lows in 2014 and now remain above the average for the 1980s and 1990s (figure 1.1). Meanwhile, investment in the mining sector has, as expected, declined as the industry has been transitioning from the investment phase to the production phase. As a result, employment in the sector has decreased and wage growth has slowed. Compared with before the boom, the mining sector has experienced a sustained increase in the value of exports (figure 1.2), in production levels, and in employment (which has more than doubled). As the Department of Regional Development (WA) noted:

> Despite the fall in investment over recent years, the resources industry remains a significant contributor to the State and the national economy. (sub. 27, p. 3)

Figure 1.1   **A larger than usual commodity cycle**

Non-rural commodity price index

Terms of trade index
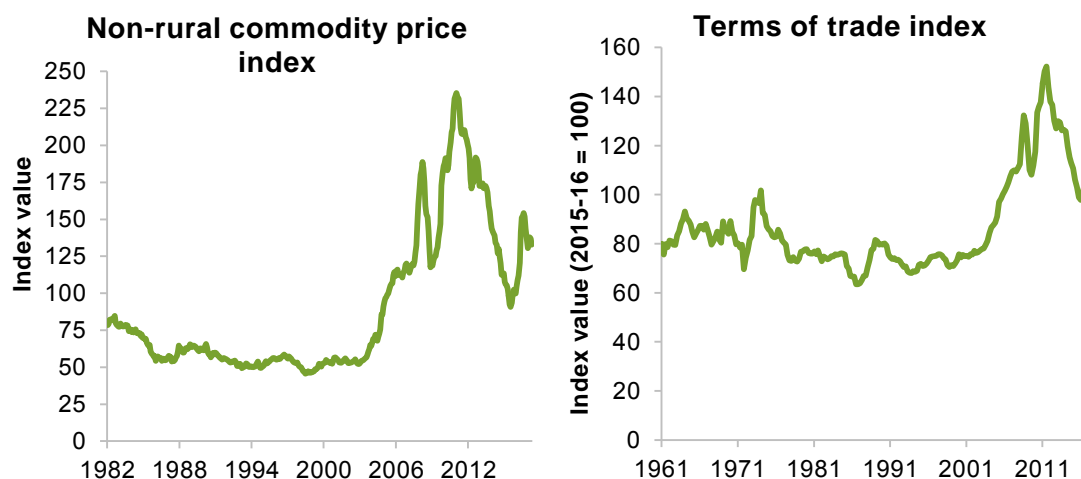
Sources: ABS (*Australian National Accounts: National Income, Expenditure and Product, Dec 2016*, Cat. no. 5206.0); RBA (2017).

Figure 1.2   **Quarterly export values**
December 1996 to June 2017
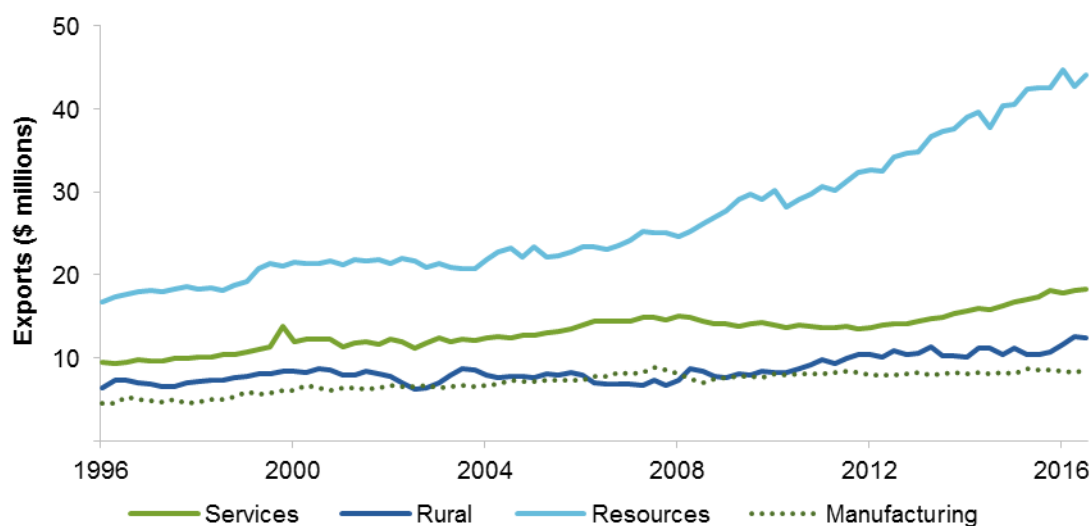
Source: ABS (*Balance of Payments and International Investment Position, Australia, Jun 2017*, Cat. no. 5302.0).

A similar sentiment was expressed by the Queensland Resources Council.

> The medium to long term demand fundamentals for Queensland's resource commodities remains strong, so the resource industry will remain an engine for growth in many regional economies in Queensland for decades to come. The resource sector's expansion in Queensland over the past decade is unprecedented and even though many sectors are adjusting to the current global

oversupply of many commodities, the resources industry in Queensland continues to generate substantial numbers of regional jobs, widespread regional economic activity and royalties for the State. (sub. 16, pp. 1–2)

The resources sector is now a larger sector (and share) of the Australian economy compared with before the boom.

The economic cycle has been significant and has had varying impacts across different geographic regions of Australia. During the boom, economic activity was particularly strong in Western Australia and Queensland. For example, in Western Australia, annual economic growth peaked at 9.4 per cent in 2011-12, with business investment accounting for a significant share of the growth. Following the end of the investment phase, economic growth in Western Australia slowed and gross state product declined by 2.7 per cent in 2016-17, after growing, on average, by about 5 per cent per year in the previous decade (ABS 2017c). Unemployment has also been trending up. On average in the year to October 2017, 86 000 people were unemployed compared with about 37 000 on average during 2008 (ABS 2017h). Recent employment data suggest conditions have stabilised, with employment in Western Australia growing only slightly more slowly than the Australian rate in the past year. Similarly, Queensland experienced unprecedented levels of construction expenditure during the boom (approximately $36.6 billion in 2013-14), which have subsequently decreased by about 70 per cent (Queensland Government, sub. 26, p. 20).

1.1 What has the Commission been asked to do?

The terms of reference for this study (set out at the beginning of this report) essentially ask the Commission to:

- identify regions that face significant challenges in successfully transitioning to a more sustainable economic base and establish an economic metric to rank regions most at risk of failing to adjust

- identify, for such regions, factors that influence their capacity to adapt to changes in economic circumstances

- devise an analytical approach for assessing the scope for economic and social development in regions, and examine prospects for, and inhibitors to, change to the structure of regional economies.

Although the terms of reference highlight the slowing of the mining investment boom as one type of adjustment pressure to which regions are currently responding, the Commission has not limited its analysis to 'mining regions' or the effects of the mining investment boom. This is because the boom has had a widespread effect on Australia's regions, and in some cases other pressures — such as changes in government policies, advances in technology, and the closure of major employers — have played a more important role in transitions in some regions. The analysis in this study includes all regions across Australia, and considers the many different forces that have shaped their development.

1.2   The Commission's approach

The Commission's approach to this study is one of many that could have been taken to address the terms of reference. Regions are complex, unique and dynamic systems, and the people within them are diverse. There is no single way to capture this diversity or to assess how each region might respond to change. In analysing the various approaches that could have been applied, the Commission settled on an approach that it considers best meets the requirements of the terms of reference.

In undertaking this study, the Commission has drawn on methodologies that have been used in the economic literature to measure economic resilience and adaptive capacity, and applied a framework with two key elements.

- *Observing change in Australia's regions over time*. This allows the Commission to identify regions facing transitional pressures, analyse their responses, and observe their development paths. From this, an understanding of the factors that influence economic resilience and adaptation can be reached and regions that might be at risk of failing to adjust can be identified. This analysis is the focus of chapter 3.

- *Constructing a measure of adaptive capacity*. This is another way of identifying regions that might be at risk of failing to adjust, and is the focus of chapter 4.

The Commission has also devised a policy framework to assess the scope for economic and social development in regions and the factors that may inhibit or facilitate change in regions. The approach and guiding principles are discussed in chapter 2 and guidance on how the framework can be applied is provided in chapter 5.

Throughout the report, case studies have also been used to illustrate how factors have influenced the transition of regions. Not only do case studies provide useful insights into the factors that affect transition, but they also highlight the complex forces that shape the development of Australia's regions. Regions that appear to have similar characteristics or levels of adaptive capacity may respond very differently to similar adjustment pressures.

As required by the terms of reference, the Commission has developed a single metric of the relative adaptive capacity of Australia's regions. There are inherent difficulties in reducing the multidimensional nature of adaptive capacity into a single indicator. The metric obscures the uniqueness of regions, and its development has been limited by the availability of data across regions. That said, the metric provides a guide for identifying regions that might be at risk of failing to transition and adjust to pressures for change. The limitations of the metric are discussed in chapters 2 and 4.

1.3 Conduct of the study

The Commission has consulted widely with stakeholders, drawing on input from participants through meetings, visits, roundtable discussions, written submissions and public forums (appendix A).

The terms of reference for this study were received on 15 December 2016, and required the Commission to produce an initial report in April 2017. Given the short timeframe for the initial report, the Commission did not release an issues paper, however it did invite public submissions. Prior to the initial report, the Commission held limited consultations with a range of organisations, individuals, industry bodies and government agencies and visited a number of regions.

The Commission released an initial report on 21 April 2017. The initial report was informed by 37 initial submissions and included the Commission's analysis and findings at that time. The Commission sought feedback on the initial report and held more extensive discussions with stakeholders. This included visits to regional areas of Australia, with public forums held in Karratha, Traralgon, Orange, Adelaide and Darwin in June and August 2017.

In total, 81 submissions were received (with 44 following the release of the initial report). Submissions are available on the Commission's website.

The Productivity Commission thanks all participants for meeting with the Commissioners and staff, making submissions, and providing helpful information. The Commission would also like to thank the Australian Bureau of Statistics for hosting an in-posted Commission staff member to access data, including from the 2016 Census, which was crucial to much of the analysis in the report.

2 The Commission's approach

Key points

- The regions considered in this study are not limited to those directly affected by the end of the mining investment boom. The study looks at all regions across Australia, and considers a variety of adjustment pressures that affect the economic performance of regional communities. Though regions are constantly changing and evolving, the catalyst for this study is major disruptions to regions' economic circumstances.

- There are three key elements to the approach adopted for this study.

  - The first is to observe change in regions over recent decades, and to use this information to understand how regions are transitioning and/or developing and to identify regions that might be having difficulty transitioning.

  - The second is to create an index of the relative adaptive capacity of Australia's regions. This index combines many attributes that are considered important in shaping the capacity of a region to adapt.

  - The third is a framework to guide governments in assessing the scope for regional development and transition.

- Regions have differing natural growth potential, which changes over time. This potential defines the region both in its ability to grow, but also its ability to respond to external shocks. Successful (or unsuccessful) transitions are difficult to define, and can have differing effects on people. The focus ought to be on the wellbeing of people rather than regions, although this study uses data at a regional scale to assess transitions.

- Many factors influence the way regional communities (that is, workers, business owners and people living in the region) respond to economic, social and technological changes.

- Adaptive capacity is a summary of some of these factors. It is influenced by a broad range of attributes and resources that regional communities can draw on when considering how to respond to changing economic circumstances, including the skills of workers, connectivity to other regions and social factors such as leadership and networks.

- In general, regions with higher adaptive capacity have a relative abundance of these factors, and are relatively well placed to transition successfully after disruptions. However, adaptive *capacity* is not a good predictor of *outcomes*, because these reflect many decisions made by individuals and businesses, as well as the type and magnitude of the disruption.

- The ability of regional communities to adapt and develop depends on the opportunities available to them and on the extent of any impediments to taking advantage of opportunities. Institutions and leadership critically influence the way resources are mobilised and the way development strategies are devised and implemented.

- Assessing the scope for transition and development in regions should be guided by an examination of each region's circumstances, the nature of the change it is experiencing, and its inherent strengths and advantages, as well as prospects for sustainable development.

2.1   Setting the scene

The Commission's task is challenging, both conceptually and statistically. There is neither a simple nor an agreed way to define and measure a 'successful transition' or the 'adaptive capacity' of a 'region'.

The mining investment boom has had significant effects on the Australian economy as a whole (box 2.1), and on many of Australia's regional economies. For example, regions can be analysed in terms of how investment in the region has been affected, how workers have moved (relocation; fly-in, fly-out; drive-in, drive-out) or how exposed the region is to overseas economic conditions. Moreover, regions are interrelated, and the effect of changes in one region can quickly flow on to others.

> Geographically, the downturn has not been confined to areas where there are mining operations, such as the Pilbara, Mid West, Goldfields Esperance and Kimberley. While these areas have certainly been affected by the slowdown in activity, other areas of the state with related industries or a significant fly-in fly-out workforce have also suffered the effects of the downturn. (WALGA, sub. 22, p. 2)

Box 2.1   **Impact of the mining investment boom**

The mining investment boom provided a major boost to the Australian economy. The boom had a strong initial focus on construction, substantially increasing demand for labour. Investment was largely located in mineral-rich regions, but had significant positive flow-on effects in major centres.

Mining activity remains, and is likely to remain, well above pre-boom levels. The so-called 'downturn' needs to be placed into this context. Shifting away from the employment-heavy construction phase of the boom to a more 'normal' production phase was inevitable. Rather than viewing this change as an economic problem, it should be seen as a natural part of the economic opportunity offered by the investment boom.

The rise and fall of commodity prices, leading to the mining investment boom and its end, have also affected the value of the Australian dollar. In turn, this has influenced the international competitiveness of many of Australia's industries. For example, the Cairns Regional Council and Advance Cairns (sub. 13) said that the relatively higher exchange rate during the boom negatively affected the region's tourism industry. Conversely, the Queensland Government (sub. 26, p. 38) noted that a lower exchange rate is likely to benefit many industries. Most, if not all, of Australia's regions are likely to have been affected by the high exchange rate that accompanied the mining investment boom. That said, there is little doubt that the nation as a whole is better off due to the mining boom, and continues to benefit from the investments in new capacity that occurred during the boom. However, there are a number of ways in which the negative implications of the disruption on the broader economy and regions in particular could have been reduced (as discussed in chapter 5) by a combination of better policy and provision of information.

Regions are also affected by other (predictable and unpredictable) forces, such as changes in policy, advances in technologies and the application of new technologies, natural disasters and drought, closures of major employers, changes in consumer preferences, and changes in international markets. In many cases, these pressures have had a more significant effect on regional performance than the mining investment boom. The Tasmanian Government Minister for State Growth said that:

> While Tasmania has not experienced the adverse after-effects of the decline in the resources boom to the extent of other states and territories, it is experiencing the impacts of other economic transitions in a number of our regional areas. These changes have been triggered by the emergence of new industries as historic industries decline, and the associated workforce implications this brings. Some industrial decline would no doubt stem from the loss of competitiveness experienced in non-mining industries that had to contend with high exchange rates that accompanied the resources boom. (sub. 21, p. 1)

Given the widespread effect of the mining investment boom, and the presence of other short- and long-term factors that significantly affect regional performance, the scope of the study has not been limited to the effect of the mining investment boom and all regions have been included in the analysis. Furthermore, the focus is principally on the wellbeing of people in regional communities rather than precise geographical boundaries, as it is people who ultimately matter.

Functional economic regions

Regions can be defined in different ways depending on the policy purpose of the analysis. For this study, regions are defined based on the way they function — using functional economic regions (FERs). FERs reflect the fact that there are significant linkages and interdependencies between regions (box 2.2). The design of FERs recognises that people often travel between regions for work or to access services, that businesses trade between regions, and that governments and people interact economically, socially and culturally across geographic areas. The use of FERs as a way of choosing a geographical scale for analysis was also advocated by a number of study participants.[3]

The FERs developed by the Commission are presented in appendix D, along with an explanation of the methodology used to define them. The use of FERs in this report differs from the definition of regions used in the initial report in response to feedback, including at a technical workshop. It should be noted that the FERs used in this study represent one approach to defining regions for examining regional transitions and planning. Others, including some State and Territory Governments, have constructed FERs in different ways (appendix D).

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[3] Denis O'Malley (sub. 4); NSW Government (sub. DR71); Queensland Government (sub. DR77); Regional Australia Institute (sub. DR57).

Box 2.2	**Functional economic regions**

A region can be defined on the basis of various attributes, such as labour markets, industry composition, natural resources and local administration. For economic analysis, 'a region is typically defined as an area that contains a cohesive network of trade and commerce; local commuting for jobs and shopping; common access to services; and association of community activities' (NSW Government, sub. DR71, p. 11). The use of functional economic regions (FERs) is designed to better reflect these interactions between people across geographic areas. FERs have been created by other organisations in Australia, including the NSW Government (sub. DR71), and the University of Newcastle's Centre of Full Employment and Equity (CofFEE nd).

For this study, FERs were constructed using a multi-step process. First, Statistical Area Level 2 (SA2) regions that constituted greater capital city areas within each state or territory were assumed to form their own FER (ABS 2010). Next, within each state and territory, SA2s that had the strongest commuting links were grouped. This aggregation was primarily done using the Intramax method (Masser and Brown 1975; Stimson et al. 2015). Some remaining SA2s that had few commuting flows were grouped with FERs that they shared a border with or to FERs that contained their nearest service centre. A small number of manual adjustments were made. A total of 89 FERs were formed at the end of this process. Further details are provided in appendix D.

Understanding regional economic resilience

The capacity of regional communities to adapt and transition from a disruption (box 2.3) and other pressures for change are of increasing interest to policy makers. The idea of 'economic resilience' is often invoked in discussions about the transition and development of regions, and is referred to as a desired feature that should be promoted. For example, the WA Department of Regional Development said that:

> While targeted to jobs, economic growth and capable people, the Portfolio's activities and investments also serve to improve economic and social resilience. (sub. 27, p. 4)

The Tasmanian Government Minister for State Growth (sub. 21, p. 3) said that the Tasmanian Government was 'committed to continuing to support growth and regional resilience', and Regional Development Victoria (2016a) stated that its programs aim to 'build prosperous, stronger regional communities'.

Despite strong interest in the notion of economic resilience, there is no consensus about how it should be defined (box 2.3). Resilience is complex and multidimensional, and has been interpreted in different ways across the economic, psychological and evolutionary biological literature. Determining whether a regional community was resilient or adaptive following a disruptive event is not straightforward. In undertaking this study, the Commission has drawn on the relevant literature and applied a framework judged suitable for the analysis, while highlighting its limitations.

Box 2.3　What is economic resilience?

Economic resilience is a term commonly used to discuss how regions respond to disruptions. However, there is a lack of conceptual and theoretical clarity about its meaning (Martin and Sunley 2015, p. 3; Pike, Dawley and Tomaney 2010, p. 16). It has been assigned multiple meanings by various authors. For example, Hill et al. defined it as:

> the ability of a region … to recover successfully from shocks to its economy that throw it substantially off its growth path. (2011, p. 2)
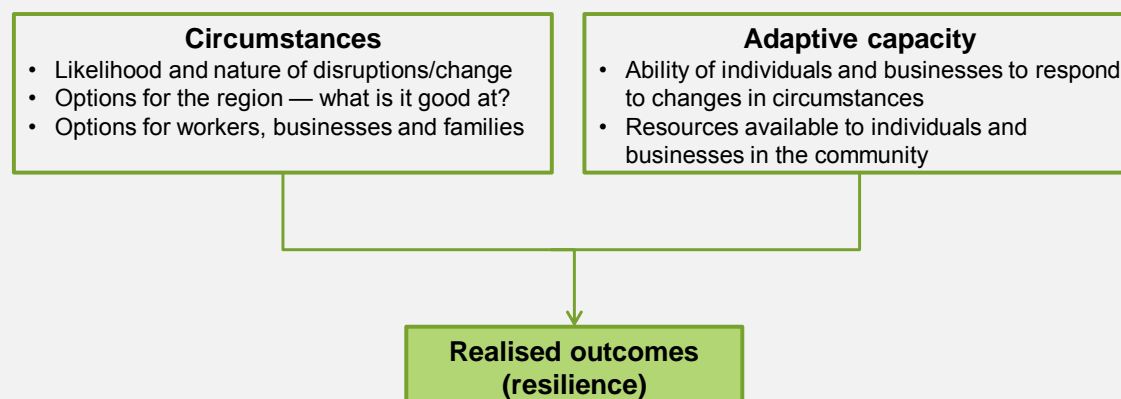
On the other hand, Martin and Sunley interpreted it more broadly as:

> the capacity … to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and social and institutional arrangements, so as to maintain or restore its previous developmental path, or to transit to a new sustainable path characterised by a fully and more productive use of its physical, human and environmental resources. (2015, p. 13)

These definitions highlight the competing notions of resilience in the economic literature as ranging from 'bouncing back' to a pre-existing state, to adapting in a way that may require changes to a region's economic base (Boschma 2015; Hill et al. 2011; Martin and Sunley 2015; Sensier, Bristow and Healy 2016).

Some have questioned the usefulness of the notion of resilience, contending that it does not add anything to existing economic concepts such as regional competitiveness, economic sustainability and path dependence of economic growth (Hanley 2001; Hassink 2010). However, Martin and Sunley (2015, p. 16) suggested that the notion of resilience is useful because it draws attention to how regions respond to specific shocks or disruptions, as opposed to slow, long-term change.

Discussions of economic resilience often use the terms 'resilience' and 'adaptive capacity' interchangeably. Although these concepts are related, they are not the same thing. Resilience is seen in the *outcomes* realised by individuals (including workers, business owners and operators, and families). Being resilient might involve, for instance, moving across regions to take up new opportunities. Adaptive capacity, on the other hand, involves the factors that shape whether individuals have the *means* to take up new opportunities, within and between regions. Measures of adaptive capacity may be associated with, but are not a good predictor of, realised outcomes (resilience) (ABARE–BRS 2010; Alasia et al. 2008; Briguglio et al. 2008; Zaman and Vasile 2014) (figure below).

Circumstances
- Likelihood and nature of disruptions/change
- Options for the region — what is it good at?
- Options for workers, businesses and families

Adaptive capacity
- Ability of individuals and businesses to respond to changes in circumstances
- Resources available to individuals and businesses in the community

Realised outcomes (resilience)

Box 2.3 (continued)

Accordingly, assessment of a region's likely development path and realised economic outcomes should take into account both its adaptive capacity and the circumstances, opportunities and prospects that it faces. As depicted in the figure below, regions that have relatively low adaptive capacity and which are also facing relatively severe and pervasive economic changes are likely to face greater difficulties in making a successful transition (indicated by the darker green shaded area).
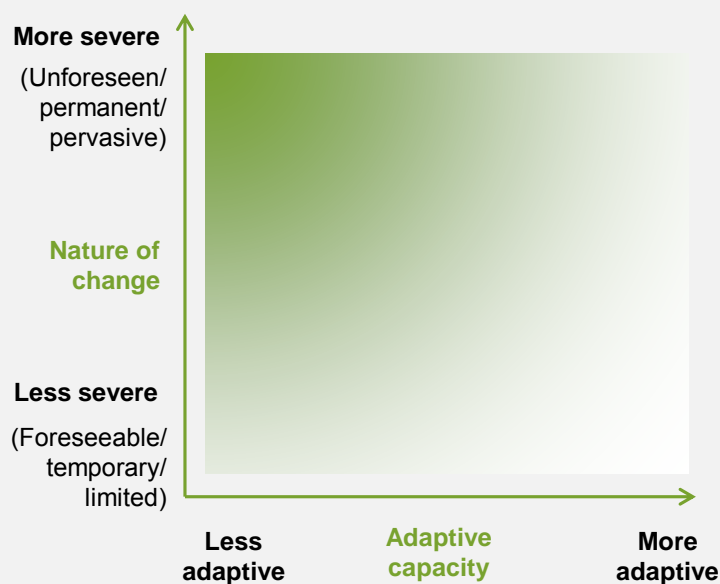
An important distinction for this study is between resilience outcomes from pressures for change, and adaptive capacity (Sensier, Bristow and Healy 2016, p. 131) (box 2.3).

- *Resilience outcomes* are observed, and can be measured in terms of indicators such as economic growth, employment, incomes and population.

- *Adaptive capacity* is not directly observable, but can have a material impact on realised outcomes. Adaptive capacity is influenced by many interacting factors, including natural attributes and connectivity to other regions and markets, and only some of these factors can be observed and measured.

The remainder of this chapter sets out the three key elements of the approach that underpins the Commission's analysis.

- Section 2.2 lays the groundwork for analysing the performance of regions over time. This analysis is conducted in chapter 3.

- Section 2.3 outlines the approach for developing the single metric of relative adaptive capacity. The results of the metric are discussed in chapter 4 and detailed in appendix E.

- Section 2.4 sets out a framework to guide governments in assessing the scope for economic and social development in regions. Chapter 5 discusses the extent to which

current and past regional planning and programs align with this framework, and makes recommendations targeted at the capacity of regions to adapt to pressures for change.

2.2 Observing the performance of regions

One way of identifying regions at risk of failing to adjust is to observe the performance of regions over time. This involves:

- first, observing patterns and trends over time and across regions

- second, identifying regions that have experienced disruptions (box 2.4) and/or ongoing pressures for change and analysing how the pressures have manifested

- finally, seeking to explain the findings in terms of the various factors and processes involved.

This broad approach to understanding the resilience of regions has been used in various studies, and is sometimes referred to as the business cycle approach (Hill et al. 2011; Martin and Sunley 2015; Sensier, Bristow and Healy 2016). However, measuring the effects of a disruption is far from straightforward. Business cycles vary in amplitude and duration, and peaks and troughs can be difficult to date. Choosing a counterfactual against which to assess the performance of a region can also be contentious. There is no single approach to identifying disruptions and their effects on performance over time.

Disruptions can vary along many dimensions (box 2.4), and one way that their effects can be observed is by examining a region's development path over time. Development paths capture changes in economic activity, and are a proxy for community wellbeing. They reflect the long-term evolution of regions as well as their reactions to disruptions and adjustment pressures. A key factor in disruption is predictability. Some shocks are unexpected and sudden, while others (especially long-term demographic trends) can be relatively predictable. New inventions or innovations can render an existing market or product obsolete or substantially reduce its size. This is a critical reason why governments should eschew 'picking winners' (chapter 5), allowing the private sector to invest where it sees potential returns.

Box 2.4 How could disruptions affect regions?

Disruptions can occur in many ways. They can be negative (for example a natural disaster), positive (a sharp increase in demand, such as a mining boom) or mixed (for example a technology change can improve efficiency but involve significant adjustment pressures for workers). The effects of disruption can vary along the following dimensions.

- **Severity** — the magnitude of the disruption and its effects.

- **Speed** — the rate at which the disruption occurs and its effects are felt. For example, a natural disaster could be a discrete event with an immediate impact, whereas the effect of an ageing population unfolds over a longer period of time.

- **Permanence** — whether the disruption is a one-off event, a periodic occurrence (commodity cycles), or a permanent change with no foreseeable return to previous conditions (technological change).

- **Extent** — whether the disruption affects many regions or sectors (including through flow-on effects), or whether it is more localised.

- **Predictability** — whether the change could have reasonably been foreseen. Periodic events are likely to have relatively high predictability (for example, a drought or commodity price cycles, as opposed to an unanticipated permanent change in demand for a major product produced in a region).

- **Sequencing** — whether the disruption is related to other (past or future) disruptions.

Source: Aither (2014).

A region's pathway following a disruption can be captured in three broad outcomes (figure 2.1).

- A region may exhibit positive growth. It may continue to grow at an equal or faster rate than previously (unaffected by the shock). This type of outcome has been termed 'shock-resistant' by Hill et al. (2011).

- A region could experience a downturn (or upturn) followed by a return to longer-term growth trends. This short-term fluctuation in the growth rate could be lower (or higher) than the region's previous growth rate. Regions that exhibit this pattern are sometimes referred to as 'resilient'.

- A region could experience a persistent decline in economic activity and a lower-growth developmental path. These regions are 'non-resilient'.

Figure 2.1   **Stylised development path of a region following a negative disruption**
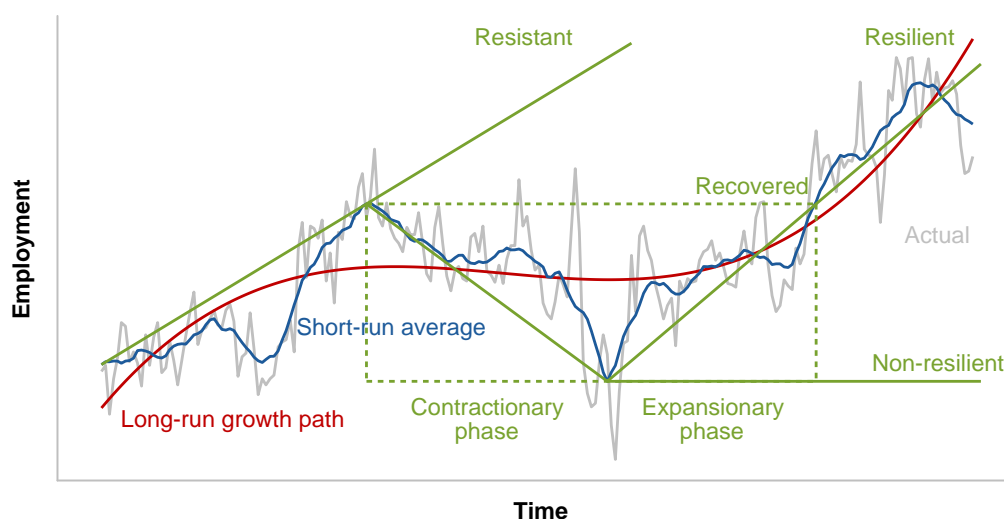
Source: Adapted from Hill et al. (2011).

In reality, regional economies are constantly responding to multiple pressures. This can make it difficult to identify substantial 'disruptions' in time series data — their effect on overall economic growth may be indistinguishable from cyclical patterns, numerous smaller (but more pervasive) forces, or longer-term structural change. This has been found to be the case in this study. The level of aggregation of the data can also make it difficult to identify disruptions that have been experienced at a local scale.

Individuals and business owners can respond to disruptions in different ways.

They might return to carrying out the same economic activities in the same manner as they had previously. Regional Development Australia Pilbara (sub. 6) suggested that if the recent increases in commodity prices were to be sustained, investments that were previously put on hold due to decreasing commodity prices would go ahead.

They might adjust by adopting more efficient ways of carrying out economic activities. For example, in the face of falling commodity prices and other forces, mining companies have sought to remain competitive by focusing on innovation, cost reduction strategies and consolidation (Matysek and Fisher 2016, p. 24). This follows a period of falling productivity as mining companies sought to expand production as much as possible to take advantage of very high prices (Matysek and Fisher 2016, p. 4).

They might choose to engage in new activities that are made more attractive (even if returns are lower). For example, many of those affected by the closures of the Holden manufacturing plant and the Port Augusta power stations in South Australia have sought to acquire new

skills in other areas (Regional Development Australia Far North, sub. 9, p. 7). Tasmania's King Island has also been 'transitioning from a largely manufacturing based workforce to a service based sector, following the closure of the on-island abattoir' (Tasmanian Government Minister for State Growth, sub. 21. p. 5).

People and businesses might choose to relocate to other regions to pursue alternative employment and economic opportunities. For example, people might relocate from rural areas to larger regional centres such as Newcastle, Wollongong, Ballarat and Geelong, which have all recently experienced employment growth above the national average (chapter 3).

It is not immediately clear which kinds of responses would be associated with a 'successful' (or 'unsuccessful') transition. As the Regional Australia Institute explained, different outcomes could be considered successful.

> Success might mean a return to pre-boom equilibrium, or pre-boom prices, or might mean a stabilisation of employment or output growth at 'sustainable' rate – ie rates that, like the national economy growth/inflation trade-off enable a region to grow without abnormal price growth. (sub. 12, p. 5)

Economic activity also varies over time, and whether or not a transition is considered successful is likely to depend on the point of time in question (and the point in time used as a comparison). A region could initially experience a large upturn, then rapid decline followed by a return to its long-term trend. This has been the recent experience of some mining regions (WALGA, sub. 22) (chapter 3).

Moreover, disruptions can have differing effects on individuals, and it is difficult to aggregate these to determine success at the regional level. A transition could involve some unemployed workers moving out of a region to find employment elsewhere, which could increase their wellbeing relative to what it would have been if they had remained in the region. However, for those who are unable or unwilling to relocate, a disruption could result in a decrease in wellbeing, since a smaller community is less able to support services and maintain its asset base, and is likely to have fewer amenities.

Ultimately, the success of a transition should be determined by its effect on the wellbeing of the people as they move into, out of, or remain within, a regional community. That said, the wellbeing of people is difficult to define and measure, and this study uses indicators such as employment levels and personal incomes as proxies (chapter 3).

What factors affect the adaptive capacity of regions?

Observing the various ways that transitions have taken place (or are taking place) across Australia's regions provides a foundation for understanding the factors that affect performance and why regions differ in their observed resilience or adaptation. The capacity of regional communities to respond to change and take advantage of the opportunities available to them is influenced by a range of factors, including the attributes of people (skills,

education and financial resources), and the natural resources and attractiveness of the area (Alasia et al. 2008; Hill et al. 2011).

The outcomes of previous transitions also matter. For example, a previous transition that attracted high-skilled workers would reinforce a region's capacity to adapt to future disruptions, whereas a transition in which workers moved to other regions would likely weaken it. A resilient community may also involve workers temporarily moving into (or out of) the region in response to changes in labour market conditions — for example, during resource investment cycles where demand for labour may be temporarily high (chapter 3). Some factors that affect adaptive capacity are relevant for all regions (although their relative importance may vary from region to region), and others relate only to specific regions (Martin and Sunley 2015, p. 25).

A diversified economic base is generally considered to have a positive effect on economic performance and adaptive capacity, and is often raised as an important factor in facilitating transition (Chisholm 1995; Dissart 2003; Haslam-McKenzie and Stehlik 2005). For example, the Illawarra Business Chamber suggested that:

> It is important that in transitioning to a post-resources boom, regions like the Illawarra have a diversified economy enabling it to better adapt to changes to the national and international economy over time. (sub. 15, p. 4)

Regional Development Australia Mackay-Isaac-Whitsunday also said that it needed to:

> … build a more diverse economy to soften the impact of any transition in what is historically a cyclical industry. (sub. 25, p. 1)

Although economic diversity might increase adaptive capacity, in some cases it might lower overall wellbeing. This would occur if a region could have generated higher income by devoting resources to a few profitable activities, but chose instead to diversify. As Regional Development Australia Pilbara explained:

> There are currently some opportunities for economic development and 'transitioning' in the Pilbara, through diversification, although the scale of diversification in terms of value is nowhere near the value of the resources sector. (sub. 6, p. 13)

Similarly, the NT Government highlighted that:

> Many transitioning regional economies are working to diversify their economies through industries such as tourism and primary industries. However, the employment generated by such industries is often lower and less well-paid than that generated by major resource-based projects. (sub. 37, p. 9)

Diversification should not be undertaken for its own sake — regions should focus on producing goods or services that can earn them the highest income (over the longest time period possible). And even though some regional communities may not be able to diversify their economic base, people (including business owners) within the community can diversify their opportunities by investing in assets elsewhere.

Some participants in this study felt that it is the existence of particular industries and services, rather than industry diversification, that enables regions to adapt well. For example, Denis O'Malley (sub. 4, p. 5) pointed to the importance of 'transaction services' in facilitating trade in regional economies. Transaction services comprise industries that facilitate business transactions such as financial services, retail and wholesale trade, media and communications.

Others suggested that regional development policy should focus on developing industries where they have a natural, historical or social advantage, as this would give the regional community the best chance of sustainable long-term growth.

> A region's comparative advantage can stem from various resources, such as its geographical location, availability of natural resources, the existence of industry clusters, access to infrastructure or the skill profile of the local population. These underlying attributes influence the types of economic activity that are likely to be successful. They also have implications for development initiatives, which are generally more effective where they build on an existing strength. (Regional Development Australia Far North, sub. 9, p. 2)

> … concentrating regional development policies on economic activities where regions have a comparative advantage will, all else equal, provide the best chance of fostering growth and prosperity. (Chamber of Minerals and Energy of WA, sub. 28, p. 7)

Some highlighted the importance of connectivity to other regions through transport and telecommunications (James Cook University, sub. 24; Regional Cities Victoria, sub. 23).

> The lack of air flights from Central Western Queensland and the Bowen Basin to Rockhampton maximised the impact of the coal industry downturn for the Rockhampton Region. This lack of flights to Rockhampton was especially strongly felt by the Region's boarding schools which found it more difficult to compete with offerings from South and North Queensland. (Rockhampton Regional Council, sub. 10, p. 3)

> Good telecommunications infrastructure and services are fundamental to regional economies having the opportunity to transition successfully from the resources boom to a more diverse and sustainable economy. (Telstra, sub. 18, p. 3)

Social factors such as local leadership and volunteering were also considered to be important.

> Experience with transitions shows consistently that while economic endowments play a role in framing the overall parameters of what the next economic state might look like, the path to a new economic state will be strongly influenced by the social factors embedded in the region. These include local leadership, networks and connections; social and cultural strengths and weaknesses; and the ability of a region to drive initiatives to support endogenous growth in alternative industries. (RAI, sub. 12, p. 6)

> Regional development and transition is the outcome of a complex interplay of a myriad of factors, reflecting the various sources of capital in play as well as local leadership and decision-making and community understanding and involvement in developing the narrative and exploring the possibilities. (Institute for Resilient Regions: University of Southern Queensland, sub. DR63, p. 3)

Increasingly, the work of maintaining a liveable society has become the province of unpaid work. Such activities require resources, often provided by the volunteers themselves, which limits the ability to be a volunteer to those who already have resources. (Voices of the Valley, sub. DR53, p. 4)

In our experience, volunteer organisations can be engaged strategically to bring about positive and long lasting improvements. Their input and knowledge contributes to efficient and effective action. (Rotary Club of Traralgon, sub. DR50, p. 2)

The Commission heard an example of the importance of local leadership in Stawell, Victoria (box 2.5) (local leadership is discussed further in chapter 5).

A large body of literature suggests that social factors have an important influence on the performance of communities.[4] These factors can be nebulous and difficult to measure. Regional Development Australia Central West (sub. DR54, p. 4) noted that 'social capital indexes do not (and possibly cannot) adequately measure local leadership, which … is a significant contributor to the economic development and adaptive capacity of regions'. Researchers have therefore tended to rely on proxies such as the level of participation in community groups and attitudinal surveys (Boulila, Bousrih and Trabelsi 2008; Sherrieb, Norris and Galea 2010).

Ultimately, a region's ability to deal with change is made up of the adaptive capacity of individuals, workers, business owners and organisations in the community. For example, a business owner who wants to change the way their business operates must be able to find workers with the necessary skills, access finances for machinery and new investments, and motivate employees through leadership.

There are a multitude of factors that can affect the adaptive capacity of individuals, many are related, and can be grouped together to make interpretations of the analysis simpler. The ability to cluster factors based on their similarities is especially useful for the Commission's metric of adaptive capacity (section 2.3). Factors can be grouped in different ways and a commonly used approach is to group them according to the five capitals framework (box 2.6).

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4   For example, Alasia et al. (2008), Dinh et al. (2016), Helliwell and Putnam (1995), Hervas-Oliver, Jackson and Tomlinson (2011), Hill et al. (2011), Lawton et al. (2014) and Sherrieb, Norris and Galea (2010).

Box 2.5 Stawell: the importance of leadership

The town of Stawell, Victoria (approximately 230 kilometres northwest of Melbourne) illustrates the importance of leadership and social networks in enabling a region to transition and develop. The town has historically relied on mining, with gold discovered during the Victorian gold rush and the first recorded mining activity in 1853 (Lenaghan 2012; Osborne and Doronila 2005, p. 85). The Stawell Gold Mine opened in 1982, but ceased operations in December 2016 due to declining profitability. The mine and its processing facility were a large source of employment for the town, providing about 380 direct jobs in a town of just over 6000 people in 2012 (Lenaghan 2012).

When the possibility of a mine closure began to take shape in 2007, the Northern Grampians Shire Council took a leadership role in preparing for this event. In June 2007, it held focus groups with community members, councillors, mine staff and council staff to identify community values, priorities and preferences that would inform council planning for life after the mine (*The Stawell Times-News* 2007, *The Stawell Times-News* 2013). The Council also commissioned the Stawell Gold Mine Future Possibilities Study in 2013 to identify viable alternative uses for the mine site, and established a set of criteria so that only 'feasible' options would be considered. Thus, tourism was ruled out in the early stages of the study (Northern Grampians Shire Council 2013, p. 17).

Ideas from the feasibility study included establishing an emergency training centre or hydroponic horticulture production facility (SED Advisory 2014). In addition, a chance contact with an astrophysicist at the Swinburne University of Technology — through professional networks — yielded a novel proposal: a physics laboratory for dark matter detection experiments. An underground mine was considered ideal because the rock would act as a natural radiation shield. Further, because the mine site at Stawell was still in operation at the time, infrastructure and utilities such as electricity, ventilation and internet access were already in place (Clausen 2016).

The Stawell Underground Physics Laboratory is currently being constructed on part of the former mine site, and, when complete, will be the first underground dark matter detector in the Southern Hemisphere. The local government expects the laboratory to provide about 215 direct jobs (Northern Grampians Shire Council 2015, p. 3), and the community expect that it will provide a stable industry for the town, attract skilled workers and increase the number of local youth pursuing higher education in science (Clausen 2016). Part of the former mine site will also be used to develop a large-scale hydroponic glasshouse facility, which is expected to create 70 new jobs in the region. The ability of the region to undertake this development so soon after the closure of the mine has been directly attributed to the Council's foresight and leadership (Pulford 2017).

> **Box 2.6   Categorising factors that affect adaptive capacity**
>
> One way of categorising factors that affect adaptive capacity is to use the five capitals framework (Dinh et al. 2016; Nelson et al. 2009b). Under this framework, factors are grouped under one of five 'capitals', which represent the types of resources that regions draw on to re-orient their livelihoods in times of change.
>
> - Human capital — labour and influences on the productivity of labour, including work experience, education, skills and health.
>
> - Financial capital — means to invest, including savings and credit.
>
> - Physical capital — investment in man-made or modified items. This includes improvements to the natural environment, infrastructure, equipment and technology.
>
> - Natural capital — land, water and other natural resources, attractiveness of the area and location relative to other regions and transport routes.
>
> - Social capital — the ability of a community to coexist, share ideas and work towards common goals.
>
> Others have grouped factors in other ways, including by modifying the capitals above. For example, Flora and Flora (2007) separated political and cultural capital from social capital, while Lawton et al. (2014) combined natural and physical capital. The Regional Australia Institute (sub. 12), proposed seven types of 'community capitals' which in addition to the above capitals, include cultural capital and political capital. Martin and Sunley (2015, p. 26) used a different framework, categorising the determinants of regional resilience according to four economic subsystems: the structural and business subsystem, the labour market subsystem, the financial subsystem and the governance subsystem.

2.3 Measuring adaptive capacity — a single metric

It is not possible to predict with confidence how a regional community will respond or adapt to any particular disruptive event, so we cannot identify regions most at risk of failing to adjust on this basis. But as noted above, resilience *outcomes* are influenced by the adaptive *capacity* of communities. The Commission's approach to developing an index to rank regions most at risk of failing to adjust (as required by the terms of reference for this study) is to develop a measure of the *relative adaptive capacity* of regional communities.

There are significant challenges associated with developing a single metric of adaptive capacity. As noted above, adaptive capacity is influenced by a complex set of factors (both social and economic). Reducing these factors into a single metric will, to some extent, disguise the unique characteristics of regions. Obtaining data on a consistent basis for each region is also challenging, and the analysis in this study is necessarily limited by this. The metric is also likely to be highly sensitive to the variables included in the analysis. This highlights the importance of sensitivity testing and cautious interpretation of the results.

There is also no agreed method for how best to combine the large set of factors that are thought to affect adaptive capacity into a single metric. A number of approaches could be

used (OECD and JRC 2008), and the choice is largely based on judgment. The Commission has chosen to use Principal Component Analysis (PCA), a technique that has previously been used by the ABS and others to construct indexes of socioeconomic disadvantage, vulnerability, resilience and adaptive capacity (box 2.7).

PCA enables the construction of a single index by summarising the data on factors that are thought to influence adaptive capacity, and presenting them in terms of the elements that explain the most variation. These elements are called principal components. Principal components can then be used to create indexes and rank regions.

Box 2.7   Indexes based on principal component analysis

- The ABS Socio-Economic Indexes for Areas (SEIFA) consist of four indexes that measure different aspects of relative socioeconomic advantage and disadvantage.

- The Australian Bureau of Agricultural and Resource Economics — Bureau of Rural Sciences (2010) developed an Index of Community Vulnerability for the Murray-Darling Basin Authority to compare the vulnerability of communities across the Basin. This was based on the five capitals framework (box 2.6).

- Baum, Mitchell and Flanagan (2013) from the Centre of Full Employment and Equity at the University of Newcastle created an Employment Vulnerability Index to rank regions according to risk of job loss.

- Dinh et al. (2016) from the University of Canberra created an index of potential community economic resilience at a small regional level. They grouped factors under the five capitals, and also included levels of economic diversity and accessibility to service centres.

- Nelson et al. (2009a) created an index of adaptive capacity for Australian farms based on the five capitals framework.

The factors that have been included in the metric are those identified as important for adaptive capacity, based on those mentioned in the economic literature and by study participants (table 2.1). Most of the variables chosen can be gathered into five groups based on the capitals framework. Some variables do not fit logically into the five capitals framework and have been included separately, including an indicator of economic diversity, which is in line with other studies in this area (Dinh et al. 2016; Lawton et al. 2014; Nelson et al. 2009b). Data that would best capture some important factors are unavailable, so in some cases, surrogate variables have been used. For example, mining employment has been used in place of the value of discovered and undiscovered minerals.

PCA was conducted on all variables, and the resulting principal components were aggregated into an overall index (appendix E). The contributions of each factor and each group of related factors were then examined to identify which played the largest part in each region's overall index score.

Table 2.1   **Indicators of adaptive capacity**

Type of indicator	Indicators included in metric
Human capital	• Proportion of people aged 15–64 who have completed year 12 or higher • Proportion of people aged 15–24 fully engaged in work or study • Proportion of employed people in high- to medium-skilled occupations (loosely corresponding with a Certificate III or IV qualification or above) • Proportion of the labour force who are employed • Proportion of people aged 15–64 who were working or looking for work • Ratio of long-term Newstart Allowance recipients to population aged 15–64 • Proportion of people aged 15–64 • Proportion of people who identify as Indigenous • Ratio of patent applicants to population • Ratio of trademark applicants to population • Business entry and exit rates • Ratio of Disability Support Pension recipients to population aged 15–64 • Estimated proportion of people aged 15+ who self-assessed their health as better than fair • Estimated proportion of people aged 18+ with high or very high psychological distress • Estimated proportion of people aged 18+ with at least one of four health risk factors (current smoker, high risk alcohol consumption, obese, no or low exercise in the previous week)
Financial capital	• Proportion of households with equivalised household income greater than $1250 a week • Ratio of total investment income to population • Ratio of government income support recipients to population • Weighted average of median house and unit sale prices • Proportion of households who live in an owner-occupied dwelling with or without a mortgage • Estimated proportion of households that are in the bottom 40 per cent of the distribution of equivalised household income and are paying more than 30 per cent on mortgage or rent
Physical capital	• Remoteness, based on Accessibility/Remoteness Index of Australia • Proportion of households that access internet from the dwelling • Ratio of mean value of non-residential building approvals over 2014–16 to population • Estimated proportion of people aged 18+ who do not find it difficult getting to places needed with transport
Natural capital	• Proportion of employed people working in agriculture industry • Proportion of employed people working in mining industry • Proportion of land as national parks or nature reserves
Social capital	• Proportion of people who volunteered • Estimated proportion of people aged 18+ who are able to get support in times of crisis from persons outside the household • Estimated proportion of people aged 18+ or their partner who provide support to other relatives living outside the household • Estimated proportion of people aged 18+ who felt very safe or safe walking alone in local area after dark • Estimated proportion of people aged 18+ who felt they had experienced discrimination or unfair treatment in the past 12 months • Estimated proportion of people aged 18+ who do not disagree with acceptance of other cultures • Estimated proportion of people who are homeless
Other	• Herfindahl index of industry diversity • Proportional change in population aged 15–64 over five years • Proportion of people who travel to work in a different region

The analysis was conducted for FERs (box 2.2), which the Commission constructed based on Statistical Area Level 2 (SA2) regions drawn from the ABS Australian Statistical Geography Standard.

The index measures the extent to which regions are 'different' to others. An index score is computed for each region, with higher (lower) scores indicating higher (lower) adaptive capacity relative to other regions. Regions are then ranked according to their score to identify those most at risk of failing to adjust.

It is important to note that the index developed by the Commission measures relative, rather than absolute, adaptive capacity — regions ranked lowly by the index do not necessarily have low adaptive capacity, rather they only have *lower* adaptive capacity relative to other Australian regions.

Using the single metric of relative adaptive capacity

The index can be used as a starting point for identifying regions that might be at risk of failing to adjust on the basis of their relative adaptive capacity. However, it does not identify whether regions will be successful in transitioning to a more sustainable economic base following a disruption. As discussed earlier, a region's outcomes depend on its circumstances as well as its adaptive capacity and prospects for development (box 2.3). The index does not account for the circumstances and opportunities that regions face or how these might change in response to an economic disruption.

Thus, the actual ability of a community to adjust depends on the precise challenge it faces, and the actions of people within communities as they seek to take advantage of opportunities available to them. Study participants pointed to a number of opportunities for transition and development, including through diversification into other activities, such as agriculture, renewable energy or tourism, or by better utilising existing infrastructure assets and building on industry specialisation (box 2.8). However, many of these proposals would require taxpayer funding and so should be subject to rigorous, transparent cost–benefit analysis. As always, there are limited resources and proposals should be compared so that the ones with the largest net benefits are chosen.

The development opportunities and prospects for regional communities depend on the particular attributes of a region, including its geographical location and proximity to other communities and markets, its endowments of natural resources and attractions, and the skills of the local population. Prospects also relate to external factors such as advances in technology and changes in consumer preferences for the goods and services provided by regional economies.

Box 2.8   Participants' views on opportunities for change

Regional Development Australia Pilbara (sub. 6, pp. 15–16):

The Pilbara has very substantial renewable energy potential, primarily in solar and wind energy. Solar power potential is based on the high number of sunlight hours in the region …

A particular niche market opportunity exists in luxury tourism, which is the leading growth sector in tourism. … The Pilbara has several sights that could be considered for luxury tourism development, including the Dampier peninsula.

Linda Nadge (sub. 1, p. 3):

My idea is to grow Broken Hill by basing a space industry here.

Cairns Regional Council and Advance Cairns (sub. 13, pp. 40–41):

Given large expanding markets in Asia, cattle exports are predicted to grow. Technological improvements, including better stock, better infrastructure and investment in properties is underpinning ability to expand supply … Cape York is likely to prove a major area for increased production.

There are strong prospects for expanding [agricultural] production beyond current limits around the Tablelands … A number of industries in the area, including sugar, only need more water to expand.

Illawarra Business Chamber (sub. 15, p. 5):

The fastest growing sector over the next 20 years in the Illawarra is expected to be health care, driven primarily by an ageing population … Education and training is also expected to grow strongly.

The Illawarra's proximity to Sydney and Canberra also provide substantial opportunities for tourism growth in the region … For the region to benefit from these growth areas and opportunities, we need improved transport connectivity to and from the region.

Upper Spencer Gulf Common Purpose Group (sub. 20, p. 1):

There is considerable potential to build on these comparative strengths and reposition the economy as a hub for renewable energy generation and testing; defence; intermodal transport and logistics; value-adding and innovation in agriculture; event and marine-based tourism; advanced manufacturing to support the mining and energy sectors; and as centres for delivery of government services and higher education/research.

Tasmanian Government Minister for State Growth (sub. 21, p. 2):

We have also been working to facilitate the growth of emerging and high growth industries, such as aged care and [National Disability Insurance Scheme] linked programs, agriculture, transport and tourism.

Western Australian Local Government Association (sub. 22, pp. 13–14):

Mining will remain an important part of the WA economy, and there remains considerable and ongoing opportunities to supply raw materials to Asia. However, there are also opportunities for WA to build on its knowledge and expertise in resources production to become a major supplier of mining technology and services.

Beyond commodities, there are also significant opportunities for WA to supply consumer goods and services to the [Asia] region … which is demanding more 'luxury' goods such as premium food and wine products and services as their incomes increase.

Queensland Government (sub. 26, pp. 16, 27):

There is also a role of cultural tourism in transitioning regional economies to reflect Tourism Australia's finding that half (51%) of all International visitors to Australia are cultural and heritage visitors.

The tourism industry is a potential bright spot for the Mackay region, with the Whitsundays being a major tourist attraction. The lower AUD is expected to encourage more Australians to travel domestically and attract more tourism from overseas.

How successful regional communities are in adjusting to change depends on whether they are able to take advantage of available opportunities. Regional communities are best placed to drive change, and in this context, local leadership and entrepreneurship have a strong role to play. Governments are not best placed to pick which industries or projects are likely to succeed in the future. As noted by the Western Australian Local Government Association:

> It is important that the policy focus is not around 'picking winners', but instead about creating an environment that will improve the efficiency and competitiveness of the economy in general. (sub. 22, p. 2)

Thus, in assessing the scope for economic and social development in regions, it is necessary to look beyond the single metric and adopt a broader framework that takes into account a region's circumstances, strengths, opportunities and existing arrangements.

2.4 A framework for assessing the scope for economic and social development in regions

The terms of reference require the Commission to:

- examine prospects for, and inhibitors to, change to the structure of regional economies

- devise a framework for assessing the scope for economic and social development.

Regional economies are continually transitioning and adapting to pressures for change, and not just those arising from large disruptions (either positive or negative). A key element of assessing the scope for economic and social development in regions is about positioning local communities to adapt to such pressures. Successful strategies are those that focus on people in regional communities (rather than businesses, industries or government bureaucracies).

Whether and how governments should support people in regions so that they can respond to challenges and opportunities in a sustainable way is a contentious issue. Governments are continually under pressure to respond to competing demands (and often respond to the 'squeakiest wheel'). Furthermore, Australia's regions are highly diverse in their characteristics and experiences, and in the risks and opportunities they face. This makes it complex for governments to determine whether and how best to support regional communities in their efforts to develop and make a successful transition, whether it be from a major but temporary disruption or from a permanent change in circumstances.

A key issue in assessing the scope for economic and social development is defining the appropriate social, economic and geographical boundaries for regions. These boundaries will not always align with existing boundaries, such as local government areas, or boundaries used by statistical organisations, such as the ABS. In determining the appropriate size and boundaries of regions, consideration should be given to the linkages and interdependencies between towns and communities within a geographical area, defined on the basis of FERs (box 2.2 and chapter 5).

The framework set out here is intended to guide governments in assessing the scope for economic and social development in regions. Although transition and development are distinct concepts, the nature of a community's economic development also impacts upon its capacity to adapt well to changing circumstances.

In practice, a regional community does not 'decide' to develop or transition but does so organically. Governments can (and in most cases do) seek to facilitate an environment so that members of the community can achieve the highest possible wellbeing, given the strengths, resources and the opportunities available. People within these communities seek to make decisions that are in their best interests, given the circumstances and opportunities they face, both in the region and elsewhere.

Governments cannot artificially create an advantage for a regional community that it does not intrinsically possess. Attempts to do so result in a negative sum game for the Australian community as a whole and will generally be futile.

Governments have a finite capacity to facilitate local growth, and need to balance this with promoting conditions for transition and development among all regions.

Existing arrangements in expenditure and planning for regional development

Governments already have arrangements in place that redistribute resources across regions and engage in planning aimed at achieving service delivery and development objectives.

Expenditure

Substantial funding is directed to people in regional communities through various channels, including:

- 'built-in' or formula-based distribution of funds across regions, including the allocation of Commonwealth Financial Assistance Grants for local governments' service delivery (box 2.9)

- state-based redistribution, through the process of horizontal fiscal equalisation (PC 2017a)

- national initiatives aimed at fulfilling universal service obligations across regions, such as the National Broadband Network (PC 2017c)

- national partnership agreements (with associated funding) in key service delivery areas such as health, education and training

- generally available measures to assist people and businesses through the taxation and social security systems

- 'discretionary' or additional funding provided to regions on an ad hoc basis, such as under the Northern Australia Infrastructure Facility, and City Deals (discussed below).

Both the Australian Government and State and Territory Governments have committed significant amounts to discretionary regional programs. At the time of writing, the Australian Government has committed an estimated $21 billion for regional Australia, which includes a $472 million Regional Growth Fund announced as part of a 2017-18 ministerial statement (Joyce and Nash 2017) (appendix C). State and Territory Governments have also committed substantial funds to regional programs (box 2.10).

A broad range of regional projects have been publicly funded. These include a large number of economic and social infrastructure projects, including roads and public transport, airport redevelopments, exhibition and cultural centres, and energy infrastructure. They also include smaller amounts of funding for regional planning and feasibility studies and action plans.

Although the estimates in box 2.10 are indicative only, they are evidence that governments are already spending substantial amounts on regional projects.

The recent City Deals initiative is another example of discretionary regional programs already undertaken by governments. The purpose of the City Deals program (a key component of the Australian Government's Smart Cities Plan) is to promote economic growth, employment, affordable housing and environmental sustainability through coordination between governments, communities and the private sector (DPMC 2016). Inspired by a similar program in the United Kingdom, Australian City Deals may involve an entire city and surrounds, or a specific regional or metropolitan urban centre (DPMC 2016). To date, three City Deals have been announced — Townsville, Launceston and Western Sydney (Taylor 2016).

Box 2.9   **Financial Assistance Grant program**

Under the Financial Assistance Grant program, the Australian Government allocates funding to State and Territory governments on a per-capita basis, to be distributed to local governments by state-based grants commissions. The Australian Government provided $3.4 billion in total under this program in 2014-15 (DIRD 2017b, p. 12). Each jurisdiction has its own methodology for allocating financial assistance grants among local governments. However, under the National Principles set out for this program, states and the Northern Territory are asked to distribute funds on a 'full horizontal equalisation basis' among local governments, so that each local government can 'function, by reasonable effort, at a standard not lower than the average standard of other local governing bodies in the State' (DIRD 2017b, p. 46). Hence, an observable pattern is that non-metropolitan local governments typically receive a much higher per-capita funding amount than their city-based counterparts (table), in view of their generally higher cost of service delivery and smaller rate base.

Financial Assistance Grants: average per-capita allocation

2014-15

Classification of local governments[a]	Average funding allocation per capita ($)
Urban Capital City	20.77
Urban Developed Small	20.55
Urban Developed Medium	20.57
Urban Developed Large	22.23
Urban Developed Very Large	34.59
Urban Regional Small	107.68
Urban Regional Medium	75.23
Urban Regional Large	77.31
Urban Regional Very Large	55.44
Urban Fringe Small	59.22
Urban Fringe Medium	33.25
Urban Fringe Large	74.16
Urban Fringe Very Large	39.18
Rural Significant Growth	73.37
Rural Agricultural Small	787.61
Rural Agricultural Medium	516.95
Rural Agricultural Large	291.39
Rural Agricultural Very Large	170.47
Rural Remote Extra Small	3 350.26
Rural Remote Small	2 819.80
Rural Remote Medium	852.70
Rural Remote Large	580.94
Total $ per capita	**68.90**

a Based on Australian Classification of Local Governments.

Source: DIRD (2017b, p. 25).

Box 2.10   **Discretionary expenditure on regional programs**

Australian Government

As at May 2017, the Australian Government has committed an estimated $20.9 billion in expenditure on regional programs (appendix C). This estimate is conservative, as it excludes concessional loan schemes and a number of programs with a significant unspecified metropolitan component. Appendix C provides further details on how the estimate was obtained.

State and Territory governments

Between 2008 and 2017, the Western Australian Government's Royalties for Regions program directed over $6.9 billion of the state's mining and onshore petroleum royalties into over 3700 infrastructure and community projects (WA DRD 2015, sub. 27, p. 5).

The Queensland Government allocated $10.7 billion to capital works in its 2016-17 Budget, with almost half ($4.9 billion) being targeted at regional Queensland (Queensland Government, sub. 26, p. 12).

The NSW Government has stated that:

> By 30 June 2017, around $9.1 billion in Restart NSW funding will be committed or reserved for programs and projects in regional New South Wales, including the Rebuilding NSW plan. This is comprised of $3.8 billion committed from Restart NSW and $5.3 billion reserved for future projects. (NSW Treasury 2017, pp. 2–10)

Between 2014 and 2017, the Victorian Government reported having spent more than $8.5 billion on regional investment, and has committed an additional $4 billion to regional capital programs from 2017-18. This additional funding includes $1.1 billion for regional public transport, $531 million for maintaining and upgrading roads and bridges, $76 million for upgrading rural and regional schools, and $48 million for building a new public service 'hub' in Ballarat (Vic DTF 2017, p. 1).

Planning

Finally, all levels of government are also involved in regional development planning (and funding) and a large number of strategies have been developed (box 2.11).

Issues affecting these planning and expenditure arrangements are discussed in detail in chapter 5.

Box 2.11   All tiers of government are involved in strategic planning

Current approaches to strategic planning vary across regions, but often strategic planning occurs at both a local and regional level, and all tiers of government are involved to varying degrees.

Local government strategic plans

Many local governments across Australia have prepared strategic plans for their communities, in accordance with the relevant state or territory legislative requirements. For example, the Victorian Government requires all local governments to prepare a medium-term strategic plan ('council plan'), which establishes 'strategic objectives, strategies for achieving the objectives, strategic indicators for measuring progress and the resources required' for implementation. These must be based on 'stakeholder and community engagement' (Vic DELWP 2017b, p. 6). Similarly, in New South Wales, local governments are required to prepare a 10-year Community Strategic Plan to 'identify the community's main priorities and aspirations for the future, and plan strategies to achieve them' (NSW DPC 2013, p. 17). The quality of strategic plans is highly variable. In some jurisdictions, state governments have reviewed local governments' strategic planning to identify models of good practice. For example, the NSW Government has highlighted 18 local governments as demonstrating good practice in the preparation of community strategic plans (NSW OLG 2014). The Western Australian Government evaluated the Shire of Irwin as having demonstrated a 'high level' of integrated planning and reporting in its preparation of community and business strategic planning documents (WA DLGC 2015, p. 18).

Regional strategic planning through alliances of councils

Some councils have formed regional alliances to achieve a more coordinated and regional focus, although the governance structure and functions of these alliances vary. In some instances, local councils continue to be responsible for funding and providing services, but strategic planning is coordinated across the region. In other cases, Regional Organisations of Councils may have a service delivery role in order to achieve a reduction in the costs associated with delivery through scale efficiencies, but may have a limited role in strategic planning.

State and territory regional planning

State and Territory governments may also facilitate regional-level strategic planning. For example, in Western Australia, the State Government has facilitated the development of regional investment blueprints since 2013 through the nine Regional Development Commissions. These are State Government statutory authorities responsible for enabling and coordinating regional development. In Victoria, nine Regional Partnerships have been established by the State Government. The partnerships bring together representatives from all levels of government, business, education and community groups and provide a mechanism for regional leaders to advise the Government on priorities identified through regional plans.

Australian Government involvement in regional planning

The Australian Government has also played a role in regional planning through Regional Development Australia (RDA) — an initiative to support growth and development in regional Australia. The programme is delivered by a network of 55 committees across Australia, which provide a mechanism for the Australian Government to build partnerships with other levels of government and key stakeholders. Each RDA has developed a regional plan or roadmap that provides a strategic vision for the region and can be used to inform policy, planning and investment. However, RDAs are often thinly resourced and 'have limited capacity to implement those plans' (Smith 2016, p. 2).

Principles for assessing the scope for economic and social development in regions

Traditional policy approaches to regional development have often involved governments providing funding for infrastructure projects and for regional industries to reduce income and wealth disparities among Australia's regions (Tomaney 2010). However, in recent decades regional policy has gradually evolved from a focus on redistribution to a desire to enhance the capabilities and competitiveness of each regional community in order to achieve self-sustaining growth (Beer 2014). This is often referred to as a 'place-based' approach to regional development (box 2.12).

Place-based policies are likely to be more effective than subsidy-based policies (although the latter is still a significant part of government policy). Guided by this way of thinking, assessment of the scope for regional transition and development should be guided by the following principles.

- Consider the views and knowledge of regional communities.

- Identify the region's relative strengths (comparative advantage).

- Consider any unnecessary regulatory impediments to people or businesses taking up economic opportunities.

- Examine whether existing programs and strategies aimed at regional development are achieving value for money, in terms of enabling people in the regional community to take advantage of opportunities and connect with other regions and markets

- Examine whether there are robust and transparent processes for policy assessment and selection, implementation, monitoring and evaluation.

These principles are discussed in turn.

First, assessing the scope for development involves collaboration between governments and the regional community itself. This requires communities to take an active role in assessing their own development objectives, needs, opportunities and possible strategies (James Cook University, sub. 24; Regional Development Australia Tasmania, sub. 3; Tomaney 2010; Vic DEDJTR 2015).

Many submissions highlighted the need for local governments and regional communities to take a leadership role in planning. Regional Development Australia Tasmania (sub. 3, p. 2) argued that 'regional communities need to take ownership and the responsibility for structured decision making and strategic planning'. Others echoed these sentiments.

> [M]uch of the responsibility for economic development needs to be taken on by local and regional leadership. Regional Economic Development Strategies need to be undertaken at a regional level, rather than handed down by Commonwealth or State Governments. (Northern Tasmania Development Corporation, sub. 7, p. 3)

Centralised decision making 'to' the region and not 'with' the region; duplication by different levels of government and agencies … continue to frustrate local initiatives and efforts. (Upper Spencer Gulf Common Purpose Group, sub. 20, p. 1)

Box 2.12   The evolution of regional policy in Australia

Regional policy in Australia has evolved from one that was largely focused on support for regional industries to one that is more focused on enhancing the capabilities and competitiveness of regional communities. This is analogous to the evolution in Australia's international aid policy from an emphasis on transfers to developing countries to a recognition of the need for strong institutions and policies in developing countries to enable sustainable, locally-driven growth (DFAT 2014).

Reflecting this shift, contemporary views on regional policy favour 'place-based' approaches that aim to promote economic and employment growth in regions 'through encouraging each region to make greater use of its own opportunity and potential' (RAI, sub. 12, p. 23). Place-based approaches emphasise 'the ability of places to grow drawing on their own resources, notably their human capital and innovative capacities' (Tomaney 2010, p. 6). This helps to prevent regional dependency and promotes a more sustainable source of growth for regions. As the OECD said:

> In response to poor outcomes, regional policy has evolved, and continues to evolve, from a top-down, subsidy-based group of interventions designed to reduce regional disparities, into a much broader family of policies designed to improve regional competitiveness … The new regional approach is based on the principle that opportunities for growth exist in the entire territory, across all types of regions. The aim is to maximise national output by encouraging each individual region to reach its growth potential from within. Before, policy makers regarded regional policies as a zero sum game. Recent reforms of regional policy in a number of OECD countries provide evidence that this thinking has undergone a paradigm shift. (2009, p. 5)

Place-based approaches have also been endorsed in some government policy documents, such as the Victorian Government's recent review of regional economic development issues.

> This Review found that a 'place-based' approach to regional development is critical. Regions must play a leading role in developing their own growth strategies and government must organise itself to enable local decision making and integrated services. This approach continues to be essential to building regional prosperity. (Vic DEDJTR 2015, p. 7)

Some study participants echoed these ideas. For example, James Cook University argued that:

> … *Place is Powerful.* Place provides a contextual platform for conceptually organizing and theorizing regional development; ensuring that material conditions of life, such as the environment, resources and capabilities are taken into account and integrated locally.

> … Each region has its own culture, natural environment, climate, identity and a unique competitive advantage. The remote, Indigenous-led Arnhem Land, for example is a very different region from Queensland's sugar and tourism-driven Wet Tropics. There is no effective alternative to empowering individual (and generally self-defined) regions to set the direction for, manage and monitor progress towards their own economic destiny. [italics original] (sub. 24, p. 2)

These submissions highlight that local leadership is critical to vibrant, dynamic, flexible and resilient regions. There is a strong case for ensuring that local councils or regional organisations can attract and develop skilled leaders (chapter 5).

Local-level engagement is also essential to create strong community ownership of potential strategies. Communities should 'have a genuine role in engaging with the strategic issues

and options and setting medium and long term priorities that balance aspirations with affordability' (WA DLGC 2016, p. 44). Community engagement 'could be achieved by establishing consultative committees, or a special community taskforce, to have ongoing input into the process' (NSW DPC 2013, p. 39).

Second, assessing the scope for transition and development should focus on a region's innate strengths or resource endowments. These are the natural, historical or social advantages enjoyed by a regional community that can be potential sources of economic growth (CED 2016). Endowments can include, for example, natural resources (including environmental quality), travel time to major cities and so on. The importance of endowments in determining the direction of regional development has been recognised in previous studies (CED 2016; CEDA 2016; OECD 2009) as well as by participants in this study. For example, the Chamber of Minerals and Energy of Western Australia (sub. 28, p. 1) said 'policies … must also take into account comparative advantage of a region based on factors such as installed infrastructure and natural resource endowments'. The NSW Centre for Economic Development (CED 2016, p. 4) said that 'attempts to retain or establish industries without an underpinning endowment are unlikely to succeed'.

Third, assessment involves identifying any unnecessary policy or regulatory arrangements that prevent (or discourage) people and businesses from taking up economic opportunities. As noted earlier, removing such impediments can improve the scope for economic development and growth across all regions.

Fourth, assessment requires considering whether existing programs and policies are delivering value for money in terms of improving the capabilities of people in regions and their connectivity with other regions and markets. Such programs may be aimed at investing in the kinds of capabilities found to be inadequate in some regions, particularly human capital and physical infrastructure (box 2.13). However, there is evidence to suggest that public investment in regions has not been effectively targeted or implemented (chapter 5).

Fifth, assessing the scope for development should also be informed by rigorous evaluation of existing programs and policies in terms of their effectiveness and value for money in improving the capacity of regional communities to adjust and develop. Processes for assessment of existing programs and of any proposed future initiatives should align with best practices (PC 2014d; VAGO 2015) (box 2.14).

Box 2.13 Focusing on enablers of regional development and transition

Enhancing the capabilities of people

Inadequate human capital (including skills, education and experience) has emerged as a key factor contributing to low adaptive capacity in Australia's regions (chapter 4). Many previous reviews have also cited an inadequate skills base as an impediment to economic development and transition in Australia's regions.[5]

The need to improve human capital in regional communities as a precursor to overcoming high unemployment and persistent socioeconomic disadvantage was emphasised by some participants. The Upper Spencer Gulf Common Purpose Group observed 'a lack of relevant higher education and vocational training opportunities in the region' (sub. 20, p. 1). The Northern Territory Government submitted that skill shortages have persisted despite 'ongoing investment in training and the delivery of a range of national workforce attraction programs' (sub. 37, p. 8).

Improving human capital does not necessarily involve increasing participation in higher education. Rather, improving capabilities is about improving the ability of people in a region to take advantage of employment opportunities and industry trends, and/or to take up business and entrepreneurial opportunities. Building capabilities in this sense might mean better targeting vocational or professional training courses to industry requirements, and promoting access to and participation in these forms of education and training. It may also involve facilitating leadership within the community to plan for and drive change.

The factors surrounding inadequate human capital in urban, regional and remote communities are complex, and can include entrenched social and economic disadvantage. The links between persistent disadvantage and other outcomes, including health, education and employment outcomes, has been canvassed in detail by the Commission in other work (McLachlan, Gilfillan and Gordon 2013; SCRGSP 2016). Delving into these complex issues is beyond the scope of this study. Nonetheless, governments may be able to encourage improvements in human capital in regional communities through initiatives such as:

- promoting stronger relationships between local industries and education providers to ensure education and training programs meet industry demands. Universities could also help by linking research and technology developments with local business owners to help them find new and innovative ways of doing business (University of Newcastle, sub. DR64)

- encouraging skilled workers to relocate into, and remaining in, regional areas, such as by promoting the lifestyle benefits of a region and improving its amenity and attractiveness. This can be seen, for example, in the G21 Geelong Regional Alliance's objective of developing a 'vibrant and active region' characterised by cultural diversity and nationally significant events and activities, as a means of attracting 'educated, skilled and interesting people' (2014, p. 21). It may also involve improving the social infrastructure and amenities of a region (such as the provision of quality health and education services) to assist in attracting and retaining a skilled workforce (CEDA 2016, p. 28)

- collecting and providing information (to people within a region and those in nearby regions and capital cities) about skills in demand within a region (RASC 2013, p. 17).

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[5] CED (2016, p. 11); Howard Partners (2013, p. 9); Tennant Creek Regional Economic Development Committee (2014, p. 28); VicDEDJTR (2015, p. 18).

Box 2.13   (continued)

Enhancing regional connectivity and infrastructure

Building capacity in regional communities might also involve investment in infrastructure that facilitates 'connectivity' — the movement of goods, services and people, and communication between people. A number of participants suggested that improved transport and telecommunications infrastructure would enable people and businesses in regional communities to take advantage of opportunities (Bland Shire Council, sub. DR45; Illawarra Business Chamber, sub. 15; NT Government, sub. 37; Queensland Government, sub. 26; RAI, sub. 12; Regional Development Australia Central West, sub. 14; Regional Cities Victoria, sub. 23). In the case of Cairns, connectivity by air is important for the region's domestic and international tourism industry (Cairns Regional Council and Advance Cairns, sub. 13, p. 18).

In its cross-country analysis of drivers of regional economic growth, the OECD found that infrastructure and connectivity were critical enablers. This includes investment in transport infrastructure, including 'connecting relatively closed and isolated regions to external markets, and ensuring that transport infrastructure capitalises on privileged geographic positions' (2012, p. 23). Echoing this perspective, the Committee for Economic Development of Australia emphasised that many industries in regional Western Australia rely on freight supply chains for transporting products to markets, and argued that 'high transport costs and poor linkages in the Regions are limiting connectivity, including into new export markets' (2016, p. 26). Regional businesses' need for improved mobile and broadband infrastructure was also highlighted in this report, as well as by others (RTIRC 2015; Vic DEDJTR 2015).

The Australian Government is undertaking a major investment in delivering broadband connectivity to all Australian premises (on demand) via its investment in the National Broadband Network. As has been highlighted in the Commission's *Telecommunications Universal Service Obligation* inquiry, quality broadband services are critically important to a region's integration with other parts of Australia and the world, and government spending (through the National Broadband Network and other programs) should be designed to deliver a cost-effective baseline broadband service (including voice) (PC 2017c). However, the Commission has not evaluated the cost-effectiveness of this or other such public investments. It is vital that such investments are subject to a national cost–benefit test, as discussed in this chapter (and in chapter 5).

Any approaches or investments should align with a strategic view of a region's individual strengths and constraints and the 'fit' of these with respect to prevailing market conditions, rather than what might be perceived as 'the next big thing'. Government should avoid trying to 'pick winners' in regional communities by investing heavily in specific industries that are predicted to be future growth areas. This point was recognised in some submissions (including WALGA, sub. 22, p. 2).

> 'Picking winners' is not the business of government and therefore any planning must be community driven, long term and strategic. Project development should consider future employment, a region's liveability and skill development. (Regional Development Australia Tasmania, sub. 3, p. 2)

Box 2.14   Key elements of a rigorous assessment of regional programs

Identifying objectives and considering alternatives

Clear policy objectives enable governments to explore all options to support regional development. Rather than beginning with a project proposal, the merits of a range of alternatives that would achieve the intended objective should be considered. This includes both policy and regulatory reform and investment solutions. This can help avoid a bias towards 'new builds' in infrastructure project selection, including in the use of business cases for 'justifying pre-determined projects' (Foxlee and Stavros 2017). Before investing in new infrastructure, governments should carefully consider alternatives to improve the use of existing infrastructure, particularly where incremental improvements or technology enables lower-cost solutions, such as global positioning systems to manage demand and better utilise existing capacity (Foxlee and Stavros 2017). Further, governments need to take care to ensure that actions to invest in infrastructure are additional to private sector investment, and would not 'crowd out' private investment.

Selecting projects based on rigorous cost–benefit assessments

Once a range of options for achieving a regional policy objective have been identified, potential programs and projects should be assessed using rigorous cost–benefit analysis. The Commission has previously recommended that governments should undertake a comprehensive cost–benefit analysis, made publicly available, for all public infrastructure investment proposals above $50 million (PC 2014d, p. 40). This does not mean that smaller projects should not also be subject to rigorous and transparent assessment and selection processes. The approach of identifying objectives, considering alternatives and assessing costs and benefits can be scaled to smaller-value projects.

Although cost–benefit analysis is imperfect, it offers a way for governments to make explicit and transparent comparisons between proposed projects on a like-for-like basis, to guide prioritisation of limited funding (Terrill 2016a). Cost–benefit analysis needs to take into account the ongoing operation and maintenance costs associated with an infrastructure investment project (PC 2014d, p. 94), to avoid the selection of projects that impose unsustainable ongoing costs on regional communities.

Establishing and using performance monitoring and evaluation frameworks

Effective monitoring and evaluation are essential for tracking and assessing the progress of regional programs against their stated objectives, both during and after implementation. To be effective, monitoring and evaluation should occur within a robust and transparent framework that sets out measurable indicators of the program's performance against desired outcomes (rather than just outputs). Monitoring and evaluation should not only consider whether project outputs were delivered or short-term benefits were gained, but whether long-term outcomes and benefits to the community were achieved.

Applying rigorous processes for project selection and implementation is essential to ensure that public money is being directed to areas that provide a net benefit to the community overall (and do not crowd out private sector investment). This makes it more likely that strategies for transition and development will be sustainable, meaning that regional communities can be self-sustaining in the long term without requiring ongoing government assistance (beyond generally available government transfers).

Using these principles to guide regional strategies

The above principles can inform governments when assessing the scope for development in regions. Governments should also ensure that any assessment takes into account the specific attributes and contexts of individual regional communities. There is no 'one size fits all' approach to assessing the scope for regional development, as highlighted by several study participants.[6]

For some regions, where many workers face job loss because of reduced labour demand in certain industries (particularly in manufacturing and agriculture), the main challenges may lie in these regions identifying and pursuing new sources of economic growth. For others, such as some very remote and urban regions facing entrenched poverty and disadvantage, the key focus might be on finding ways to address these social and economic challenges to lift participation in education and employment. The most appropriate policy measures will in practice be very different, but the guiding principles still apply.

FINDING 2.1

Australian, State and Territory governments already have a suite of existing arrangements aimed at redistributing resources across regions, achieving service delivery objectives and planning for regional transition and development.

There are also generally available measures provided to assist people and businesses across all regions when faced with economic disruptions, under the social security, tax, training and job services systems.

Assistance beyond these arrangements should be rare, occurring in response to extreme circumstances that strongly portend the development of permanent disadvantage in a regional community, and that cannot be addressed by existing arrangements. Additionally, such assistance should be designed carefully to ensure that it is only temporary.

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[6] For example, Cairns Regional Council and Advance Cairns (sub. 13, p. 7); Queensland Government, (sub. 26, p. 12); South Australian Government (sub. 34, p. 13); Upper Spencer Gulf Common Purpose Group (sub. 20, p. 1).

FINDING 2.2

There is no single approach to assessing the scope for economic and social development in regions. However, assessments should be guided by the following principles.

- Incorporate the views and knowledge of regional communities.

- Consider a region's relative strengths and inherent advantages.

- Identify barriers to people or businesses relocating, either within the region, or to other regions.

- Identify unnecessary regulatory impediments to people or businesses taking up economic opportunities.

- Include robust and transparent evaluation of existing programs and policies.

- Include rigorous strategic regional planning and cost–benefit analysis of any proposed programs, policies or strategies.

- Consider the scope for private economic activity that is not dependent on ongoing government financial support (other than payments made under general taxation, social security and welfare laws).

3 Performance of regions

Key points

- Over the past 30 years, the Australian economy has adjusted well to changing economic pressures. However, not all regional communities have experienced the same resilience.

- Over the past five years the number of employed persons has grown in most regions (about 77 per cent), although some regions (about 26 per cent) have experienced population decline.

- It is difficult to distinguish specific disruptions from the normal variation in economic and social indicators. However, some general patterns can be observed, especially in regions which are predominately resource-based or agricultural.

- Workers in resource-based regions (mining, oil and gas production) had, on average, higher income growth than in other regions during the mining investment boom. Although income growth in mining regions has slowed since the boom, median incomes are still higher in mining regions than other areas of Australia.

  - Labour mobility, largely through fly-in, fly-out workers, has spread the benefits of the mining investment boom to other regions and also diluted the impact of the end of the boom on individual regions.

  - The rapid rise (and subsequent fall) of house prices in some mining areas has had negative wealth effects on some people who bought during the boom, including investors who had no connection to the resources sector.

- Productivity improvements and the growth of regional centres and cities are driving a long term adjustment in agricultural regions.

  - These changes are the result of natural forces and are important to ensuring the long term success of agriculture. They have resulted, however, in decreasing employment and populations in some agricultural regions.

- Capital cities and many regional centres are experiencing rapid population growth, particularly in 'lifestyle' centres along the coast and for regional centres that are well connected to major cities. The high rates of population growth in capital cities reflect overseas migrants and an increasing propensity for urban living.

In many respects, the current Australian economy bears little resemblance to the economy of the early twentieth century. Although Australia has enjoyed a sustained period of economic growth, there has been substantial transformation in the nature of businesses and jobs over the past few decades. The services sector has grown to dominate the Australian economy (as it has in other developed countries) and agriculture and manufacturing have shrunk in relative terms. Overall, employment and GDP have been growing at a national level, with a changing composition. In part, favourable countercyclical factors have benefited Australia, such as strong demand for resources from China. Australia's economy has performed strongly through some difficult periods including the 1997 Asian Financial

Crisis, the 'dotcom bubble' (1997–2001) and the global financial crisis of 2007-08. Thus providing evidence that the Australian economy is adaptive and resilient overall.

The above discussion does not mean that all regions are growing in line with the national trend or that all regional communities are resilient in the face of adjustment pressures. Many of Australia's regional economies are reliant on mining or agricultural activity with products sold on global markets. They are susceptible to price cycles, the weather and other exogenous shocks and their cyclical nature means they experience varying rates of growth. Even so, some regions may be more adaptive and flexible than others, and this flexibility improves the overall resilience of the Australian economy.

Drawing on the framework presented in chapter 2, the Commission would have preferred to identify functional economic regions (FERs) that have experienced an out-of-the-ordinary economic disruption (cycles that are larger than usually observed).

However, sufficient data for employment are only available at the Statistical Area Level 4 (SA4) (87 regions across Australia).[7] Data on population and incomes are available at the more disaggregated Statistical Area Level 2 (SA2). The SA2 data have been aggregated into FERs. Gross regional product data have not been used in the report because robust estimates are not available at the required level of disaggregation.

Using the data available, it has not been possible to identify many examples of regions experiencing major isolated disruptive events. Rather, regions continually experience ups and downs. This could be a feature of the normal fluctuations in economic activity, which has more variability at a disaggregated level, or due to other factors. For example, events such as cyclones in Darwin and Cairns, and droughts have had large adverse impacts on regions. Although such events impact on communities, they do not appear to result in large shocks to regions in terms of economic activity as indicated by employment levels. In addition, there appear to be long–term trends across classes of regions, including those that are predominately focused on mining or agriculture or are regional population centres (towns and cities). These trends, and the factors that have shaped the performance of particular regions, are explored further in this chapter.

This chapter starts with an examination of recent economic and demographic trends in regions throughout Australia (section 3.1). Data are typically shown over the past 5 years as this coincides with the transition phase following the end of the mining investment boom. Drawing on the themes emerging from this analysis, the chapter then explores change in three types of regions: resources regions (section 3.2), agricultural regions[8] (section 3.3) and urban regions (section 3.4).

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[7] The ABS also defines smaller regions, but there are fewer data about employment over time because the source is surveys. The survey sample size is generally too small to be able to use it at the more disaggregated level.

[8] Resources regions and agricultural (including pastoral) regions are defined as those with a share of employment in those activities higher than 10 per cent of total employment.

3.1 Recent trends in regional growth

Most regions have experienced employment growth

Almost all SA4 regions have displayed significant variability in the growth rate of employment, as indicated by the large interquartile ranges (figure 3.1).[9] Even so, most regions have experienced overall positive growth in the number of employed persons in the past five years (about 77 per cent of regions). Most also display negative rates of growth from time to time and a number have experienced an overall fall in employment. The geographic distribution of regional growth in the number of employed persons is shown in figure 3.2.

Figure 3.1 **Employment growth is variable across Australia's regions**

Median annual employment growth and interquartile ranges for SA4 regions, October 2012 to October 2017, year average data[a]
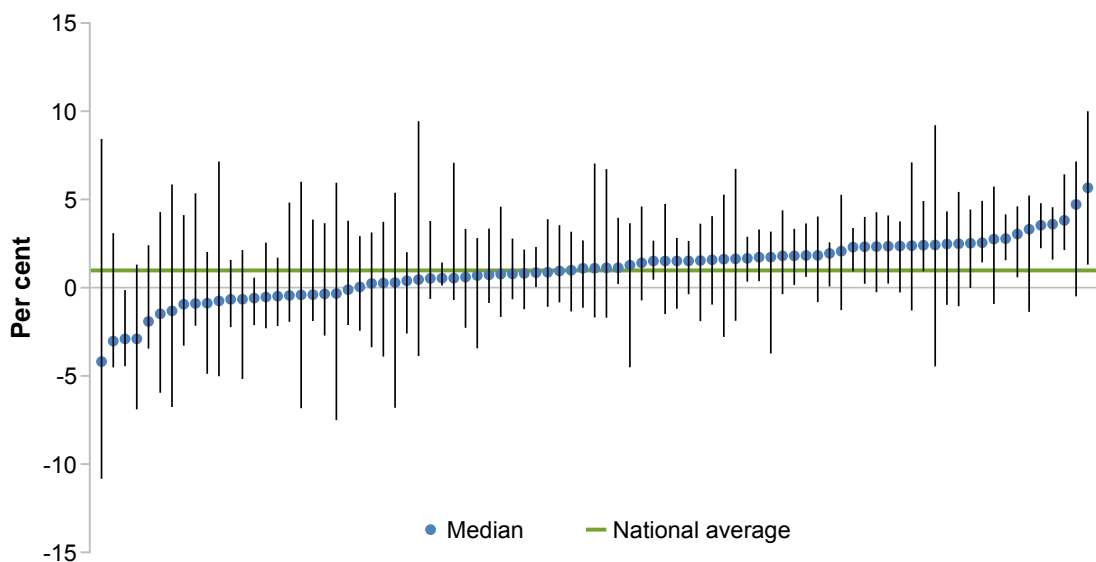
a Data are for year average employment growth rates. Each blue dot represents the median annual employment growth over the period, for each region. The black lines extend to the annual growth rate for the 25th and 75th percentile.

Source: ABS (*Labour Force, Australia, Detailed – Electronic Delivery, Oct 2017*, Cat. no. 6291.0.55.001).

Over the longer term, even more regions have experienced an increase in employed persons. About 92 per cent of SA4 regions experienced positive employment growth in the past 10 years (that is, only seven regions had a decrease in the number of employed persons). Four regions had negative growth over the shorter and longer term, and included agricultural regions like Murray in New South Wales and the Western Australia – Wheat Belt. As discussed later, these regions have had more enduring employment decline than other regions.

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9   The data in figure 3.1 are year average employment growth rates. Unadjusted data show even greater variability.

Figure 3.2 **The number of employed persons is growing in most regions**

Average annual employment growth from year ending October 2012 to year ending October 2017, by SA4 region
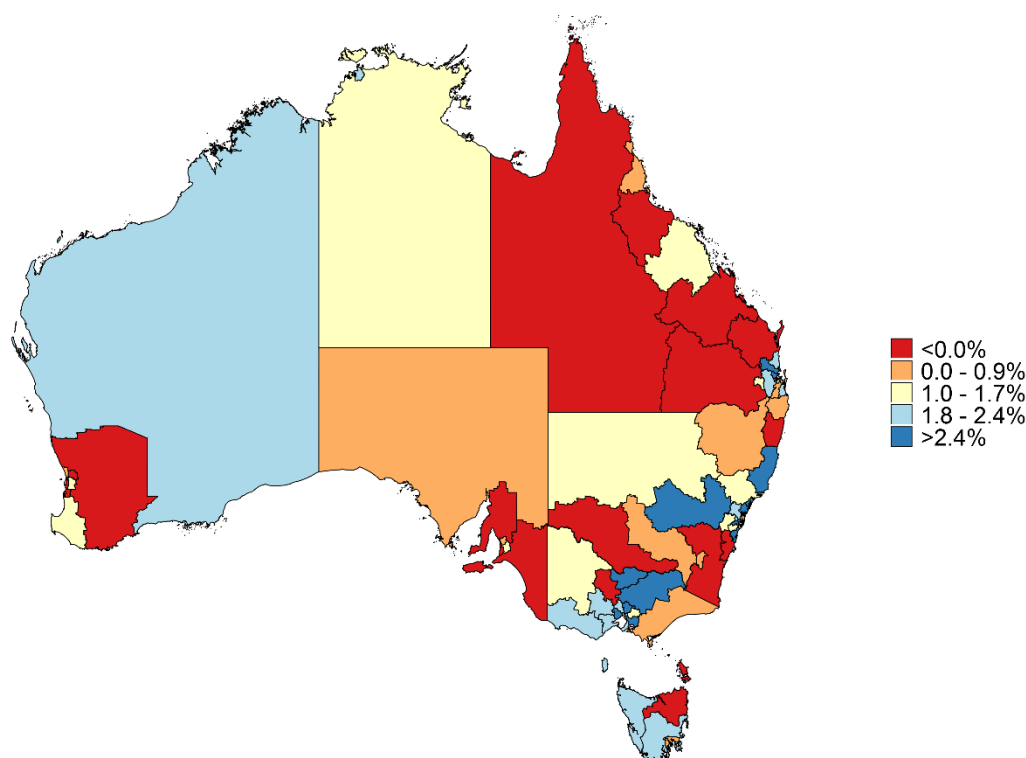

Legend:
- <0.0%
- 0.0 - 0.9%
- 1.0 - 1.7%
- 1.8 - 2.4%
- >2.4%

Source: ABS (*Labour Force, Australia, Detailed – Electronic Delivery, Oct 2017*, Cat. no. 6291.0.55.001).

An emerging theme from this analysis is that regions experiencing the lowest rates of employment growth have a large agricultural (and pastoral) base. For example, between 2012 and 2017 employment fell by 4 per cent in the Western Australia – Wheat Belt and by 15 per cent in Murray in New South Wales (as illustrated in figure 3.15 later in this chapter). This is reflective of the long-term decline in employment in agriculture over many decades, due in part to technological progress and improved management. In contrast, mining employment had been reasonably stable until a period of rapid increase from 2005, roughly coinciding with the start of the mining investment boom. Even though employment has since declined, the number of people now employed in mining is more than double what it was prior to the boom. For example, Western Australia – Outback, which is heavily mining dependent, experienced high rates of employment growth (12 per cent in the five year period up to year ending October 2017) (discussed later and illustrated in figure 3.8).

The employment rate in a region can be measured as the ratio of employment to working-age population.[10] Employment rates in some mining regions (Western Australia – Outback and Mackay) are well above the Australian average. However, Fitzroy and Queensland –

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[10] Working-age population is measured as the number of persons aged 15 years and over. The ratio is also equivalent to the participation rate multiplied by one minus the unemployment rate.

Outback had a decline in their employment rates in the past five years. The declines were associated with declining participation rates more so than rising unemployment.

Most agricultural regions had employment rates below the Australian average, with Murray in New South Wales having a ratio below 50, associated with rising unemployment. Riverina had a declining employment rate which was associated with declining participation. In contrast, Shepparton and Warrnambool and South West had increasing employment rates.

FINDING 3.1

All Australian regions experience significant variation in their growth in employment, with many having occasional periods of negative growth. Even so, most regions (67 out of 87 SA4 regions) have seen net increases in the number of employed persons over the five years to October 2017. Many regions with low rates of employment growth have a large agricultural base.

Unemployment is highest in remote regions

Unemployment rates tend to be highest in remote regions, including areas of the Northern Territory, South Australia and far north Queensland (figure 3.3). At the FER level, the highest unemployment rate was in the APY Lands — a large Indigenous area in remote north-west South Australia. It has had an unemployment rate above 20 per cent for at least the past 5 years, suggesting that there are long-term underlying factors at play, such as limited economic and employment opportunities rather than short-term disruptions.

Figure 3.3   **Unemployment rates were highest in remote areas**

Year average unemployment rate, by functional economic region, June 2017

Legend:
- <4.2%
- 4.2 - 4.9%
- 5.0 - 5.9%
- 6.0 - 7.1%
- >7.1%
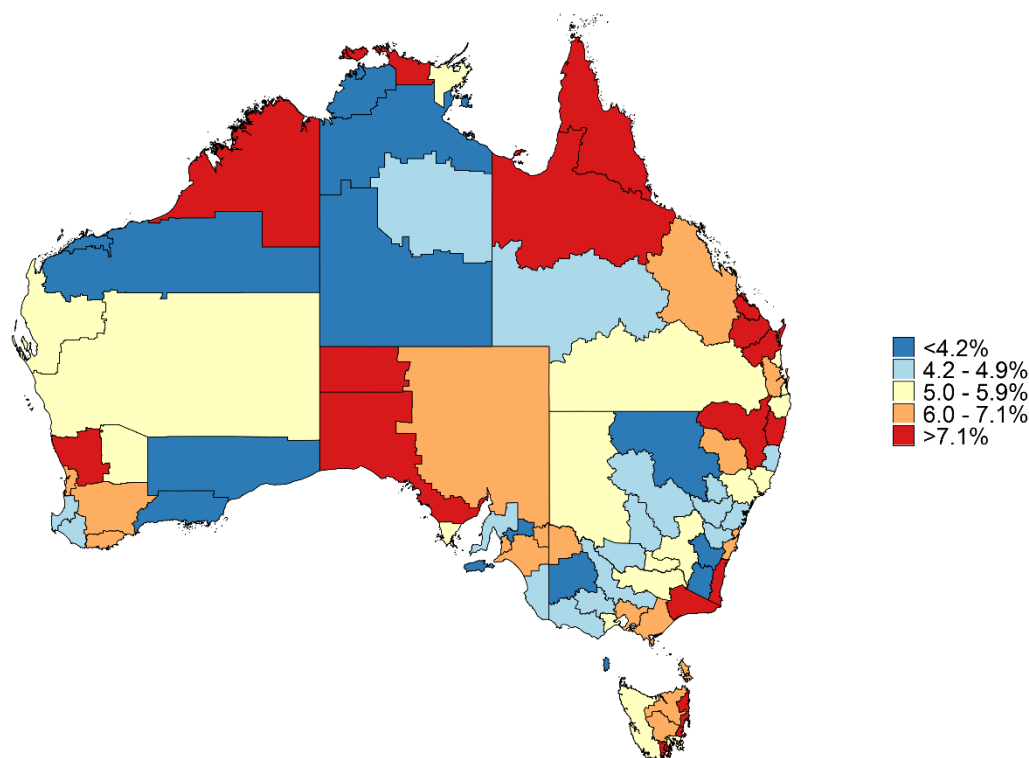
*Source*: Department of Employment (*Small Area Labour Markets, June 2017*).

Regional population has grown although some towns are in decline

Although the majority of regions experienced growth in population between 2011 and 2016, 26 per cent of FERs recorded a population decline (figure 3.4). Most of the regions with declining populations were in remote and very remote areas with large geographic areas and are sparsely populated. Thus the total geographic area of regions with declining population is large. Australia's pattern of becoming more urbanised is similar to the experience in other OECD countries (OECD 2016b, p. 17).

These patterns of growth and decline across regions reflect longer term trends. Although Australia's population has increased by about 40 per cent over the past 25 years, many regional areas have experienced a decline in their population during this time (section 3.4).

Patterns of population growth over the longer term might also be related to the relative abundance of economic opportunities. For example, the 'geographic concentration of Australia's mineral wealth has led to much stronger economic and employment growth in Western Australia, Queensland and the Northern Territory' (PC 2014b, p. 7) and population growth since Federation has been higher in Western Australia and Queensland.

Figure 3.4   **Population decline has been predominantly in inland regions**
Annual average population growth by functional economic region, 2011 to 2016

Legend:
- <0.0%
- 0.0 - 0.4%
- 0.5 - 0.8%
- 0.9 - 1.2%
- >1.2%
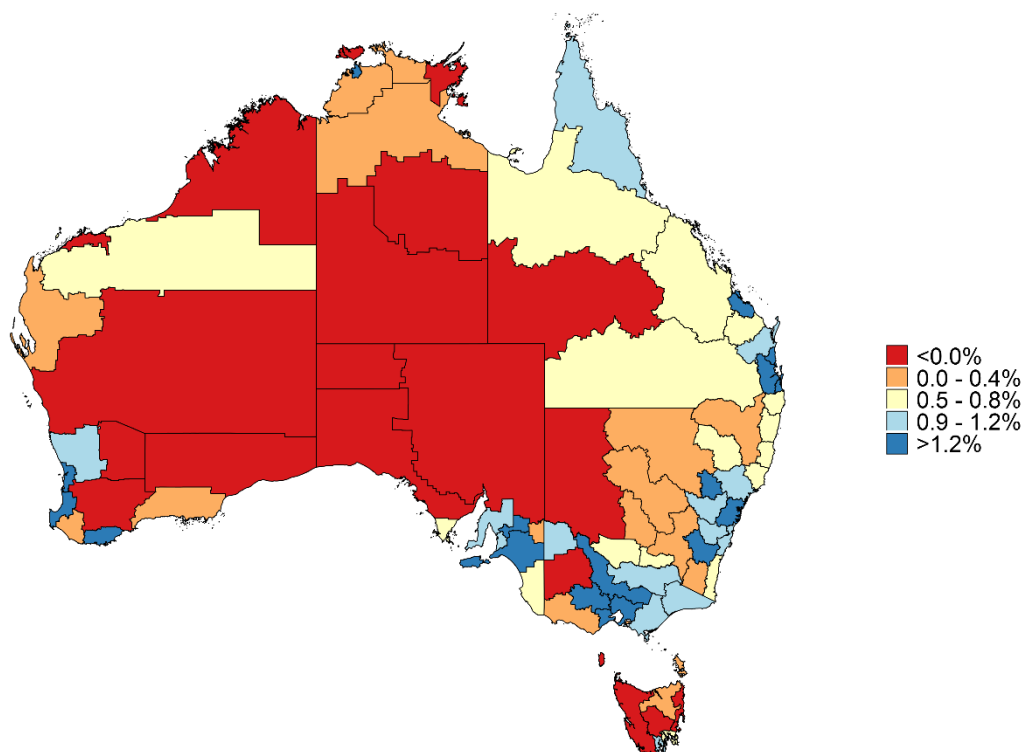
Source: ABS (*Regional Population Growth, Australia, 2016*, Cat. no. 3218.0).

Incomes have grown in most regions

Mean personal income[11] is generally higher in mining-intensive regions than in other parts of the country (figure 3.5). Port Hedland – Newman and Karratha had the highest mean incomes in Australia in 2014-15, at about 50 per cent above the Australian average.

However, some agricultural regions, particularly those in Western Australia, recorded high rates of mean income growth during the period 2010-11 to 2014-15 (figure 3.6). In fact, the highest income growth across all regions in this period occurred in the South Wheatbelt and Central East Wheatbelt regions of Western Australia (growing at about 15 per cent per year between 2010-11 and 2014-15) where higher than average rainfall helped boost yields. In contrast, the lowest income growth between 2010-11 and 2014-15 was in Horsham (growing at less than 0.5 per cent per year).

11 The income data used in the analysis here are based on tax data from the ABS and the Australian Taxation Office. It includes employee, investment and business income. The ABS states that care should be taken in interpreting the data because some low income earners, for example those who do not lodge a tax return and do not have a payment summary, may not be present in the data.

In many states, incomes in regional areas grew more rapidly than in metropolitan areas. For instance, the median incomes in regional New South Wales, Victoria, Queensland and Western Australia all outstripped the income growth rates in their capital cities in the period 2010-11 to 2014-15. But income levels in capital cities generally remained higher than in other regions. Overall, the greater urban areas of Darwin and Perth grew at above the national average, but in Sydney, Adelaide and in particular Hobart and Melbourne, income growth was below the national average between 2010-11 and 2014-15.

Incomes where mining is the predominant industry (particularly regions in Queensland and Western Australia) increased rapidly until 2012-13 (roughly coinciding with the end of the construction phase of the boom). In Port Hedland – Newman and Karratha, mean incomes grew by more than 10 per cent between 2010-11 and 2012-13. As discussed further below, mining employment has an effect on regions not usually associated with mining operations because of labour market linkages, particularly fly-in, fly-out (FIFO) and drive-in, drive-out (DIDO) workers, and because many mining employees work in cities.

Figure 3.5   **In 2014-15, incomes were highest for people living in mining regions**

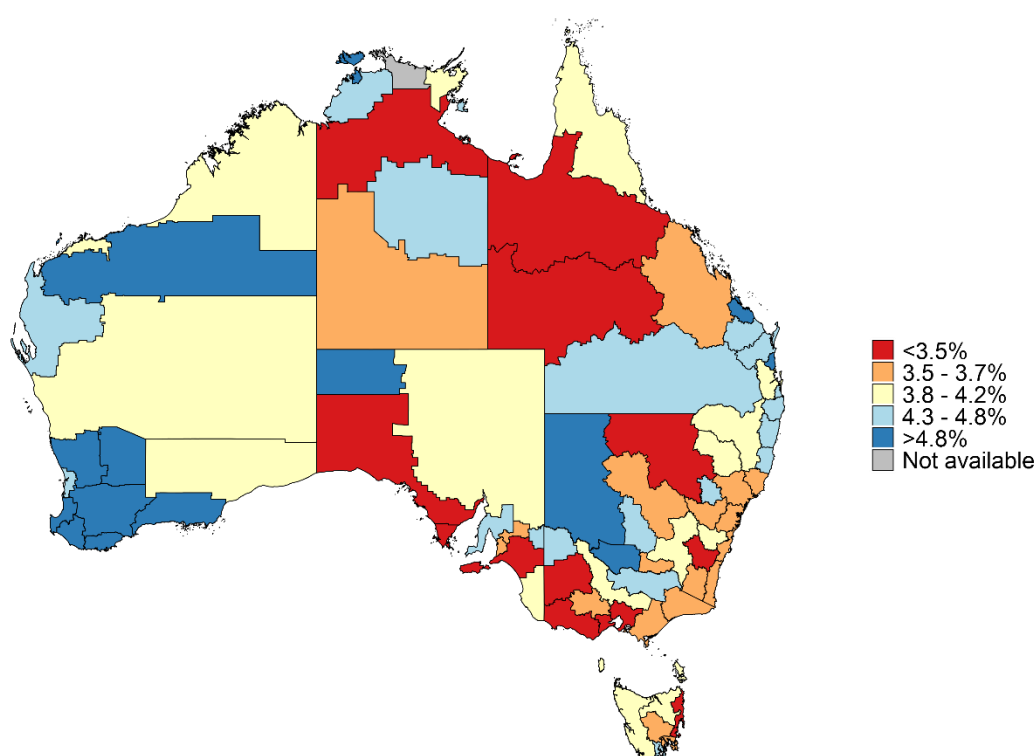Mean personal income, by functional economic region
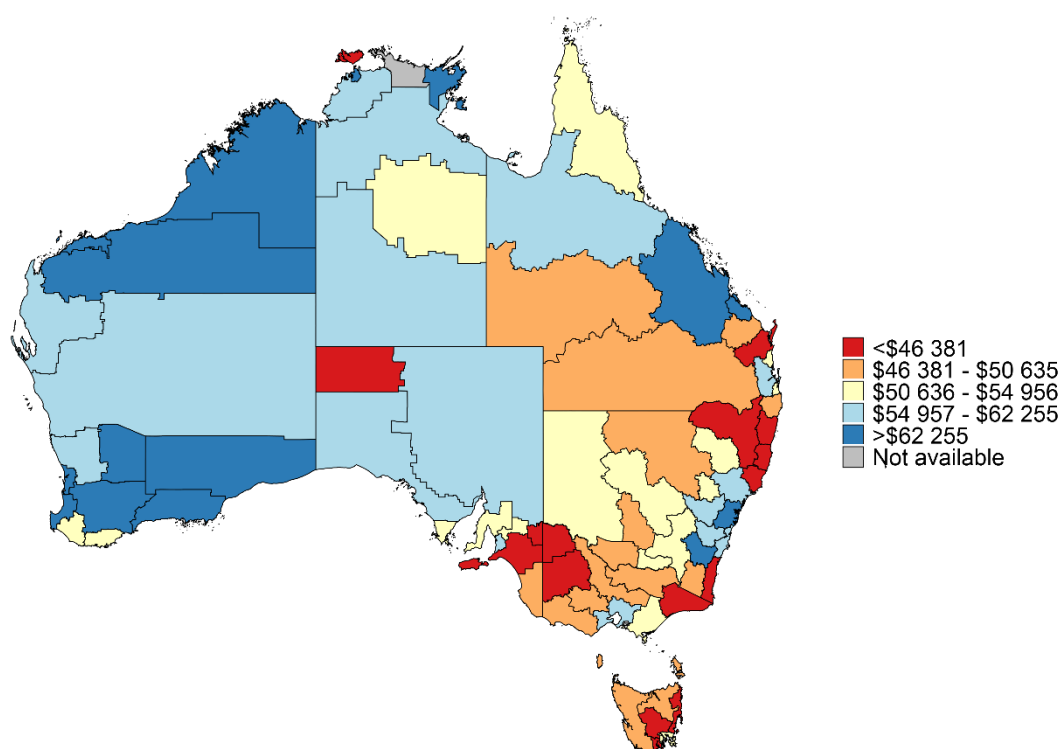
Source: ABS (*Estimates of Personal Income for Small Areas, 2011–2015*, Cat. no. 6524.0.55.002).

However, there is emerging evidence that following the end of the investment boom incomes are growing more modestly in mining-intensive regions. The growth rates in mean incomes

in Port Hedland – Newman and Karratha between 2012-13 and 2014-15 were less than the Australian growth rate. In contrast, over the same period income growth in many agricultural regions in New South Wales and Victoria exceeded the Australian rate. A number of factors have contributed to the rise in incomes in agricultural regions. The value of agricultural production has increased rapidly in recent times, due to strong demand for Australia's exports, favourable global market prices for livestock, a depreciating exchange rate and subdued growth in input costs (ABARES 2017, p. 22). However, as agriculture is subject to price cycles and weather cycles, these short term trends will not necessarily continue.

Figure 3.6   **Strong income growth in many regional areas recently**

Annual change in mean income by functional economic region, 2010-11 to 2014-15

Source: ABS (*Estimates of Personal Income for Small Areas, 2011–2015*, Cat. no. 6524.0.55.002).

Although no FERs (except French Island which has very few people) experienced a decline in mean income over the period 2010-11 to 2014-15, at the more disaggregated SA2 level a handful of regions, with diverse characteristics, experienced a decline in incomes.

Themes for further analysis

The analysis above points to regions being diverse, reflecting differences in their endowments of natural resources, economic geography, their history of development, the mix and relative size of economic activities undertaken, and the nature of economic and other shocks that have affected them. Although much of the analysis in this chapter is necessarily undertaken at a high level of regional aggregation, changes *within* regions themselves are often important. For example, the Hunter Business Chamber (sub. 19, p. 3) highlighted that while Newcastle itself is performing well in terms of economic activity, many smaller towns in the Hunter region are not faring as well. Similarly, areas considered to be successfully transitioning in Queensland were not those hardest hit by the slowdown in resource investment (CCIQ, sub. 17, p. 2). Economic and population growth in regional centres can indeed obscure what is happening in the wider region. However, a number of general observations have emerged which are explored further in this chapter.

Regions whose economic base is large scale mining have generally had the highest rates of growth in employment (from 2005), notwithstanding the end of the investment boom (section 3.2). That said, not all mining areas are prospering — some are in decline. Some regions have marginally economic mines and some have existing mines that are approaching the end of their economic lives. Furthermore, population and income growth in most mining areas has slowed in recent years, although income levels remain high.

Labour mobility, particularly with regard to FIFO and DIDO workers in remote resources projects, is emphasised in the study's terms of reference and was also a key issue raised by study participants.[12] The implications of FIFO work are complex. FIFO workers can connect resources regions to labour 'source' regions, affecting income and employment outcomes

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[12] For example, Cairns Regional Council and Advance Cairns (sub. 13), Western Australian Department of Regional Development (sub. 27), Western Australian Local Government Association (sub. 22).

well beyond where resources extraction occurs (RAI, sub. 12, pp. 9–14). It also facilitates matching of peak, but transient, demand for workers and avoids the development of some infrastructure and services that would only be used for a temporary population increase. The mining boom's impact on labour mobility is explored in section 3.2.

Regions predominately based on agriculture, particularly broadacre cropping and pastoralism, tend to have lower rates of growth in employment and have experienced consolidation of small towns into larger regional towns (section 3.3). At the same time, there has been an improvement in the productivity of agriculture, enabling production to increase with fewer workers (figure 3.7), and median incomes in agricultural regions have grown strongly in recent years. The Regional Australia Institute (sub. 12, p. 24) noted the steady reduction in agricultural employment across much of regional Australia, with the Chamber of Minerals and Energy of Western Australia (sub. 28, p. 22) linking this to reduced labour requirements driven by capital intensification of broadacre agriculture.

There has also been a long-term trend of an expanding services sector and, more recently, declining manufacturing (figure 3.7) (discussed below). The extent to which regions are affected by these long-term structural changes in the broader Australian economy depend on their industry mix and how concentrated employment is in particular sectors.

Manufacturing

In 2016, the regions with the largest number of people employed in manufacturing were greater capital city regions, particularly Melbourne and Sydney. For example, over 160 000 people work in manufacturing in the Greater Melbourne region, which is about 8 per cent of total employment in the region. Manufacturing tends to be concentrated in pockets of outer-suburban areas which have affordable land and where workers in manufacturing live. The growth in population and professional services sector in some cities has forced manufacturing activities further out from the CBD (DIRD 2015, pp. 65–67). At the SA4 level, Melbourne – South East, Sydney – South West, Adelaide – North, Logan – Beaudesert and Ipswich (Greater Brisbane) all have a high share of manufacturing employment (ABS 2017d).

Manufacturing employment has long been decreasing in Australia and production has been also decreasing over the past 10 years (figure 3.7). The declining share of the manufacturing sector has largely been caused by increasing international competition and the growing services sector, particularly within cities (Daley, Wood and Chivers 2017, p. 5). Many traditionally strong manufacturing regions such as Illawarra, Geelong and Newcastle have experienced large decreases in total manufacturing employment. Manufacturing employment has also decreased in Sydney, Melbourne and Adelaide (ABS 2017i).

Figure 3.7 **National trends in employment and value added by industry**
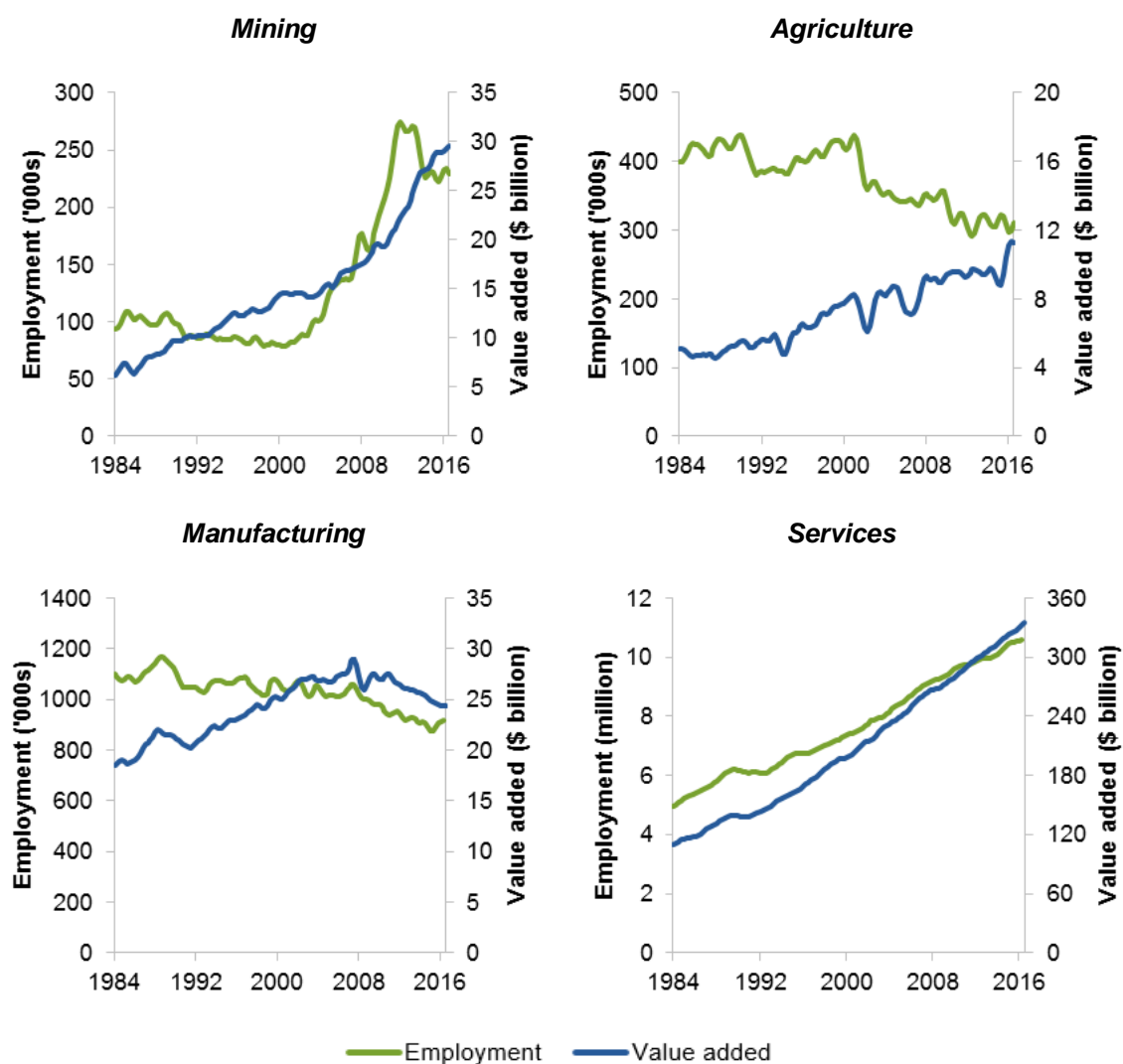
Sources: ABS (*Labour Force, Australia, Detailed, Quarterly, Aug 2017*, Cat. no. 6291.0.55.003); ABS (*Australian National Accounts: National Income, Expenditure and Product, Jun 2017*, Cat. no. 5206.0).

The impact of declining manufacturing employment is likely to differ across regions, with some better placed to take advantage of employment growth in other sectors (box 3.1). The transition of manufacturing workers has been helped by governments and employers that have provided assistance to workers retraining for work in other sectors (Department of Employment, sub. DR75, p. 13; Stitt 2017).

Box 3.1 The end of car manufacturing in North Adelaide and Geelong

The closure of the Holden automobile factory in North Adelaide in October 2017 following the closure of Ford's Geelong engine plant in October 2016, brought an end to passenger vehicle manufacturing in Australia. The two factories and local parts suppliers, have been important employers in both regions. The closure of the industry will spur significant adjustment in both regions as many retrenched workers seek to find new work and some take early retirement.

Although the disruptions in North Adelaide and Geelong are similar, there are significant differences between the two regions that will likely affect how they adjust to the closures.

- **Labour market conditions**. Unemployment is about 8 per cent in Adelaide – North (SA4), compared with about 5.5 per cent in Geelong (SA4). About one in three unemployed workers in North Adelaide had been unemployed for more than a year in 2016 (ABS 2017i).

- **Economic conditions in connecting regions**. About 10 per cent of Geelong workers commute to Melbourne for work (BITRE 2015, p. 11), where employment growth is relatively high (averaging 2.2 per cent per year between 2006 and 2016). As well as service sector growth, high population growth has also helped stimulate construction in Geelong and Melbourne. By contrast, employment growth in the Greater Adelaide labour market has been considerably lower than Melbourne (averaging 0.8 per cent per year over the same period) (ABS 2017h).

- **The capabilities of the region's residents**. It follows that differences in these capabilities are likely to contribute to adjustment outcomes. Human capital, including educational attainment, age, English proficiency as well as labour mobility affect how retrenched manufacturing workers will fare in transitioning into new employment (PC 2014a, p. 185). On average, residents of Adelaide – North have fewer formal qualifications (11 per cent with a bachelor degree or higher qualification, compared with 16.5 per cent in Geelong) and are more likely to be 'blue-collar' workers (37 per cent, compared with 33 per cent in Geelong) (ABS 2013a).

Despite the end of car manufacturing and the general decline in manufacturing employment, Geelong has experienced high rates of employment growth and unemployment is below average (figures 3.2, 3.3). Employment growth in Adelaide – North was relatively low but remained positive prior to the closure of the Holden plant in October 2017. Early evidence suggests that Northern Adelaide is outperforming expectations in adjusting to the end of car manufacturing with many component suppliers successfully transitioning into other manufacturing production (Elston, G, SA DSD, Adelaide, pers. comm., 30 Nov 2017).

FINDING 3.3

Regions with an economic base concentrated in manufacturing tend to have declining employment in manufacturing consistent with the inexorable rise in service industries and desirable shifts in technologies. Many of these are sub-regions within greater metropolitan areas of capital cities and have demonstrated adaptability in adjusting to declining manufacturing employment.

Services

The share of employment in services and its share of GDP has risen markedly, and is the dominant sector of the economy (figure 3.7). Employment growth in the past 10 years has been highest in arts and recreation, healthcare and social assistance and professional, scientific and technical services. Regions with economies predominantly based on services (typically cities and large regional centres) tend to have higher economic growth. Workers in these sectors often live in inner suburbs within cities. These areas tend to have high average incomes, high income growth and population growth (driven largely by overseas migration) and the highest concentrations of people with post-school education and migrants (Daley, Wood and Chivers 2017, p. 3). The growth of cities and large urban centres is further discussed in section 3.4.

Some services, such as tourism, are becoming increasingly important in some areas, including regional areas (for example, in Cairns — box 3.2). Jones and Tee (2017) also noted that regional towns such as Newcastle and Port Macquarie have seen declines in traditional sectors (including coal mining and manufacturing) and experienced an increase in employment in the services sectors (box 3.4). Strong growth in health care and social assistance in Port Macquarie has occurred due to an ageing population. Other regions have been less successful in adjusting, including the Whyalla region, which is endeavouring to diversify and grow sectors such as tourism, aged and disability care and tertiary education.

Box 3.2   Tourism in Cairns

The Cairns region is less concentrated in mining activity than other regions of northern Queensland and more dependent on agriculture, healthcare and food and accommodation (Queensland Government, sub. 26, p. 26). Tourism is also an important industry in Cairns and, as an export exposed industry, was impacted by the high value of the Australian Dollar during the mining investment boom which made Australia a relatively more expensive destination for international tourists. Between 2006 and 2011, the number of international tourists to northern Queensland dropped from 870 000 to 650 000 per year (The Australia Institute 2012). In addition, the high Australian Dollar made travelling overseas relatively cheaper for Australian holidaymakers, further reducing domestic tourism to regions such as Cairns.

The decrease in commodity prices from their peak has seen the Australia dollar fall closer to its long-term average which has helped the tourism sector. In northern Queensland, the number of international tourists has increased sharply beyond pre-boom levels (TRA 2017). A sustained lower Australian dollar is expected to continue to encourage more international and domestic tourists to visit the region (Queensland Government, sub. 26, p. 26).

The promise of increasing tourism activity because of expanding Asian markets and a low Australian dollar has helped revitalise sectors dependent on tourism around Cairns and increased investment in upgrades and developments in accommodation and entertainment facilities.

3.2 Exploring trends in resources regions

Commodity cycles are a common feature of the resources sector. However, the recent resources investment boom was one of the 'largest shocks to hit the Australian economy in generations' (Downes, Hanslow and Tulip 2014, p. 1). Between 2005 and 2012, mining investment and employment tripled (Doyle 2014, p. 7; figure 3.7). The mining investment boom provided substantial benefits because prices stayed high for a long period. By 2013, it was estimated that the resources boom had raised average real wages by 6 per cent, raised real per capita household disposable income by 13 per cent and lowered the unemployment rate by about 1.25 percentage points (Downes, Hanslow and Tulip 2014, p. 1).

The economic contribution of the resources sector continues to be significant to many parts of Australia. The Western Australian Department of Regional Development stated that:

> Iron ore exports are driving an increase in State net exports, which are forecast to grow by 19.25 per cent in 2016-17. Strong export growth is expected over the forward estimates as LNG production ramps up. (sub. 27, p. 3)

Even though the transition from the mining investment and construction phase to the production phase was widely expected, mining regions have experienced significant adjustments. The number of workers needed for mining construction is significantly higher than those needed for production.[13] In addition, many mining companies have been trying to reduce their production costs in response to lower commodity prices (Chambers 2015b; Deloitte Access Economics 2014, p. 50; Saunders 2015). Although employment in the mining sector remains more than double pre-boom levels, it has decreased from its peak in 2012 (figure 3.7).

The drivers of performance and transition in resources regions

The performance of resources regions is strongly linked to commodity prices, production and investment. However, there are a number of dynamic, interconnected factors that drive regional resilience (chapter 2). Resources regions that are adjusting to the end of the mining investment boom are undergoing varying transitions that depend on the characteristics of their region (box 3.3).

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[13] The significantly larger employment requirements for a construction period in the resources sector is common in other areas such as infrastructure and manufacturing. It is important for the broader community to understand that larger employment requirements during these periods do not necessarily translate into long-term requirements.

Box 3.3   Drivers of transition in resources regions

The Chamber of Minerals and Energy of Western Australia (sub. 28, p. 4) described three types of resources regions that will experience different transitions following the mining investment boom.

- Regions (such as the Pilbara) that enjoy an advantage in regional markets for mineral and energy commodities will experience a relatively smaller transitional impact. During the construction phase these regions benefited from significant investments in new projects and project expansions which will provide an economic and employment base for decades to come, largely independent of commodity market cycles.

- Regions with high cost structure mines that are only economically viable during periods of relatively high commodity prices will experience a significant impact from the cyclical downturn in commodity prices. For example, in the Kimberley Region of Western Australia, three mines that accounted for 30 per cent of gross regional product at the peak of the iron ore price cycle are now in care and maintenance.

- Regions that are highly prospective for mineral and/or petroleum resources, but relatively under-explored because of relatively high exploration costs and/or accessibility challenges will also experience a significant transitional impact. When specific commodity prices are relatively high, risk capital markets have a greater propensity to invest in exploration in these regions. Investments are also more likely to occur where new technologies reduce the cost of mining.

Regions where the resources base depletes to the point where mining is not feasible will also face significant adjustment.

Government policy and political stability can also have a significant impact on the viability of resources projects. Changes to these settings can change the position of mining companies and the outlook of a region (Minerals Council of Australia, sub DR80, p. 37).

Many other factors affect a mining region's adaptive capacity and growth. Many submissions discussed the high share of mining activity in some regional economies and the impact of this on their resilience. Regional Development Australia Mackay-Isaac-Whitsunday submitted that increased diversification would be important for the region's adaptive capacity.

> Based upon Remplan data dated 31st December 2016, the mining sector currently provides 17.1% of the jobs in our region, 67.1% of our regional exports and 38.1% of our regional expenditure. The industry remains critical to our region, however we need to build a more diverse economy to soften the impact of any transition in what is historically a cyclical industry. (sub. 25, p. 1)

However, as noted in chapter 2, caution should be exercised in pursuing diversification as the primary strategy to build adaptive capacity. There are costs associated with diverting resources away from their highest value use and towards lesser value economic activities. Other factors that affect a mining region's adaptive capacity include: demography, capacity in existing processing and logistical infrastructure; regional cost structures (which are a function of remoteness, relevant regulations and local economies of scale); labour mobility; government policies; changing community values and the attractiveness of a region as a place to live.

Many resources regions have expanded and continue to grow

Many resources regions have continued to perform well since the end of the mining investment boom, although differences in employment patterns are emerging across regions (figure 3.8). In Western Australia – Outback, employment has continued to increase and has

grown by about 12 per cent in the five years since 2012. In Mackay and the Hunter Valley (excluding Newcastle), employment growth during the mining investment boom was high but has steadied during the production phase, with coal price fluctuations affecting employment in the short-term. Despite employment growing strongly in Queensland – Outback during the mining investment boom, employment has subsequently dropped sharply and returned to a long-term declining trend.[14]

Figure 3.8   Trends in employment differ between mining regions

Selected SA4 regions with a high share of mining employment
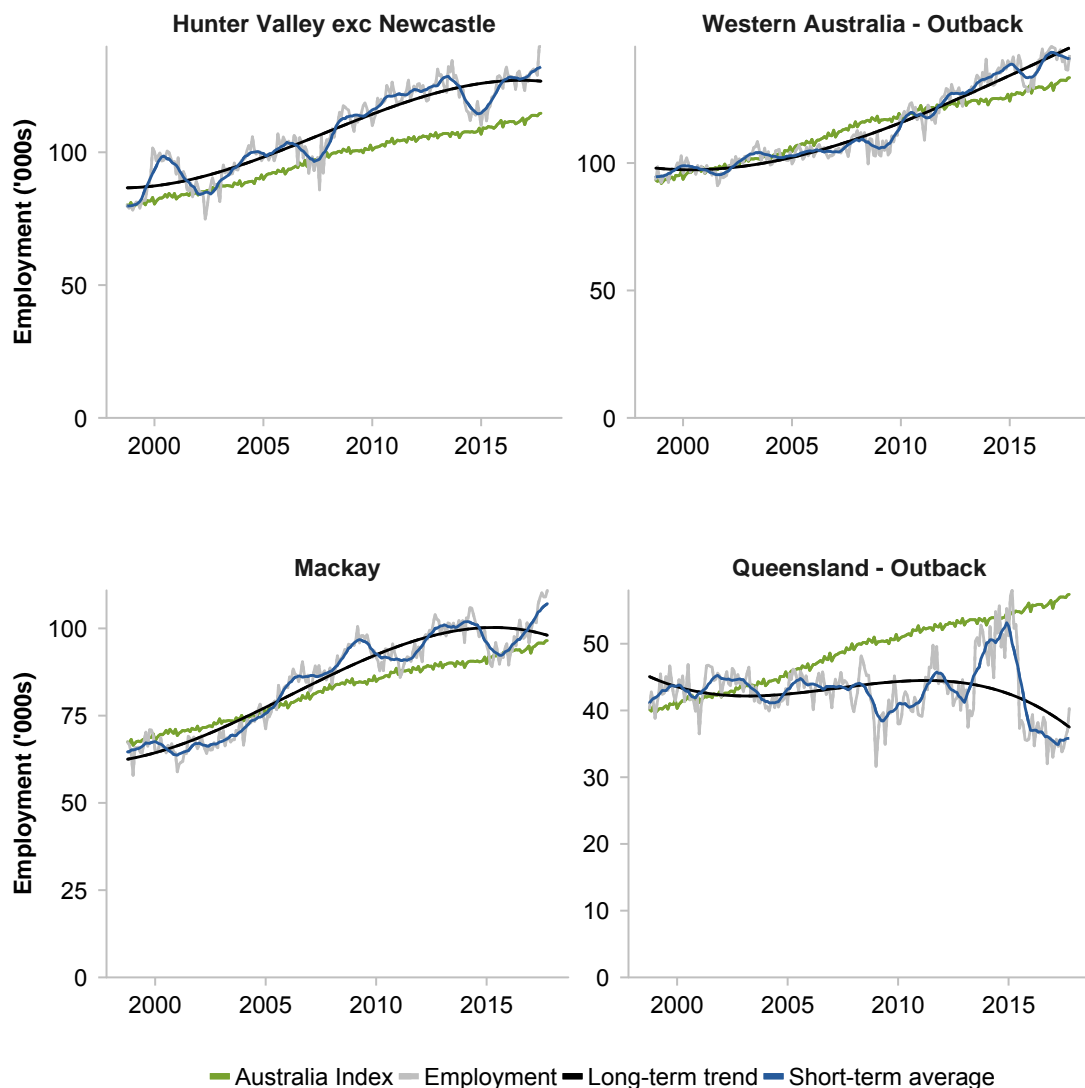
Source: ABS (*Labour Force, Australia, Detailed – Electronic Delivery, Oct 2017*, Cat. no. 6291.0.55.001).

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[14] Employment figures for these regions do not account for FIFO employment.

The recent mining investment boom has been particularly transformative for the Pilbara. As a result of large-scale investment in the region during the mining investment boom, the Pilbara's contribution to national output grew from 2 per cent in 2005 to 6 per cent in 2014 (RDA Pilbara, sub. 6, p. 6). Iron ore production in Western Australia (of which the Pilbara accounts for 97 per cent) increased from 230 million tonnes in 2004-05 to 790 million tonnes in 2016-17 (figure 3.9). Although production has grown and is expected to increase further, direct employment in iron ore mining in Western Australia has been decreasing since 2013-14. The trend is also exhibited in other mining regions. During the same period, annual coal exports in Queensland increased from 145 million tonnes to 218 million tonnes, with export growth expected to continue into the future (Qld DNRM 2017, p. 3).

Figure 3.9   **Iron ore production is expected to continue growing in Western Australia[a]**
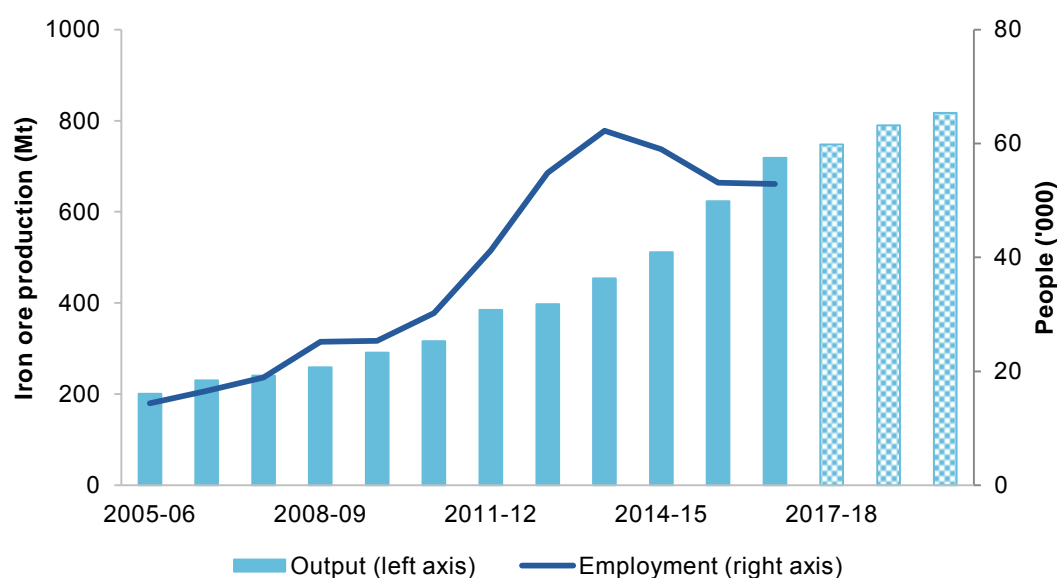
a 'Employment' measures direct employment in iron ore mining. Iron ore production for years 2017-18 onwards are projections.

Sources: WA Department of Mines and Petroleum (*Resource Data Files, 2016-17*); WA Department of Treasury (*2016-17 Government Mid-Year Financial Projections Statement*).

Many mining regions are transitioning from construction to production

Many mining regions that underwent large expansions are now transitioning from construction to production. Fewer workers are needed during production and some mining regions are grappling with lower employment than at the height of the mining investment boom. In turn, this has resulted in declining populations and slower personal income growth across some mining regions, although incomes generally remain high. This period of consolidation following a large expansion is consistent with the commodity cycle, particularly given the size of the most recent cycle (WA CME, sub. 28, p. 9).

Despite decreased employment in some mining regions, unemployment has not risen substantially (figure 3.10), although at a more granular level, unemployment impacts have been disparate. The relatively low and stable unemployment rates in Karratha, Port Hedland – Newman, Goldfields and Greater Darwin[15] regions can be partly explained by the high labour mobility of people in the mining and associated industries, with workers leaving the region at the end of a project (Conway Highbury, sub. DR59, p. 4; NT Government, sub. 37, p. 8; (PC 2014b, p. 14). For mining towns in isolated regions such as the Pilbara or Goldfields 'people resident in the town are largely attracted by the work opportunities, and not by the town itself, with a time horizon set on the period of residency' (WA CME sub. 28, p. 21). For example, resident population in the Karratha region has dropped by nearly 10 per cent since it peaked in 2013. The Mackay region, has a relatively more diverse economy and large service centres and has not seen population decline to the same extent as in the Pilbara or Goldfields (ABS 2017l). Consequently, the unemployment rate in Mackay rose between 2012 and 2015, until dropping in 2016 with employment stimulated by higher coal production in response to higher coal prices (BP 2017; Passmore 2017).

The high mobility of mining industry workers aids the transition of workers who move (or commute) to regions with good employment prospects, and leave when prospects weaken. In mining regions where labour is less mobile, the end of major projects has the potential to create high unemployment. Centennial Coal Company said:

> Unlike regions in which mines employ FIFO/DIDO workforces, the Lithgow area will to some reasonable extent be unable to 'export' the consequences of increased unemployment, and equally, underemployment. The evidence from the Springvale employee survey indicates that a significant proportion of the workforce is unlikely, or reluctant to, move from the area, despite recognition of labour market constraints in the region. (sub. 29, p. 14)

Highly mobile workforces also often fit the business models currently favoured by mining companies that use temporary mining camps rather than developing townships to service temporary mining activities, as these come at a significant cost (RAI, sub. 12, p. 8). However, when mining operations are located near established towns, the large changes in population from both short-term migration and FIFO workers can be a major disruption on the township (discussed later in this section).

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[15] Although the Greater Darwin region has a relatively low share of mining employment (2.2 per cent in 2016), mining and construction sector projects have a large influence on population fluctuations (NT Government, sub. 37, p. 2)

Figure 3.10   **Unemployment rates have varied across mining regions**
Selected functional economic regions with a high share of mining employment
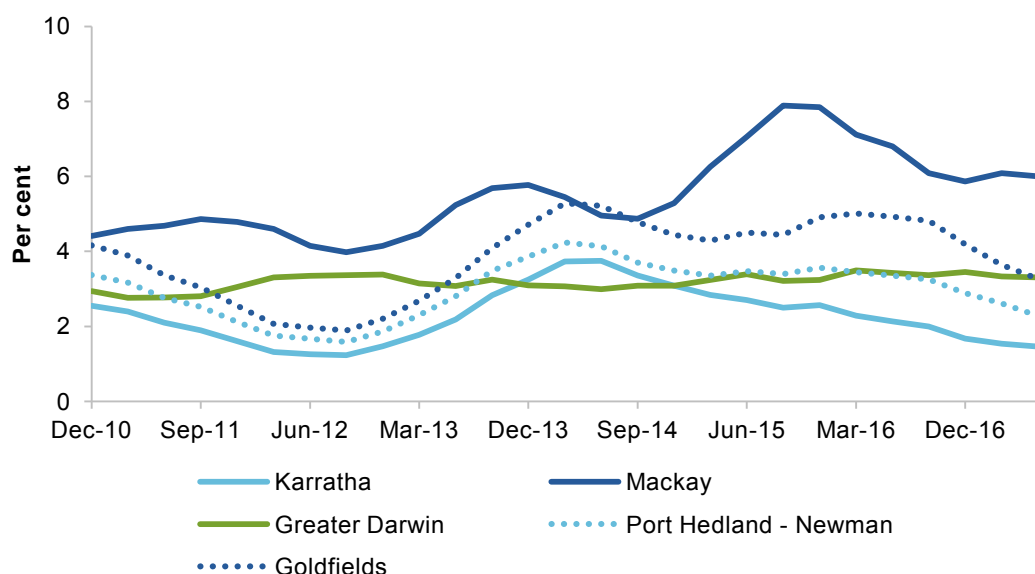
Source: Department of Employment (*Small Area Labour Markets, June 2017*).

Despite the large impact of the transition from mining construction to production, many mining regions continue to perform well based on many economic indicators. Indeed, employment in the mining industry remains more than double the pre-boom levels (figure 3.7). WA CME said:

> In the case of the Pilbara, periods of population stagnation or moderate decline that occur after an expansion phase, occur in a regional, economic and social environment substantially more robust than it was prior to the expansion. This is because the production capacity has been increased, additional infrastructure has been created or new knowledge/technology developed that will inform future development. (sub. 28, p. 9)

The Queensland Government (sub. 26, pp. 28–29) stated that 'Mackay's economy is showing positive signs of adjustment from the [end of the] resources boom' and that 'employment in the Fitzroy region rose 5.3% in 2016, compared with growth of 0.5% in employment across Queensland'. The strength of mining regions measured across most economic indicators shows that they are stronger than they were before the boom and have continued to perform well relative to other regions.

There are challenges for mining regions in transitioning to alternate activities

As mining regions grow, support industries grow around them and their economies naturally diversify. The Hunter region is traditionally renowned as a coal mining and manufacturing region but has undergone significant changes to its economic composition over a number of decades and it has transitioned into a well-diversified economy, drawing on its many

competitive strengths (box 3.4). There are other examples of towns originally developed because of their resource base that have grown to become diversified cities including Ballarat and Bendigo (Victoria) and Wollongong (New South Wales). However, not all mining towns possess other competitive strengths that will allow them to become diversified regional centres (discussed further in section 3.4).

Box 3.4　　Structural change has taken decades in the Hunter

Newcastle (approximately 150km north of Sydney) has traditionally been dependent on heavy industry. Having a large, natural deep-water port and close proximity to coal fields in the greater Hunter region, the Hunter economy developed from mining, power generation, manufacturing and to a lesser extent, agriculture. In the 1960s, the Hunter region was responsible for 40 per cent of Australia's coal production and 80 per cent of New South Wales' electricity generation. The BHP Steelworks, built in 1915, was a significant part of Newcastle's industry and in the 1960s employed 12 000 people.

Tariff reduction, increasing international competition and the steel industry crisis in the 1970s and 1980s saw a steady decrease in manufacturing in the Hunter region, including the loss of 5000 jobs at the BHP Steelworks between 1981 and 1985. The reduction in manufacturing employment was accompanied by growth in service industries. The closure of the BHP Steelworks and loss of approximately 4000 jobs in 1999 signalled the end of an era in the Hunter region, although mining and manufacturing have remained important industries. The Hunter region was able to recover well from the steelworks closure, in part due to the diversified Newcastle economy and helped by the start of the mining investment boom. Newcastle's proximity (and good transport links) to Sydney and its large hinterland population were also factors that aided its transition to a more services driven economy.

The closure of the steelworks improved air quality and ultimately helped Newcastle rebrand itself as an attractive place to live. Employment in healthcare, construction, education and professional services have grown particularly strongly since the closure of the steelworks. About 26 500 students are enrolled at the University of Newcastle and the John Hunter Hospital is the second largest hospital in New South Wales. The Hunter region is home to over 635 000 people and Newcastle – Maitland (population 435 000) is the seventh largest city in Australia.

The Hunter region performs well based on most economic measures. It has experienced steady population growth and increasing labour market participation. Unemployment and income are close to the Australian average.

Sources: ABS (2017b); Hunter Valley Research Foundation (2011); Newcastle Herald (2009); Wilkinson (2011).

Some other mining regions are in decline

Many mining regions in Australia are continuing to grow, but others have had a tougher transition from the end of the mining investment boom and high commodity price cycle. In some regions, high costs mean that mining is only viable during high-price periods and activity will cease during low-price periods — with mines maintained in order to resume production in high-price periods (box 3.3). Three iron ore mines in the Kimberley that accounted for 30 per cent of gross regional product have been placed into care and

maintenance since the end of the high-price period (WA CME, sub. 28, p. 3). Mining employment in the Kimberley more than halved between 2011 and 2016 with the employment share in mining decreasing from 6 per cent to 2.4 per cent. In the Northern Territory, resources exploration has decreased significantly since the end of the high-price period (NT Government, sub. 37, p. 3). Although these changes reflect the cyclical nature of the resources industry, they do pose challenges for these regions in the short term.

In other mining regions, as mineral deposits are exploited and become more marginal, their production costs increase and the economic advantage of the region diminishes. The mining investment boom provided a temporary reprieve to Mount Isa, but falls in metals prices and the closure of depleted mines since the end of the high-price cycle have had a detrimental impact on the town and surrounding region (box 3.5). Employment in Queensland – Outback (SA4) (which includes Mount Isa) was significantly higher than the long-term trend during the mining investment boom but, by 2015, this pattern had reversed (figure 3.8). In the Northern Territory, the impending closure of the Ranger uranium mine (near Jabiru) and the Gove bauxite mine (near Nhulunbuy) pose significant challenges for these towns that will undergo large changes to their economic composition.

A number of other mining regions have experienced fluctuations in population and employment in past decades as a result of changes in commodity prices, depleted resources and other external shocks. An example is Whyalla. In 1958, BHP built an integrated steelworks at its site in Whyalla, and its population quickly rose from about 14 000 people in 1961 to about 28 000 people in 1968. The construction of the Steelworks was completed in 1968 and the workforce of BHP reached about 7000 people in 1970. Preliminary planning by the Department of Lands at that time allowed for a city of 100 000 people. Whyalla has since been affected by a worldwide downturn in the steel industry and closure of the Whyalla Shipyards in 1978 (Whyalla City Council 2017). Whyalla's population peaked at about 33 000 people in 1976 and subsequently declined to about 22 500 people in 2016 (ABS 2017l). The future of Whyalla is likely to remain strongly tied to the steelworks, which has recently undergone an ownership change and a commitment to reinvest in the steelworks (Griffiths 2017).

Similarly, the Latrobe Valley has experienced long-term declining employment in mining and power generation. The region is rich in brown coal reserves and produces 85 per cent of Victoria's electricity (Latrobe City Council, sub. 35, p. 1). However, the privatisation of the State Electricity Commission of Victoria in the 1990s, the closure of the Hazelwood power station in 2016, and planned closures of other power stations and coal mines have further decreased the influence of those industries in the Latrobe Valley (Voices of the Valley, sub. DR53, p. 2).

Box 3.5   Mount Isa: the challenge of transitioning

Mount Isa (with a population of about 19 000 in 2016) is one of Australia's largest mining towns and a significant regional centre for Queensland's vast north–west. Historically, Mount Isa's economy has been based on natural resources (lead, silver, copper and zinc). However, the cyclical nature of the resources sector has meant that the town has experienced significant upswings and downturns. The winding down of the mining investment boom — which provided a temporary reprieve to Mount Isa — has had a significant economic and social impact. Despite temporary population growth during the mining investment boom, Mount Isa's population has been declining sharply since 2011. Plant closures and redundancies have significantly increased the unemployment rate in the town (figures below).

Long-term population decline   **Unemployment has increased**
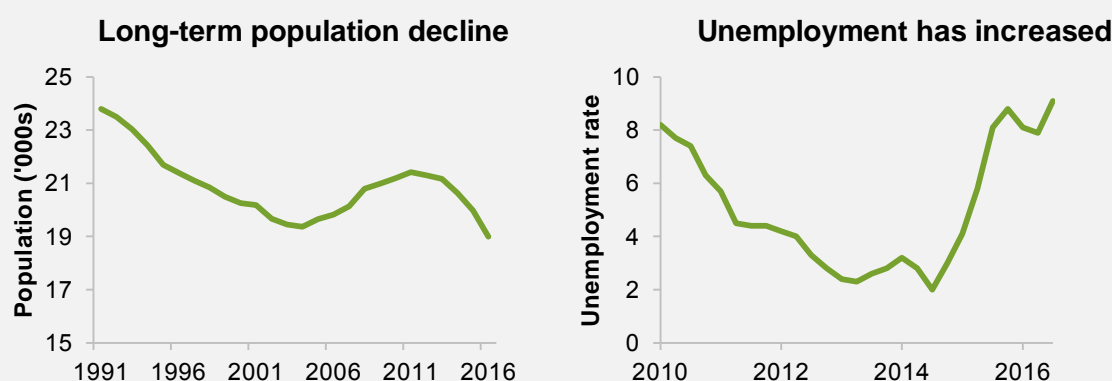
The lower ore quality of the remaining reserves also poses challenges to Mount Isa's mining industry. The Queensland Government said that:

> The North West Minerals Province (NWMP) (centred on Mount Isa) faces short and longer term challenges related to declining ore grades and maturing operations. Importantly, the region continues to have substantial mineral endowments which may offer significant future development opportunity, with the future outlook for the region heavily dependent on the identification and development of new commercial resource projects. (sub. 26, p. i)

Drought has also had a recent impact on the Mount Isa community.

> The majority of the Outback region [including Mount Isa] remains drought declared. The severe drought conditions have impacted the livelihood of agricultural producers in the region (primarily cattle graziers), with flow on effects to small businesses and the broader community. (sub. 26, p. 23)

Sources: ABS (*Regional Population Growth, Australia, 2016*, Cat. no. 3218.0); Department of Employment (*Small Area Labour Markets, June 2017*).

FINDING 3.4

Mining regions continue to have high incomes and have substantially more people employed than prior to the boom. Many regions with a high concentration of activity based on mining have transitioned well from construction to production following large expansions in capacity during the mining investment boom.

However, mining operations in regions that are smaller in scale, are economically marginal or are approaching the end of their economic lives have been most affected by the end of the high-price cycle.

The effect of the mining boom on local housing and businesses

The influx of temporary residents and FIFO/DIDO workers during the construction phase had a significant impact on established towns in mining regions. For example, population growth in the Karratha region between 2005 and 2012 averaged 5.8 per cent annually and at the height of the mining investment boom in the Pilbara, an estimated 50 000 FIFO workers added to the region's resident population of 66 000 (WA DRD 2014, p. 2). In the Bowen Basin (inland of Mackay), 25 000 nonresident workers added to the estimated residential population of 82 000 (Qld DTT 2012, p. 1). The length of the high price commodity cycle period and construction phase of the mining investment boom meant that temporary workers were also required for a long period of time and this had a significant impact on mining communities. Demand for many goods and services expanded substantially, and widespread price increases occurred. Price rises were reported on basic items such as coffee all the way through to rents and houses (HoR SCRA 2013, pp. 2, 65; Lannin 2013; Perriam 2009).

House prices increased substantially in many mining towns during the investment boom (figure 3.11). High demand for housing was driven by the influx of temporary residents and FIFO/DIDO workers. Over the course of the investment boom, median house prices in Karratha increased from $200 000 to $800 000 and the median house price peaked at over $1.2 million in Port Hedland. Similar, but smaller changes to the housing market were seen in other mining towns such as Moranbah, Emerald and Miles (not included in figure 3.11). The potential for high rental returns also saw property investors buy into the market. For example, the median rental price in Port Hedland reached $2000 per week at the height of the boom (Schlesinger 2011).

The end of the mining investment boom saw rapid re-adjustment in the housing market in many towns, with house prices returning to pre-boom levels in only a few years, creating winners and losers. Anecdotal evidence suggests that there have been increased mortgagee sales in resources regions. In the Pilbara, some individuals have realised losses of over $500 000 on properties that were bought close to the housing market peak. This has resulted in a large number of bankruptcies in mining towns (Barrett 2015; Laurie 2017; Stephens 2017). Investors were also affected by the price cycle, with many having purchased properties sight-unseen in mining towns close to the peak in property prices (Taylor 2012; Wilkie 2016).

Inflated costs in mining regions during the investment period had some negative effects on people and businesses, particularly those outside the mining industry. For example, the cost of operating a business in the Pilbara was estimated to be more than 50 per cent higher than Perth (RDA Pilbara, sub. 6, p. 20). The high wages on offer in mining regions made it difficult for businesses to retain staff that were attracted to the high wages in the mining sector. It was also difficult to attract workers from other regions because of the high cost of living (Williams 2011). High costs of living, particularly for housing, affected those on lower incomes, with anecdotal evidence of this leading to increased overcrowding and homelessness (Diss 2014). In the Pilbara, the slow release of residential land during the mining investment boom constrained housing supply and exacerbated the size of the housing

market price cycle (Green, Newman and Mitchell 2014, p. 45). Although the cost pressures faced by small businesses in mining regions have reduced since the peak of the mining investment boom, they still remain higher than in other regions (RDA Pilbara 2015, p. 14).

Figure 3.11   House prices have fallen to pre-boom levels in some regions

Median house prices for selected regions at the SA2 level
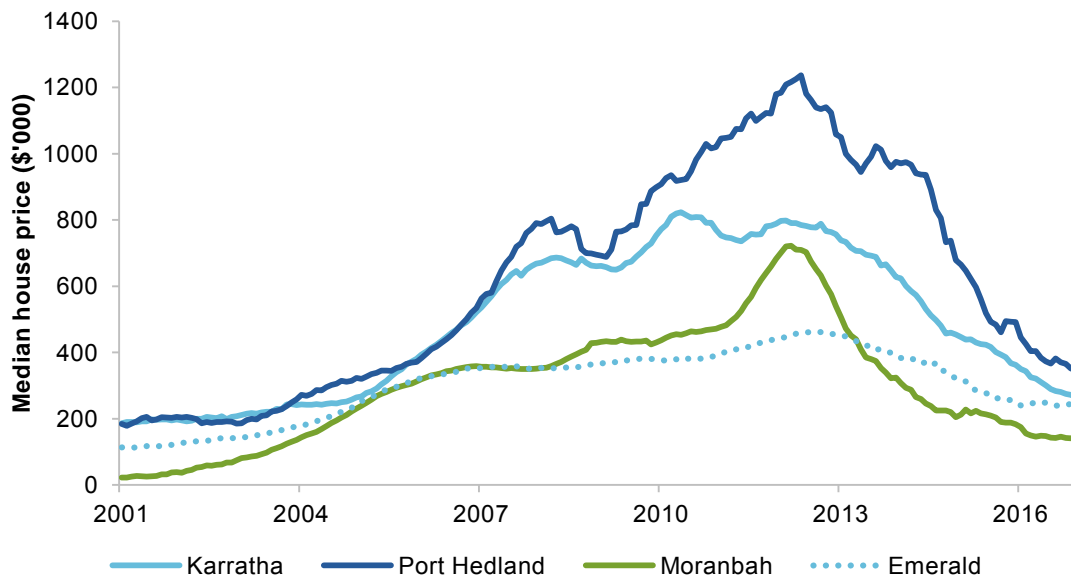
Source: Commission estimates based on CoreLogic data.

Mobile labour was instrumental in meeting demand for workers during the resources boom

FIFO/DIDO workers played a significant role in supplying labour to resources regions during the mining investment boom. Although not always regarded as a positive influence, mobile labour can complement the local labour market by filling shortages and providing the specialist skills required to complete resources projects (WA CME, sub. 28, p. 22). A number of projects that increased the capacity of mining operations occurred in remote regions. The investment in these operations would have been unviable without the use of FIFO workers (WA CME, sub. 28, p. 22; Minerals Council of Australia, sub. DR80, p. 35).

However, the ongoing use of FIFO workers has been said to erode human and social capital in resources regions, as nonresident worker populations may be less committed to and engaged in the community (RDA Mackay-Isaac-Whitsunday, sub. 25, p. 3). This reduces the potential benefits of mining activity for local communities (Storey 2010, p. 1163). Temporarily high populations can also place additional strain on community services (HoR SCRA 2013, p. 36).

Many mining sector workers live in cities

A large proportion of workers in the mining and construction industries live and work in cities. In 2011, about 60 per cent of mining sector workers in Western Australia lived in the Greater Perth region and, of those, two-thirds also worked in Greater Perth, predominantly in the CBD (box 3.6). In Queensland, about 25 per cent of mining sector workers live in Greater Brisbane with 85 per cent also working there (ABS 2013c, 2013a). Jobs in capital cities have extended beyond administrative roles with many engineers and managers in the mining sector working in capital cities. Changes in technology have reduced the need to employ people on mine sites in remote locations. For example, autonomous trucks and drill systems are used on some mine sites in the Pilbara and monitored by workers in Perth (Diss 2015). Mining sector workers in inner-suburban areas mostly filled the professional mining sector jobs in the Perth CBD (ABS 2013a).

Cities are also the dominant source regions for FIFO workers in the resources sector. About 70 per cent of FIFO workers in Western Australia's resources sector[16] live in the Greater Perth region. Others come from south-west Western Australia including the Bunbury – Busselton region. About 14 per cent of FIFO workers in Western Australia were sourced from interstate during the peak of the boom; mostly from regions in Queensland and New South Wales (Deloitte Access Economics 2014, p. 39; Haslam-McKenzie and Hoath 2014, p. 49; RAI, sub. 12, p. 13). Overseas workers make up a small proportion of the resources sector labour force. At the height of the mining boom they accounted for about 3.5 per cent of the mining workforce and 2 per cent of the total construction workforce (box 3.7).

In the Greater Perth region, the largest numbers of FIFO workers came from outer-suburban areas particularly around Peel such as Mandurah, Serpentine – Jarrahdale, Rockingham and Mundaring. These workers were largely technicians and trades workers; machinery operators and drivers; and labourers who greatly increased their income potential through FIFO work (ABS 2013a; Haslam-McKenzie and Hoath 2014, p. 49). Although most FIFO workers lived in Greater Perth, only about 2.5 per cent of Greater Perth workforce worked in a FIFO capacity near the height of the boom (box 3.6). In Mandurah, a popular FIFO region, about 4 per cent of the local workforce was employed in a FIFO capacity.

In Queensland and New South Wales, the proximity of large regional centres to mining regions has meant less reliance on the capital cities as the major source of labour (although many FIFO/DIDO workers still live in Brisbane and Sydney). For example, mines in western New South Wales source external labour from regions including Sydney, Illawarra, and the Hunter. In the Hunter Valley, the majority of workers are sourced from within the region or nearby regional centres such as the Central Coast (NSW Government 2011, p. 2). In Queensland, Townsville, Cairns and south-east Queensland have been large source regions for FIFO workers (Queensland Government, sub. 26, p. i).

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[16] The resources sector is defined as mining, mining construction and ancillary support.

Many mining workers work in cities, but many also commute to mining regions

For workers living in the Greater Perth region in 2011, by industry
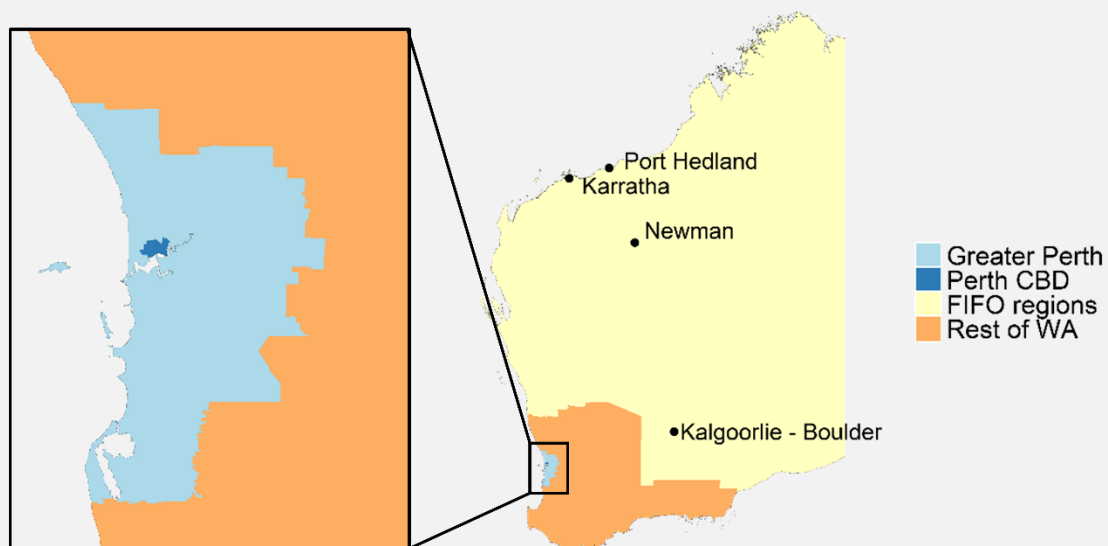
Location of work		All industries	Mining industry	Construction industry
Greater Perth	%	96.6	65.9	92.7
(Perth CBD)	%	(23.4)	(43.1)	(11.5)
FIFO regions[a]	%	2.5	29.8	5.1
Rest of WA	%	0.9	4.3	2.2
Number	no.	759 702	34 766	60 058

a FIFO regions are Gascoyne, Goldfields, Kimberley, Mid West, Karratha and Port Hedland – Newman.

Source: Commission estimates based on ABS (*Census of Population and Housing, 2011*, Cat. no. 2001.0).

Box 3.7   Temporary overseas labour was small, but important

During the mining investment boom, the high demand for specialist labour saw an increase in temporary labour through the work (skilled) visa (subclass 457). However, 457 visa holders accounted for only 3.5 per cent of the mining workforce and 2 per cent of the construction workforce at the height of resources investment in 2012 (Doyle 2014, p. 11). Temporary workers under the 457 visa scheme helped fill the (temporary) high demand for skilled mining and construction workers. This is reflected in the net change in the number of 457 visas granted over the course of the boom (figure below). Some 457 visa holders were highly specialised workers that move globally between projects (Bahn, Yap and Barratt-Pugh 2012, p. 23).

At the peak of the mining investment boom, approximately 2000 temporary 457 visa holders resided in the Pilbara. This number has since dropped to below 800. In the Pilbara, roughly two-thirds of 457 visa holders worked in mining or construction with others in industries such as accommodation and food services, transport, postal and warehousing and manufacturing. Similar trends are observed for other mining regions as well. For example, the number of people living in Mackay on 457 visas peaked at 1700 in 2013 but declined to just over 500 by July 2017. The end of the mining investment boom has also seen a fall in the number of 457 visa holders in Perth where the number of temporary workers peaked at over 36 000 in 2013, but has since fallen to 16 000 in 2017 (DIBP 2017).

A small number of 457 visa holders worked in the mining and construction industry
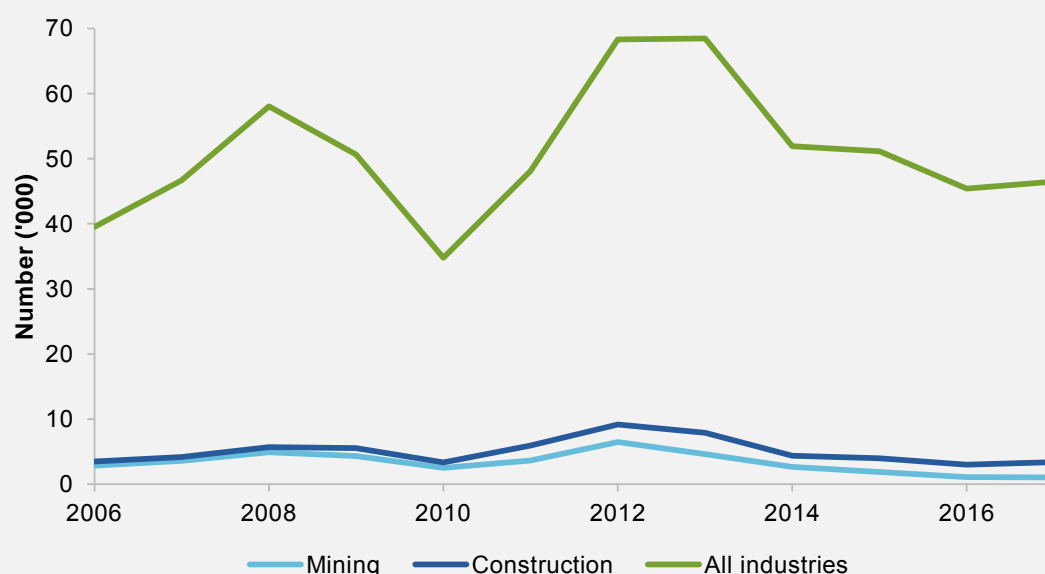
Source: Department of Immigration and Border Protection (*Work in Australia – Statistics, Sept 2017).*

Mobile workers spread the benefits of the boom to other regions of Australia

The employment of FIFO workers spread the benefits of the mining investment boom to non-mining regions, and without them, the price fluctuations observed in mining regions may have been more severe (PC 2014b, p. 25). The high incomes of FIFO workers brought large economic benefits to their local communities through multiplier effects

(Haslam-McKenzie and Hoath 2014, p. 5; WA CME, sub. 28, p. 20). FIFO work also enabled workers to earn very large salaries and avoid temporarily relocating. FIFO practices have also been advantageous for some Indigenous Australians, who are able to access high-paying employment but still live on their traditional land (WA CME, sub. 28, p. 23). In addition, many workers prefer FIFO arrangements, including because of lifestyle choice, flexibility in work days, access to facilities offered in larger urban areas, access to social and support networks and continuity in their partner's career. Although, concerns have been raised that people who undertake FIFO/DIDO work may be at a heightened risk of poor mental and physical health (HoR SCRA 2013; WA EHSC 2015).

Although unsustainable spending by high wage resources sector workers has been a common anecdote, evidence shows that households generally increased their saving during the mining investment boom, particularly in Western Australia (Carr, Fernandes and Rosewall 2017, p. 9). This has been important in reducing the impact of the transition for workers not needed during the production phase. Even so, the decrease in mining investment has had a significant impact on labour market conditions across regions where mining workers live (box 3.8). In Perth, unemployment has steadily increased from 4.0 per cent in 2012 to 6.5 per cent in 2017 in contrast to the relatively stable rates of unemployment in Western Australian mining regions (figure 3.10). The Peel region (near Mandurah), where many FIFO workers lived has been especially impacted by the end of the mining investment boom (WALGA, sub. 22, p. 11).

FINDING 3.5

Mobile labour (such as fly-in, fly-out workers) was instrumental in meeting the high demand for workers during the investment phase of the resources boom, and helped to spread the benefits of the boom to other regions.

Many of the workers employed in the investment phase lived in regions outside mining areas, such as capital cities and other regional centres, or temporarily lived in the region. In addition, many mining workers work in capital cities and their greater metropolitan areas.

The natural completion of the high mining investment phase has affected labour markets and economic conditions across the country, particularly in Western Australia but also in many regions outside of traditional resources areas.

Box 3.8   Townsville is transitioning away from mining and processing

The direct contribution of mining to Townsville's economic activity is relatively small, but many downstream businesses, such as mineral processing and professional services, have been affected by slowing mining investment. Also affecting the region was the March 2016 closure of the Yabulu nickel refinery, with the loss of about 550 jobs (Queensland Government, sub. 26, p. 25; Robins 2016).

Townsville has also been a source of FIFO workers for Queensland mines, mainly around Mount Isa. About 4000 Townsville workers undertook FIFO work in other parts of Queensland in 2011. However, the use of FIFO has fallen considerably since, with lower demand for labour following the closure of some mines in outback Queensland and the end of mine expansion works around Mount Isa (box 3.5).

Townsville has a diverse economy and many jobs require skills or other attributes that may not be possessed by workers returning from FIFO arrangements or retrenched from manufacturing. This may be reflected in the doubling of unemployment in Townsville and the decrease in labour market participation, which has fallen by 15 percentage points since 2011 (figure below). Despite its weakening labour market, Townsville has continued to experience population growth. Townsville is currently undergoing a large transition following the end of the mining investment boom and seeking to build on other competitive strengths in agriculture and tourism. The city also has a City Deal in place which aims to attract investment to the region (Townsville Enterprise, sub. DR72, p. 3).

Townsville (SA4): a region in transition away from mining and mineral processing
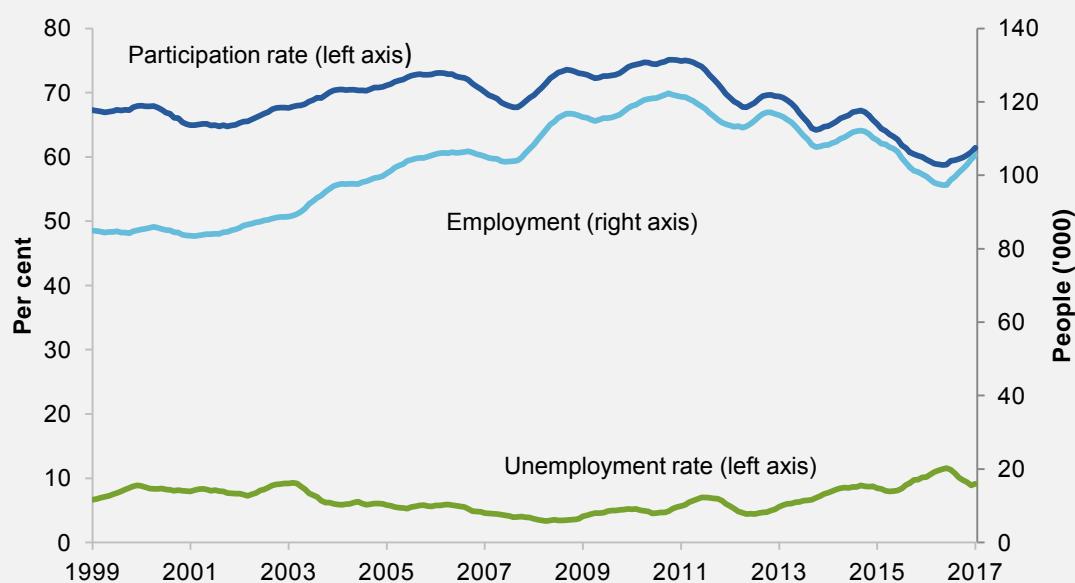
Source: ABS (*Labour Force, Australia, Detailed – Electronic Delivery, Sept 2017*, Cat. no. 6291.0.55.001).

3.3   Agriculture and the consolidation of towns

Many regions of Australia remain strongly connected to the performance of the agricultural sector. Agriculture is highly diverse across the country, ranging from large-scale cattle properties in the north of Australia, to intensive irrigated horticulture in the Murray-Darling

Basin. The drivers affecting agricultural regions also differ. Whether a region contains irrigated or dryland agriculture, forestry or fishing industries, produces commodities exposed to international competition, specialises in livestock or cropping, or undertakes land-intensive or small-scale production affects how exposed the region is to various disruptions, such as currency movements, commodity price volatility and the weather.

Although this diversity presents challenges in identifying common patterns across agricultural regions, some broad trends have impacted on agriculture generally. In particular, farms are now larger and more productive. This has in part resulted in agriculture employing fewer ongoing workers than it once did. There has also been a centralisation of rural populations in larger regional centres which has resulted in a decline in the populations of some small towns initially established for farming communities.

Farm productivity has increased due to consolidation and the adoption of new technology

Many agricultural products are sold on competitive international markets or compete with imported produce for domestic markets. The prices that primary producers receive for these products have often not kept pace with the increase in prices for the inputs used. This includes wages paid to workers and the price and availability of water, fertiliser, seeds and chemicals. Notwithstanding a recent improvement in prices for farm products (largely reflecting a depreciation of the Australian dollar), the agricultural terms of trade[17] in 2015-16 were 31 per cent lower than in 1974-75 (figure 3.12).

Productivity improvements and technological innovation, especially in cropping, have seen primary producers lower their costs of production. Drivers of productivity growth have included better and larger machinery, use of technology (including autonomous vehicles), new crop varieties (including genetically modified varieties), precision agriculture (the precisely measured application of fertiliser and water using sensor technology) and the increasing size of farms. Other drivers include the use of video technology for monitoring watering sets and the use of drones for mustering.

The supply of land for farming is unlikely to increase, given the competing demands from other sectors for that land (PC 2016c, p. 64). This means farmers will need to continue improving productivity, including through the intensification of farming. More intensive farming has allowed production to increase from existing land. This is partly due to more intensive production techniques being used by existing industries, including greater use of inputs such as feed, chemicals and irrigation systems to achieve higher production yields and reduce inputs (PC 2005, p. 42). Intensification can lead to land use conflicts and other issues. For example, intensive farming could raise environmental concerns for nearby residents (PC 2016c, p. 90).

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[17] The agricultural terms of trade refer to the ratio of prices received for agricultural outputs to the prices paid by farmers for agricultural inputs.

Productivity improvements have differed across different types of agriculture. From the late 1970s, dairy (average productivity growth of 1.6 per cent a year) and broadacre cropping (1.5 per cent) have seen large improvements in productivity. These have exceeded productivity improvements for beef (0.9 per cent) and sheep (0 per cent) (Gray, Oss-Emer and Sheng 2014, p. 10).

Figure 3.12   **Long-term decline of the agricultural terms of trade**
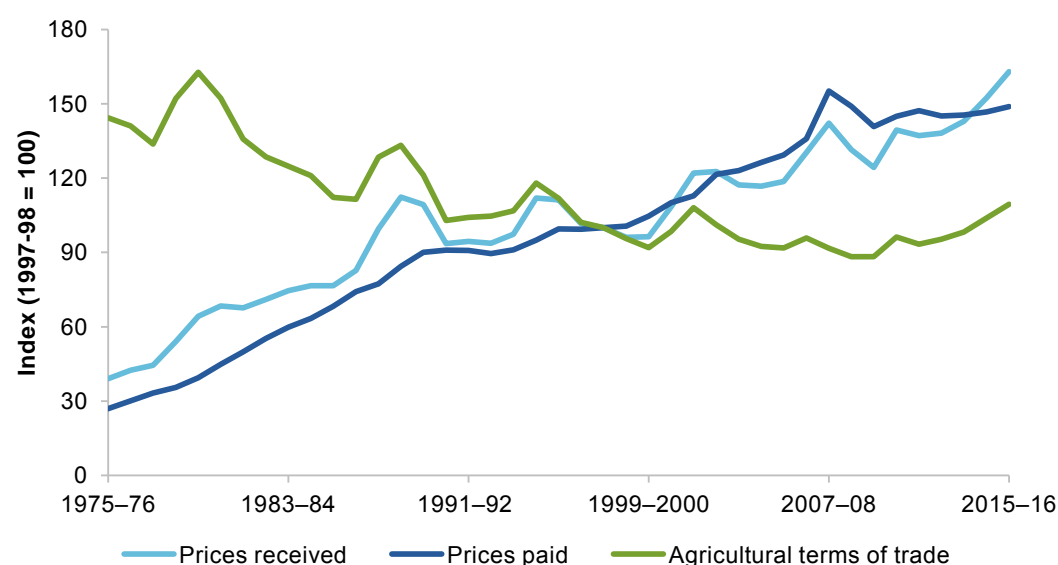
Source: ABARES (*Agricultural commodity statistics 2016*).

Improvements in productivity have also taken place in the supply chain from the farm gate to market. For example, technology and changes in preferences have seen a move from rail to road transportation for many goods (PC 2016c, p. 382). Rural roads have improved and larger trucks are used to move grain from farms to fewer and larger receival sites (or even direct to port), which are located closer to main rail lines. More produce is being moved using fewer workers. There is further potential for productivity gains in this area. For example, there is substantial scope for improvements in transport regulations, such as better processing of heavy vehicle road permits, that would further reduce the burdens faced by agricultural producers (PC 2016c, p. 362).

As well as productivity improvements, the agricultural industry has also benefited from recent favourable international market conditions, including increased demand from Asia due to rising incomes and Australia's reputation for quality produce, as well as the depreciation of the Australian dollar.

Productivity improvements mean less labour is required …

Higher productivity has meant that national agricultural production has increased over time, while requiring fewer inputs, including workers. The value of real agricultural production increased by about two and a half times over the four decades to 2003-04 (PC 2005, p. 17). This was achieved without an increase in the number of agricultural workers. More recent productivity estimates for the industry indicate that two thirds of industries experienced productivity growth[18] in nearly all five year periods between 1989-90 and 2014-15. The economy-wide average rate of productivity growth was 0.9 per cent, but the agriculture, forestry and fishing industry had the highest growth (2.6 per cent) (PC 2016b, pp. 9–10).

As a result of these productivity improvements (and the associated reduction in demand for agricultural workers) and growth in employment in the services sector, employment in agriculture has fallen from 6.1 per cent of Australian workers in 1984 to 2.6 per cent in 2016. This reflects a much longer term decline in the agricultural workforce from the 1930s (figure 3.13). For those regions that have historically relied on agriculture, the reduction in employment in agriculture has resulted in ongoing adjustment. Fewer jobs in a region can have a number of simultaneous effects, including out-migration, growth in other industries, and unemployment. Off-farm income has also become increasingly important for agricultural workers (PC 2005, pp. 110–113).

Figure 3.13   **Employment in agriculture has declined over a long period**
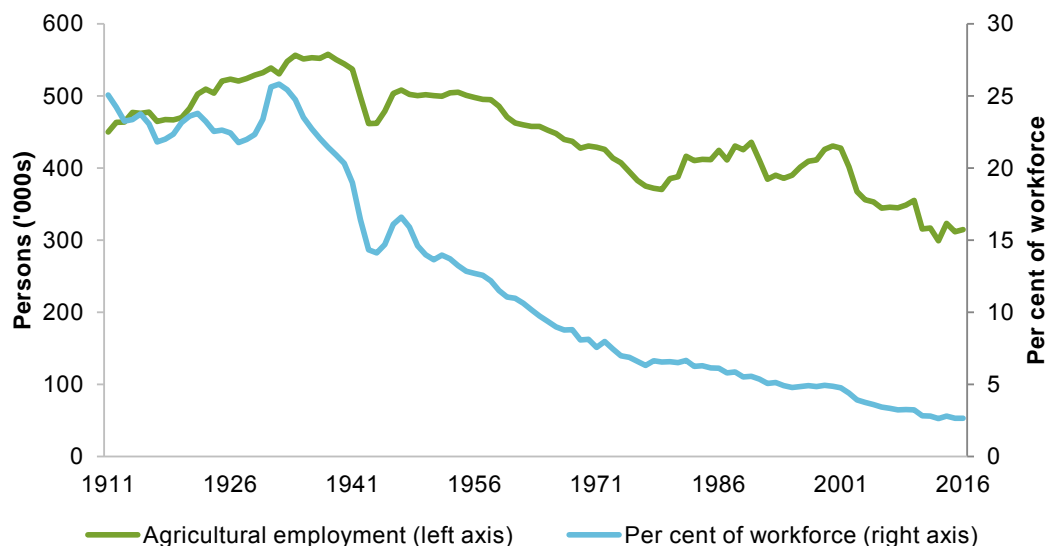
Sources: ABS (*Labour Force, Australia, Detailed, Quarterly, Feb 2017*, Cat. no. 6291.0.55.003) and Commission estimates using Withers, Endres and Perry (1985).

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18 Measured as multifactor productivity.

Another form of income is from compensation for coal seam gas (CSG) mining and exploration made on agricultural (and other) land. Land owners (including many farmers) have been compensated for CSG mining on their land, particularly in Queensland, where there has been significant CSG development. For example, in Chinchilla, which has a population of about 7000 and 70-80 farm businesses, it was estimated that compensation averaged $50 000 per farm in 2012. The income was not distributed evenly because some farms had more wells or infrastructure being put in place (Towler et al. 2016, p. 267). There is potential for improvements to the way landowners are compensated (chapter 5).

… But temporary workers are often needed

Many farms are family-run, and hire few ongoing workers. The seasonal nature of agricultural work can make it difficult to attract and retain Australian workers. Consequently, farm businesses often rely on temporary workers, including overseas workers, to fit their seasonal labour requirements. Farmers also use contractors to meet their labour demands or to carry out specific activities, such as shearing (PC 2016c, pp. 444–445).

About 34 000 working holiday makers worked in the agriculture, forestry and fishing industry in 2015-16 (PC 2016c, p. 447). To a lesser extent, farmers also sponsor temporary skilled workers under the 457 visa program. There were about 900 new subclass 457 visas sponsored in the agriculture, forestry and fishing industry in 2016-17 (DIBP 2017).[19]

The number of people granted new subclass 457 visas in agriculture nearly tripled between 2010-11 and 2012-13 (from 473 to 1385) (DIBP 2017). This was in line with the broader trend for total new 457 visas granted, which also peaked in 2012-13 (box 3.7). Since that time the annual number of visas granted in the agriculture, forestry and fisheries industry has been steady at about 900. More than one-third of these visas granted in 2016-17 were for managers and professionals. People with managerial skills are likely to be needed more in the future, to help run farms that are becoming increasingly larger in scale. There may also be greater demand for highly skilled workers to operate sophisticated machinery and other technology used for farming.

Different types of agricultural activity use different sources of labour. A survey by ABARES on irrigation farms in the Murray-Darling Basin revealed that most farm employees in the vegetable and horticulture industries are seasonal workers, with most of these non-citizens (Valle, Millist and Galeano 2017, p. 5). The vegetable and other horticulture industries are more labour intensive than other agriculture industries. In contrast, the cotton industry has more full-time employees, and those workers who are seasonal are typically Australian or New Zealand residents. To help attract more seasonal workers in horticulture, the Australian Government introduced the Seasonal Work Incentives pilot program on 1 July 2017 (Department of Employment, sub. DR75, p. 11) (chapter 5).

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[19] The Commission (2016b, p. 447) noted that there were about 2100 primary subclass 457 visa holders in total in the agriculture, forestry and fisheries industry in June 2015.

Populations in agricultural regions are consolidating into larger towns

There are now fewer people living in some smaller regional towns that were initially established for farming communities. Improved access to personal transport has meant that many people can now live in regional centres (where there is better access to services) while working in rural areas. The historical linkage between the development of regional towns and primary industry has also become less important (BITRE 2014, pp. 201–226). Indeed, those towns most reliant on expenditure by farmers have tended to have the lowest population growth (Levantis 2001, p. 34).

The services provided by smaller towns, such as banking and finance, retail, machinery repairs, professional services, education and health have consolidated to larger regional towns and centres. Service providers in small towns have had to compete with those in larger towns, which are often cheaper (because of economies of scale) and able to provide a wider range of services (BITRE 2014, pp. 227–252). Some businesses have become unviable and closed as a result. Once it becomes necessary for residents of small towns to travel regularly to larger towns for services, demand for other local service providers falls (BITRE 2014, p. 235). Wagga Wagga is an example of these changes (box 3.9). The decline of small towns is not a new phenomenon. Over the past century, a number of towns have lost many of their residents, with some towns depopulating entirely (box 3.10).

Towns with fewer services become less attractive for residents. In the absence of a local industry or other social connections, people will often relocate closer to regional centres, and if the population becomes too small, a cycle of business closures and further population decline can set in. This is particularly true after the closure of critical services such as medical general practitioners, schools and post offices. This will sometimes lead to shrinking towns with rapidly ageing populations as younger people move away to where local employment opportunities lie. Providing basic services (including, for example, a flexible local bus service) can be important to those remaining in such towns (chapter 5).

Population decline and the loss of services affects the people remaining in these communities. Some people who leave a region to pursue other opportunities may have played key roles in the community, for example by leading local sporting clubs or volunteer organisations (box 3.11). Population decline can result in a deterioration of a community's social and cultural life, and a loss of local leadership expertise and skills. This trend is not unique to Australia, with many OECD countries experiencing similar trends. Nor is it a trend that governments should prevent. People move to larger population centres for employment and for lifestyles reasons. Trying to discourage such voluntary movements would be harmful to those people who would otherwise choose to move. Furthermore, it would be difficult to make all towns and cities grow in population or become economic centres. Attempting to stave off decline would hamper the growth of successful regional cities.

Box 3.9   **A Wagga Wagga-centric Riverina**

The Riverina, in southern New South Wales, is primarily a cropping region, with wheat (the major crop) grown alongside rice, canola and barley. It also has a substantial dairy sector. Over time, the region's population has increasingly centred on Wagga Wagga at the expense of smaller towns. The Riverina region grew by about 11 500 people between 1991 and 2016, with Wagga Wagga growing by about 9500 people (about 85 per cent of the Riverina's growth). Much of the remaining growth was in the next largest town (Griffith), while most smaller towns remained stable or declined. Unemployment in Wagga Wagga has been trending down since 2010.

When the Riverina was settled, the population was spread more widely on large pastoral holdings. A large number of small towns sprang up, providing services to the surrounding farms as well as housing (including for farm workers). While the major city (Wagga Wagga) provided specialised services, these smaller towns housed machinery and fertiliser suppliers and marketed farm products.

During the 20th century, the Riverina has seen a steady consolidation of the population into the regional centre. Improved transport facilities (especially roads and vehicles) increased competition between service providers in previously separated regional towns. Such providers had to 'get big or get out', creating pressure to consolidate into fewer, larger centres. Centres were often those residing on major transport routes, such as Wagga Wagga.

As a result of centralisation, many nearby smaller towns have experienced population decline. For example, the population of Boree Creek has declined steadily over recent history (to 199 people in 2016). That said, the experience of towns in the Riverina was not uniform. For example, Junee has a correctional centre, providing an alternative employment base from traditional agricultural activities, and has staved off population decline. Furthermore, unemployment has fallen in Junee and the unemployment rate has declined from over 8 per cent in 2011 to under 5 per cent in 2017.

Sources: ABARES (2016); ABS (2013c, 2017b); Department of Employment (*Small Area Labour Markets*); Stayner (1996).

Many small communities around Australia are trying innovative approaches to address declining populations and the associated social and economic impacts. For example, the community of Nhill has focused on attracting immigrants to the region. Both the availability of jobs (at the local duck processing plant) and leadership were viewed as crucial in attracting people to the town (ABC 2015). A report by Deloitte Access Economics and AMES, a settlement agency, stated that this initiative has added more than $40 million and 70 full time equivalent jobs to the local economy (AMES and Deloitte Access Economics 2015, p. 4). Similarly, the pig industry in Pyramid Hill in central Victoria has attracted Filipino immigrants to the area. The Loddon Shire Council (2016) reported:

> Shops in the township are fully occupied, residential development is on the rise and Pyramid Hill's two schools are defying the enrolment decline experienced in many rural townships.

Box 3.10 Shrinking Australian towns — historical examples

Population movements have been an ongoing feature in the history of Australia's regions. As reported by the Bureau of Infrastructure, Transport and Regional Economics, numerous towns in both the 1911 and 1961 Census, with a population of at least 500 in either Census, had populations of less than 200 by the 2006 Census.

'Lost' towns
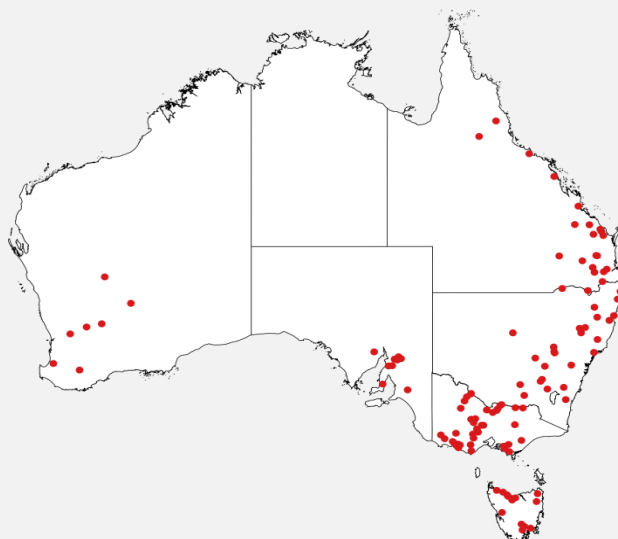
Historical examples of depopulated Australian towns include Irvinebank (Queensland), Farina[20] (South Australia) and Joadja (New South Wales).

> … the town of Irvinebank in Queensland, 80 kilometres south-west of Cairns, had a mining and tin smelting operation that grew to around 1300 persons by 1911 … However, during the twentieth century the town went into decline … [with] a population fall to below 150 persons by 1961. (BITRE 2014, p. 78)

> Between 1882 and 1884, Farina, 640 km north of Adelaide in the Lake Eyre Basin, grew to become the railhead for the Great Northern Railway. The town's population peaked at 300 in 1894 but then began the slow, inexorable decline as hotels, post office, school and police station were closed until only the station owner and his family remain today. Drought, rabbits, relocation of the rail and the coming of the motorcar all are factors in the decline. (Olston 2008, p. 101)

> … Joadja's vast shale deposits became a vital part of colonial life. Seams were excavated and the shale used to produce crude oil and kerosene, giving a power source and much-needed economic boost to the colony. … At its peak, 1100 people lived in the Joadja valley, most of them working for the area's key landowner and employer, the Australian Kerosene Oil and Mineral Company. …

> Shale was exported from Joadja to markets across the world from 1870 until 1904, when cleaner and cheaper methods of oil production were discovered. For several years after the mines shut down, people continued to live in the remote valley but by 1911 all had left … . (Stubbs 2012)

*Source*: BITRE (2014).

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[20] Farina is not shown as a lost town because its population was not above 500 in either 1911 or 1961.

Box 3.11   Social fabric of communities — sport and the Mallee

Sport plays an important part in the social and cultural life of rural communities, contributing to 'community identity, sense of place, social interaction and good health' (Tonts 2005, p. 137). However, when population decline occurs, towns often face a difficult battle to retain sufficient players and fill the various administrative positions required to keep teams and leagues operating (Jackson 2011, p. 16).

The decline of Australian Rules football clubs in the Mallee region of North West Victoria provides a clear example. The Mallee has experienced significant population decline and, as a result, the number of viable football teams has decreased. At the start of the 1980s, 16 teams were competing in two football leagues — the Northern and Southern Mallee competitions. These two leagues merged in 1997, and in 2015 the combined league was disbanded altogether. Of those original 16 teams, one team is still playing and two have disbanded. The remaining 13 teams eventually formed four teams in neighbouring competitions.

Population decline and social impacts – North West Victoria
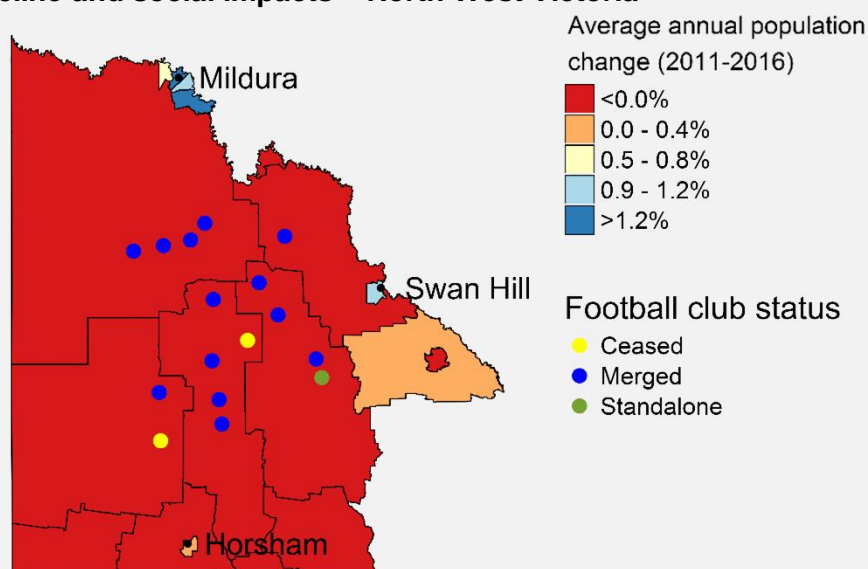
Some locals have reflected upon the social and economic costs of the demise of the league. The former President of the league, Alan Malcolm (2015), noted:

> You lose the football team, the town suffers. Every town wants to keep their football and netball team because it's such an important social fabric of the community.

A local publican, Greg Wallace, highlighted some of the ways that the demise of local teams could be adversely affecting the community.

> It's a really good way for farmers to talk to each other. It's like a men's shed where they can talk to somebody and it doesn't matter … I am worried about depression in the future. (Malcolm 2015)

Economic concerns with the remaining teams playing in neighbouring competitions were cited.

> Everybody will be going towards major towns to do their shopping, because they'll go to places like Swan Hill every second week, Horsham every second week or Mildura every second week, so while they're there they'll do their shopping, That'll make a big difference to our business. (Malcolm 2015)

Source: ABS (*Regional Population Growth, Australia, 2016,* Cat. no. 3218.0).

What does this mean for agricultural regions?

The combination of the above trends has contributed to a common pattern of declining employment in many agricultural regions, but positive growth in (most) regional centres that support them. As some agricultural regions also include regional cities and towns, the overall impact on employment and population can differ substantially. For example, two agriculturally-focused regions which have had downward trends in employment over a long period (notwithstanding some volatility) are Western Australia – Wheat Belt and Murray (New South Wales) (figure 3.14). Employment in other agricultural regions has fluctuated, but there is no clear long-term pattern, particularly in those regions that also have regional centres.

Figure 3.14   **Employment has been declining in some agricultural regions**
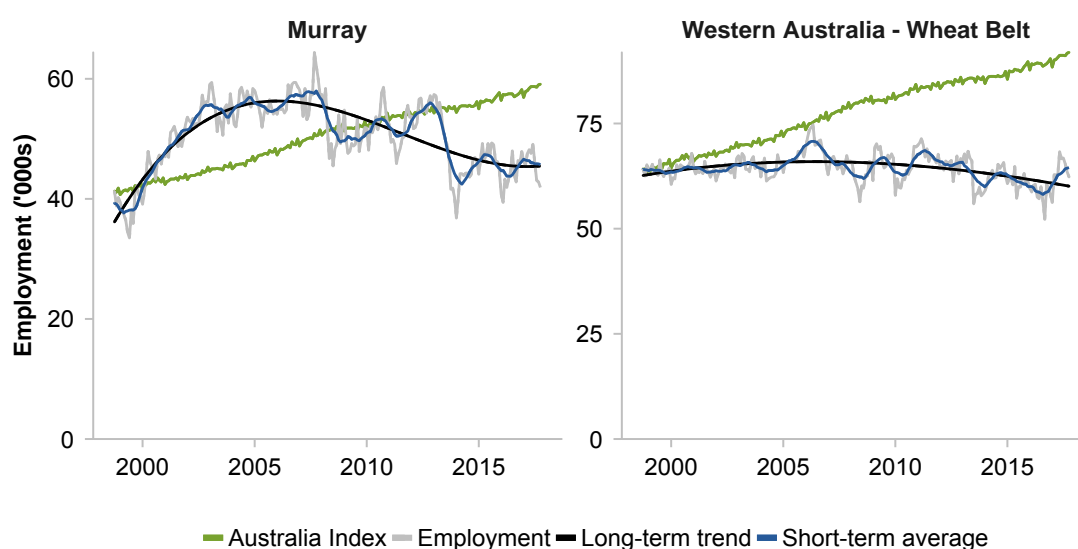
Source: ABS (*Labour Force, Australia, Detailed – Electronic Delivery, Oct 2017*, Cat. no. 6291.0.55.001).

House prices in agricultural regions have tended to increase, although growth has been slower than for other types of regions. There has also been some divergence in house prices across agricultural regions. Prices in areas close to Perth (Toodyay and York – Beverley) experienced faster growth than areas further from Perth (Merredin and Mukinbudin) (figure 3.15). Not only are Merredin and Mukinbudin further from Perth, but they also have substantially lower annual rainfall levels, making the agricultural lands surrounding the towns more marginal for grain growing (Pook, Risbey and McIntosh 2012, p. 29).

Income levels in many agricultural regions are rising rapidly, due in part to improving market conditions (discussed above). In the Western Australia – Wheat Belt, median personal income rose by over 25 per cent between 2010-11 and 2014-15 (figure 3.6). In areas like York – Beverly and Mukinbudin, the growth rate was even higher. Even in regions like

Murray in New South Wales, which has experienced a sharp downward trend in employment (figure 3.15), median incomes rose in line with the Australian average (15 per cent).

Figure 3.15 **Rapid house price increases at the onset of the boom**

Selected Western Australia – Wheat Belt regions, at SA2 level
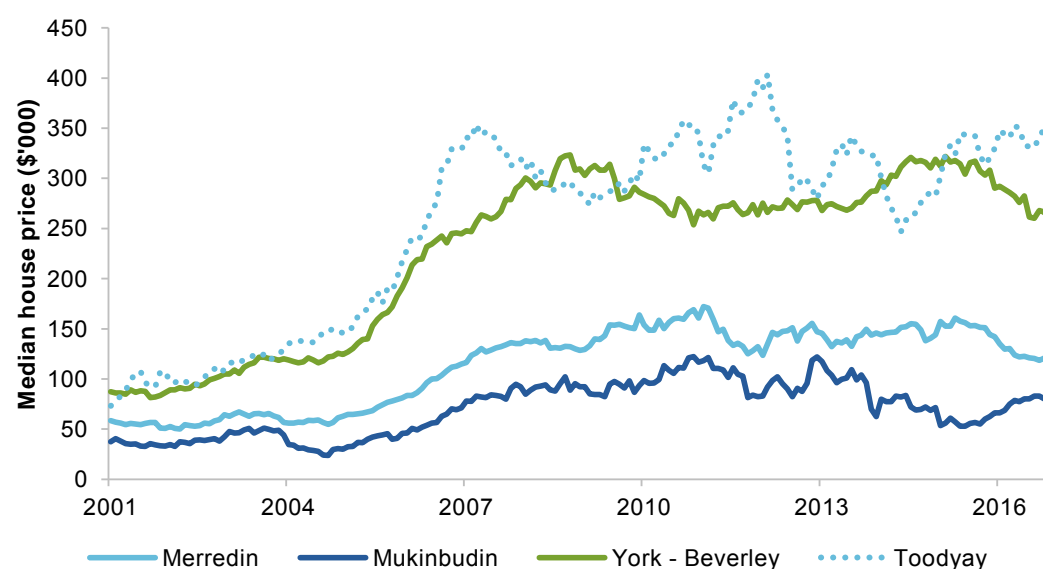
Source: Commission estimates based on CoreLogic data.

FINDING 3.6

Efficiencies and technological innovation are generating higher levels of agricultural production using less labour. This is driving a long-term trend of lower employment in agricultural regions. There is also a pattern of consolidation from smaller towns to larger regional centres, which affects the social fabric of these communities.

3.4   Growth of cities and regional centres

Australia is one of the most urbanised countries in the OECD and like the OECD generally, Australia is becoming more urbanised over time. Australia's urban population is notably concentrated in relatively few major cities compared with most other OECD countries (OECD 2016b, p. 17). About 64 per cent of Australians live in Australia's five largest cities (Sydney, Melbourne, Brisbane, Perth and Adelaide) with about 40 per cent living in Greater Sydney and Greater Melbourne (ABS 2017l). The dominance of this small number of cities is unlike other comparable countries such as Canada which have a more even population spread (Tiffen and Gittins 2004, pp. 14–15).

Large urban centres are growing the fastest

Despite Australia's population having grown by 40 per cent since 1991, 16 out of 89 FERs have experienced population decline over the past quarter-century (figure 3.16). Many of these are inland or remote regions and many have a high share of agricultural employment. The regions of Longreach (Queensland), Central East Wheatbelt (Western Australia) and Far West NSW – Lower Murray (New South Wales), have all had population decline of over 20 per cent since 1991. Capital cities and some other regions with large urban centres, especially near the coast have experienced high population growth. Between 1991 and 2016, 70 per cent of Australia's population growth occurred in its five largest cities. Since the end of the mining investment boom in 2012, this has increased to about 80 per cent and is projected to continue into the future (PC 2017b, p. 124). In slower growth cities, like Adelaide and Hobart, population growth has also been faster than the rest of the state (figure 3.17).

Figure 3.16   **Capital cities and coastal areas have grown fast**

Average annual percentage change in population for functional economic regions, 1991 to 2016

Legend:
- <0.0%
- 0.0 - 0.6%
- 0.7 - 1.1%
- 1.2 - 1.6%
- >1.6%
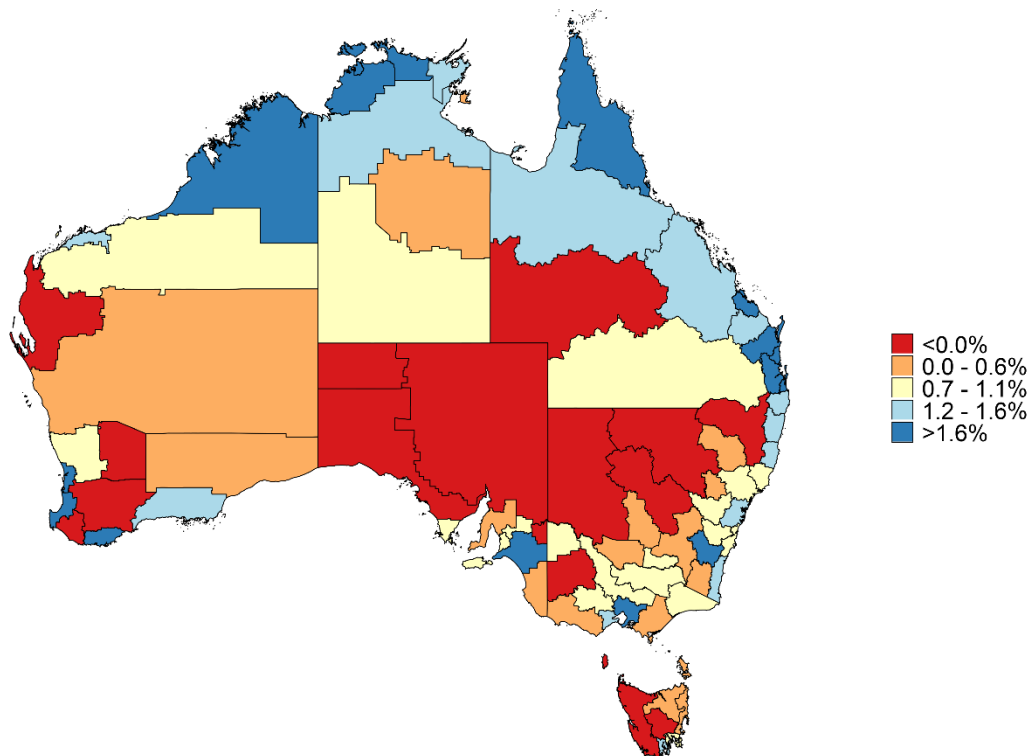
Source: ABS (*Regional Population Growth, Australia, 2016,* Cat. no. 3218.0).

Figure 3.17   **Population growth has been highest in capital cities**[a]
Average annual percentage change in population, 1991 to 2016

a Capital city population defined by functional economic regions.

Source: ABS (*Regional Population Growth, Australia, 2016,* Cat. no. 3218.0).

Overseas migration is driving strong population growth in capital cities

Since 1991, over half (55 per cent in 2016) of Australia's total population growth has come from net overseas migration (rather than natural growth) with its share increasing in recent times (ABS 2017b). Most migrants settle and live in cities, particularly Sydney and Melbourne and, to a lesser extent, Brisbane and Perth (Wilson and Charles-Edwards 2017). It is estimated that about 85 per cent of migrants live in cities with a population over 100 000, compared to 64 per cent of people born in Australia (ABS 2014). In New South Wales, Victoria and Western Australia, overseas migration has been the major source of population growth in recent decades, with the majority of population growth concentrated in Sydney, Melbourne and Perth (figure 3.18). New migrants tend to live in the inner city, in pockets of affordable housing or within close proximity to higher education institutions (ABS 2014; Daley, Wood and Chivers 2017, p. 24; PC 2015, pp. 136–138).

Internal migration of young people (aged 15-24) from regional areas to capital cities has also contributed to population growth in capital cities, with Melbourne, Brisbane and Perth being the most popular cities that young people have migrated to (ABS 2017j).

Figure 3.18   **Net overseas migration has driven population growth**
Sources of population growth by state, 1991 to 2016
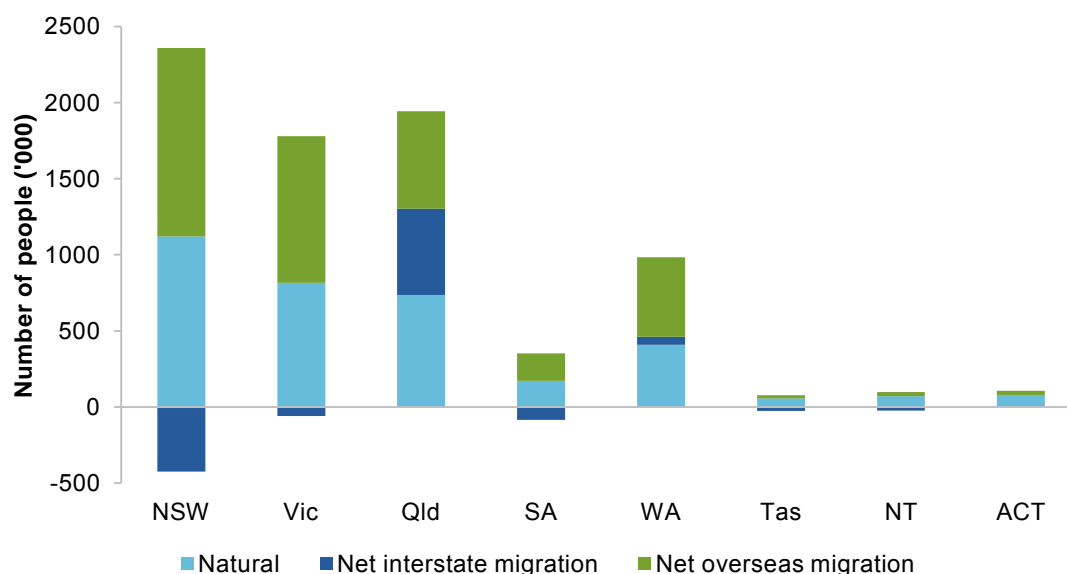
Source: ABS (*Australian Demographic Statistics, Sep 2016*, Cat. no. 3101.0).

Cities offer deep and diversified labour markets

Cities play a major role as hubs of economic activity and the large growth in services employment, particularly knowledge-based services, has attracted people to capital cities. Many of Australia's high growth industries are in professional services that rely on the agglomeration benefits of large cities such as deep pools of specialised labour and knowledge spillovers. As cities grow, they provide greater agglomeration benefits to business, which acts as a stronger natural incentive for knowledge-based businesses to operate there (Kelly and Mares 2013, pp. 9–13; Puga 2010).

Aside from greater labour market and education opportunities, cities offer a wide variety of services including health and entertainment that suit many people's lifestyle preferences. For migrants, cities can offer communities of people from similar cultural backgrounds, which can be important for developing social networks (Rudiger and Spencer 2003, p. 6).

Some small cities and regional centres are growing faster than capital cities

Some small cities and regional centres have also experienced high population growth, outstripping growth in capital cities in some instances. The Gold Coast and Sunshine Coast in Queensland, Busselton and Bunbury in Western Australia, and Victor Harbor in South Australia have experienced much higher population growth in recent decades than their respective capital cities (figure 3.19).

Much of the population growth in regional centres is a result of natural growth and net internal migration from both people leaving rural regions and large capital cities (Budge and Butt 2009, p. 13). Net overseas migration contributes only a small part of population growth outside of capital cities as few migrants settle there. The Sunshine Coast and Geelong are examples of cities that have experienced high internal migration. Internal migration to the Sunshine Coast has predominantly been from families and retirees leaving Sydney and Brisbane (Thomson 2014). Geelong's high internal migration has largely come from retirees leaving Melbourne and young people (aged 15-24 years) moving from west and south-west Victoria (ABS 2013a). Retirees make up a sizable proportion of migration to smaller cities in some instances (box 3.12). However, some smaller cities that are popular among retirees can struggle to attract people of working age (RAI 2016, p. 13).

Figure 3.19   Some small cities and regional centres have also grown quickly[a]

Annual average percentage change in population, 1991 to 2016
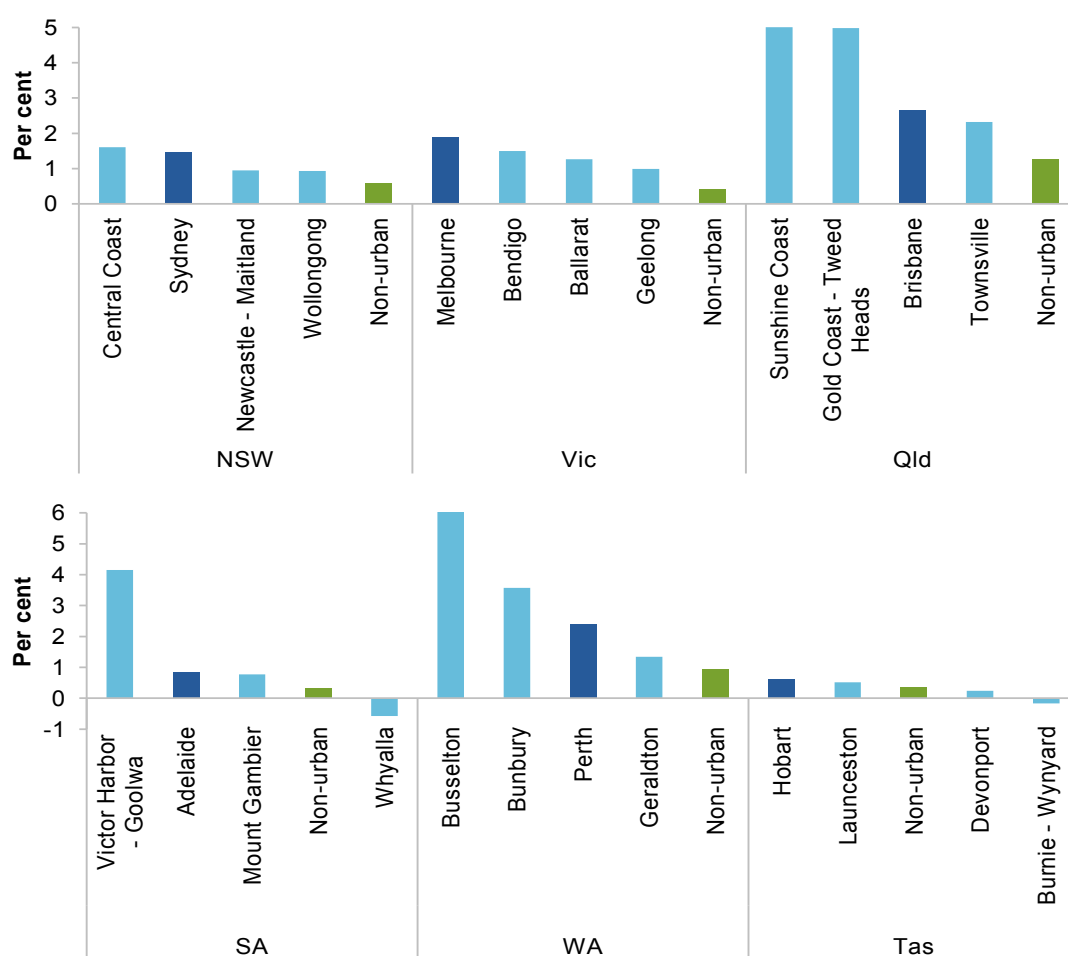
[a] Annual average population change for the four largest cities/regional centres for each state, and non-urban regions based on ABS Significant Urban Area Structure.

Source: ABS (*Regional Population Growth, Australia, 2016,* Cat. no. 3218.0).

Many of the fastest growing small cities and regional centres have attracted people because of their high natural amenity, particularly along the coast. These 'sea change' regions have been popular with families and retirees and have defied trends in population compared with other regional areas. Tourism has also been important in creating employment opportunities in many of these regions. For example, the Gold Coast, Sunshine Coast and Fraser Coast in south-east Queensland have all experienced strong population growth in recent decades and lifestyle factors have been a predominant reason for people moving there (Stimson and Minnery 1998).

Some small cities that have experienced high population growth in recent years have also experienced high rates of employment growth as economic activity becomes increasingly concentrated in larger centres. For example, Newcastle, Wollongong, Ballarat and Geelong have all experienced employment growth above the national average over the past five years (figure 3.2). These smaller cities also offer greater affordability (particularly for housing) and a different lifestyle to major cities, including less congestion and pollution (RAI 2016, p. 5). Small cities (including smaller capital cities) stand to gain from population growth, particularly people of working age, due to increased agglomeration benefits and further diversification (Regional Capitals Australia, sub. 30, p. 3).

Box 3.12   Some regional centres are popular among retirees

The most popular destinations for retirees are places along the coast, such as Mackay (Queensland), Geelong (Victoria), Newcastle and Port Stephens (New South Wales). Retirees make up a substantial proportion (in some cases over 30 per cent) of the population in some regions including the New South Wales South Coast, Shoalhaven and Southern Highlands. Although many retirees are leaving cities, there are also many who move to the inner city as they downsize. Inner city Melbourne and inner city Sydney have experienced some of the largest net influxes of people over the age of 65 in the past five years (ABS 2017k, 2017j).

Connectivity between regions is crucial

Connectivity is important in creating opportunities for regional communities undergoing transition. This has been seen in many agricultural regions (section 3.3). The importance of connectivity was outlined in a number of submissions. For example, Regional Capitals Australia (sub. DR78, p. 11) said: 'creating regional hubs that are liveable and connected should be a priority for governments of all levels'.

Although smaller cities are areas of economic activity in their own right, their physical connectivity to capital cities is crucial in providing businesses with access to larger markets (box 3.13). In Victoria, over 33 000 people commute to Melbourne daily from the cities of Geelong, Ballarat, Bendigo and Latrobe, with most using the train (Vic DEDJTR 2015, p. 15). These centres have also benefited from public transport upgrades which have enabled more people from these regions to commute to Melbourne. Upgrades have coincided with

population growth in these centres that has outpaced other regional centres, such as Shepparton, that lack similar rail access to Melbourne.

The importance of high-speed internet in facilitating connectivity was also raised in many submissions. Connectivity through high speed internet can attract businesses and people to a region. As highlighted by Regional Capitals Australia (sub. 30, p. 9): 'better internet connections draw jobs to regions not just by attracting businesses, but by attracting workers for whom fast broadband is a baseline requirement to move to an area'. The rollout of the National Broadband Network and the Mobile Black Spot Program aim to narrow the telecommunications gap between capital cities and regional areas (PC 2017c).

Box 3.13   **Connectivity of Ballarat**

Ballarat, a city of more than 100 000 people in Victoria, has been a successful regional centre over recent decades. Located about 110 km north-west of Melbourne, Ballarat was originally founded as a gold mining town, but over a long period has diversified and now performs well on most indicators of regional performance. The Ballarat region has experienced high employment growth, particularly in recent times, and unemployment in Ballarat has been trending down over recent years (ABS 2017h).

Part of Ballarat's success can be linked to connectivity. Compared with Melbourne, Ballarat has a lower cost of living and less urban congestion. Ballarat has been connected to Melbourne via a freeway since the 1990s and is on many major highways, which connect it to agricultural and industrial centres (Regional Capitals Australia, sub. 30, p. 4).

The commencement of a faster train service in 2006 has enabled commuters to travel to Melbourne in about one hour, comparable with many outer suburbs of Melbourne (Litras 2006). Reduced commuting times has seen the number of daily commuters to Melbourne increase rapidly. In 2013-14, an estimated 7400 people commuted to Melbourne each day, with 4700 (63 per cent) travelling by train (Vic DEDJTR 2015, p. 15).

The growth of satellite suburbs

Satellite suburbs[21] have been some of the fastest growing areas in Australia over recent decades. Satellite suburbs offer people access to cheaper housing but still enable them to access the labour market of a larger city and the smorgasbord of services and attractions available. They may also offer a more regional lifestyle compared with metropolitan areas (Salt 2017). Improved connectivity has also been crucial to population growth in satellite suburbs. For example, upgrades to train services in 2006 coincided with higher population growth in Melton and Bacchus Marsh, which are satellite suburbs of Melbourne (ABS 2017b; box 3.11). Migration to satellite suburbs has predominantly been from families moving out of capital cities (ABS 2017j).

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[21] Satellite suburbs are urban areas within close proximity to a city that are not part of the larger metropolitan area of the city.

Some regional centres are experiencing long-term population decline

A small number of regional centres have experienced long-term population decline. They share some similar disadvantages, many of which are not easily amenable to change. The decline of industries that brought about the town's development has contributed to their population decline, which in many cases reflects structural and technological change in the economy. Other factors have made transitioning to alternative economic activities challenging. Indeed, historical evidence suggests that single industry communities, particularly those based on non-renewable resources, often do not survive the decline or depletion of their resource base (Storey 2010, p. 1171).

Some regional centres experiencing population decline have mineral deposits that are becoming more marginal as mines reach the end of their viable lives (box 3.14). Regional centres such as Broken Hill in New South Wales (26.0 per cent population decline), Whyalla (14.3 per cent), Port Pirie (5.9 per cent) and Port Augusta in South Australia (5.9 per cent), Moe – Newborough in Victoria (10.6 per cent) and Mount Isa in Queensland (10.4 per cent) have experienced significant population decline between 1991 and 2016. Regional centres experiencing population decline are generally isolated with relatively poor connectivity to capital cities (Martinez-Fernandez et al. 2012, p. 220). They also lack the scale to benefit from agglomerated industries and to move into fast growing service sectors. Furthermore, most of the people leaving are of working age (ABS 2017j). For remaining residents, population decline can see services provided to the community decline, which can reduce quality of life (Collits 2000).

Box 3.14   Population decline in Broken Hill

Located more than 1100 km from Sydney and more than 500 km from Adelaide by road, Broken Hill is an isolated regional centre in western New South Wales that has been experiencing significant population decline over recent decades. At its peak in the 1950s, Broken Hill was home to 30 000 people with over half of its employment in the mining industry. Currently, Broken Hill has a population of 18 000 people with employment in mining accounting for only 10 per cent of total employment (ABS 2017l).

The reduction in mining employment (due to a depleting mine and improved technology which requires fewer workers) has affected other businesses in the town and the number of businesses has been declining as Broken Hill loses mining, retail, transport and administrative services. The Broken Hill City Council has also been forced to undergo a major restructure and cut services in order to remain viable (Gooch 2016).

Utilising its natural advantages, Broken Hill has been part of the development of the largest solar power plant in the southern hemisphere and is set to become home to one of the largest wind farms in Australia. However, ongoing employment opportunities as a result of these developments will be small (AGL Energy 2017; Paton 2015).

Broken Hill's isolation means it does not have the same connectivity as other regional centres and its relatively small size limits scope to move into other growth industries that generate employment. As such, transitioning away from mining employment to other industries with a large and stable employment base has been an ongoing challenge for the town.

The causes of population decline in isolated regional centres and internal migration to Australia's small cities are somewhat different to those facing small towns in agricultural regions. In agricultural regions, declining smaller towns are a function of declining permanent agricultural employment and better transport connectivity. Migration patterns show that people in small agricultural towns have generally moved to larger urban centres within the same FER. By contrast, people who have left isolated regional centres with a declining population have had to move outside their FER.

FINDING 3.7

Capital cities have experienced high population growth over the past 25 years. Growing demand for services and large increases in knowledge-based service employment has resulted in demographic change in Australia's largest cities.

Many smaller cities and regional centres have also grown (in some cases more quickly than capital cities) due to movements of people from inland regions and the migration of families and retirees from capital cities. Connectivity to large cities and proximity to the coast are important drivers of the wellbeing of those living in smaller cities and regional centres.

4   Regional adaptive capacity

Key points

- The Commission has developed a single metric of regional adaptive capacity. This was challenging due to the complexity of identifying, measuring and weighting the large set of factors that influence a community's ability to deal with change.

- The metric can be used to explore some broad themes and patterns of adaptive capacity in Australia's regions. It provides a 'litmus test' to identify regions potentially at risk of failing to adjust to pressures for change. However, the metric, on its own, is not suited to guiding policy decisions.

- The analysis shows that people-related factors (including education, skills, employment, income and community cohesion) strongly shape adaptive capacity, particularly for communities in urban areas. For communities in remote areas, these and other factors associated with remoteness, such as accessibility to services and infrastructure, have the strongest influence on results.

- The proportion of regions that are in the least adaptive category increases with remoteness. As these regions are sparsely populated, very few people live in regions with low adaptive capacity. In contrast, the most adaptive regions are concentrated in major cities — where most of the population resides. Pockets of disadvantage still exist in major cities.

- Regions that have a high share of employment in mining and related industries typically have relatively lower adaptive capacity, as estimated with the metric. One reason is that a high concentration of mining employment has a negative impact on the index. Other factors, such as physical infrastructure and social capital are also important.

- Regions with a large share of employment in agriculture have a diverse range of adaptive capacity outcomes, with some having above average adaptive capacity and some below average. This reflects differences across agricultural regions in financial capital, human capital and social factors, such as safety at night and volunteering.

- The use of sensitivity analysis shows that the relative rankings of regions is subject to a degree of uncertainty and therefore the ranking of regions could change significantly when different variables are included in the index. Thus the published list of 77 functional economic regions ranked from least adaptive to most adaptive should be treated with a degree of caution.

- Even if relative adaptive capacity could be measured accurately, on its own it does not identify whether regions will be successful in transitioning to a more sustainable economic base following a disruption.

The Commission was asked to develop a metric, combing a series of indicators, to assess the degree of economic dislocation/engagement, transitional friction and local economic sustainability of regions across Australia and to rank those regions to identify those most at risk of failing to adjust.

The approach to this task is to measure the relative adaptive capacity of regional communities and to use this as a 'litmus test' to identify regions potentially at risk of failing to adapt to pressures for change. This is a challenging task due to the complexity of identifying (and measuring) the large set of systemic factors that influence a community's ability to deal with disruption to its economic circumstances.[22] There is no agreed approach to measuring adaptive capacity and the concept itself is contested (chapter 2).

The framework and the factors that have been used as indicators of adaptive capacity are outlined in chapter 2. The 2016 Census of Population and Housing was a key data source for many variables included in the Commission's index of relative adaptive capacity. Additional detail on the index and the methodology used to construct the index are available in appendix E.

Broadly speaking, regions with a high index value of adaptive capacity are in a relatively better position to respond to changes in their economic circumstances. However, the realised outcomes in a region arising from a disruption depends on a number of matters, including:

- how sensitive and exposed the region is to a particular set of changes

- the opportunities available to communities to transition into other economic activities or to build on existing strengths and comparative advantages

- whether there are any impediments to adjustment, such as policy or regulatory barriers.

Ultimately, the changes experienced in communities are driven by the individual decisions of workers, business owners and others in the community as they seek to do what is in their best interests given the circumstances.

4.1   How should the metric be interpreted?

The Commission's index of relative adaptive capacity (box 4.1) is based on a widely accepted methodology. This index can be used to identify regions that may have problems responding to economic shocks. That said, caution is required in interpreting and applying it to policy making aimed at building resilience.

The index of relative adaptive capacity cannot capture the unique attributes of each regional community. As noted by James Cook University:

> Each region has its own culture, natural environment, climate, identity and a unique competitive advantage. The remote, Indigenous-led Arnhem Land, for example is a very different region from Queensland's sugar and tourism-driven Wet Tropics. (sub. 24, p. 2)

Further, factors that increase adaptive capacity in response to one type of disruption might decrease adaptive capacity for a different type of disruption. As such, any single measure of relative adaptive capacity for all Australian regions will have limitations.

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[22] Systemic factors are those defined and measured consistently across all regions in the analysis.

Relative adaptive capacity is an unobservable attribute of a region. It is not a measure of resilience to disruptive events. Rather, it is a summary of the complex set of factors affecting resilience, including the skills and education of regional workforces, access to infrastructure and services, availability of natural resources, financial resources available to businesses and individuals, and industry diversity. For this report, a relative measure of adaptive capacity has been inferred, derived using data across all regions. Principal component analysis has been used to construct the metric. This is a method applied to develop similar metrics, such as the ABS Socio-Economic Indexes for Areas (SEIFA). In general, regions with higher adaptive capacity have attributes that are likely to increase the potential to transition successfully following an economic disruption.

Sensitivity analysis has been undertaken to understand and illustrate the degree of certainty in the estimated index.[23] This provides insights into the extent that indicators included in the dataset, such as levels of education, incomes and remoteness, influence confidence in the index score for each region. The larger the confidence intervals for index scores of regions, the less reliable the score and ranking. The degree of confidence in the individual index scores tends to be lower for remote and very remote regions (figure 4.1 and box 4.2).

There are a large number of regions whose relative rankings could change substantially when indicators are included or excluded from the analysis. For example, Karratha (Western Australia) and Yorke Peninsula (South Australia) — both estimated to have below average adaptive capacity — have confidence intervals so large that their maximum index score within that confidence interval range would also place them in the most adaptive capacity category.

A number of the variables included in the metric analysis are imperfect proxies of the underlying factors thought to shape adaptive capacity (which is itself difficult to define). The ranges presented in figure 4.1 should therefore be thought of as lower-bound estimates of the sensitivity of the results.

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[23] Statistical bootstrapping has been applied to gain insights into the accuracy (defined here in terms of confidence intervals) for the metric. The technique uses random sampling methods. In each case, random sampling has been applied to regions within the dataset and the variables (indicators) that have been used in forming principal components.

Figure 4.1   Rankings of adaptive capacity

Index values for each functional economic region and their 90 per cent confident intervals, sorted from lowest to highest[a]
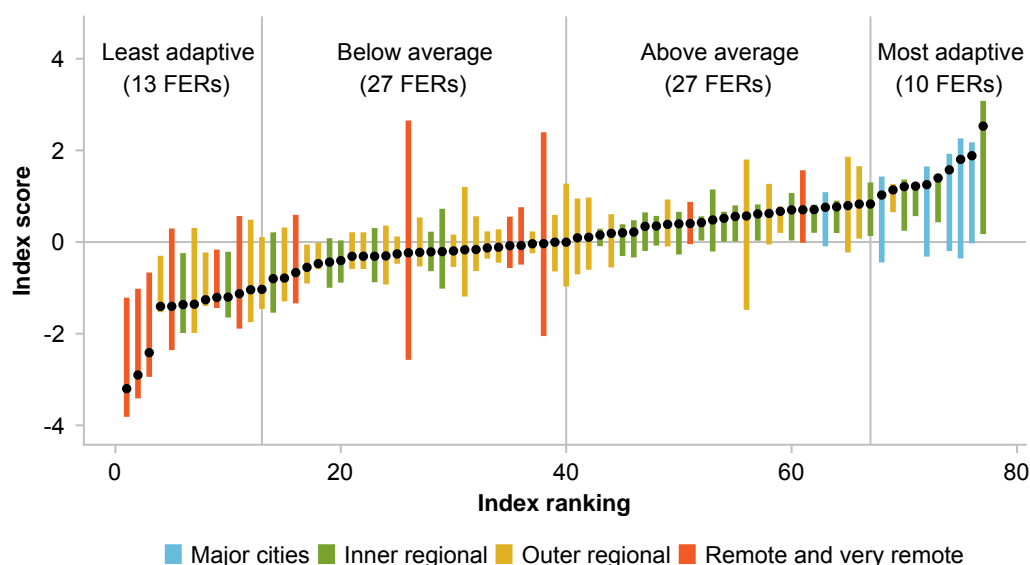
a Regions are defined using functional economic regions (FERs). The top and bottom group of regions are defined as those above and below one standard deviation of the mean index value of adaptive capacity across all regions. Regions are ordered based on their final index value, where the whiskers represent the upper and lower 5 percentiles (90 per cent confidence intervals) of the region's index value across sensitivity analysis. Remoteness of regions is represented in the colouring of the lines.

Source: Productivity Commission estimates.

Box 4.2   Factors influencing the relative rankings of adaptive capacity

The index for each region is highly sensitive to a small number of key variables which, when removed, dramatically change the rankings of regions.

Variables related to remoteness play a key role in determining the sensitivity of a region's ranking. This is primarily due to physical and natural capital factors. A number of remote and very remote regions are highly dependent on natural resources (in particular mining) or are particularly disadvantaged by multiple physical factors, including access to infrastructure and services.

For example, a mining region that has average scores for all variables *except* mining employment (which could be very high), could have a low score for most index calculations (that include the mining employment variable), but would have a more mid-level ranking for the small number of sensitivity runs where the mining employment variable is excluded.

Even if adaptive capacity could be measured accurately, it does not, on its own, identify whether regions will be successful in transitioning to a more sustainable economic base following a disruption. As noted earlier, this depends on how sensitive a region is to a particular disruption (which can vary by magnitude and probability), the opportunities available to regional communities and the actions of people within those communities. As

such, on its own, the metric has limited suitability as a guide for policy decisions, particularly the allocation of funding. However, the metric can be used to explore broad themes and patterns of adaptive capacity in Australia's regions, and can be used as a 'litmus test' to identify regions potentially at risk of failing to adjust to pressures for change.

FINDING 4.1

The Commission's index of relative adaptive capacity is based on a widely accepted methodology. The metric can be used as a litmus test to identify regions which may find it difficult to adjust to significant economic disruptions.

However, caution is required in interpreting the metric and using it as a basis for policy making. A single metric of relative adaptive capacity cannot fully capture the unique attributes of each regional community. Further, the metric does not predict the likely outcome of a region to a shock, which is based not only on the region's adaptive capacity but also the nature of shocks it faces, the options available to people affected, and the decisions that they make.

4.2   Some emerging themes of adaptive capacity

A map of the results of the index is shown in figure 4.2. Regional communities that are likely to have the lowest relative adaptive capacity (about 17 per cent of all regions[24]) are predominantly located outside of greater capital city regions and concentrated in outer regional and remote/very remote areas of Australia. These regions are generally located across the inner parts of Australia (South Australia and the Northern Territory) and across much of Tasmania.[25]

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[24] Those regions classified as 'least adaptive' are those with a relative adaptive capacity value that is more than one standard deviation below the mean relative adaptive capacity for all regions. There are 13 regions in this category.

[25] There are also two regions incorporating parts of the east coast of Australia in the least adaptive capacity category (Bundaberg and Gympie, in Queensland). The primary reason for their low score is due to low measures of human capital. Other regions with low adaptive capacity also tend to have lower measures of human capital.

Figure 4.2   **Relative adaptive capacity of Australia's regions[a]**

Least adaptive
Below average
Above average
Most adaptive
Not estimated
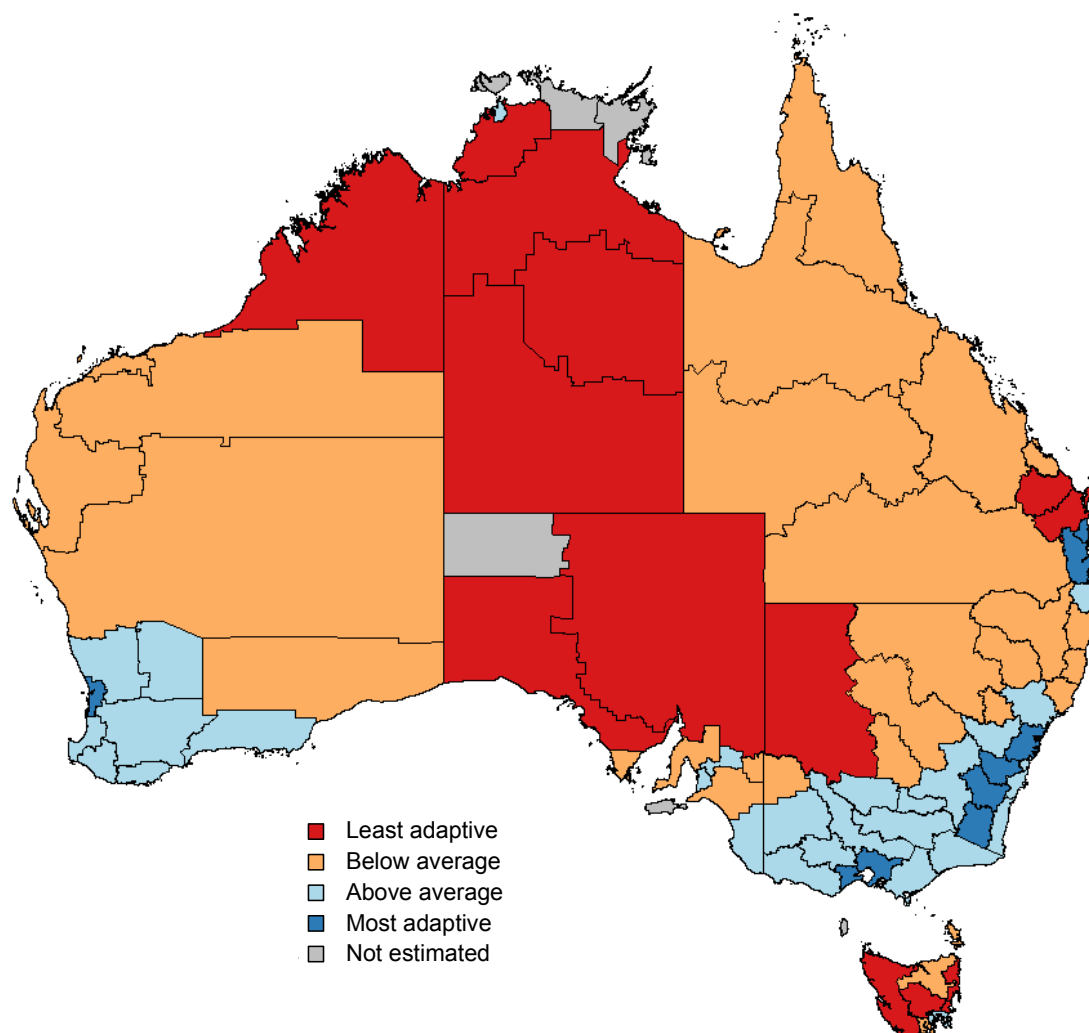
a Regions are defined using functional economic regions. 'Not estimated' regions were excluded from the analysis due to insufficient data. Least (most) adaptive regions are defined as those below (above) one standard deviation of the mean index value of adaptive capacity across all regions.

Source: Productivity Commission estimates.

Many of the regional areas with above average adaptive capacity are located in areas in Victoria, New South Wales and Western Australia. All metropolitan cities have at least above average adaptive capacity.

In total, 90 per cent of regions in Victoria have at least above average adaptive capacity. This contrasts starkly with South Australia, the Northern Territory, Tasmania and Queensland, where between 17 per cent and 33 per cent of their regions have at least above average adaptive capacity. Just over half of the regions in New South Wales and Western Australia have at least above average adaptive capacity.

Index of relative adaptive capacity and population

Although maps are useful to illustrate the geographical spread of the adaptive capacity of regions, they do not convey the number of *regions*, or the number of *people*, within the least adaptive category of regions.

The proportion of regions, by number, that are remote and very remote is higher among the least adaptive category when compared with all regions (figure 4.3). Nearly half of the regions in the least adaptive category are remote or very remote. In contrast, no major cities are in the least adaptive category.[26] Similarly, the share of the population living in the least adaptive regions in remote and very remote areas is higher than the share of the population living in remote and very remote areas overall.

Although very remote regions cover large areas of Australia, they are sparsely populated compared with major cities and smaller urban and regional areas. Indeed, most Australians live in capital cities (section 3.4), with levels of population in regions declining as remoteness increases.

Because the outer regional and remote regions are sparsely populated, there are few people living in the least adaptive regions (figure 4.3). In contrast, although major capital cities are few in number, the population living in major cities is large.

In total, about 659 000 Australians live in the least adaptive regions, representing 3 per cent of the total population. In contrast, there are nearly 16 million people who live in the most adaptive regions (66 per cent of the population) (figure 4.3). The most adaptive regions are concentrated in major cities. This does not mean there are not pockets in cities where adaptability is low — as discussed in chapter 3, some areas within cities are characterised by high concentrations of people with low skills and are vulnerable to, for example, declining manufacturing employment. However, these sub-regions are located within major city areas that are typically associated with diverse industry structures, more highly educated and skilled workers, and have good access to services and infrastructure (all factors that positively contribute to the adaptive capacity of the city as a whole).

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[26] Regions have been classified based on the remoteness areas structure in the Australian Statistical Geography Standard for Statistical Area Level 2 areas, aggregated to the functional economic region level by weighting by population. There are four categories of regions. These are: major cities (which includes most capital cities and their greater metropolitan areas, as well as the Gold Coast); inner regional areas (such as Hobart, Canberra and Geelong); outer regional areas (such as Dubbo, Townsville and Darwin); and remote and very remote areas (such as Port Hedland – Newman, Karratha and Eyre Peninsula).

Figure 4.3   Regions and population by relative adaptive capacity and remoteness

**Remote and outer regional areas feature strongly
in the least adaptive category...**

... but very few people live in the least adaptive regions
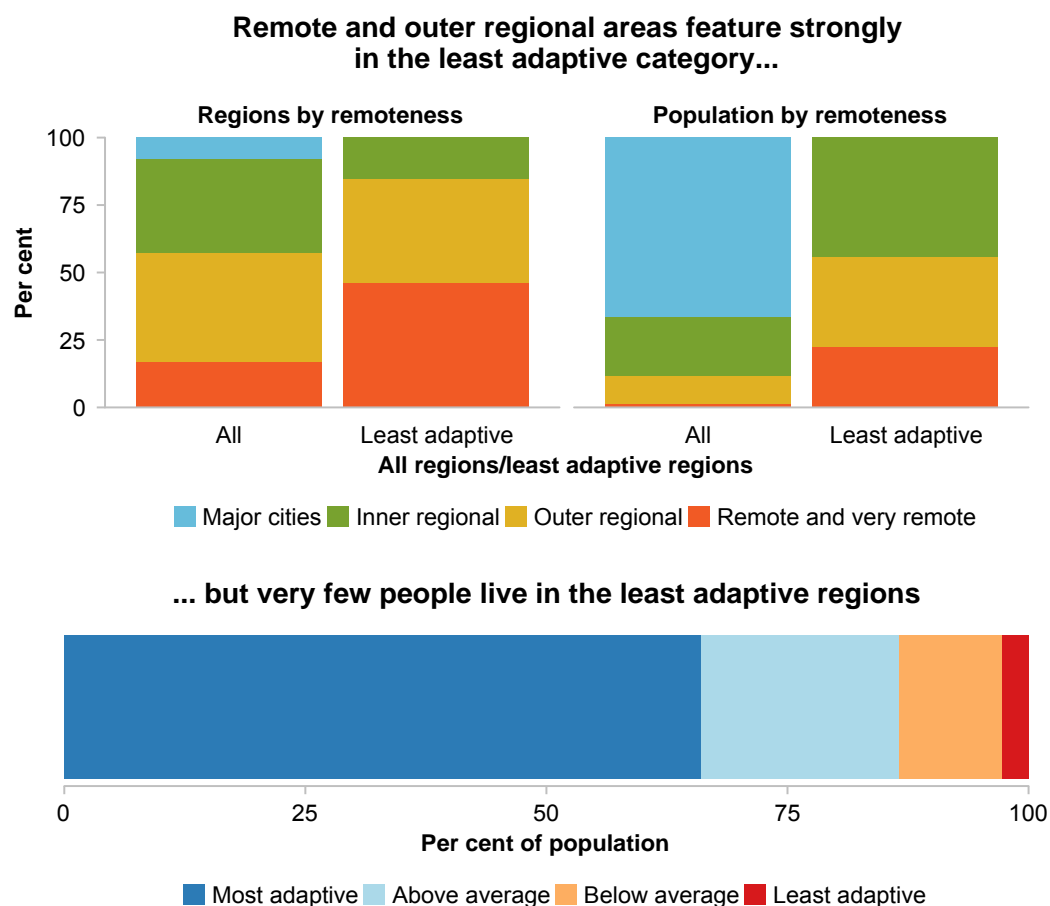
Source: Productivity Commission estimates.

FINDING 4.2

The proportion of regions in the least adaptive category increases with the degree of remoteness. About 659 000 people (or 3 per cent of the population) live in the least adaptive regions. In contrast, nearly 16 million people (66 per cent of the population) live in the most adaptive regions, which are concentrated in major cities.

Factors affecting regional rankings of adaptive capacity

There is no simple explanation for why the adaptive capacity of communities varies so markedly. Although the index value for each region is driven by the many factors included in the index, people-related factors (including education, skills, employment and incomes) appear to have a strong influence, particularly for communities in urban areas. For

communities in remote areas, these and other factors associated with remoteness, such as accessibility to services and infrastructure, have the strongest influence.

Overall, communities in cities and inner regional areas have the highest capacity to adapt, largely due to their connectivity with other regions and markets, and the diverse skills and higher education levels of their workforce. Where inner regional areas have more limited adaptive capacity, this is frequently attributable to general social and economic disadvantage.

Remote areas with low relative adaptive capacity are typically those with limited access to resources that underpin economic and social wellbeing. Access to infrastructure and services is more limited in these areas and people within these communities have lower levels of education and fewer employment opportunities.

Youth engagement in work or study is particularly low in remote and very remote communities (regardless of adaptive capacity) — 47 per cent on average compared with 65 per cent for all other types of regions. Low youth engagement can mean greater risk of unemployment and cycles of low pay and employment. Youth engaged in work or study may reflect both opportunities as well as people's intrinsic motivation to pursue these opportunities (DIRD 2015a).

Another story emerges when examining the main sources of economic activity in the regions that have been found to have the lowest adaptive capacity (figure 4.4). For inner regional areas with the lowest adaptive capacity, government services are the main source of employment. As remoteness increases for the least adaptive regions, agricultural employment begins to play a more prominent role. In inner regional and outer regional areas with the lowest adaptive capacity, the government services that are the main source of employment are health care and social assistance.[27] In remote and very remote regions with low adaptive capacity, both health care and social assistance and public administration and safety are the main government services people are employed in. (The reasons why some agricultural regions have low adaptive capacity are discussed later.)

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[27] Government services include public administration and safety, education and training, and health care and social assistance, but may also include people employed in these industries from the private sector. The other services in figure 4.5 are accommodation and food services.

Figure 4.4   **Main source of employment for the least adaptive regions by class of remoteness**
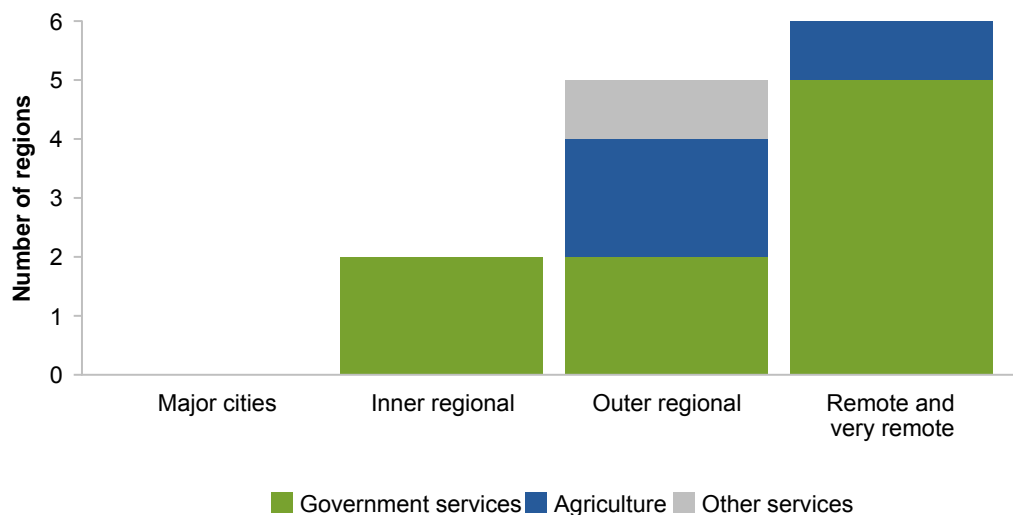
FINDING 4.3

The main factors shaping the index value of relative adaptive capacity for each region relate to:

- people-related factors (including educational achievement, employment rates, skill levels, personal incomes and community cohesion)
- the degree of remoteness and accessibility of infrastructure and services.

Most mining regions have below average adaptive capacity

There is considerable interest (as reflected in the terms of reference for this study) in considering whether regions affected by the resources investment boom are likely to be at risk of failing to adjust.

Those functional economic regions that have a relatively high share of employment in mining have below average adaptive capacity, as assessed using the relative adaptive capacity index. They include larger population centres in the Pilbara, such as Karratha and Port Hedland, as well as Mackay and Mudgee.

As noted by James Cook University (sub. 24, p. 5), classifying regions based on common characteristics potentially enables inferences in data-poor areas, however there is a risk that incomplete or incorrect data could lead to 'wrong' typologies. The unique attributes of regions means that seemingly similar towns or regions may experience very different

development paths due to small differences. This is apparent in the experiences in Nhulunbuy (in the Northern Territory) and Weipa (in Queensland) (chapter 3).

That said, some common factors have been identified which have a negative impact on the adaptive capacity of mining regions. These relate primarily to natural assets, and the characteristics of the communities in the region as well as concentration of employers and activities.

Regions with mines that have high cost structures (and that are therefore only economically viable during periods of relatively high commodity prices) face challenges from cyclical downturns. For example, in the Kimberley region of Western Australia, three mines that accounted for 30 per cent of gross regional product when iron ore prices were at their peak are now in care and maintenance (chapter 3).

Natural assets present both opportunities and risks for mining regions. Mining provides opportunities for employment within these communities. Some of the towns in these regions may not exist were it not for the mineral endowments in the area. Indeed, some towns were developed solely to service the mining industry, and a number of these have since been abandoned.

> The new towns built to service the mining industry in the 1960s and 1970s were located immediately adjacent to the major resources (e.g. Tom Price and Mt Tom Price, Newman and Mt Whaleback, Leinster and Leinster Nickel Operations) and the port facilities (e.g. Dampier and Dampier Port, Wickham and Cape Lambert). Some towns that were located near resources that have become exhausted have subsequently been removed entirely — such as Goldsworthy and Shay Gap. (Chamber of Minerals and Energy of WA, sub. 28, p. 18).

However, a lack of diversity can present a challenge as it leaves the communities exposed to disruptions that could negatively impact the value of mining activity and lead to the collapse of economic activity that was once feasible in the region. This is reflected in the estimation of the metric — as the share of mining employment increased, it had a more negative contribution to the index.[28]

Another characteristic that has a negative contribution to the metric for most mining regions is social capital. Indicators such as rates of volunteering, self-assessed feelings of safety at night and discrimination are worse across most mining regions.

There are some differences in people–related factors across mining regions. For instance, Karratha and Port Hedland are characterised by having relatively high human capital (in particular, high education, employment and participation, and trade skills), which are all associated with higher adaptive capacity. The Western Australian Department of Regional Development (sub. 27, p. 5) noted that improved social and community infrastructure in the Pilbara, particularly Port Hedland and Karratha, 'is encouraging people to stay in town,

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28 Although a higher concentration in mining had a negative impact on the metric, this was not always the case for concentrated employment in general. Employment in agriculture had a small positive impact on the metric, though industry diversity had a small negative effect.

educate their children locally and plan a future in the region'. Other mining regions have lower human capital, which reduces their adaptive capacity.

Although Karratha and Port Hedland have higher human capital outcomes, their adaptive capacity is lowered, partly because they have relatively low financial capital. Despite having high household incomes, these regions tend to have low investment incomes and low home ownership.

Although mining regions are exposed to commodity cycles, and most were assessed as having relatively low adaptive capacity, many have proven to be sustainable in the longer term where there are secure resources that can be mined economically. As noted in chapter 3, regions (such as the Pilbara) that have a comparative advantage in markets for minerals and commodities have benefited from significant investments in new projects and expansions during the investment boom. This will likely provide an economic and employment base in these regions for decades to come, largely irrespective of commodity market cycles. As noted earlier, employment in many mining regions is higher than before the commencement of the mining boom.

The adaptive capacity across agricultural regions is very diverse

In total there are 22 regions with a relatively high share of employment in agriculture. As discussed in chapter 3, these agricultural regions have diverse characteristics. They are located from across Western Australia through to the East coast. While some are located in inner regional areas (for example Warrnambool), many lie in outer regional and remote/very remote areas.

The adaptive capacity scores across agricultural regions are diverse. Three agricultural regions are in the lowest adaptive capacity group, with the remainder roughly evenly split between having below average or above average adaptive capacity.

Many factors contribute to the diversity of adaptiveness across agricultural regions.

Most of the agricultural regions with above average adaptive capacity (five of the nine) are located in Western Australia. As noted in chapter 3, agricultural regions in Western Australia (especially in the Wheat Belt) recently performed better than other agricultural regions, on measures such as income growth. And financial capital is one of the key indicators where there is a noticeable difference between those agricultural regions with relatively low or high adaptive capacity. Agricultural regions with the highest adaptive capacity tend to have higher rates of home ownership and less housing stress. They also have higher household incomes, investment incomes and relatively few recipients of government pensions and allowances.

As noted in chapter 3, there has been an ongoing agglomeration in agricultural areas towards regional centres that are better serviced and connected. These factors are important for adaptability. For instance, those agricultural regions that have relatively low adaptive

capacity are typically associated with being in remote areas and having poor access to transport.

People–related factors also differ between those agricultural regions with relatively low adaptive capacity and those with above average capacity. Although as noted above, these factors are important across all regions.

Finally, social capital is important. The loss of key leadership skills and the ongoing challenges agricultural regions face as community leaders leave a region was noted in chapter 3. Agricultural regions with higher adaptive capacity typically display higher volunteering rates and better perceptions regarding being safe at night. The role that volunteering plays in supporting communities respond to challenges was noted by the Rotary Club of Traralgon Central Inc. (sub. DR50, p. 1):

> Volunteer organisations cover a wide range of social, physical, spiritual and mental (educational) fields. Whilst not at the top of the list in economic terms, a significant part of the response to human stresses and challenges is met by the aggregated support and effort of volunteers, providing a positive effect in supporting families.

Similarly, Volunteering Australia (sub. DR61, p. 2) stated that volunteering is crucial in 'building strong and resilient communities, by encouraging economic participation, mitigating isolation and loneliness, and increasing social inclusion, community participation and cohesion'.

5 Strategies for successful transition and development

> **Key points**
>
> - Governments can best facilitate regional transition and development by ensuring that their policies and regulations do not unnecessarily impede the forces of progress and change.
>   - Streamlining regulations in areas such as planning and development would make it easier for business owners (potential and existing) to find new sources of income and growth.
>   - Removing hindrances to workers and business owners taking up opportunities in other occupations, activities and locations by promoting mobility and flexibility is also important.
> - Governments should avoid providing ad hoc financial assistance to regions, which is often ineffective in facilitating transition and development.
>   - There is substantial public expenditure on regional programs by all governments. The effectiveness of these programs is often unclear, and there is evidence of inadequate processes for project selection, implementation and evaluation.
> - Primary responsibility for regional development policy is — and should remain — with State, Territory and local governments. The Australian Government should focus on national economic development. The Australian Government's role in regional development policy should be limited and supportive of State and Territory governments, including in response to extreme events in particular regions.
> - At the State and Territory government level, more rigorous and transparent assessment of regional initiatives, underpinned by stronger arrangements for regional planning, is critical to improve outcomes for regional communities from government expenditure.
>   - State and Territory governments (in consultation with local governments) should develop definitions of regions based on functional economic regions to inform transition and development in regions.
>   - State and Territory governments should also nominate an entity with sufficient capacity to develop and publish a strategic plan for each region. That plan should assess the region's capabilities and identify priorities for transition and development.
>   - Discretionary funding for regional development should be directed to the priorities identified through these strategic plans, with priorities justified by rigorous cost–benefit analyses.
> - Where a regional community has experienced severe, pervasive and persistent changes, such that there is a strong likelihood of it becoming permanently disadvantaged, specific assistance may help ease the transition for vulnerable individuals.
> - Public service decentralisation is generally a costly and ineffective way of promoting regional development. Government efforts are better directed toward improving the planning and delivery of infrastructure and government services.

Despite significant and systemic changes across Australia's regions, most have continued to grow and prosper. History shows, however, that the factors underpinning regional activity do change and that some regions will inevitably decline. Good policy needs to recognise this reality in supporting regions to adapt to changing circumstances.

The focus of this chapter is to provide guidance on how the principles set out in chapter 2 can be implemented to support regional development and transition. In doing so, it highlights three main priorities:

- removing regulatory impediments to growth

- improving the effectiveness of regional planning and expenditure

- identifying those rare occasions where specialised transition assistance may be appropriate.

In his 10th satire, the Roman poet Juvenal wrote that the populace no longer wanted important facilities such as aqueducts, roads and sewers, instead preferring bread and circuses (panem et circenses). This desire for large projects (such as stadiums for entertainment) continues to this day, as governments in all jurisdictions announce — frequently without consulting the local community — major projects that have not been subject to rigorous and transparent cost–benefit analysis. These are also inferior to many projects that could help grow a region's economy, such as maintenance and modest improvements to existing infrastructure over time. This is sometimes referred to as a 'ribbon cutting' problem: governments naturally want to be seen to be doing something, and modest improvements or day-to-day governance are not as exciting or visible as a large and 'visionary' project. Transparent analysis of the various options can help demonstrate net benefits from smaller projects to the community and build its understanding of opportunity cost and the risks of gambling on major projects to resolve the underlying problems faced by many of Australia's regions.

5.1 Removing unnecessary impediments

All governments can facilitate regional transition and development by removing obstacles that reduce flexibility and discourage people and business owners from taking up opportunities. Governments can do this by:

- removing unjustified or excessively burdensome regulations that get in the way of business owners developing or adopting new products or services, accessing new markets, or working more efficiently

- removing unnecessary impediments to people gaining new skills and finding employment in more profitable and viable industries or occupations.

This creates an environment conducive to employment and growth in regional communities and facilitates movement of labour and other resources between regions.

Removing unnecessary impediments to doing business

Previous Commission studies have identified unnecessary impediments facing business owners, including regulations that are inflexible or that have not kept pace with technology and other changes in the way businesses operate (box 5.1).

Impediments to more efficient use of land

Planning, zoning and development processes were cited by participants as a major impediment to regional adaptation and growth. Participants reported that complex and excessively prescriptive arrangements impose costs and delays on businesses seeking to expand, become more innovative, or take up new opportunities. For example, Regional Development Australia Pilbara submitted that:

> The high cost of approvals, permits and licences for development in the mining sector continues to impose a constraint to development. Recently, the proprietors of the Roy Hill iron ore development in the West Pilbara stated that thousands of approvals, permits and licences were required to develop the mine. (sub. 6, p. 25)

Overly onerous environmental regulation or 'green tape' can also impose excessive costs and inhibit development (Minerals Council of Australia, sub. DR80, p. 31).[29] For example, Cairns Regional Council and Advance Cairns argued that:

> Realisation of opportunities in the Cairns region are variously being held back by extreme environmental policies … Major additional costs … are currently being imposed on the urgently needed deepening of Cairns seaport to take increasing size of ships needing to use the port, by requiring on-shore placement of dredged material. The cost of upgrading the Kuranda Range Road, Cairns' main westward link in the region has been 'blown out' by excessive costs of meeting extreme environmental parameters. (sub. 13, pp. 45–46)

Restrictions on alternative land uses can also undermine the capacity of regional businesses to expand or improve productivity through investment and innovation. The Western Australian Local Government Association submitted that:

> … the planning regime can act as a constraint on development, particularly in the case where new activities are not permitted land use under the existing Local Planning Scheme. … in situations where the development activity does not fall within the permitted uses, this will require the Scheme to be amended. Typically, the process to review and adopt a new Local Planning Scheme to accommodate land uses not covered previously has been unwieldy and time consuming. This can act as a barrier to new development and the diversification of the economy. (sub. 22, pp. 19–20)

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[29] Also discussed in the Commission's Regulation of Agriculture inquiry report (PC 2016c).

Box 5.1 Regulatory impediments affecting regional businesses

Planning, zoning and development processes

Planning, zoning and development regulatory processes can be a costly barrier to business entry and investment (PC 2011, 2015b) and can be complex, excessively prescriptive, and often anticompetitive (PC 2014e, p. 2, 2017b, p. 122). In agriculture, planning and zoning regulations often stifle innovation and impede farm businesses from becoming more efficient (PC 2016c, p. 57). In tourism, State and Territory governments' development assessment frameworks can 'impose unnecessarily high costs and delays', partly due to duplication across governments (PC 2015a, p. 22). Recommendations to address these issues include:

- a greater emphasis on strategic land use plans (integrated across levels of government) to promote consistent decision making and simplify development assessments

- broad, simplified zoning definitions and development control instruments

- explicitly linking development assessment criteria to stated policy objectives

- a risk-based or 'track' system for development assessments, where development applications are subject to different levels of scrutiny in proportion to the degree of likely impact or risk (PC 2017b, p. 148)

- statutory timeframes for ensuring timely assessments (PC 2011, p. xlix)

- removing restrictions on land use from pastoral leases (PC 2016c, p. 35)

- applying competition policy principles to land use regulations and policies (PC 2017b, p. 146).

Environmental regulation

The complexity and cost of environmental regulation is evident in native vegetation and biodiversity conservation regulations, which can have unnecessary costs on farm businesses and limit farmers' capacity to adapt and improve productivity. Complex, inflexible and duplicative regulations are responsible for this excess regulatory burden (PC 2016c, p. 105).

Other agriculture-related regulation

Agriculture is a key sector for many regions (chapter 3). There would be benefits in streamlining or removing regulations that impede farm businesses from using more efficient production techniques, attracting investment, and taking advantage of new technologies, such as through:

- more consistent and streamlined arrangements for regulating heavy vehicle road access (PC 2016c, p. 345)

- increasing the screening thresholds for examination of foreign investments in agricultural land and agribusinesses by the Foreign Investment Review Board (PC 2016c, p. 527)

- removing moratoria on genetically modified crops (PC 2016c, p. 24).

There is also scope for improving the way in which landowners are compensated for mining and exploration activities undertaken on agricultural land. For example, this can involve efforts to reduce transactions costs and improve transparency for landholders and gas companies in negotiating agreements relating to coal seam gas mining (PC 2015c, pp. 85–86).

As an example, under the Local Planning Scheme for the Shire of Chittering (Western Australia), 'agricultural resource' zoned land cannot be used for developing aged care accommodation, amusement facilities, car parks, convenience stores, fast food outlets,

garden centres, hotels or motels, medical centres, resorts or service stations (WA DP 2017, pp. 54–56).

The quarantining of land for coal mining in the Latrobe Valley is one instance in which planning policy may be impeding development and adaptation in Victoria (box 5.2).

Box 5.2   Coal reserves and land use planning in the Latrobe Valley

The Victorian Government has identified the Latrobe Valley's brown coal reserves as a resource of state significance, protected under state planning policy. Its *State Planning Policy Framework* (clause 14) stipulates that land use planning in the Latrobe region should:

> Protect the brown coal resource in Central Gippsland by ensuring that:
>
> - Changes in use and development of land overlying coal resources … do not compromise the winning or processing of coal. (Vic DELWP 2017a, p. 104)

Accordingly, the Gippsland Coalfields are subject to State Resource Overlay 1 under the Latrobe Planning Scheme. Applications to develop land affected by this overlay are assessed with regard to 'the need to ensure development of the land does not inhibit the eventual development and use of the coal' (Vic DELWP 2017a, p. 498).

These arrangements have restricted alternative land uses in the Latrobe region, as observed by the Latrobe City Council (2016, pp. 3–6). The Council cited several examples in which plans to develop land have been thwarted by the overlay (Latrobe City Council, sub. 35). For example, it cited the Gippsland Heavy Industry Park site as ideally suited to various heavy industries due to its size, topography and separation from neighbouring residential areas. However, the State Resource Overlay has prevented 'non-coal or energy related investments' on this site (Latrobe City Council, sub. 35, attachment, p. 7).

A further issue raised relates to Indigenous land, and the scope for development of such land by or with Indigenous communities. James Cook University (sub. 24) considered that regulatory arrangements relating to land tenure impede Indigenous Australians from gaining the full economic benefits of their land. These concerns were echoed in a 2015 report prepared for the Council of Australian Governments, which recommended that Australian governments streamline native title processes to enable Indigenous owners to use their land for economic development and to raise capital for investment (Senior Officers Working Group 2015, p. 3). In its *White Paper on Developing Northern Australia*, the Australian Government (2015, p. 11) committed to improving the efficiency of native title processes to better enable Indigenous land to be used for economic purposes.

Labour shortages and impediments to the use of temporary workers

Regulatory arrangements in relation to temporary migrant workers can also create impediments for mining and agricultural businesses (chapter 3). Although temporary skilled migrants account for a small fraction of the mining workforce, over 90 per cent of them are highly skilled workers (Minerals Council of Australia, sub. DR80, p. 38). As a result, the

Minerals Council of Australia expressed concern that recent changes to Australia's temporary skilled migration arrangements:

> … present considerable barriers to accessing and developing global leadership and technical talent in mining organisations operating in Australia and overseas. The additional introduction of new 'more targeted' occupation lists … was done without consultation and consideration of the business environment and have resulted in immediate impediments to the mining industry accessing crucial professional, management and technical skills. (sub. DR80, p. 38)

Many farm businesses hire temporary migrants to fill labour shortages, mostly through the Working Holiday Maker, Seasonal Worker and Temporary Work (Skilled) (subclass 457) visa programs (chapter 3). Excessive compliance costs and administrative complexity within temporary migration programs can impede farm businesses' ability to employ temporary migrant workers (PC 2016a, pp. 381–382, 2016c, p. 30). The adoption of the recommendations of an independent review of the subclass 457 program (Azarias et al. 2014) would address some of these concerns (PC 2016a, p. 369, 2016c, p. 443).

In addition, some previous inquiry participants expressed concern about the impact of changes to the tax status of Working Holiday Makers on farmers' ability to fill seasonal labour shortages. The Australian Government's Seasonal Worker Incentive Trial, introduced from July 2017, may help to address this issue. The trial aims to encourage job seekers to take up short-term placements to earn additional income, without affecting income support payments (Department of Employment, sub. DR75, p. 11).

Removing unnecessary impediments to pursuing new opportunities

There are many reasons why people may not take up job opportunities that require them to change occupations or locations. These include personal and social reasons, such as family commitments, lifestyle preferences, a region's social infrastructure and amenities (RAI, sub. 12, pp. 15–16) and the costs of relocating. Changing occupations may also require workers to undertake education or training.

There are also regulatory arrangements that can make it more difficult for people in regional communities to pursue employment or training opportunities (box 5.3) and barriers that act to reduce mobility of workers and their families. These include:

- occupational licensing requirements, particularly where there are different licensing schemes across states and territories — as noted by the Regional Australia Institute (sub. 12, p. 17). The Commission found that occupations such as tradespeople, real estate agents and other building-related occupations are governed by jurisdictional occupational licensing, which can 'impose a barrier on individuals who are considering working interstate' (PC 2014b, p. 275)

- land use planning restrictions (contributing to a lack of affordable housing) and stamp duty (increasing the cost of buying property and/or reducing the price received when selling property) — which can discourage people from moving to take up job opportunities (PC 2017b, p. 149).

> **Box 5.3   Regulatory impediments to moving between regions**
>
> **Occupational licensing**
>
> In its reviews of the operation of the Mutual Recognition Agreement (which enables licensed workers to work in different jurisdictions), the Commission recommended expanding the use of automatic mutual recognition to increase geographic labour mobility (PC 2015e, pp. 13–15). Australian Heads of Government and the New Zealand Prime Minister expect that the Cross Jurisdictional Review Forum will present a response to the report's findings (DET 2017). However, two years after the report's release, this meeting has not yet taken place, nor is there any public indication of when it will occur.
>
> **Housing**
>
> Participants in the Commission's *Geographic Labour Mobility* study cited insufficient housing supply and a lack of affordable housing as barriers to geographic labour mobility (PC 2014b, pp. 22–23). Two regulatory areas were frequently cited as contributing to distorted housing costs:
>
> - inefficient land use planning processes and the delayed release of land for residential development, which can limit housing availability
>
> - stamp duty, which imposes additional costs on property transactions and discourages the buying and selling of property.
>
> The study also noted that tax arrangements that create a 'bias towards home ownership' (such as the capital gains tax exemption for the family home) could potentially impede labour mobility, as 'home owners are less likely than renters to move' (PC 2014b, p. 271).

Removing such barriers would enable people in regions to make better use of their existing resources. For instance, removing impediments to re-employment in other industries or occupations allows people to put their skills and knowledge to new uses. Removing unnecessary planning and development barriers also enables business owners to direct their financial resources to more profitable ends.

In some cases, barriers may exist in the form of inadequate information about alternative employment and business opportunities. Industry bodies and governments can help to remove this impediment by 'providing adequate information on changes in labour market and business environments to stakeholders across regions' (RAI, sub. 12, p. 16). Some Australian Governments already provide such information online, such as in the South Australian Government's WorkReady website (SA DSD 2017) and the Australian Government's Job Outlook website (DoE 2015).

The Commission has previously made recommendations on leading regulatory practices. These include having simple, streamlined and transparent regulatory processes, strong community engagement in overall regional planning (so that less consultation is required for development proposals), and coordination between regulators to avoid duplication (PC 2011, 2012a, 2013). Many of these practices have not been fully implemented (PC 2015b, 2017b). Implementing these recommendations would help to remove impediments to entrepreneurial activity in regional communities and foster an environment where people and business owners can more easily adapt to changing economic circumstances.

Governments can primarily facilitate successful development by removing unjustified or excessively burdensome regulations that impede people and businesses from taking advantage of opportunities. Significant benefits would arise from expediting regulatory reforms in land use planning and development, environmental, agriculture-related regulation and occupational licensing.

These 'win-win' reforms benefit all regions but are particularly important to regions that do not have the advantages and range of opportunities found in capital cities and major regional centres.

5.2 Improving the effectiveness of planning and expenditure for regional development

Government expenditure and investment in regions is insufficiently transparent and is often poorly considered. First, it is unclear whether the overall amount of taxpayer funds dedicated to regional development is optimal. Governments have spent, and continue to spend, large amounts of money on regional programs (chapter 2). The Commission has not assessed the benefits of, and is not endorsing, the overall amount of regional spending.

Second, there is evidence that expenditure decisions have generally not been adequately informed by robust regional planning. Many plans and strategies have been developed, but the significant funding that has been directed to regions is not always linked to the strengths and priorities of communities. Adding to this, regional initiatives and projects have suffered from inadequate assessment, selection and independent evaluation. As such, there is a compelling case to improve the effectiveness of planning and expenditure in regions.

Issues associated with expenditure and investment decisions

There is also evidence that raises questions about whether these programs have successfully met their objectives and achieved value for money, and whether there is scope for governments to use regional funding more effectively. Furthermore, there is evidence to suggest that much of the expenditure on regions has not been well planned or evaluated.

Unclear and conflicting objectives of regional programs

A crucial starting point in targeting regional programs involves governments clearly identifying what such programs are intended to achieve, and the policy problem they are designed to solve. Governments have established regional programs to achieve various objectives, including:

- promoting a region's economic development and employment growth

- providing infrastructure and services that are also provided to metropolitan areas

- addressing differences in the cost of service delivery, such as through differential funding for local governments, and subsidies for services such as telecommunications

- repairing or maintaining infrastructure and services, particularly where these have deteriorated in quality or their capacity has not kept pace with population growth.

As these objectives suggest, government expenditure on regional programs does not necessarily constitute special treatment. Many programs badged as 'regional' are intended to provide similar services to those available in capital cities, to replace inadequate or deteriorating infrastructure, or to respond to increased demand for services.

However, many regional programs conflate service delivery and development objectives (Daley 2012, p. 3). Further, governments have approved and funded individual projects that either do not clearly specify their objectives or are not aligned with the overall goals of their 'umbrella' program. For example, in a report on the WA Royalties for Regions program, the Auditor-General noted that the program had six objectives and not all projects funded through the program were clearly aligned with one of these six objectives (OAG 2014, p. 6).

Multiple objectives for regional expenditure makes it difficult to assess whether government funding has been successful in achieving its goals, and indeed whether the goals relate to a clear policy problem.

Investments in regional projects have not always followed good processes

Regional programs have not always been well targeted, often due to inadequate project selection and assessment processes. Compounding this, a lack of evaluation makes it difficult to gauge whether these programs have achieved their objectives cost-effectively.

Assessments of regional funding initiatives by State and Commonwealth audit offices have revealed a number of problems with the processes used to select and fund regional projects (box 5.4). For example, the Victorian Auditor-General noted that many of the assessments of major economic infrastructure projects funded from the Regional Growth Fund were subjective and lacked evidence upon which to base funding decisions. In a review of the Royalties for Regions program, the WA Auditor-General found that it was unknown whether the projects would deliver long-term benefits for the communities, due in part to inadequacies in the selection, monitoring and evaluation of the projects.

Box 5.4 Examples of inadequate project assessment and evaluation

Regional Growth Fund (Victoria)

The Victorian Auditor-General's Office (2015) found evidence of a lack of transparency and rigour, as well as inadequate monitoring, evaluation and performance reporting, in the Victorian Regional Growth Fund (RGF), which provided about $570 million in regional grants during 2011–2015.

> Weaknesses in the design and implementation of the RGF mean that the Department of Economic Development, Jobs, Transport & Resources (the department) cannot fully demonstrate that value for money and the goals and objectives of the RGF have all been achieved. (VAGO 2015, p. x)

For example, the audit found that the $295 million Economic Infrastructure Program kept no documentation of the pre-application process. In the context of a non-competing grant funding model, this absence of documentation contravened best practice guidelines and made it 'difficult to ascertain if [Regional Development Victoria] funded the best available projects' (VAGO 2015, p. 19).

The audit also highlighted significant discrepancies in reporting of employment outcomes:

> … Monitoring and reporting activities primarily focused on jobs and investment leveraged. However, the figures reported are potentially misleading … Reported job numbers primarily relate to expected, rather than actual jobs created. (VAGO 2015, p. x)

> Of the total 6023 jobs expected to be directly created by the RGF, only 167 jobs have actually been achieved based on the projects completed so far. (VAGO 2015, p. 34)

Furthermore, the Auditor-General noted that many of these problems were attributable to the Victorian Government not having fully addressed the recommendations in its 2012 audit of the Provincial Victoria Growth Fund (VAGO 2015, p. 23).

Royalties for Regions (Western Australia)

The Western Australian Auditor-General reported a number of problems with Royalties for Regions (RfR) project selection, monitoring, benchmarking and evaluation (OAG 2014).

- Projects were submitted for Cabinet approval that did not clearly indicate outcomes to be delivered or demonstrate long-term sustainability.

- Since 2009, the Department of Regional Development (DRD) had been developing indicators to benchmark and measure the impact of projects against the six RfR objectives, but these had still not been implemented.

- Not all RfR projects were clearly aligned with one or more of the six RfR objectives, and only half of project business cases reviewed complied with the DRD's requirement to include specific and measurable outcomes.

- At the time of audit, the DRD had completed only seven evaluations of RfR projects, and these only reported on outputs delivered, rather than on whether they met their intended outcomes.

- The DRD had no monitoring system to oversee the progress of individual projects and of the overall program, despite over 3500 projects having been approved (at the time of audit).

It concluded that 'what long term benefits these projects were expected to deliver and how projects are actually contributing towards achieving the RfR objectives is essentially still unknown' (OAG 2014, p. 5).

With respect to Queensland's Royalties for the Regions program, the Queensland Audit Office concluded that it was not clear whether the projects that were funded 'represented the optimal mix and so, best value for money', or 'whether investing in other projects with relatively greater merit would have been a better use of scarce public resources' (QAO 2015, p. 2). The Office found weaknesses in the processes used for assessing grant applications, and reported that ministerial decisions were made to fund projects found to be inferior by departmental assessments (or projects where no assessment had been undertaken), with inadequate documentation of the reasons for these decisions.

In reviewing the third and fourth rounds of the Regional Development Australia Fund, the Australian National Audit Office found an 'absence of alignment or a clear trail between the assessed merit of applications against the published selection criteria' and funding decisions (ANAO 2014, p. 16). The auditor reported that 27 per cent of grant applications that were approved for funding (representing almost half of the total $225 million funding) had not been recommended by the advisory panel tasked with assessing applications (ANAO 2014, p. 15). It noted that this situation was similar to that found in an earlier audit of the first round of the Fund, arguing that 'the recommendations made in the first audit, agreed by the department, had not been implemented by the department' (ANAO 2014, p. 16).

As noted by Regional Development Australia Far North:

> Both the State and Federal Governments have had various grants and funds available in the region over the last 20 years. These grants and funding have provided mainly short term opportunities in the form of new infrastructure and programs, with a few of them providing opportunities for longer term outcomes including employment. (sub. 9, p. 11)

Some regional programs may also have had unintended consequences for the communities they were intended to benefit, such as by affecting their capacity to maintain their infrastructure assets. New infrastructure can impose significant ongoing operational and maintenance costs, especially for local governments.[30] In some cases, local governments have found themselves responsible for ongoing costs associated with infrastructure investment decisions into which they had little input or consultation (box 5.5). It is crucial that ongoing costs are explicitly estimated and reported, and plans made for how they will be funded, before governments commit to new investments. If not, there is little prospect of realising the Commission's hope that 'white elephants … become an endangered species' in Australian public infrastructure (PC 2014d, p. 36).

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[30] Centre of Full Employment and Equity, University of Newcastle (sub. DR44, p. 14); Shire of Victoria Plains (Western Australia) (sub. DR49, p. 1), Western Australian Local Government Association (sub. 22, p. 21).

Box 5.5   **Ongoing costs of regional infrastructure investment**

Latrobe City Council

On 10 March 2017, the Victorian Government announced investments in new sporting facilities in the Latrobe City Council region worth $85 million. Included was $46 million for a new Gippsland Regional Aquatic and Leisure Centre in Traralgon (Andrews 2017a). Although the local community has advocated for a new swimming pool (Chambers 2015a), based on the absence of publicly available information, it appears that there was no public consultation with the local community or Latrobe City Council prior to the announcement. The Victorian Government has committed to funding the upfront capital cost. It is unclear whether the proposal has committed the Latrobe City Council to ongoing expenditure, and if so, its order of magnitude. The lack of transparency and public consultation raises questions about whether or not the specific announcement delivers the best possible value for money to the region from the substantial expenditure.

Murrindindi Shire Council

The Murrindindi Shire Council received about $33 million in infrastructure assets from the Victorian Government to rebuild Marysville after the 2009 Black Saturday bushfires. The council reported that decisions to provide these new infrastructure assets were made by the Victorian Government 'on council's behalf or with extremely limited input sought from council' (Doutre 2014). Many of these assets (including a multipurpose community building, sports hall and basketball court) were subsequently underutilised by the local community, with many residents viewing the buildings as 'too big, too expensive to hire and [not fitting] with the needs of the small town' (Morris 2015). The council estimated that it was incurring about $1.7 million annually in operating expenses and maintenance costs for these assets, leading to increased costs for ratepayers (Morris 2015).

Progress has been made, but more needs to be done

With such large sums being directed into regional programs, it is essential that these programs are rigorously evaluated to ascertain whether taxpayers are getting value for money and whether regional communities are getting the highest possible net benefits from expenditure. This highlights the importance of systematic arrangements for project assessment and selection, monitoring and evaluation (chapter 2).

There appears to have been some improvement in public investment processes in the past three years. This may be partly attributable to the work of infrastructure advisory bodies such as Infrastructure Australia. Established in 2008, and subject to a reformed governance structure in 2014, Infrastructure Australia is an independent statutory body responsible for assessing proposed infrastructure projects that are nationally significant or that are seeking Australian Government funding of more than $100 million (Infrastructure Australia 2017, p. 6). Several State and Territory governments have also established infrastructure advisory bodies, including New South Wales, Victoria, Queensland and Tasmania. There is some evidence that this work has contributed to informing government decisions about investment in regional programs. For example, in its 2016-17 Budget, the Australian Government noted

that \$1.5 billion in funding for a range of road infrastructure projects for Victoria (a reallocation of previous East West Link funding) would be conditional on assessment by Infrastructure Australia (for those projects over \$100 million) (Treasury 2016, p. 16).

While this suggests awareness of the importance of robust processes for selecting and implementing regional programs, the challenge is for governments to make such processes a systematic part of all regional initiatives that are undertaken. Many regional programs are funded by State and Territory governments, without (or with less than \$100 million in) Australian Government funding. Indeed, it appears that most state-funded regional projects are less than \$20 million in value.[31] For these projects, rigorous strategic planning processes are essential for ensuring that funding is prioritised in order to maximise the net benefits for regional communities.

Issues associated with regional strategic planning

As discussed in chapter 2, all levels of government are involved in regional development planning (and funding) and a large number of strategies have been developed. However, there is inadequate collaboration and coordination between the many parties involved; indeed the lack of collaboration and coordination has often been deliberate. There is also insufficient focus on regional priorities, a lack of capacity and expertise within councils, inadequate data to support strategic planning and failures to identify significant regional issues. This has exacerbated the problems of inadequate targeting and selection of regional investments identified in the previous section.

Strategic planning processes sometimes fail to identify significant risks for communities

Ineffective planning processes have in some instances failed to identify significant risks and issues facing regional communities. For example, Voices of the Valley noted that 'the closure of Hazelwood Power Station was expected but not anticipated in planning processes' (sub. DR53, p. 2). Although governments responded following the announcement of the closure, the response was ad hoc and rushed and spending was not aligned with community preferences (Lazzaro 2017). Governments could have avoided these problems by better planning for the closure and facilitating people to adapt to the change before it occurred.

Similarly, in the Pilbara region of Western Australia it has been recognised that a 'lack of planning and infrastructure delivery by government' contributed to accommodation and land supply becoming 'a critical issue for the region' during the mining investment boom

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[31] For example, Queensland's Royalties for the Regions program provided \$485 million to fund 151 projects from 2012-13 to 2014-15 (QAO 2015, p. 1); Victoria's Regional Growth Fund provided about \$570 million to fund over 1800 projects during 2011–2015 (VAGO 2015, p. 29); Western Australia's Royalties for Regions program provided \$4.2 billion in funding for over 3500 projects between 2008 and 2014 (OAG 2014, p. 5).

(Grylls 2016). The Senate Select Committee on Housing Affordability in Australia (2008) identified the slow release of land by LandCorp (the Western Australian Government's land and property developer) as a contributing factor. Although there were a variety of issues contributing to the slow release (such as native title processes and environmental planning), the Committee found LandCorp should have done more forward planning.

Planning processes have also failed to address long-term challenges for regional communities where they are driven by electoral cycles. The Commission of Inquiry into Greater Geelong City Council found that:

> The City Plan has elements of a vision for Geelong, but it is essentially a Corporate Plan explicitly designed to 'guide the City of Greater Geelong's activities during the term of our current Council'. The Plan meets the Council's statutory obligation, but it is not compelling and does not look to the horizon of Geelong's new future. It is not a long-term strategy that identifies the evidence-based choices to be made for the future and to drive the economic prosperity of Geelong. (2016, p. 41)

Many councils lack the capacity to undertake rigorous strategic planning

Some local councils lack resources and expertise to undertake effective planning, prioritisation of projects and implementation or delivery. The Commission has previously identified that the capacity of local governments varies considerably (PC 2008, 2012a). In particular, small to medium-sized local governments frequently lack in-house specialists or technical expertise to determine value for money and prepare an appropriate business case for proposed projects (PC 2014d, p. 296).

Participants drew attention to the effect of government policies that restrain local governments' ability to raise revenue. These are typically in the form of state government legislation regarding local government charges, and rate pegging in some jurisdictions.

> These restrictions limit the efficiency of the [local government] sector and the ability to appropriately raise own-sourced revenue or manage assets in the best interests of their communities. These constraints also restrict the sectors' ability to invest in productivity enhancing infrastructure, and provide important services for the community — which will be critical to ensuring the successful transition in the local economy. (WALGA, sub. 22, p. 18)

This limited capacity to raise revenue can make it difficult to fund the required technical expertise in analysing data, undertaking business case analysis and prioritising investments, let alone contributing to investment or funding operating costs associated with projects. During a public forum in Orange, the Commission heard that:

> Some councils found it difficult to prepare, or build capacity in their economy with limited funds. … While grant funds are available from state and federal governments, Ms Bennett [CENTROC executive officer] said there were challenges for smaller councils due to rate pegging. … 'The application requires a business case – which is no problem – but they sometimes lack capacity to pay for it or do it internally,' she said. (Rurenga 2017)

The Australian Local Government Association also commented on the variable capacity of local governments:

> Given the fact that local government in Australia is characterised by a high degree of diversity in terms of its functions, characteristics and revenue sources, it should not be surprising that the capacity of councils to strengthen the ability of regions to transition will vary. (sub. DR68, p. 3)

The constraints on local governments' ability to raise revenue have broader implications for the capacity of local governments and can act as an impediment to the provision of local government services (box 5.6).

Box 5.6   Principles to guide local governments in revenue raising

The capacity of local governments to manage and deliver services, and provide and maintain infrastructure, has implications for the costs of doing business in regional communities. The Commission has previously set out principles to guide local governments in revenue raising, decision making and financial management. These include, for example, ensuring that services are provided at minimum achievable cost while maintaining desired service quality, and using competitive tenders and other commercial arrangements to enable more cost-effective provision of services. Adhering to such principles can help enable local governments to be financially sustainable and better meet the costs of providing services and maintaining infrastructure for their communities.

Source: PC (2008).

Inadequate data to support regional development planning

Timely access to relevant regional-level data and information is crucial to understanding regional issues and to guide decisions on how scarce resources will be allocated. In its submission, Queensland Resources Council highlighted the challenges of accessing up-to-date local data:

> A genuine transition towards regional diversification needs to reflect the unique regional differences and be firmly anchored in accurate analysis of local data. Too often, regional communities facing rapid growth are drawn into debates over the current local relevance to their community of census data collected several years ago. (sub. 16, p. 4)

Regional Capitals Australia commented that:

> Examining the wider regional impact for comparison between regions … presents a challenge. This is largely due to the unavailability of required data sets.

> … RCA [Regional Capitals Australia] found large data gaps associated with understanding the level and drivers of growth and investment in RCCs [regional capital cities] alone. There was almost no data available to understand the comparative impact on a city through regional funding or the impact on a regional area where investments into a city had occurred. [emphasis original] (sub. 30, p. 6)

Regional Development Australia Central West (sub. DR54, p. 6) also stated that 'one of the greatest barriers to regional economic development in the Central West is the lack of access to appropriate data to inform evidence-based decision making in the region'. It is currently working with Central NSW Councils and the regional Economic Development Forum (14 local councils) on a Data Co-Design Project to develop quality reliable datasets that can be accessed via a regional shared data platform.

Improvements in the capacity of local governments and other agencies to access and assemble relevant data could assist in developing and evaluating regional policy. This sentiment was recognised in a review of regional economic development in Victoria:

> The Victorian Government needs to improve sharing of its knowledge, expertise and networks to support the evolution and delivery of regional strategic planning. By providing more high quality data, and consistent methodologies and frameworks for economic analysis, regional planning groups will be able to strengthen their analysis and advocate the best set of priorities for their region. (Vic DEDJTR 2015, p. 54)

Once functional economic regions (FERs) are defined by State and Territory governments (discussed below), statistical agencies should ensure that relevant data be made available on an FER basis.

Lack of a regional focus in development planning processes

Strategic planning at the local level does not always focus on the strengths and attributes of the regional community as a whole. A focus on planning based on local government boundaries can lead to inadequate coordination and cooperation between neighbouring councils and create inefficient competition for resources. When decisions to facilitate transition and development are made at the local government level, they are more likely to focus on specific local issues rather than considering the region as a whole.

In some instances, the lack of a regional focus may be due to inadequate coordination at the State or Territory government level. Local governments and state-based local government associations interviewed by Pugalis and Tan (2017) expressed this frustration.

> The current Tasmanian government does not have an economic development strategy. Local governments feel they are working in a vacuum. (Local government officer, regional or rural council, TAS)

> The lack of a state or national level policy on settlement patterns and population shifts means that councils are working in a vacuum. They end up competing against each other to attract residents and businesses in what seems to be a zero sum game. There is no policy context within which local communities can operate and contextualise their work to build on their strategic advantages and develop their communities. (Regional/peak body, WA) (quoted in Pugalis and Tan 2017, pp. 131–132)

Recognising these concerns, some State and Territory governments are facilitating the identification of regional priorities using bodies defined by FERs (chapter 2). For example,

the NSW Government is working with regional communities to develop *Regional Economic Development Strategies* for each of its regions, which are defined by FERs.

> Every REDS [Regional Economic Development Strategy] will … identify bespoke enabling infrastructure and other interventions for each region, providing a clearly articulated and practical economic development strategy that can be used to inform and guide economic activity generally, as well as guide the allocation of public funding. (NSW Government, sub. DR71, p. 4)

Some local councils have also recognised the value of having a regional focus and have voluntarily undertaken regional strategic planning and development, sometimes in collaboration with State governments and other bodies (box 5.7).

Despite this progress, there is still an insufficient focus on regional priorities in some regions. For example, the Chamber of Commerce and Industry Queensland noted that a better focus on regional plans was necessary to further identify points of competitive advantage and direct investment and attention to regional areas most in need (sub. DR62, p. 3). Similarly, regional planning in Tasmania is done on an ad hoc basis, with the Tasmanian Government placing greater emphasis on industry strategies.

Duplication of government efforts in regions

Lack of collaboration and coordination has resulted in duplication of government efforts in some regions, causing confusion. For example, the Upper Spencer Gulf Common Purpose Group said that:

> The need to avoid duplication of time, effort and resources in supporting the transition of the region has been sharply brought into focus over the previous year with the establishment of several SA Government committees, including the 'Upper Spencer Gulf and Outback Taskforce', 'Arrium Whyalla Taskforce', 'Port Pirie Transformation Taskforce', 'Upper Spencer Gulf Economic Transition Forum' and 'Port Augusta Power Stations Committee', along with the new Federal Government 'Upper Spencer Gulf Regional Jobs and Investment Local Planning Committee' … None of these committees involve the local Councils. (sub. 20, p. 2)

Fragmented effort and lack of coordination was also raised by others:

> … there appears to be an over-abundance of services paid for by governments of all levels that work in isolation, are competitive in nature, that gives the strong impression of fragmented effort and low value for money outcomes in the community. (Northern Tasmania Development Corporation, sub. 7, p. 2)

> There also appears to be little consultation between the Government Departments and Councils in relation to what grants are needed in regional NSW and the resources available to apply for and acquit the grants. (Bland Shire Council, sub. DR45, p. 13)

> **Box 5.7   Examples of regional approaches to strategic planning and development**
>
> *Northern Economic Plan (Adelaide)*
>
> The Northern Economic Plan for Northern Adelaide is a high level strategy document, jointly developed as a partnership between the State Government and 3 local councils (Playford, Salisbury and Port Adelaide Enfield). The purpose of the plan is to create a shared vision to build on the region's strengths and set a pathway for transition. The plan was developed in anticipation of the closure of automotive manufacturing in Northern Adelaide by the end of 2017 and identifies priorities to 'counter the job losses … and to sustainably transform the region's industrial base over the longer term' (Government of South Australia 2016, p. 6). To deliver on the plan, a partnership model was created. The Community Leaders Group (comprised of the Minister for Automotive Transformation, the three Mayors and the Economic Development Board as well as representatives from the business and community sectors) is responsible for monitoring progress and directing change if required. The Northern Economic and Social Implementation Board (comprised of representatives from local and State governments, and the business, education and not-for-profit sectors) also meets regularly to ensure proposals are proceeding efficiently (Government of South Australia 2016, p. 30).
>
> *Wide Bay Burnett Regional Organisation of Councils (Queensland)*
>
> The Wide Bay Burnett Regional Organisation of Councils is made up of Cherbourg Aboriginal Shire Council and Bundaberg, Fraser Coast, Gympie, North Burnett and South Burnett Regional Councils (each represented by the Mayor, CEO and one Councillor). The organisation plays a key role in driving economic development in its region, having developed a *Regional Economic Development Strategy 2014–19* and complementary *Regional Infrastructure & Investment Strategy* (2016). These documents identify 'challenges, opportunities and priorities for regional public infrastructure to support the economic activity and growth' and provide a strategic framework to guide activities and investment opportunities across the region that align with community and industry priorities (WBBROC 2016, p. 3). It was anticipated that progress towards achieving the aspirations would be measured on an annual basis during a proposed forum of regional leaders.
>
> *Cradle Coast Authority (Tasmania)*
>
> The Cradle Coast Authority is owned by nine councils in the North West region of Tasmania. It is a joint authority recognised under the Local Government Act. The Authority's purpose is to advocate for the Cradle Coast region and enable cooperation and coordination on regional development:
>
> > The Authority … is well placed to help strengthen the development potential of our communities, businesses and places in the Region. It can achieve this by providing the regional leadership, shared understanding, governance and facilitation to support solutions that are best tackled through collective action. (Cradle Coast Authority, sub. DR52, p. 2)

In Western Australia there are a number of entities involved in strategic planning, which can lead to a duplication of effort, particularly where roles are unclear (box 5.8). A 2010 review of Regional Development Commissions in Western Australia identified areas of overlap 'related to the Commonwealth Regional Development Australia organisations, strategic planning functions, local government and RDL [Department of Regional Development and Lands]' (CRRDC 2010b, p. 43). Additionally, strategic plans may not be well aligned across

different levels of government — even where collaboration is occurring between officers on the ground. For example, the Wheatbelt Blueprint included the following disclaimer:

It is anticipated that elements of this inaugural Wheatbelt Regional Investment Blueprint may be at odds with stated government priorities at a Local, State and Federal level. Over time, with ongoing engagement, data collection and analysis, it is hoped that greater alignment is achieved between stakeholders. (WDC 2015)
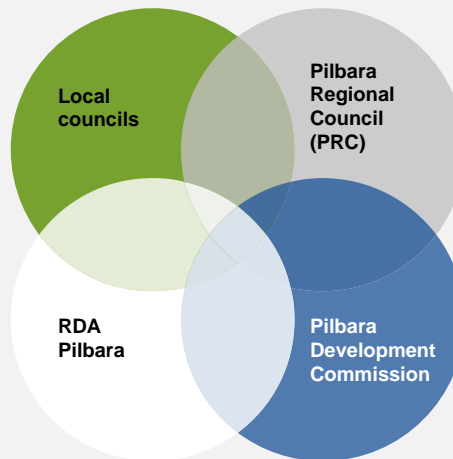

Box 5.8   Strategic planning in the Pilbara region

There are multiple entities with a role in regional development and strategic planning in the Pilbara region (diagram below). This has led to an overlap in roles and responsibilities. As the Pilbara Regional Council has previously noted:

The general consensus is that within the Pilbara all three spheres of government are duplicating rather than coordinating effort … (Pilbara Regional Council, quoted in CRRDC 2010a, p. 90)

All local councils are required to prepare a Strategic Community Plan. Local councils also develop growth plans, which provide a high-level blueprint to facilitate growth.

The RDA Pilbara has developed Regional Strategic Plans (2011-2014 and 2013-2016) that set out a vision and priorities for the region.

Local councils

Pilbara Regional Council (PRC)

RDA Pilbara

Pilbara Development Commission

The PRC must also develop a Community Strategic Plan (although it is more focused on a vision for the PRC rather than the Pilbara region overall). The PRC also plays a role in advocacy for the region and improving the efficiency of service delivery.

The Commission has a lead role in planning and development through the *Pilbara Regional Investment Blueprint*. It is also responsible for delivering the Pilbara Cities initiative, which was transferred from the Department of Regional Development and Lands in 2012.

The Western Australia example highlights the potential for overlap with the Regional Development Australia (RDA) program. This issue was also identified in an independent review of the RDA program:

The Australian Government, along with most state and territory governments, have not shown total commitment to the RDA Programme, maintaining or creating other mechanisms to achieve similar policy and program outcomes (Smith 2016, p. 2)

The review discussed the challenges of integrating RDA organisations with other regional entities, particularly where RDA boundaries do not align with FERs or those used by State and Territory governments.

Existing boundaries of Australian Government regional programs are not aligned with each other, let alone work in harmony with the boundaries of state and territory programs. Only 58 percent of respondents who were not members of RDA Committees provided a positive rating in relation

to the extent to which their current RDA boundary accurately reflects the way in which individuals interact with people, businesses and organisations. (Smith 2016, p. 3)

The review recommended that the Australian Government cease the RDA program in June 2017 and engage a network of Directors of Regional Development and embed these into established state-based regional development bodies, aligned with the FERs of each state and territory. The Australian Government did not accept these recommendations and in August 2017 announced the continuation of the RDA program, with some modifications (box 5.9).

Box 5.9   **Independent review of the RDA program**

The independent review of the Regional Development Australia (RDA) program made a strong case for reforms to reduce the fragmentation of regional policy interventions and deliver coordinated initiatives that strengthen regional economies. Recommendations included that the Australian Government:

- cease RDA program operations

- strengthen its partnerships with the states, territories and local government to formalise tailored tripartite arrangements for regional development

- engage a network of Directors of Regional Development to enhance community collaboration and linkages to deliver on established regional visions, and in consultation with the states and territories, embed its network of Directors of Regional Development in established state-based regional development bodies aligned to the functional economic regions of jurisdictions

- establish a Regional Collaboration Fund, drawing on established funding within the current RDA program (as a minimum), to enable investment in human capital, regional leadership and collaboration, and fund regional development activities.

- appoint a Regional Investment Commissioner located within Austrade.

In response, the Australian Government announced the continuation of the RDA program under a new charter. RDA committees will shift their focus from planning to a more facilitative role focused on 'growing strong and confident regional economies that harness their competitive advantages, seize on economic opportunity and attract investment' (DIRD 2017a, p. 6). This will involve RDA committees playing a more active role in 'facilitating proposals and projects that boost jobs, innovation and stimulate economic growth in their regions' (DIRD 2017a, p. 6). Other key reforms include implementing a strengthened performance framework and establishing a new appointment process for committee members.

Sources: DIRD (2017a); Smith (2016).

Are strategic plans and priorities being implemented?

Strategic planning processes do not always influence government expenditure decisions and lead to investment in priority areas identified in plans.

As noted by the Regional Australia Institute:

> In essence, the stronger the regional leadership, the more demanding it is that its priorities will be validated and acted upon by government at all levels. This creates a problem for governing bodies as it is rare in Australia for regional leadership to influence decisions about resources – advocacy is sought, but consequential action is typically held back. The consequences of inverting this dynamic and enabling regional leaders to make validated decisions about resources are significant – appearing as a loss of direct control and an increase in program risk. (sub. DR57, pp. 10–11)

The Commission heard instances where strategic plans are developed through extensive consultation processes but amount to little in terms of implementation of projects that have been identified as priorities for the region (RAI, sub. DR57, p. 11). The East Kimberley Chamber of Commerce and Industry noted:

> Northern Australia is littered with report after report, and various matters which could unleash growth and development but sadly most of those reports sit on office shelves gathering dust. We do not need to keep funding studies that do not lead to the private sector investing. (sub. DR66, pp. 1–2)

The Queensland Tourism Industry Council highlighted the need to build on existing plans:

> The importance of building on existing local, regional and state-based relevant strategies cannot be overstated. Often the community in general and the business community specifically are encouraged to participate in strategic planning exercises. These are run by different levels of government and multiple agencies and generally result in a document being produced with a strategic direction and perhaps specific action plans. Too often these plans gradually fade from view and participants are left wondering how their contribution was valued. This is particularly frustrating when subsequent planning exercises make no reference to previous work or existing and related strategies in different portfolios or different levels of government. (sub. DR65, p. 11)

With respect to the regional plans developed by the RDA organisations, the independent review noted that there is a great deal of variation in the quality of the plans and the acceptance that those plans are the main driving mechanisms for growth. Further, RDA committees have limited capacity to implement the plans. The report concluded that, despite record Australian Government investment — particularly in regional infrastructure, transport and communications — government investments are not resonating with regional Australians.

There may be a number of reasons why some strategic plans are not being implemented. It may be because they do not identify specific actions, or where they do they are not backed by a rigorous evidence base that can be used to support expenditure decisions. For example, the Goulburn Valley Sub Regional Plan (Victoria) identifies an action to secure additional peak travel time commuter services between Shepparton and Melbourne, but provides no analysis to support this increase (Hume RMF 2010). In other instances, there may not be a role for governments to fund the priorities identified — rather it could be a private sector responsibility. Additionally, there could be a lack of collaboration and coordination on the priorities resulting in little action from governments or the private sector.

Without meaningful collaboration, strategic planning is unlikely to influence governments' expenditure and investment decisions. For example, a review on regional economic development in Victoria found:

> While Regional Strategic Plans are highly valued … the plans and priorities do not consistently inform Victorian Government decision making. … the Victorian Government does not look across the plans in a systematic way, consistently prioritise the projects advocated within them, or provide coordinated advice to portfolio Ministers about what should be funded through existing and new Budget allocations. (Vic DEDJTR 2015, p. 56)

Subsequently, in 2016 the Victorian Government established the nine Regional Partnerships mentioned earlier in this section. Although it is still too early to assess the effectiveness of these partnerships in achieving regional development outcomes, the model highlights the importance of improving collaboration and enhancing local leadership (box 5.10). That said, feedback from stakeholders indicates there is still significant room for improvement in the extent to which regional development is coordinated between local leaders and the Victorian Government.

Box 5.10   Fostering local leadership

Strong local leadership is critical for flexible and resilient regions. Places with strong leadership are more likely to have better economic outcomes, as leaders guide change and help improve the performance of a place. As the OECD (2015, p. 9) expressed:

> … this leadership dividend might occur in many different ways. This can include how public and private coalitions are built, how external investment is attracted and leveraged, how major redevelopment projects are defined and promoted, how skills and employment systems are recalibrated towards new economic sectors, and in how institutional reforms are devised and promoted.

No single individual or organisation has the authority to undertake region-wide economic development. Thus, to be effective, regional leadership should be a collective responsibility encompassing local institutional actors — public, private and community groups (Stimson, Stough and Salazar 2009). Collaboration between levels of government and stakeholders in a community is also important to avoid duplication, 'fragmented effort and low value for money outcomes' in development programs (Northern Tasmania Development Corporation, sub. 7, p. 2). It also helps to ensure that programs do not conflict.

It is therefore important to create conditions that foster local and regional leadership. This requires a coalition of leaders with broad interests across government, business and community sectors, and 'needs to be based on collaboration, power sharing, a forward-looking approach and flexibility.' (Beer and Clower 2014, p. 16). Simply appointing a qualified CEO to a regional entity or providing a leadership course will not be sufficient to promote strong regional leadership.

Governments can also foster local and regional leadership by giving communities decision-making power in relation to their own development.

> If we want stronger regional leadership we need to invest in it – not through leadership courses alone, but by providing the opportunity for regional leaders to achieve influence and impact for their communities in areas outside of local government and centrally prescribed service delivery. (RAI, sub. DR57, p. 11)

Still, this will not guarantee that effective leadership will emerge. An important additional factor is scale — smaller regions or towns might find it much more difficult to develop local leadership.

Substantial funding has been devoted to regional programs by successive Australian, State, Territory and local governments over many years. The effectiveness of these programs in facilitating development in regions is unclear, largely due to a lack of robust and transparent evaluation.

There is scope to achieve considerably improved outcomes for regional communities by changing the way regional programs are designed and delivered. Fundamental to this is applying rigorous and transparent processes for choosing, implementing, and evaluating regional spending.

Failure to set out clear objectives, build capacity and adequately plan for new spending risks regional communities missing out on opportunities and taxpayers' funds being squandered.

Strong and effective local leadership is critical in developing and implementing regional development plans. There is a case for State and Territory governments to build capacity in leadership of regional institutions and community groups and to ensure these entities can attract skilled leaders.

Improving the effectiveness of planning and expenditure in regions — a way forward

There is significant confusion, overlap and unhealthy competition between the Australian, State, Territory, and local governments in the pursuit of regional development. Over recent years the tendency for such confusion and rivalry has increased. Several governments have expressed concern to the Commission that their investments in regional programs have not been adequately 'recognised'. This is a worrying trend — political recognition is not a valid objective for good public policy.

These issues are made more challenging by inadequacies in the institutional and governance arrangements that limit the effectiveness of planning and expenditure in regions with respect to transition and development. There is insufficient collaboration between and within governments. Although there have been efforts to improve collaboration and governance, they do not fully and systematically address the issues.

The Australian population expect and deserve good government at all levels, working cooperatively in the interests of the people of Australia.

The Australian Government should focus on national economic development

Australia is a federation and primary responsibility for regional policy is — and should remain — with subnational governments. Over recent years successive Australian governments have encroached more into regional policies that should have remained with the states and territories. It is time for this trend to be reversed. The Commission has found little justification for, or benefit from, the Australian Government pursuing separate regional development strategies to those of the states and territories. By returning to their core business, the effectiveness of State and Territory governments in delivering regional programs can more readily be assessed, with a supporting role by the Australian Government where relevant. This would also reduce the scope for blaming another jurisdiction for failures of policy development and implementation.

Instead, the Australian Government should focus on national economic development through policy settings that have broad application across regions. National policy settings in areas such as education, health, communications, defence and trade, as well as the 'built-in' distribution of funds across regions (such as Financial Assistance Grants for local governments' service delivery) have a significant impact on development in regions. As such, it is important that the Australian Government works effectively in collaboration with all tiers of government to ensure that services meet the needs of people living in regions.

Where discretionary Australian Government expenditure for regions exists, it should be subject to independent, rigorous and transparent evaluation of its costs and benefits, with a view to ending costly and ineffective programs.[32] This requires clarity about the intentions of the programs (clear objectives and policy rationale) and a performance measurement framework. For discretionary regional programs that are found to have significant net benefits, ideally, the Australian Government should transfer responsibility to the relevant states and territories. These should be programs that support state and territory priorities, which have been established in collaboration with local communities and subject to rigorous cost–benefit analyses.

There remains a case for the Australian Government to provide additional support to assist regions that have been affected by a severe negative economic shock and for which existing support mechanisms are clearly not sufficient (section 5.3). This happens rarely in Australia.

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[32] For the sake of clarity, such rigorous and transparent evaluation should also apply to state and territory regional expenditures.

FINDING 5.4

States and the Northern Territory are responsible for regional development and the establishment of local governments within their jurisdictions. Assessment of regional development strategies needs to consider the circumstances of local regions and communities. Although all tiers of government have a shared interest in regional development, central responsibility for regional development best resides with State and Territory governments, supported by local governments.

RECOMMENDATION 5.1

The Australian Government should abolish the Regional Development Australia program.

RECOMMENDATION 5.2

Current discretionary funding allocated by the Australian Government specifically to regional development (such as funding for regional grant programs, City Deals and the Northern Australia Infrastructure Facility) should be subject to independent, rigorous and transparent evaluation.

Where discretionary regional programs are found to have significant net benefits, the Australian Government should transfer responsibility to the relevant states and territories consistent with their primary roles in regional development. Where the programs do not have significant net benefits they should be abolished.

State and Territory governments should play a lead role in facilitating transition and development in regions

Improvements to the way proposals for regions are identified and prioritised and then linked to expenditure decisions of governments is essential for ensuring that funding to regions is directed in ways that achieve the greatest net benefit for the community. To achieve this, State and Territory governments should:

- develop definitions of regions based on FERs to be used for regional strategic planning purposes, and align relevant regional boundaries to these FERs

- nominate an entity with sufficient capacity to develop and publish a strategic plan for each FER. That plan should assess the region's capabilities and identify priorities for transition and development.

- direct any discretionary funding for regional development or transition to the priorities of regions identified in a regional strategic plan — all decisions to fund regional programs should be transparent, including prior publication of cost–benefit analyses

- enhance cooperation and collaboration, including by pooling of funding with local governments for regional projects.

These recommendations are discussed in more detail below.

Strengthening arrangements for strategic regional planning to improve the way projects are identified and prioritised in and across regions

State and Territory governments should play a lead role in strengthening regional development governance arrangements, in close collaboration with local councils and existing regional entities.

State and Territory governments should develop definitions of regions, based on FERs, to be used for regional development planning purposes. In the long term, FERs might be revised as linkages in regional areas change.

RECOMMENDATION 5.3

State and Territory governments, in consultation with local governments and communities, should develop a single consistent definition of Australia's regions to be used to inform regional development planning and policy.

Regions should be based on functional economic regions, so as to take into account the stronger linkages and interdependencies between neighbouring communities.

State, Territory and local governments should adopt these classifications for guiding regional policy and planning.

In nominating a regional entity, State and Territory governments, together with local governments, should undertake an assessment of the existing agencies responsible for regional development and consider whether changes are appropriate.

Making use of existing regional bodies may be the best approach in some states, particularly where an existing body has strong and effective leadership and established links to the community and other levels of government. As an example, in Victoria, the newly developed Regional Partnerships could be used. Similarly, Regional Economic Development Strategies are currently being developed for each FER in New South Wales. In some other regions, there may be a need to clarify roles and responsibilities to reduce duplication. New entities or groups may need to be created in jurisdictions where gaps are identified.

The nominated entity would be responsible for a public assessment of the capabilities and attributes of its region and community, including (where relevant) identification of specific activities and/or projects to facilitate regional transition and development. All proposals should be underpinned by rigorous and transparent assessment, selection and community consultation processes (box 2.14). This planning process should be a collaboration between relevant State, Territory and local governments, as well as with businesses and the community. It should be undertaken in collaboration (and be integrated where relevant) with

other planning processes, such as infrastructure and land use planning. The regional entity should publicly report on progress in implementing the plan.

In cases where significant strategic planning and community consultation has already occurred, nominated entities could build on and support existing plans by developing a list of specific actions and priorities based on rigorous cost–benefit analysis (where necessary).

State and Territory governments should ensure that the nominated entity has sufficient capacity to undertake this task. This should include consideration of whether the local councils (which might form such an entity through a formal regional organisation of councils) and existing regional groups have sufficient skills and capacity to undertake rigorous, evidence-based analysis of community needs and to develop high quality business cases for proposed projects.

Responsibility for funding and delivery of proposals identified through the planning process would vary depending on the project or activity. Importantly, the process would not necessarily result in additional expenditure from governments and there should be no presumption that all proposals will be publicly funded. Indeed, the strategic planning process may identify scope to reprioritise or better target existing expenditure. For example, through the planning process, local councils may identify an opportunity to pool some of their revenue sources to deliver services more efficiently at a regional scale. Other initiatives may be aimed at enhancing the capabilities of regional communities, for example, through more locally targeted training and employment programs that are funded and implemented by other government agencies. It may also be the case that the private sector co-contributes or fully finances some projects or that user charges are used to recover the costs of delivering a new program or service.

RECOMMENDATION 5.4

State and Territory governments should ensure that each functional economic region has a nominated entity that:

- is responsible for developing a credible regional strategic plan that identifies the capabilities and attributes of the region and, where relevant, identifies priority actions and projects for facilitating transition and development in the region

- is sufficiently resourced and capable of developing high-quality business cases for proposed regional initiatives

- has representation from the relevant State, Territory and local governments, businesses and the regional community

- utilises and incorporates past planning priorities where they have been soundly and rigorously developed.

Better targeting State and Territory government regional expenditure to the priorities identified through rigorous planning

It is important that any discretionary government expenditure for regions is clearly linked to the needs and priorities of regions and is underpinned by rigorous assessment, selection and evaluation processes. This includes expenditure from grant programs, such as regional growth funds, which are often administered on an ad hoc basis by the state or territory government department or agency responsible for regional development. This would better align regional development expenditure by State and Territory governments with the priorities that deliver the highest benefit to regional communities.

Any discretionary funding for regions should be targeted to projects and/or activities identified as priorities in a regional strategic plan. Funding decisions by governments should be open and transparent, including prior publication of detailed cost–benefit assessments and explanation of the selection of projects across regions, as well as public evaluations of alternative proposals for achieving the same objectives (PC 2017b).

It is also essential that local councils are aware of and have the capacity to fund any commitments to ongoing maintenance and operating costs associated with the project.

The selection of large regional development projects would be further improved by building on the work of Infrastructure Australia and state-based infrastructure advisory bodies. This would help governments prioritise infrastructure projects between regions and systematically embed transparent, rigorous infrastructure investment processes in governments' decision making.

Where governments choose to pursue regional projects or activities that are inconsistent with the priorities identified through rigorous regional planning processes or independent infrastructure advisory bodies, governments should provide a public justification for how and why the project was selected. Ultimately, expenditure decisions are the responsibility of government and relevant Ministers. However, accountability for the discharge of this responsibility is best achieved through openness and transparency.

> **RECOMMENDATION 5.5**
>
> State and Territory governments should direct discretionary expenditure for regional development (for example from regional growth funds) to areas that have been identified as priorities in a published regional strategic plan.
>
> Decisions should be transparent, including publication of cost–benefit assessments. For major regional infrastructure projects, decisions should be informed by the work of Infrastructure Australia and state-based infrastructure advisory bodies.
>
> Where governments choose to pursue projects that have not been assessed as a priority by infrastructure advisory bodies, or are inconsistent with the priorities of regions as identified in strategic plans, governments should provide a public justification for why these projects have been selected.

Public service decentralisation

Relocating (decentralising) government departments and agencies is another strategy that has been used by various Australian governments in an attempt to assist particular regions.

The overarching objective of government departments and agencies is to provide government services in a cost-effective manner, such as in health, education and training, law enforcement, emergency services and so on. In doing so, many services are delivered in regional areas using local employees. A significant proportion of government employees are located outside of capital cities. In 2016, employment in 'public administration and safety' constituted 7.1 per cent of all employment in greater capital city areas, and 6.7 per cent of employment outside of greater capital city areas.[33]

However, governments have at times sought to relocate public service agencies to achieve regional development objectives (Poulton 2016). Various government agencies have been relocated to regional areas for development reasons (box 5.11), and governments have shown renewed interest in using decentralisation as a strategy for facilitating regional development. In April 2017, the Australian Government announced its intention to pursue a broad program of decentralisation. All portfolio Ministers are required to identify which non-policy functions of their departments are suitable for relocation to regional areas, or else justify why they are unsuitable to do so (Nash 2017a). Some study participants endorsed decentralisation to promote regional development and growth (Linda Nadge, sub. 1, p. 3).

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[33] Commission estimates based on ABS (2017d).

Box 5.11	**Examples of public service decentralisation**

In Victoria, several government agencies have had central offices relocated to regional cities. These include the State Revenue Office in 2001 (Ballarat), the Rural Finance Corporation in 2005 (Bendigo) and the Transport Accident Commission in 2009 (Geelong) (Afflick 2014; City of Greater Bendigo 2017, p. 4; Poulton 2016, p. 11). In 2017, the Victorian Government announced that it would be relocating 600 public service jobs (across several departments) to Ballarat, with $47.8 million committed to establishing a new government office (Andrews 2017b). It has also committed to relocating Melbourne-based jobs (including those in the Earth Resources Regulation agency) to the Latrobe Valley (Andrews 2017c).

The Australian Government also has agencies located in regions. The Australian Securities and Investments Commission conducts registry functions out of its office in Traralgon, Victoria, and employs almost 350 people onsite (Cormann 2015; Latrobe City Council, sub. 35, p. 1). The Australian Pesticides and Veterinary Medicines Authority is in the process of moving from Canberra to Armidale, New South Wales (Towell 2017b).

The Australian Government has also announced that the new Regional Investment Corporation is to be located in Orange (NSW), stating that this aligns with the strengths of the region due to the presence of agencies such as the NSW Rural Assistance Authority and the Department of Primary Industries (Dingwall 2017b).

The impact of decentralisation on government service provision

First and foremost, potential relocations should be assessed according to whether they improve the cost-effectiveness of providing government services. The fundamental purpose of government departments and agencies is to provide services at a standard that fulfils their departmental objectives, at the lowest possible cost to taxpayers. In assessing how a proposed relocation will affect the quality and cost of service provision, governments should prepare a detailed business case that considers all relevant factors (box 5.12).

Decentralisation can affect the cost and quality of government service provision in many ways. Governments (and thus taxpayers) incur direct monetary costs during relocation, relating to infrastructure, equipment and staff remuneration and incentive packages.

Decentralisation can also affect service quality due to changes in the availability of qualified and skilled staff. The most experienced staff may be least willing to relocate, as they have access to job opportunities elsewhere. Staff turnover during a relocation can create a 'brain drain' (NSW Business Chamber 2013, p. 2) resulting in loss of productivity and corporate knowledge (NSW Decentralisation Taskforce 2013, p. 19). Agencies that require highly technical or specific skills face a greater risk of reduced productivity and quality of service delivery from decentralisation.

> **Box 5.12   Potential effects of decentralisation on the cost-effectiveness of government service provision**
>
> In estimating the potential effects of a proposed decentralisation initiative on the cost and quality of service provision, governments should consider:
>
> - direct monetary costs, including staff incentive and compensation packages, office and infrastructure setup costs (such as office space, and information and communications technologies)
>
> - the skills base of the destination region, including the potential for recruiting local workers with requisite technical, professional and managerial skills, and whether the local skills base will be sufficient to cover staff attrition over time
>
> - the impact on service quality and efficiency due to staff turnover and administrative or organisational disruptions associated with the move
>
> - the estimated rate of employee retention needed to maintain continuity in the organisation's service provision (taking into account the risk of existing employees choosing not to move)
>
> - the relative importance of industry or inter-organisational networks to the department's service delivery, and whether these are available (or could be established) in the target region
>
> - the relative importance of a physical (face-to-face) presence with stakeholders and the impact a move may have on this
>
> - the target region's services, amenities, affordability and liveability, and how this will affect recruitment of suitable staff and the remuneration that will be required to attract such staff.

For example, in the case of the Australian Pesticides and Veterinary Medicines Authority (APVMA)'s relocation from Canberra to Armidale, an independent analysis found that there was a significant risk the authority would be unable to relocate or replace key executive, managerial and technical staff (Ernst & Young 2016, p. 4). The Commission's previous concerns that the loss of capabilities would impede the organisation's effectiveness and exacerbate the regulatory delays (PC 2016c, pp. 293–310) appear to have been borne out, at least in the short term. Between July 2016 and February 2017, the APVMA lost 20 regulatory scientists and 28 other employees (Dingwall 2017a), amounting to over one-quarter of the staff employed by the agency at 30 June 2016 (APVMA 2016, p. 8). In the March 2017 quarter, the agency finalised 42 per cent of new product applications, compared with 84 per cent in the September 2016 quarter (APVMA 2017).

Relocated agencies may also lose the productivity advantages associated with location in capital city areas, such as access to shared infrastructure and inter-organisational networks (Office of the Chief Minister (ACT), sub. 33, p. 1; Urbecon 2016). To some extent, these disadvantages might be mitigated through approaches such as co-location of departments or services in a destination region (as is the case of the proposed Victorian GovHubs), enabling them to share resources and make use of inter-agency connections.

Decentralisation as a regional development strategy

If a proposed relocation improves the cost-effectiveness of service provision, it should be considered a 'win-win' proposal and should proceed. However, where decentralisation is driven by regional development objectives, and is expected to increase the cost (and/or reduce the quality) of service delivery, governments should decide whether they wish to impose this community-wide cost to achieve development benefits for a target region. In such cases, the Australian community may reasonably expect an open and transparent explanation of why a net cost is justified, what development benefits are likely to be realised, and how any risks will be managed.

In the case of the APVMA, analysis of the move found that it would impose a net economic cost on the Australian community of $23 million (Ernst & Young 2016, p. 2). In other instances, it does not appear that any such assessment had been done prior to the relocation decision. For example, it does not appear that a business case was prepared prior to the recently announced plan to relocate Melbourne- and Geelong-based staff from the Australian Government Department of Agriculture to a proposed new $8 million 'biosecurity hub' in Darwin (Towell 2017a).

Such issues are not limited to the Australian Government. The New South Wales Audit Office reported an 'absence of business cases' for four public sector relocations that occurred in the early 2000s (WorkCover to Gosford; the Department of Local Government to Nowra; Mineral Resources to Maitland and the State Debt Recovery Office to Lithgow) (NSW AO 2005, p. 2). The audit found that there was no documentation of the policy objectives or the basis for choosing these particular agencies and locations, and, crucially, no post-relocation evaluations.

Where governments intend to use decentralisation to assist target regions, this requires an assessment of the impacts of decentralisation on both the source and destination regions. It is important that the materiality of the impact of a proposed decentralisation initiative on both the region 'losing' employment and the region 'gaining' employment is well understood.

The impact of decentralisation on source and destination regions

Proponents of decentralisation have made a number of claims in terms of the benefits of this approach for facilitating regional development. Decentralisation is said to:

- boost employment and economic growth in the target region
- increase population in the target region
- benefit employees and their families through increased liveability and affordability
- reduce population pressures in major cities.

These claims are examined as follows.

Impacts on employment

The extent to which decentralisation contributes to employment growth in the destination region will depend on whether agencies relocate existing workers, or are able to source local workers with the requisite skills (Poulton 2016). If employees are relocated, or are recruited from outside the destination region, there may be little or no direct employment growth, but simply a transfer of jobs between regions. Relocating government agencies may result in indirect employment growth, driven by increased consumption spending by relocated employees and their families. However, rather than creating net growth in employment, such impacts essentially redistribute growth (Daley 2012, p. 5).

Caveats also arise in relation to claims that decentralisation generates jobs in the process of constructing new infrastructure (such as office buildings and fitouts) (Urbecon 2016). For example, the Victorian Government stated that building the GovHub office in Ballarat will create up to 500 construction-related jobs (Andrews 2017b). However, construction jobs are for a specified period, and construction workers are often sourced from outside the region, so the impact on employment, economic activity and population will be temporary (similar to the mining investment boom).

A recent evaluation of a large UK-based public service decentralisation program found that it successfully increased public sector employment in the target regions with little or no effect on local private sector employment (Faggio 2015, p. 32). This study found that the relocation of over 25 000 jobs from London and the South East region to other regions of the United Kingdom during 2004–2010 increased total public sector employment in the destination regions and stimulated growth in local (private sector) service jobs, particularly in consultancy and legal services. However, the program had a small negative effect on local private sector manufacturing jobs, so that the overall private sector employment effect was negligible (Faggio 2015, pp. 32–33). Nevertheless, the author noted that without information on all the costs and benefits of the program, it was 'impossible to quantify whether those changes were net welfare improving for the local economy and its residents' (Faggio 2015, p. 33).

Impacts on the population

Where agencies relocate existing employees from capital cities, this can increase population in the destination region. The Regional Australia Institute (RAI 2016, p. 30) argued that population movements can benefit capital cities by reducing the pressures caused by population growth, such as pollution and congestion. However, this impact is likely to be minimal, due to the relatively small number of jobs directly relocated by a government department or agency (Daley and Lancy 2011, p. 29). Relocation could encourage longer-term population movement in a regional centre if it increases the region's attractiveness to private sector investors and business owners. However, it is highly unlikely that relocation of public servants will, of itself, make a regional centre attractive.

Population growth will only be sustained if employees choose to move to the region permanently. If employees 'relocate' their jobs but not their place of residence (by

commuting or telecommuting to work), there will be no impact on the destination region's population. Even if some employees permanently move to the destination region, the overall impact may be minimal relative to the region's population. In larger regional centres such as Ballarat or Geelong, for example, the impact of several hundred relocated employees relative to an existing population in the vicinity of 100 000–200 000 is less than one per cent. The impact would be greater when the destination region has a small population. However, small towns may be less appealing to many workers, and this could impose greater costs on governments if they must pay a high premium to attract workers to the region.

Impacts on employees

The effect of relocation on the agency's employees depends on their individual circumstances and preferences, and on the attributes of the destination region. Some employees (and their families) who relocate may experience benefits associated with moving from a capital city to a regional centre. Compared with living in capital cities, regional centres may offer a shorter commute and more affordable housing (RAI 2016, p. 30).

However, most Australians choose to live in capital cities, including for their wider range of employment options, services and amenities (chapter 3). Thus, it is likely that many public servants living in capital cities would either choose not to relocate, or would do so reluctantly. This may impose significant challenges on employees and their families, including reduced job and career opportunities for relocated workers (and their partners), the need to change schools for children, and a lack of family and social connections.

Relocating agencies sometimes work with the destination region to assist employees to make a transition into their new community. For example, the Transport Accident Commission (TAC) helped relocating employees and their families to access medical and hospital services and engage with local community organisations (such as sporting clubs) during the relocation to Geelong. The Geelong Football Club provided free tickets for newly relocated staff as a means to build organisational culture and to establish links with their new community (Poulton 2016, p. 22).

Impacts on local housing and labour markets

Where the number of jobs relocated is large (relative to the region's population), there may be upward pressure on house prices, rental prices, housing supply, and wages in other industries in the region. Although this may benefit some in the regional community (such as workers in other industries, and existing homeowners), it may impose costs on others (such as renters and home buyers). Local businesses may face increased wage costs if they must compete with higher wages and better conditions offered by relocating government departments and agencies (Urbecon 2016). These potential impacts are similar to those experienced by some regions during the mining investment boom (chapter 3).

Is decentralisation a cost-effective way of facilitating regional development?

The above factors are important considerations where governments are seeking to use decentralisation as a regional development strategy. As discussed, the impacts of a relocation will depend on the characteristics of both the source and destination regions, and on the attributes of the relocating agency and its employees. However, it is likely that most decentralisation initiatives will simply redistribute jobs, people and economic growth from one region to another. Furthermore, where regions lack a strong base of infrastructure, employment opportunities, education and health services, and social networks, it may be difficult to attract and retain employees to live in the region.

Where a rigorous analysis indicates that there would be net benefits to a target region from a decentralisation initiative, governments should assess these benefits against the net cost to:

- the source region
- Australian taxpayers and users of government services (associated with any reduction in cost-effectiveness of service delivery).

This would enable governments to determine the full opportunity cost of using decentralisation as a development strategy. Having done so, governments should also assess whether the same or greater benefits could be achieved at lower cost to taxpayers using alternative regional development strategies (such as those discussed in this chapter).

FINDING 5.5

Decentralising public sector agencies imposes costs and risks on governments, taxpayers and users of government services. These risks include a loss of efficiency and service quality, and difficulty sourcing specialised skills and expertise.

Although decentralisation has the potential to increase employment in target regions, in most cases it simply redistributes economic activity across regions. As a regional development strategy, decentralisation is unlikely to make a long-term, systemic difference to regional growth and resilience.

The principles expounded above in relation to decentralisation also apply to government procurement (purchasing) of materials, equipment and other resources. Analogously to governments' decisions about geographic location, decisions about procurement should be made on the basis of what will achieve the most cost-effective service provision. If 'buying local' (purchasing equipment that has been made in Australia, or in a specific region) is also the most cost-effective option, then this can be considered a 'win-win' solution. However, a mandated policy requiring government departments to purchase locally-made equipment and resources is likely to simply impose greater costs on taxpayers and divert productive resources (people, capital and land) away from relatively more valuable economic activities (PC 2016d, p. 37). Moreover, such policies 'can also create a permanent expectation' of government support for particular local industries, at the expense of taxpayers and the rest of the economy (PC 2016d, p. 37).

5.3 Specific adjustment assistance

The impact of economic changes and transitions may place a disproportionate burden on some groups of people. Some workers may become unemployed, some firms may go out of business and some towns may disappear or decrease significantly in size (as has been the case throughout Australia's history). This can have significant social impacts on people in regional communities.

Successful adaptation is not easy to define (chapter 2). Some people may question the 'success' of regional adaptation where it results in workers and businesses leaving to take up opportunities elsewhere. These changes often generate greater value and so increase the wellbeing of the individuals who move, and raise the wellbeing of the population as a whole, but can also have adverse effects on those left behind.

> … we are seeing a net out-migration of skilled workforce, because those with skills in demand will leave (and have done so) in the pursuit of employment elsewhere. This leaves regions vulnerable, particularly those who rely on single-industries. (Regional Development Australia Far North, sub. 9, p. 9)

Given these impacts, governments might at times wish to provide more targeted assistance to people in regional communities who have been disproportionately affected by economic, social or environmental changes and pressures. Such a policy response should be targeted to the most vulnerable people in regional communities that have experienced severe, pervasive and persistent changes, such that there is a strong likelihood of becoming permanently disadvantaged. It would be reserved for exceptional events where regions are affected by a severe negative shock, and as such, its application is expected to be rare. There might also be selected groups of individuals who, although residing in regional communities that are generally performing well, are themselves vulnerable and have particular needs for support to make a successful transition.

Importantly, given the context of this study, adjustment from the mining boom is not causing significant economic disruption and does not justify special intervention from governments.

Adjustment assistance in Australia has often been directed at multiple policy objectives. These have included securing employment for displaced workers or business owners, supporting an industry through structural change, compensating property owners for the loss of rights, and generating new economic opportunities in communities affected by change (Beer 2015, p. 24). Assistance has been more likely if a change is policy-induced, or where a region has experienced the loss of a major employer. A review of regional adjustment policy found that governments almost always provided assistance after a sudden external shock to a rapidly growing industry, though assistance was also common in regions where there had been a longer-term, gradual decline in industries (Aither 2014, p. 8).

As a general principle, assistance is best aimed at promoting adaptation and easing the transition process for *people*, rather than at preserving industries and *regions* (Aither 2014;

PC 2001). Where governments choose to provide specific assistance to facilitate adaptation, consideration should be given to the effectiveness of different kinds of assistance programs.

Assistance to individuals

When might governments provide special adjustment assistance to individuals?

Governments often wish (and are expected by the community) to provide some assistance to workers facing job losses,[34] to compensate for a loss of income, to find new employment or to retrain. Generally available measures, such as those provided under the social security and tax systems (including income support, training and job search assistance), can help cushion the distributional effects of economic changes (PC 2012b, 2014a).

People are affected by economic changes all the time, and many of those who are adversely affected do not receive any assistance beyond these generally available measures (PC 2001). Relying on income support systems in the first instance promotes fairness and equity among the many thousands of Australians who experience involuntary job losses every year (PC 2012b, pp. 71–72), targeting assistance to those in need, whatever the cause. Some participants expressed concerns about inequitable outcomes when particular industries or regions receive specific assistance while others do not.

> Conveniently, there seems to be help for 'some' when they get into strife, i.e. communities near capital cities that provide workers for auto, aviation and steel. Yet when one of the 'other' communities suffers, the convenience of 'globalisation' rises to defend domestic political decisions. (Linda Nadge, sub. 1, p. 2)

On the other hand, there can be good reasons for governments to provide additional assistance (over and above generally available measures) in certain circumstances (IC 1993; PC 2001). The additional assistance might involve, for example:

> … training assistance, advice on establishing a small business, job fairs, information seminars on employment opportunities, assistance and advice on writing job applications and in preparing a contemporary CV for employment and measures to recognise prior learning. (Beer 2015, p. 28)

Such assistance might be justified when severe structural change is induced by government policy change (such as deregulation). In this instance, the case for assistance on equity grounds is strongest when a reform imposes a clear and significant burden on a specific group (particularly an already vulnerable group); delivers benefits mainly to relatively advantaged groups; or involves a largely unanticipated and material change to a well-defined and defensible 'property right' (PC 2001, p. 41). There may also be a case for assistance where accessibility to generally available measures is inadequate, or where it can improve

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[34] The private sector should also assist displaced workers. It is important that government programs do not relieve businesses of their obligations to assist such workers, including through actions to mitigate 'phoenix' activity (where corporate entities are deliberately liquidated in order to avoid paying employee entitlements and other liabilities) (PC 2015b).

the efficiency of the adjustment process by addressing market-based impediments to adjustment (PC 2001, p. 55).

Additional assistance might be warranted on equity grounds where the effects of economic change are sudden, severe and disproportionately affect large groups of people who are already vulnerable and where there is limited alternative employment (Aither 2014; PC 2001, p. 59). For example, additional assistance may be warranted following the sudden closure of a major employer where it has a substantial and material impact on the local economy (due to the firm's size relative to the size of the employment base in a region). Some examples which would meet the criteria of severe negative economic shock are the collapse of BHP steel works in Newcastle (box 3.4) or the closure of automotive manufacturing. In the case of automotive manufacturing, the Commission has previously found that it would be more efficient and equitable to better target the assistance (box 5.13). Similarly, much of the response to the closure of the Hazelwood mine and power station (in Victoria's Latrobe Valley) is likely to be a costly and ineffective approach to alleviating adjustment costs in the region (indeed, it is unclear if the closure truly meets the criteria of an extreme event).

Additional assistance might also be justified on economic efficiency grounds (PC 2014a), where it enables highly vulnerable people to transition into re-employment or retraining rather than entering (or continuing) a 'downward spiral' of persistent unemployment and disadvantage. As well as having financial and social impacts, long-term unemployment can make it harder for people to regain employment due to erosion of skills, professional networks, confidence and related factors (ABS 2011b). For example, assistance might be provided to overcome information problems about employment and housing prospects in other locations (IC 1993). (Removing regulatory barriers, as discussed in section 5.1, will also help facilitate transitions and so would reduce the cost of specific adjustment assistance.)

The need for special adjustment assistance should be assessed on a case-by-case basis, taking into account the costs and benefits of assistance. As this section has highlighted, this should also take into account how predictable the economic change was, the severity of the impact on a region, the vulnerability of the individuals affected and the scope for generally available measures to support people to transition.

What are the costs and benefits of special adjustment assistance to individuals?

In some instances where the impact of a company's retrenchment on the local community is severe, the Australian Government provides additional employment and training assistance through targeted structural adjustment programs (Department of Employment, sub. DR75, p. 13). These programs are currently (or have recently been) in place for workers in the automotive manufacturing industry (box 5.13), retrenched workers from Queensland Nickel (North Queensland), BlueScope Steel (Illawarra), Caterpillar Underground mining (North-West Tasmania), Arrium (Whyalla), Hazelwood mine and power station (Latrobe Valley) and Alinta Energy (South Australia). The structural adjustment programs provide accelerated access to intensive employment services and additional funding for employment

service providers. Department of Employment data show that the cost of these structural adjustment programs is approximately $6000 per placement (Department of Employment, sub. DR75, p. 14).

The Australian Government may also appoint a local Employment Facilitator to connect retrenched workers with support services and to 'work together with a range of stakeholders and service providers across Australian, state and local government to ensure a co-ordinated approach to service delivery' (Department of Employment, sub. DR75, p. 14).

In an evaluation of the effectiveness of worker assistance programs, Beer (2015, p. 29) found that such programs can have benefits, including:

- enabling individuals to retain, enhance and make full use of their skills

- reducing reliance on income support payments

- stimulating economic growth

- ameliorating the social, family and health impacts of unemployment.

In the case of government assistance programs for the Tasmanian forestry industry, targeted re-employment programs assisted people to find alternative employment (box 5.14).

On the other hand, such programs can be misdirected, such as where training provision does not align with contemporary business needs or where displaced workers are encouraged to transition 'into well-known industries and employment opportunities rather than sectors with long-term prospects' (Beer 2015, p. 28).

In some cases, stakeholders have questioned the suitability of mainstream employment service providers assisting retrenched workers. For example, the quality of job placements following the closure of Mitsubishi was found to be lacking (box 5.13). Similar concerns were raised following the closure of Bridgestone Tyres in 2009 (Nous Group 2013, vol. 3, p. 30).

Problems can also arise when governments contribute to false expectations in regional communities about the likely future success of an industry, or when successive governments' assistance policies create conflicting incentives. This may have occurred in government policy responses to the automotive industry (PC 2014a) and the Tasmanian forestry industry (box 5.14). In the latter case, assistance was initially directed towards encouraging workers and businesses to exit the industry, but a change of government and policy direction led to assistance programs supporting the industry to continue. Conflicting policies can reduce individuals' incentives to retrain or otherwise plan for changing circumstances.

Box 5.13 Assistance to automotive manufacturing employees in SA

North Adelaide is facing adjustment pressures following the closure of the Holden automobile factory in October 2017, with the labour market conditions suggesting a relatively challenging adjustment process (chapter 3, box 3.1). To aid the adjustment process, governments have introduced a range of specific adjustment measures, drawing on past experiences.

In 2004, Mitsubishi Motors Australia Limited announced the loss of approximately 1100 jobs through the closure of its engine assembly plant at Lonsdale along with voluntary redundancies at its Tonsley Park vehicle assembly plant (both located in Adelaide's South). In response to this announcement, the Australian and South Australian Governments implemented two main packages of assistance. The $45 million Structural Adjustment Fund for South Australia (SAFSA) offered grants to businesses investing or expanding in South Australia. The $10 million Labour Adjustment Package provided accelerated access to intensive employment services.

Assessments of the assistance packages identified that the government response was rushed and not very effective (Armstrong et al. 2008). The majority of firms that received SAFSA funding did not meet employment targets, and over half the funds went to businesses in the north of the city (when almost all displaced workers lived in the south). Further, the grants did not focus on sectors in which the affected region could have developed a competitive advantage (Thomas, Beer and Bailey 2008). As for the Labour Adjustment Package, workers were not aware of their entitlements and employment service providers had little experience dealing with skilled workers (Beer et al. 2006). As a result, in a survey conducted 12 months after redundancy, only 6 per cent of displaced workers in employment reported they had found a job through Job Network agencies (Armstrong et al. 2008). Further, no funds were designated for training or re-skilling, despite a recognised skills shortage at the time, meaning that retrenched workers were unable to take advantage of growth in industries such as defence and mining (Thomas, Beer and Bailey 2008).

In developing the current assistance package, the South Australian Government appears to have recognised a number of key lessons from past experiences. The Automotive Transformation Taskforce was established to coordinate a whole of government response, thereby reducing duplication and ensuring processes are streamlined and seamless (Government of South Australia 2015, p. 7). The Taskforce delivers specific aspects of the South Australian Government's *Our Jobs Plan*. The plan focusses on six key actions in response to Holden's announced closure including retraining automotive workers so they can find jobs in emerging sectors and supporting the most adversely affected communities to generate local economic activity and jobs. As part of the Taskforce's response, it delivers the Automotive Workers in Transition Program. This program includes information sessions to inform workers of their entitlements, career advice and planning to reduce the likelihood of future assistance, skills recognition, training and business start-up advice. Services are also available to support the automotive supply chain (through the Automotive Supplier Diversification Program), with eligible businesses able to access funding for diversification strategy and market development, retooling and corporate mentoring.

Despite the improvements over time, the Commission (2014a) found that the provision of assistance to retrenched automotive manufacturing employees at a level that exceeds the assistance generally available to other jobseekers is likely to be unwarranted and relatively costly and also raises equity issues. It would be more efficient and equitable to target assistance to those retrenched employees who are most likely to encounter the greatest difficulties in finding re-employment. In addition, the Commission noted that regional adjustment funds are likely to be a costly and ineffective approach to alleviating adjustment costs in regions affected by closures in the automotive manufacturing industry.

There are also broader equity concerns associated with providing special assistance. For example, in the Latrobe Valley, some stakeholders raised concerns that assistance for the closure of the Hazelwood mine and power station is not reaching the most disadvantaged in the community. Voices of the Valley noted that:

> There is little attention being given to those people in the 'working' age group who are currently unemployed and who have little hope of finding a job in the region although there are more of them than there are of power industry workers. (sub. DR53, p. 2)

There is also a risk that those benefiting from an assistance program may crowd out other job seekers in the region. These equity issues may be particularly important to consider where a region already has a relatively high rate of unemployment.

Box 5.14   Transitioning away from forestry in Tasmania

The forestry industry in Tasmania is relatively small, accounting for only 2 per cent of gross state product. Market conditions in the industry have been increasingly tough in recent decades, due to increased global competition and changes in demand. In particular, demand for wood products has shifted away from hardwood native forest products to softwood plantation products. These effects were exacerbated by the global financial crisis, the high Australian dollar, the cessation of Gunns Ltd hardwood operations in 2011 and their subsequent liquidation in 2013, causing the size of the forestry industry in Tasmania to shrink (Tas DTF 2013).

In 2011, the Australian and Tasmanian Governments signed the Tasmanian Forests Intergovernmental Agreement, designed to transition away from forestry to a more diverse and sustainable economic base. The agreement involved grants to incentivise industry exit or structural adjustment for businesses involved in harvesting, haulage and sawmilling. Additional support was given to retrenched forestry employees and those voluntarily leaving the industry, to enable them to retrain and find new employment. These schemes appear to have been successful. For example, 95 per cent of retrenched workers who went through Forestworks' Workers Assistance Service were able to find new work (Callan and Bowman 2015, p. 24).

The Intergovernmental Agreement appears to have been relatively successful in transitioning workers from the forestry industry to other industries. However, it is unclear if this would have been the case without the support packages. Evaluating the support, Macintosh (2013) argued that the buyouts and structural adjustment support came at a high cost yet did not meet harvest reduction targets. He was critical of the amount of support provided to the forestry industry given the agreement's stated intention to transition away from forestry.

A change of government in 2014 saw the agreement scrapped, with the new government focused on reforming Forestry Tasmania (the government entity responsible for the management of public forests). Tasmanian forestry production has since been growing (ABARES 2016b).

How can governments achieve better outcomes?

Individual specific adjustment assistance (beyond generally available measures) should be reserved for those who would have the most difficulty becoming re-employed (PC 2014a, p. 28). This may be because the affected workers are older or have highly specific skill sets (PC 2001, p. 59). Providing adjustment assistance broadly across an industry's workforce

risks allocating resources to jobseekers who would have found employment without additional assistance. The Australian Government should consider ways to better target specific adjustment assistance. This could involve initially assessing an individual employee's risk of not finding re-employment without assistance, to determine the most appropriate level of support.

Where governments choose to provide adjustment assistance, it is important that support facilitates change and helps people adapt, instead of preventing change from occurring. Focus should be on assistance measures that are likely to be most effective and efficient at meeting the policy objective; that is, securing employment or business opportunities. This requires that careful assessment and design be applied to any specific measures, ensuring the policy is transparent, simple to administer, limited in duration and compatible with general safety net arrangements. The design of any measures should further be informed by robust, independent and transparent evaluations of assistance programs over the long term to assess the effects on employment, as well as the broader impacts. Although such assessments are limited, a number of lessons have been learnt from experience.

First, it is clear that an effective response requires coordination between the various stakeholders to ensure that delivery of information and services to retrenched employees is effectively targeted. In this regard, there is some qualitative evidence that local coordinators have been successful in coordinating responses and connecting retrenched workers with relevant services (Nous Group 2013, vol. 3; Spoehr 2014). Another option is for specific adjustment assistance to be jointly funded by the Australian and State and Territory governments, and local governments where feasible and relevant. By enhancing cooperation, this approach would encourage governments to allocate expenditure to the activities that are agreed to deliver the most benefits in a cost-effective way.

Second, adjustment assistance should be designed to meet the particular circumstances of the individuals, sector and community involved. For example, in the ForestWorks program (box 5.14), retrenched forestry industry workers were recruited as assistance coordinators. This was seen as a key factor in the success of the program, as coordinators were peers with shared culture, skills and experience (Callan and Bowman 2015, pp. 32–33; OECD 2016a, p. 119). In this case, coordinators provided most of the job search assistance as mainstream employment service providers lacked the necessary experience (OECD 2016a, p. 126).

Third, any training component should focus on future business and employment opportunities. Skills and training services that appear to be of the most value include:

- recognition of prior learning and skills assessments

- short certification processes designed to make jobseekers more attractive to potential employers (such as 'white cards' required for employment on construction sites)

- foundation training that improves employability and general skills (such as basic language, literacy and numeracy or resume writing) (Nous Group 2013, vol. 1, p. 13).

The effectiveness of training measures can also be enhanced where activities establish links with local employers and connect training with work experience (Callan and Bowman 2015; OECD 2016a).

Finally, governments can reduce the need for assistance to individuals after economic disruption by promoting their ability to adapt and respond to changes before they occur. An analogy can be made to policy support in relation to natural disasters. In that context, the Commission has previously cited the need for a greater focus on preparedness and mitigation, and for policies to promote insurance availability and individual financial reliance. Governments should provide relief only in the most extreme events (PC 2014c). When applied to the context of regional assistance more generally, this suggests governments should remove unnecessary impediments to transition (section 5.1). Governments should reserve assistance after the fact as a last resort for unexpected circumstances and highly vulnerable groups of people.

Assistance to industries and regions

Governments have provided assistance to specific industries or regions to support investment and preserve jobs. Such assistance has been directed at retaining particular industries, attracting new jobs to the region or given to infrastructure and community projects to boost economic activity in a region. Historically, this has often occured where industries have faced structural adjustment as a result of changing policy or market conditions, and where these industries have had strong connections with particular regions, such as automotive manufacturing (Daley and Lancy 2011; PC 2014a).

In some instances, governments have assisted specific industries facing transitional pressures from increased global competition and microeconomic reform. In the 1980s, this was reflected by the use of 'industry plans' (Hazledine and Quiggin 2006, p. 157). The purpose of these plans (for the steel, automotive, and textiles, clothing and footwear industries) was to support these industries in the face of long-term restructuring while continuing to gradually reduce tariff protection (Conley and van Acker 2011, p. 507) — that is, the Australian Government replaced tariff protection with direct payments or grants. For example, the steel industry plan was developed in response to large job losses in the early 1980s, which dramatically increased unemployment in the Illawarra (New South Wales) region (Burrows, Masouman and Harvie 2015). Under the plan, the Australian Government provided subsidies (through 'bounty' payments) to the steel industry for specified products, as well as other assistance measures[35], in return for an undertaking by BHP to continue operation (Button 1983).

However, in the past, regional adjustment assistance has often been a costly and ineffective approach to facilitating transition in regions affected by change (PC 2014a, 2016d). For example, Grattan Institute analysis (Daley and Lancy 2011, p. 22) found that regional and

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[35] Other assistance measures included a fast-track antidumping system, quotas on imports from developing countries at preferential tariff rates and the creation of a Steel Industry Authority (Button 1983).

industry assistance programs have often been 'badged' as regional economic development projects, despite often doing 'little to create sustainable economic growth' or to ensure that benefits accrue to regions in greatest need. In particular, the authors reported that:

- regional job attraction schemes (which subsidise businesses to establish or expand in particular regions) have generally not been economically worthwhile — often imposing significant budget costs and redistributing the location of jobs at a high cost

- regional structural adjustment packages (such as assistance provided to retain automotive manufacturers, and grants provided to prevent plant closures) often come at a high cost per job (between $20 000 and $60 000) and do not appear to have had a significant impact on a region's long-term employment trends or overall economic performance (compared to similar regions that did not receive such assistance) (Daley and Lancy 2011, p. 26).

As well as being costly in terms of governments' limited resources, poorly designed adjustment assistance programs can also be inequitable (by treating individuals in similar circumstances differently). This was seen, for example, in some aspects of the adjustment assistance provided to Australian farm businesses facing drought (PC 2009, p. 123).

In some circumstances, assistance measures may be conducive to successful adaptation where it facilitates the transition of businesses out of an industry — if their position is not self-sustaining. For example, dairy farmers were able to access tax-free payments of up to $45 000 to help them exit the industry following deregulation in July 2000.[36] Under severe and unexpected circumstances (such as natural disasters), offering this option of adjustment assistance might be more efficient than no assistance, particularly if an industry has been under sustained pressure and is receiving other government support. For example, in the case of assistance to north Queensland banana growers following Cyclone Yasi in 2011, some businesses might have benefited from the option of exit assistance. In this instance, banana growers in the region had been under sustained financial pressure for about a decade, having been affected by significant disease outbreak (2001–2003), Cyclone Larry (2006) and Cyclone Yasi (2011).

Governments can face community pressure to assist businesses to continue operating, as shown in the change of policy with respect to the Tasmanian forestry industry (away from supporting voluntary exits and towards rebuilding the industry) (box 5.14).

To help avoid these problems, assistance designed to sustain regions or industries (as distinct from individuals) should be avoided in all but the most exceptional circumstances. In general, commodity price cycles, natural disasters (other than the most extreme events) and the closure of a firm do not warrant assistance to industry or a region. Where support is provided, it should be within the context of a strategic development framework designed to build the adaptive capacity of people and businesses in a regional community and to capitalise on a region's strengths. Governments should avoid using industry assistance as

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[36] The voluntary Dairy Exit Program was part of a broader $1.8 billion industry restructuring package, which also included direct payments to dairy farmers and support for dairy communities. Consumers of milk paid a levy of 11 cents per litre (from July 2000 to February 2009) to fund the package.

'de facto regional policy' (Beer 2015, p. 22) without a coordinated, strategic regional policy approach.

As in the case of Nhulunbuy (Northern Territory), this might be done in the context of a social objective to support an isolated but important regional hub following a major disruption (box 5.15). This case study highlights some of the challenges and high costs in managing transition in a remote town that is a service hub for a large surrounding population of predominantly traditional owners with strong ties to their land and customs. Managing the transition is a work in progress and it is too soon to assess the effectiveness of the support.

FINDING 5.6

Generally available welfare, training and employment measures promote fairness and equity and are usually the most effective means for facilitating transition. Assistance that creates false expectations about the future success of a particular business, industry or region can lead to confusion and reduce individuals' incentives to plan and adapt to changing circumstances.

Past assistance to industries and regions has often been costly, ineffective, counter-productive, wasteful, poorly targeted and inequitable.

There might be some cases in which economic change and the accompanying transition process results in continued decline in employment. Such circumstances are not new; population movements in Australia leading to regional decline have been an ongoing concern, with many previously thriving settlements shrinking and in some cases disappearing (box 3.10).

Where a region faces long-term, continued decline, with limited prospects for sustainable development, it might be that governments' efforts are best directed at 'manag[ing] population decline gracefully and efficiently' through enabling continued service delivery to residents who wish to remain (RAI, sub. 12, p. 22). This does not mean that services should be provided within all towns or at the same level as might be expected in a major urban or regional centre. This would likely come at a high cost to the community as a whole. As noted by the Queensland Government (sub. 26, p. 17), effective and efficient delivery of human services and social infrastructure to regional and remote communities 'is complicated by the challenges of distance, isolation, coordination, cost and unique community characteristics'.

By choosing to live in particular geographic areas (whether metropolitan, regional or remote) people make trade-offs between ease of access to and costs of goods and services and other lifestyle factors. At the same time, some people may be unwilling to move, because they have grown up in a regional community and have strong social ties, including caring responsibilities. Indigenous Australians also have strong connections to the land and regional communities they live within.

Box 5.15 Transition assistance for Nhulunbuy

Nhulunbuy is a town of about 3000 people located in north-east Arnhem Land. The town was developed during the 1970s to service the bauxite mine and alumina refinery. Nhulunbuy is a well serviced town with an airport, sea port, hospital, GP clinic, bank, schools and many recreation facilities. It is the main service centre for the East Arnhem region, which is home to about 15 000 people (ABS 2017l; East Arnhem Land Tourist Association nd).

In November 2013, Rio Tinto (the operator of the mine and alumina refinery) announced it would suspend alumina refining, and the refinery was placed into full care and maintenance in May 2014. The closure of the refinery resulted in the number of people employed by Rio Tinto falling from 1450 to approximately 400 (Northern Territory Government, sub 37, p. 6).

NT Government support to Nhulunbuy reflects its objective of retaining it as a service hub for the East Arnhem region, while also making the town sustainable by reducing its reliance on mining and the refinery. After the refinery curtailment was announced, the NT Government established the Gove Taskforce, comprised of senior representatives from Rio Tinto, the Australian Government, the Northern Land Council and local stakeholders to oversee the transition of the town (Northern Territory Government, sub. 37, p. 6). Senior NT Government staff worked directly with Rio Tinto and other stakeholders in Nhulunbuy while receiving guidance from senior leadership in Darwin. The transition of Nhulunbuy is following three key phases:

1. In the initial 12 months after the curtailment, the focus was on immediate support for the community including counselling and financial planning for individuals. Businesses were supported with up to $1.5 million available in grants aimed at helping improve business practices and to upskill staff. The Gove Community Advisory Committee (formed by the Gove Taskforce) was responsible for mediating between the community and the taskforce so that all stakeholders had a clear understanding of the challenges and opportunities in the region.

2. The second phase was to stabilise the town. This included a strong commitment by the NT Government, affirming Nhulunbuy as the regional hub for East Arnhem Land and agreeing to maintain the same level of government spending on services in the region regardless of whether the population declined or not. Rio Tinto also moved their remaining fly-in, fly-out workforce to become residents in Nhulunbuy, taking advantage of available housing in the town. This provided people and businesses with confidence about the town's future.

3. The final phase is the ongoing transition of Nhulunbuy, which is focused on reducing the town's reliance on mining by diversifying the local economy. The Gove Taskforce established Developing East Arnhem Limited (DEAL), to act as the front door to the region, establish connections between government, industry and business and support the capacity of businesses in the region. The NT Government and Rio Tinto each gave $2 million in upfront funding to establish DEAL and Rio Tinto provided the rights to 250 houses in Nhulunbuy to provide ongoing revenue and housing options for businesses (DEAL 2016). DEAL is currently facilitating $200 million worth of projects in the region (many of which are private ventures) and encouraging further investor engagement with the region. For example, DEAL is working together with other stakeholders on a proposal to develop a space centre in the region.

Nhulunbuy has stabilised its population and regional economy above initial expectations. The population of the town and the gross regional product have increased since the refinery curtailment due to increased tourism, an increasing number of small businesses, and greater efforts to procure goods and services from local business. The long-term plan for Nhulunbuy is to continue developing the capacity of businesses in preparation for the closure of the mine within 10-15 years (NT Government, sub. 37, p. 6).

Importantly, then, such support should not be mislabelled as promoting economic opportunities where such opportunities cannot realistically exist. It is instead ensuring that a minimum basic level of services is available, along with general social services and income support.

Taking all these factors into consideration, governments might reasonably seek to ensure remaining residents have access to a minimum level of services, whether these are provided in neighbouring regions or through remote access arrangements. Such a service, for example, could include a flexible local bus system to assist older and isolated Australians to connect to the local centre. In making decisions about how best to manage declining regions, governments should strike a balance between ensuring remaining residents have access to services that support their wellbeing, and promoting equitable outcomes across the population as a whole.

RECOMMENDATION 5.6

Specific adjustment assistance (beyond generally available measures) should be reserved for extreme events that are likely to result in high levels of permanent disadvantage in a region. It should be targeted to the people who are least likely to make a successful transition and be focused on improving their employment prospects.

Assistance designed to sustain regions or industries (as distinct from individuals) should be avoided. Assistance should be designed to facilitate movement towards explicit and transparent adjustment goals, which might be a path of managed decline.

A   Public consultation

The Commission received terms of reference for this study on 15 December 2016, and was asked to deliver an initial report in April 2017. To meet this timeline, the Commission adjusted its initial consultation processes, and did not release an issues paper.

The Commission invited public submissions by 15 February 2017. A total of 37 submissions were received prior to the release of the initial report, and another 44 were received following the release of the initial report in April 2017 (table A.1). These submissions are available online at http://www.pc.gov.au/inquiries/completed/transitioning-regions.

Consultations were held with representatives from the Australian, and State and Territory and regional government departments, agencies, local governments and peak bodies, in each of the sectors covered in this study (table A.2). Public forums were also held in Karratha (Western Australia), Traralgon (Victoria), Orange (New South Wales), Adelaide and Darwin in June and August 2017.

Roundtable discussions were also held in Perth and Canberra. These roundtables focused on the policies associated with economic transition and the measurement of regional adaptive capacity, respectively. Roundtable participants are listed at table A.3.

The Commission thanks all parties who have contributed to this study.

Table A.1   **Submissions**

Individual or organisation	Submission number
Association of Mining and Exploration Companies (AMEC)	5, DR70
Australian Local Government Association (ALGA)	DR68
Australian Major Performing Arts Group	DR67
Bland Shire Council	DR45
Brohier, Peter	DR43
Business Council of Co-operatives and Mutuals	DR69
Business SA	DR76
Cairns Regional Council and Advance Cairns	13
Centennial Coal Company	29
Centre of Full Employment and Equity (CofFEE) (University of Newcastle)	DR44
Chamber of Commerce and Industry Queensland (CCIQ)	17, DR62
Chamber of Minerals and Energy of WA	28, DR58
Collits, Paul	DR40
Conus Business Consultancy Services	DR39
Conway Highbury	DR59
Cradle Coast Authority	DR52
Department of Employment	DR75
Department of Regional Development (WA)	27
East Kimberley Chamber of Commerce and Industry	DR66
Germanos, Carl	DR74
Head, Brian	36
Hunter Business Chamber	19
Illawarra Business Chamber	15
Illawarra Forum	DR55
Institute for Resilient Regions (University of Southern Queensland)	DR63
James Cook University	24
Jobs Australia	31
Latrobe City Council	35
Minerals Council of Australia	DR80
Morandini, John	8
Nadge, Linda	1
NAJA Business Consulting Services	DR42
National Rural Health Allliance	32
New South Wales Government	DR71
Northern Tasmania Development Corporation (NTDC)	7
Northern Territory Government	37
O'Malley, Denis	4
Office of the Chief Minister (ACT)	33

Table A.1　(continued)

Individual or organisation	Submission number
Pilbara Regional Council	DR38, DR47
Queensland Government	26, DR77
Queensland Resources Council (QRC)	16
Queensland Tourism Industry Council	DR65
Regional Arts Australia	DR60
Regional Australia Institute (RAI)	12, DR57
Regional Capitals Australia (RCA)	30, DR78
Regional Cities Victoria	23
Regional Development Australia - Central West	14, DR54
Regional Development Australia - Darling Downs and South West	DR51
Regional Development Australia - Far North	9, DR73
Regional Development Australia - Illawarra	DR56
Regional Development Australia - Mackay-Isaac-Whitsunday	25
Regional Development Australia - Northern Territory	DR81
Regional Development Australia - Peel WA	11
Regional Development Australia - Pilbara	6
Regional Development Australia - Tasmania	3
Regional Universities Network	DR48
Rockhampton Regional Council	10
Rotary Club of Traralgon	DR50
Shire of Victoria Plains	DR49
South Australian Government	34
Tasmanian Minister for State Growth	21
Telstra	18
Tilleard, Robert	2
Townsville Enterprise	DR72
University of Newcastle	DR64
University of Queensland Business School	DR41
Upper Spencer Gulf Common Purpose Group	20
Voices of the Valley	DR53
Volunteering Australia	DR61
WA Parliamentary National Party	DR79
Western Australian Local Government Association (WALGA)	22

Table A.2   **Consultations**

Individual or organisation

NEW SOUTH WALES

Dr. Anton Kriz, University of Newcastle

Hunter Research Foundation Centre

Local Government NSW

Muswellbrook Chamber of Commerce

Muswellbrook Council

Newcastle City Council

NSW Department of Premier and Cabinet

NSW Department of Primary Industries

Orange City Council

Prof. Caroline McMillen, University of Newscastle

Regional Development Australia - Hunter

Regional Development Australia - Sydney

Reserve Bank of Australia

Western Sydney Regional Organisation of Councils

VICTORIA

Australian Bureau of Statistics (ABS)

Department of Economic Development, Jobs, Transport and Resources

Department of Premier and Cabinet

Dr Ernesto Valenzuela

Earth Resources

Grattan Institute

Infrastructure Victoria

Latrobe City Council

Latrobe Valley Authority

Lifeline Gippsland

Municipal Association of Victoria

Prof Robert Stimson, University of Melbourne

PwC Australia

Regional Development Victoria

QUEENSLAND

Queensland Department of State Development

Queensland Treasury

Queensland Department of Premier and Cabinet

Queensland Department of Agriculture and Fisheries

Queensland Resources Council

AgForce Queensland

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Toowoomba Chamber of Commerce and Industry

Toowoomba Surat Basin Enterprise

Toowoomba Regional Council

Southern Downs Regional Council

Table A.2   (continued)

Individual or organisation

QUEENSLAND (continued)

South Burnett Regional Council

FKG Group

Wellcamp Airport

Advance Cairns

Cairns Regional Council

Quicksilver Group

Prof. Allan Dale, James Cook University

Regional Development Australia - Townsville and North West Queensland

Townsville City Council

Townsville Enterprise

SOUTH AUSTRALIA

Automotive Transformation Taskforce

Business SA

Centacare

City of Playford

City of Salisbury

Cowell Electric

Good Shepherd

Housing SA

Local Government Association of South Australia (LGASA)

Northern Economic Plan

Petro Diamond Australia

Primary Industries and Regions SA (PIRSA)

Prof. Andrew Beer, University of South Australia

Prof. John Spoehr, Flinders University

Regional Development Australia (RDA) Whyalla and Eyre Peninsula

SA Department of State Development

Sudel Industries

TAFE SA

University of South Australia (UniSA)

Whyalla Aged Care Incorporated

Whyalla and Eyre Peninsula Heavy Industry Cluster

Whyalla Chamber of Commerce and Industry

Whyalla City Council

Whyalla Steelworks, Arrium

WESTERN AUSTRALIA

Avon Regional Organisation of Councils (AROC)

Chamber of Minerals and Energy WA (CMEWA)

Heartlands WA

Karratha City Council

Merredin and Districts Farm Improvement Group (MADFIG)

Table A.2   (continued)

Individual or organisation

WESTERN AUSTRALIA (continued)

Onslow Chamber of Commerce and Industry

Pilbara Development Commission

Port Hedland Chamber of Commerce and Industry

Regional Development Australia - Pilbara

Regional Development Australia - Wheatbelt

Rio Tinto

Shire of Northam

University of Western Australia (UWA) Centre for Regional Development

WA Department of Finance

WA Department of Primary Industries and Regional Development

WA Department of State Development

WA Department of Treasury

WA Local Government Association (WALGA)

Wheatbelt Business Network

Wheatbelt Development Commission (WDC)

Wheatbelt East Regional Organisation of Councils (WEROC)

TASMANIA

Burnie Chamber of Commerce and Industry

Burnie Council

Central Coast Chamber of Commerce and Industry

Cradle Coast Authority

Department of State Growth

Devonport Chamber of Commerce and Industry

Devonport Council

Launceston Chamber of Commerce and Industry

Northern Tasmania Development Corporation

Regional Development Australia - Tasmania

Tasmanian Irrigation

University of Tasmania

NORTHERN TERRITORY

Department of Primary Industries and Resources

Department of the Chief Minister

Department of Trade, Business and Innovation

Department of Treasury and Finance

East Arnhem Regional Council

Gumatj Aboriginal Corporation

INPEX

Northern Institute

Regional Development Australia - Northern Territory

Table A.2 (continued)

Individual or organisation

AUSTRALIAN CAPITAL TERRITORY

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Australian Local Government Association (ALGA)

Australian Public Service Commission

Australian Treasury

Bureau of Infrastructure, Transport and Regional Economies (BITRE)

Department of Agriculture

Department of Employment

Department of Industry, Innovation and Science (DIIS)

Department of Infrastructure and Regional Development (DIRD)

Department of Prime Minister and Cabinet

Minerals Council of Australia

National Centre for Social and Economic Modelling (NATSEM)

Office of the Treasurer

Regional Australia Institute (RAI)

Video/teleconference

NSW Department of Industry, Skills and Regional Development

NT Department of the Chief Minister

NT Department of Infrastructure

NT Department of Primary Industry and Resources

NT Department of Trade and Business Innovation

NT Department of Treasury and Finance

James Cook University

Peel Development Commission

Pilbara Development Commission

Primary Industries and Regions South Australia (PIRSA)

Queensland Treasury

Queensland Department of State Development

Queensland Department of Premier and Cabinet

Queensland Department of Agriculture and Fisheries

SA Department of State Development

Tasmanian Department of Premier and Cabinet

Tasmanian Department of State Growth

WA Department of Regional Development

Table A.3   **Roundtables**

Organisation

Metric Roundtable

Australian Bureau of Statistics

Regional Australia Institute

Department of Employment

Bureau of Industry, Transport and Regional Economics (BITRE)

Department of Infrastructure

Department of Industry, Innovation and Sciences

National Centre for Social and Economic Modelling (NATSEM)

Treasury

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Geoscience Australia

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

NSW Centre for Economic and Regional Development

Policy Roundtable

Department of Finance

Department of Local Government and Communities

Department of Agriculture and Food

Department of Premier and Cabinet

Department of Treasury

Department Regional Development

Department State Development

Gascoyne Development Commission

Pastoralists and Graziers Association

Peel Development Commission

Pilbara Regional Council

Regional Development Australia - Peel

Regional Chamber of Commerce and Industry

WA Farmers

WA Local Government Association

B Results of the relative adaptive capacity single metric

This appendix contains tables that list the results of the index of adaptive capacity for the functional economic regions (FERs) developed by the Commission. It contains information on each region's ranking and score. Due to the wide confidence intervals, caution should be exercised when interpreting the results. Detailed information on the Commission's construction of FERs is in appendix D. Detailed information on the Commission's construction of the index of relative adaptive capacity is in appendix E.

There are four categories of adaptive capacity.

- *Most adaptive* regions are those whose index value was more than one standard deviation above the mean (10 regions in table B.1).

- *Above average* regions are those above the mean index value and within one standard deviation of the mean (27 regions in table B.2).

- *Below average* regions are those below the mean index value and within one standard deviation of the mean (27 regions in table B.3).

- *Least adaptive* regions are those whose index value was more than one standard deviation below the mean (13 regions in table B.4).

There are 12 FERs not included in the index of adaptive capacity because they lack the relevant data for the analysis (table B.5). Most of the excluded FERs are islands with small populations. As such, the final index was calculated for 77 of the 89 FERs.

A map showing the geographical boundaries of the FERs constructed by the Commission can be found in figure B.1.

Table B.1   **Most adaptive regions**

Ranking	Region	Region ID	State/territory	Score	90 per cent confidence interval
1	Canberra Region	122	NSW-ACT	2.53	(0.17, 3.08)
2	Greater Melbourne	200	Vic	1.88	(-0.03, 2.18)
3	Greater Sydney	100	NSW-ACT	1.80	(-0.36, 2.26)
4	Greater Perth	500	WA	1.58	(-0.20, 1.93)
5	Geelong	202	Vic	1.40	(0.43, 1.47)
6	Gold Coast	304	Qld	1.25	(-0.32, 1.65)
7	Goulburn - Southern Highlands	121	NSW-ACT	1.22	(0.57, 1.26)
8	Sunshine Coast	307	Qld	1.21	(0.25, 1.36)
9	Cooma	101	NSW-ACT	1.14	(0.65, 1.26)
10	Greater Brisbane	300	Qld	1.03	(-0.44, 1.43)

Source: Productivity Commission estimates.

Table B.2   **Above average regions**

Ranking	Region	Region ID	State/territory	Score	90 per cent confidence interval
11	Warrnambool	210	Vic	0.83	(0.13, 1.30)
12	South Wheatbelt	513	WA	0.83	(0.07, 1.65)
13	Horsham	209	Vic	0.80	(-0.23, 1.86)
14	Bunbury - Busselton	501	WA	0.77	(0.20, 0.90)
15	Greater Adelaide	400	SA	0.76	(-0.09, 1.09)
16	Bendigo	203	Vic	0.71	(0.20, 0.82)
17	Central East Wheatbelt	512	WA	0.70	(-0.02, 1.57)
18	Barossa	401	SA	0.70	(0.03, 1.07)
19	Albany	510	WA	0.67	(0.20, 0.78)
20	Manjimup	502	WA	0.62	(-0.05, 1.27)
21	Greater Hobart	600	Tas	0.61	(0.03, 0.82)
22	Greater Darwin	700	NT	0.57	(-1.48, 1.80)
23	Shepparton - Wodonga	204	Vic	0.56	(0.01, 0.80)
24	Central Highlands	201	Vic	0.52	(0.01, 0.66)
25	Deniliquin	114	NSW-ACT	0.48	(-0.21, 1.15)
26	Albury	113	NSW-ACT	0.42	(0.03, 0.56)
27	Esperance	503	WA	0.40	(-0.05, 0.88)
28	Illawarra - Nowra	109	NSW-ACT	0.40	(-0.27, 0.66)
29	Central West Wheatbelt	511	WA	0.39	(-0.10, 0.93)
30	Wagga Wagga - Young	120	NSW-ACT	0.35	(-0.08, 0.57)
31	Latrobe	207	Vic	0.34	(-0.19, 0.65)
32	Hunter	117	NSW-ACT	0.22	(-0.34, 0.48)
33	Richmond - Tweed	118	NSW-ACT	0.20	(-0.30, 0.39)
34	South Coast NSW	102	NSW-ACT	0.19	(-0.55, 0.61)
35	Bathurst - Orange	103	NSW-ACT	0.15	(-0.09, 0.29)
36	Limestone Coast	409	SA	0.10	(-0.60, 0.97)
37	East Gippsland	205	Vic	0.09	(-0.70, 0.95)

Source: Productivity Commission estimates.

Table B.3   **Below average regions**

Ranking	Region	Region ID	State/territory	Score	90 per cent confidence interval
38	Yorke Peninsula	402	SA	0.00	(-0.97, 1.27)
39	South Tasmania	604	Tas	0.00	(-0.64, 0.59)
40	Karratha	509	WA	-0.03	(-2.05, 2.40)
41	Darling Downs - South West QLD	302	Qld	-0.04	(-0.24, 0.23)
42	Longreach	306	Qld	-0.08	(-0.49, 0.76)
43	Eyre Peninsula	404	SA	-0.08	(-0.57, 0.55)
44	Mudgee	104	NSW-ACT	-0.11	(-0.45, 0.28)
45	Griffith	119	NSW-ACT	-0.13	(-0.36, 0.23)
46	Armidale - Moree	115	NSW-ACT	-0.16	(-0.63, 0.56)
47	Goldfields	505	WA	-0.17	(-1.19, 1.20)
48	Mildura	208	Vic	-0.19	(-0.54, 0.16)
49	Murray Bridge	407	SA	-0.21	(-1.02, 0.73)
50	Launceston - North East Tasmania	601	Tas	-0.21	(-0.64, 0.23)
51	Parkes - Cobar	107	NSW-ACT	-0.23	(-0.53, 0.54)
52	Port Hedland - Newman	508	WA	-0.24	(-2.57, 2.65)
53	Tamworth	116	NSW-ACT	-0.26	(-0.47, 0.12)
54	Townsville - Mt Isa	308	Qld	-0.30	(-0.93, 0.36)
55	Gladstone	303	Qld	-0.31	(-0.88, 0.31)
56	Mackay	305	Qld	-0.31	(-0.59, 0.21)
57	Mid West	507	WA	-0.31	(-0.59, 0.21)
58	Coffs Harbour - Grafton	105	NSW-ACT	-0.41	(-0.89, 0.04)
59	Port Macquarie	111	NSW-ACT	-0.44	(-1.00, 0.08)
60	Dubbo	106	NSW-ACT	-0.47	(-0.59, -0.01)
61	Far North QLD	301	Qld	-0.55	(-0.90, -0.05)
62	Gascoyne	504	WA	-0.67	(-1.34, 0.59)
63	Loxton	410	SA	-0.79	(-1.30, 0.32)
64	Taree	110	NSW-ACT	-0.80	(-1.54, 0.21)

Source: Productivity Commission estimates.

Table B.4   Least adaptive regions

Ranking	Region	Region ID	State/territory	Score	90 per cent confidence interval
65	West Tasmania	605	Tas	-1.03	(-1.46, 0.11)
66	East Tasmania	602	Tas	-1.04	(-1.75, 0.49)
67	Kimberley	506	WA	-1.13	(-1.89, 0.57)
68	Bundaberg	309	Qld	-1.20	(-1.65, -0.21)
69	Whyalla - West Coast SA	403	SA	-1.21	(-1.44, -0.17)
70	Far North SA	406	SA	-1.26	(-1.40, -0.23)
71	Central Tasmania	603	Tas	-1.36	(-1.98, 0.31)
72	Gympie	310	Qld	-1.37	(-1.99, -0.24)
73	Central Australia	701	NT	-1.40	(-2.36, 0.30)
74	Far West NSW - Lower Murray	108	NSW-ACT	-1.40	(-1.53, -0.30)
75	Katherine	708	NT	-2.42	(-2.94, -0.66)
76	Daly	703	NT	-2.90	(-3.41, -1.02)
77	Barkly	702	NT	-3.20	(-3.81, -1.21)

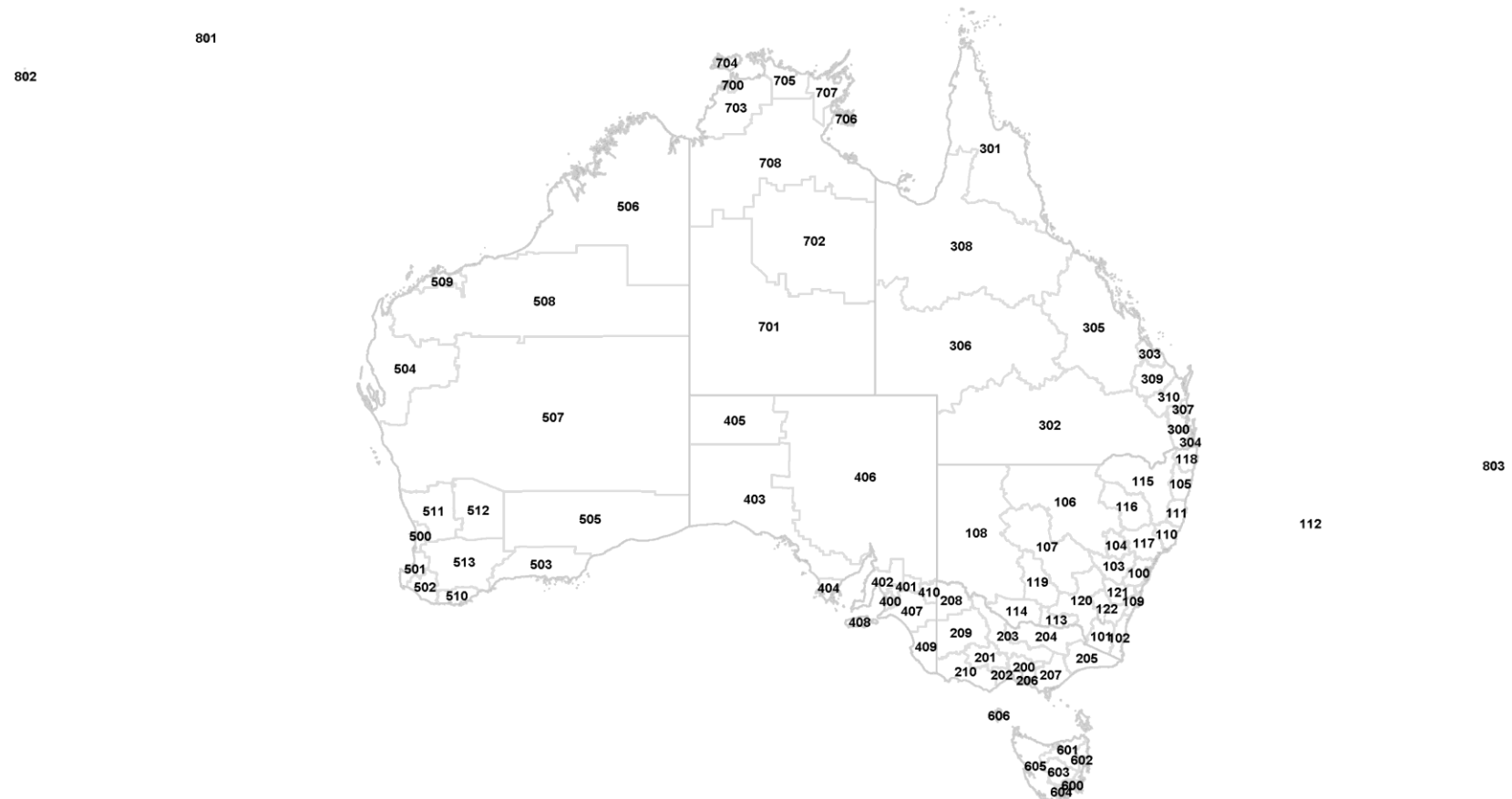*Source*: Productivity Commission estimates.

Table B.5   Regions excluded from the analysis

Ranking	Region	Region ID	State/territory	Score	90 per cent confidence interval
na	Lord Howe Island	112	NSW-ACT	**na**	**na**
na	French Island	206	Vic	**na**	**na**
na	APY Lands	405	SA	**na**	**na**
na	Kangaroo Island	408	SA	**na**	**na**
na	King Island	606	Tas	**na**	**na**
na	Tiwi Islands	704	NT	**na**	**na**
na	West Arnhem	705	NT	**na**	**na**
na	Anindilyakwa	706	NT	**na**	**na**
na	East Arnhem	707	NT	**na**	**na**
na	Christmas Island	801	Other	**na**	**na**
na	Cocos Island	802	Other	**na**	**na**
na	Norfolk Island	803	Other	**na**	**na**

na Not applicable

Source: Productivity Commission estimates.

Figure B.1   Functional economic regions[a]

a Numbers correspond to Region ID.

Source: Productivity Commission estimates.

C Australian Government expenditure on regional programs

Details to support the estimate of Australian Government regional expenditure for box 2.10 in chapter 2 are presented in table C.1. Figures for selected state governments are given in box 2.10.

These figures are indicative only. Regional programs can involve multiple levels of government, departments and policy areas, and change over time. This makes it difficult to establish a robust estimate of expenditure on regional programs.

Most notably, government financial reporting often makes it difficult to separately identify the purpose and nature of regional programs. This can occur because:

- many areas of government expenditure benefit non-metropolitan regions, but do not have regional development as their primary purpose (such as disaster recovery, pest and disease management and agricultural support)

- programs that may be intended to support regional growth and development may not be separately allocated to individual regional communities (such as tourism marketing programs for an entire state or territory)

- many large expenditure programs are not disaggregated into metropolitan and regional components. For some large projects, such as major road and rail projects that link regional centres with capital cities, there are likely to be benefits accruing to both metropolitan and regional areas, yet it is difficult to determine the relative magnitude of these expected benefits

- jurisdictions may use different methods of budget reporting (for example, some jurisdictions report only current and forward estimates, while others supply actual amounts spent; some jurisdictions report expenditure by functional area, without detailing specific grants).

Table C.1 Australian Government funding commitments for regional programs
As at May 2017

| Program[a]	Funding ($m)
Agricultural Competitiveness White Paper — a fairer go for farm businesses	25.2
Agricultural Competitiveness White Paper — building 21st century water, transport and communication infrastructure	499.5
Agricultural Competitiveness White Paper — strengthening our approach to drought and risk management	64.1
Leadership in Agricultural Industries Fund	5.0
National Institute for Forest Products Innovation	4.0
Northern Australia Rice Industry	4.0
Rural Financial Counselling Service	7.1
Relocation of the Australian Pesticides and Veterinary Medicines Authority	25.6
Community Infrastructure Projects — New Announcements: Sunshine Coast Regional Council Submarine Cable Study	0.3
Community Infrastructure Projects — New Announcements: Mt Roland FireLight Trial Festival in Tasmania + Tasmanian Winter Events Program on the North West Coast of Tasmania	0.1
Mobile Black Spot Program	220.0
Regional Arts Fund	3.4
Regional Study Hubs	15.2
Rural and Regional Enterprise Scholarships	24.0
Jobs and Growth in Tasmania — University of Tasmania campuses in Launceston and Burnie	150.0
Deakin University — Support for the Warrnambool Campus	14.0
Rural Health Commissioner and Pathway for Rural Professionals — Establishment	4.4
Rural General Practice Grants Programme	13.1
Better Targeted Rural Financial Incentives for Doctors	457.8
Developing Northern Australia — Positioning the North as a Leader in Tropical Health	6.4
Rural Health Multidisciplinary Training Programme	775.0
John Flynn Placement Programme	15.2
Strengthening Medicare — Rural Procedural Grants Programme	73.3
Alcoa Portland Aluminium Smelter — Financial Assistance	30.0
Northern Australian Tourism Initiative	13.6
Northern Australia Water Resource Assessment	15.0
Cooperative Research Centre for Developing Northern Australia	75.0
National Resources Development Strategy — Exploring for the Future	100.5
Regional Jobs and Investment Packages	220.0
Regional Growth Fund	472.2
Regional Rail in Victoria	500.0
Faster Rail Connecting Capital Cities and Orbital Regional Centres	20.0
Building Better Regions Fund	297.7
Tasmanian Jobs and Growth Package	80.3
Developing Northern Australia — Improving Northern Cattle Supply Chains (Northern Australia Beef Roads Programme)	100.0

(continued next page)

Table C.1 (continued)

Program[a]	Funding ($m)
Northern Australia Roads Programme	600.0
National Highway Upgrade Programme	225.8
Developing Northern Australia — Freight Rail Analyses	4.9
Tasmanian Freight Rail Revitalisation	59.8
Regional Aviation Access	87.8
Victorian Infrastructure Package	565.0
Great Ocean Road (Victoria)	50.0
Great Western Highway (New South Wales)	200.0
Pacific Highway (New South Wales)	5 600.0
Bruce Highway (Queensland)	6 700.0
Cape York Region Package (Queensland)	208.4
Outback Way (Queensland, Northern Territory and Western Australia)	142.0
Adelaide to Tarcoola Re-Railing Upgrade Acceleration (South Australia)	252.0
Anangu Pitjantjatjara Yankunytjatjara Lands (South Australia)	85.0
South Australian Regional Roads Package	11.0
Great Northern Highway — Muchea to Wubin Upgrade (Western Australia)	275.8
NorthLink WA — Swan Valley Bypass (Western Australia)	648.4
Midland Highway (Tasmania)	400.0
Regional Roads Productivity Package (Northern Territory)	90.0
Regional Development Australia Committees	74.3
Townsville City Deal	150.0
Seasonal Work Incentives for Job Seekers — Trial	27.5
Strong and Resilient Communities	12.6
Regional and Remote Student Access to Education — Additional Support	93.3
TOTAL	**20 894.5**

a Loans schemes and programs with a significant unspecified metropolitan component have not been included in the above estimates.

Source: Joyce and Nash (2017).

Consequently, publicly available government financial reports do not yield a robust estimate of the relative levels of expenditure on regions compared with capital cities. Using unpublished departmental data, a recent Grattan Institute analysis of transport infrastructure investment showed the relative shares of Commonwealth and State governments' road and rail investment that was allocated to capital cities and to non-capital city areas during the period 2005-06 to 2014-15 (Terrill 2016b, p. 28) (figure C.1). This analysis revealed that Commonwealth and State governments have spent proportionally more (relative to population and size of regional economy) in regional areas of New South Wales and Queensland than in large, faster growing capital cities such as Sydney, Melbourne and Perth.

Figure C.1 Governments have spent more on road and rail in regional areas than in capital cities, relative to population growth and share of national GDP[a]

2005-06 to 2014-15
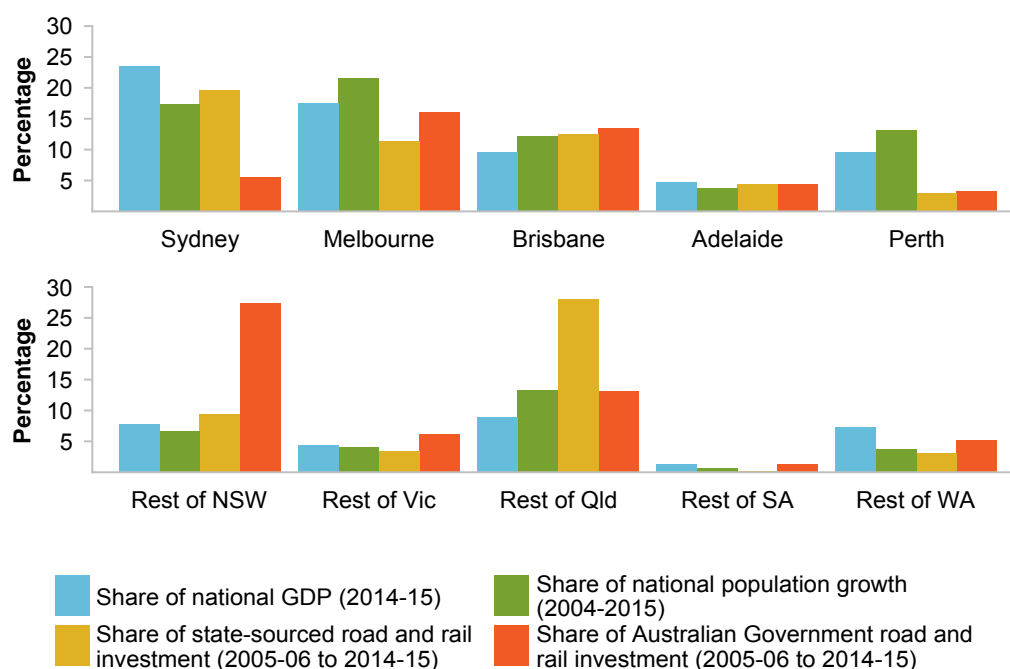
a Excludes private sector contributions to public-private partnerships.

Source: Terrill (2016b, p. 28).

However, this analysis also needs to be interpreted cautiously, as it does not account for key factors including:

- differences in the quality and adequacy of existing transport infrastructure

- differences in the cost of providing a comparable service in capital cities compared with regional areas

- benefits accruing to capital cities because of improved transport connectivity with regional areas (and vice-versa).

A key issue affecting the interpretation of the data in the above figure and table is whether the expenditure has been used for maintaining an existing level of service or whether it was an investment in additional capacity or service quality. It is not possible to distinguish governments' investment in new infrastructure in response to growth and transition in a region from investment in repairing and/or replacing deteriorating infrastructure (or, for that matter, catching up on past underinvestment in maintenance). Furthermore, it is not possible to identify the proportion of investment spending that relates to promoting growth and development as distinct from providing a basic level of service (such as public transport) with adjustments for changing population and demographic characteristics.

Improved government budget reporting processes would be needed to enable such identification. This would be a first step toward clarifying, respectively, the extent of government expenditure allocated to:

- providing and maintaining basic services (noting that the cost of service provision will differ across regions)

- developing (that is, extending) regional capacity and connectivity beyond current levels.

D Functional economic regions

In examining regional transitions, it is important to consider how a region is defined. A region can be defined on the basis of various attributes, such as labour markets, industry composition, natural resources and local administration. For economic analysis, 'a region is typically defined as an area that contains a cohesive network of trade and commerce; local commuting for jobs and shopping; common access to services; and association of community activities' (NSW Government, sub. DR71, p. 11). Functional economic regions (FERs) are designed to better reflect these common economic linkages between people across geographic areas. FERs should be considered in policy making because the different challenges faced by different FERs require different policy responses (Karlsson and Olsson 2015, p. 2).

FERs were developed for this study to demonstrate a possible approach to defining regions for examining regional transitions and planning. These FERs are only illustrative but the approach can be built upon by governments, in consultation with councils and communities.

This appendix describes the usefulness of FERs (section D.1) and the way they were constructed for this study (section D.2). Maps of the FERs, and some comparisons with other definitions of regions used by governments and organisations in Australia are also presented (section D.3).

D.1 Why use functional economic regions?

FERs reflect the notion that geographic areas are linked by the interactions between people across areas. It recognises that people travel between geographic areas for work and to access goods and services, and that firms hire workers, purchase services and sell their products across geographic areas.

> [A] functional region is an integrated economic system defined by the interaction which takes place in its networks, e.g. commuting, communication, decision-making and distribution of goods and services. … A functional region has a much higher frequency of all types of interactions within its borders than with other functional regions. (Karlsson and Olsson 2015, p. 4)

FERs are usually based around a centre, such as a town or city, with which the region is strongly economically interdependent. Areas within the same FER can have different characteristics, and they interact with each other for access to goods, services, labour and capital (Karlsson and Olsson 2015, p. 3). A central town might contain more people and businesses, and less farm land, relative to its surrounding areas. In this case, the surrounding areas would be more dependent on the central town for access to its workforce and services,

and the central town might be more dependent on its surrounds for access to jobs, farm produce and users of its services.

Individual FERs are also related to each other and are part of a larger system (Karlsson and Olsson 2015, p. 17). FERs within the system have differing patterns and degrees of specialisation, which are influenced by factors such as their endowments and historical developments in the division of labour. They are connected with each other to varying degrees through the flow of goods, services, labour, capital and information.

The boundaries of FERs can change over time as the nature of transport and communication infrastructure changes with technological development. As transport methods and routes to a particular city improve (for example, through the development of better road or rail infrastructure), more people from areas that are further away could travel towards the city for jobs and services, to such an extent that they too become part of the same FER.

FERs provide a suitable approach for thinking about transitions, development and planning because they consider the similarities and linkages between geographic areas, acknowledging that they operate in an integrated way. Planning solely based on administrative boundaries, such as local government areas (LGAs), or statistical areas, can lead to inadequate consideration of the geographic systems they operate within. It can result in insufficient coordination and inefficient competition for resources in areas that may be closely related through commuting flows and access to services (chapter 5).

The Statistical Area Levels of the ABS Australian Statistical Geography Standard (ASGS) were designed in part to reflect community interactions, labour markets and regional characteristics, as well as administrative boundaries and population sizes (ABS 2010). However, they were not designed to be used for government decision making and, as a result, some of these areas are too large or too small for regional planning purposes.

The Australian Government and some State and Territory governments and local councils have defined boundaries at a regional level to help identify regional priorities and facilitate regional strategic planning and development (chapter 5). Governments have used different approaches to define these regional boundaries, and the boundaries do not always coincide across levels of government (section D.3).

New FERs were developed for this study to overcome the difficulties of using small-scale statistical areas for examining the issues of regional transitions and development. These FERs also achieve a more consistent approach to defining regional boundaries that reflect economic linkages within regions. They are used for the presentation of the results of time series analysis (chapter 3) and the index of adaptive capacity (chapter 4).

D.2   Methodology

There are various ways of developing FERs, from political or administrative approaches to more formal approaches using statistical analysis. A common statistical approach is to define

FERs based on labour markets, where interactions between geographic areas are captured through work commutes by residents.[37] FERs formed in this way take into account work commutes, but are also likely to capture other aspects of household and firm behaviour. Activities such as individuals accessing goods and services, and firms hiring workers, purchasing services and selling products, often occur close to where households and firms are located (Karlsson and Olsson 2015, p. 7).

In Australia, both the University of Newcastle's Centre of Full Employment and Equity (CofFEE) (CofFEE nd; Mitchell and Stimson 2010; Stimson et al. 2015) and the NSW Government (sub. DR71) have created FERs using methods that rely on journey to work data.

This study uses journey to work data as the main input to the development of FERs, but also considers access to services. Journey to work flows were used to aggregate smaller geographic areas to FERs via the Intramax method. The basics of this method are described below. The section then details how this method was applied and the other processes involved in creating FERs for this study.

Intramax method

The Intramax method is a hierarchical clustering algorithm developed by Masser and Brown (1975). It has been used in the creation of FERs in Australia (Mitchell and Stimson 2010; Mitchell and Watts 2010; Stimson et al. 2015) and other countries, such as Slovenia (Drobne and Bogataj 2012) and South Africa (Nel, Krygsman and de Jong 2008).

The method creates FERs from smaller geographic areas using a stepwise procedure. At each step of the process, the two areas with the strongest commuting links get grouped together. This is based on an objective function, which finds the maximum difference between observed o and expected e travel flows (in both directions) between a pair of areas i and j.

$$\max \left(o_{ij} - e_{ij} \right) + \left(o_{ji} - e_{ji} \right), \qquad i \neq j$$

The objective function measures the extent to which observed journey to work flows exceed the flows that would have been expected if there was no systematic relationship between the two areas (that is, if the probability of working in a particular location was not affected by where people live). The areas that have the highest observed commuting flows between them, relative to their expected flows, get clustered. The clustering process continues at each step, resulting in fewer but larger regions, until a specified stopping point is reached.

Calculating the objective function requires a matrix of data on journey to work flows. Each row of the matrix represents a place of residence (origin), each column represents a place of work (destination), and each cell contains the number of people who travel from a particular

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[37] Alternatives to a labour market approach include those based on housing markets, business linkages, shopping and service districts, and administrative areas (to capture public service delivery) (Karlsson and Olsson 2015, p. 8).

origin to a particular destination for work. Box D.1 details how data from this matrix are used in the Intramax procedure.

A simple illustration of the clustering process

An iteration of the Intramax clustering process is illustrated in table D.1 using a hypothetical matrix of journey to work flows for 100 people between three places. Panel 1 of the table presents the original journey to work matrix, which contains the observed travel flows between each pair of regions. Panel 2 presents the expected travel flows between each pair of regions. These are calculated from the row and column totals of the original journey to work matrix (box D.1). Panel 3 shows how the objective function (both the original and the transformed versions described in box D.1) is calculated for each pair of regions, using values from panels 1 and 2. The pair of places that produces the highest value of the objective function is the pair containing Place A and Place B. In panel 4, this pair is grouped together in an updated journey to work matrix.

Where to stop the clustering process?

If the clustering process was to continue without stopping, then all places would eventually get grouped into one single region. There are two main approaches to deciding when to stop the clustering process (Stimson et al. 2015, p. 5). It could be stopped when a specified percentage of all travel flows are intra-regional. The percentage of flows that are intra-regional is calculated by summing the diagonals of the journey to work matrix (shaded in grey in the example in table D.1) and dividing by the total number of people. Alternatively, the clustering could be stopped when a specified number of regions is reached.

Additional constraints to the clustering process

Constraints can be added to the Intramax procedure to restrict the pairs of places that are allowed to get grouped together. Two constraints were investigated for this study — a contiguity constraint and a distance constraint. These are described in the subsection below in the context of how the Intramax method was applied to this particular study.

Box D.1   Details of the Intramax method

The Intramax method creates functional economic regions (FERs) by grouping together geographic areas that have the strongest commuting links at each iteration of the procedure. These areas are identified according to the objective function, which calculates the difference between observed and expected travel flows between pairs of areas i and j.

$$\max \left(o_{ij} - e_{ij}\right) + \left(o_{ji} - e_{ji}\right), \qquad i \neq j$$

Given a matrix of data on journey to work flows T, the observed travel flow o_{ij} between an origin i and a destination j is the value of the cell t_{ij} in the matrix.

The calculation of the expected travel flow e_{ij} draws on probability theory. If two events A and B are independent, the probability of one does not affect the other and the following relationships hold.

$$P(A|B) = P(A) \implies \frac{P(A \cap B)}{P(B)} = P(A) \implies P(A \cap B) = P(A) \times P(B)$$

Supposing that the two 'events' are living in origin i and working in destination j, then the expected travel flow e_{ij} from origin i to destination j, assuming independence, is given by:

$$e_{ij} = n \times P(t_{i*}) \times P(t_{*j}) = n \times \frac{\sum_{k=1}^{J} t_{ik}}{n} \times \frac{\sum_{k=1}^{I} t_{kj}}{n} = \frac{\sum_{k=1}^{J} t_{ik} \sum_{k=1}^{I} t_{kj}}{n} = \frac{T_{i*}T_{*j}}{n}$$

where:

- n is the total number of people who work in all areas

- $\sum_{k=1}^{J} t_{ik} = T_{i*}$ is the sum of all outflows from origin i to all J destinations

- $\sum_{k=1}^{I} t_{kj} = T_{*j}$ is the sum of all inflows to destination j from all I origins

- $P(t_{i*}) = \frac{T_{i*}}{n}$ is the probability that a person's place of residence is origin i

- $P(t_{*j}) = \frac{T_{j*}}{n}$ is the probability that a person's place of work is destination j.

Substituting the observed and expected travel flows into the objective function gives:

$$\max \ \left(o_{ij} - e_{ij}\right) + \left(o_{ji} - e_{ji}\right) = \left(t_{ij} - \frac{T_{i*}T_{*j}}{n}\right) + \left(t_{ji} - \frac{T_{j*}T_{*i}}{n}\right) = \left(\frac{nt_{ij}}{T_{i*}T_{*j}} - 1\right) + \left(\frac{nt_{ji}}{T_{j*}T_{*i}} - 1\right)$$

Transforming this function by adding or multiplying it by a constant does not change the pair of areas that would maximise it. Therefore, the objective function can be simplified to the following:

$$\max \ \left(\frac{t_{ij}}{T_{i*}T_{*j}} + \frac{t_{ji}}{T_{j*}T_{*i}}\right), \qquad i \neq j$$

This changes the function to be in terms of proportional (rather than number value) differences in travel flows. It also makes the function algebraically and computationally simpler as it is solely composed of the cell values and row and column totals of the journey to work matrix.

Once the pair that maximises the objective function is identified, the areas that make up the pair get grouped together and the journey to work matrix is reduced by one column and one row to reflect this. Then the new journey to work matrix is used in the next iteration to determine the next pair of areas to combine.

Sources: Based on Masser and Brown (1975); Stimson et al. (2015).

Table D.1   Intramax method — hypothetical example of one iteration

Panel 1: Observed journey to work flows $\left(o_{ij} = t_{ij}\right)$

Origin \ Destination	Place A	Place B	Place C	Total outflows
Place A	20	2	8	30
Place B	23	5	12	40
Place C	7	3	20	30
Total inflows	50	10	40	100

Panel 2: Expected journey to work flows $\left(e_{ij} = \frac{T_{i*}T_{*j}}{n}\right)$

Origin \ Destination	Place A	Place B	Place C	Total outflows
Place A	15	3	12	30
Place B	20	4	16	40
Place C	15	3	12	30
Total inflows	50	10	40	100

Panel 3: Objective function for each pair of places

Pair of places	Original objective function $\left(o_{ij} - e_{ij}\right) + \left(o_{ji} - e_{ji}\right)$	Transformed objective function $\left(\frac{t_{ij}}{T_{i*}T_{*j}} + \frac{t_{ji}}{T_{j*}T_{*i}}\right)$
Place A – Place B	$(2-3)+(23-20) =$ **2**	$\frac{2}{30 \times 10} + \frac{23}{40 \times 50} =$ **0.0182**
Place A – Place C	$(8-12)+(7-15) = -12$	$\frac{8}{30 \times 40} + \frac{7}{30 \times 50} =$ 0.0113
Place B – Place C	$(12-16)+(3-3) = -4$	$\frac{12}{40 \times 40} + \frac{3}{30 \times 10} =$ 0.0175

Panel 4: Updated matrix of observed journey to work flows

Origin \ Destination	Place A – Place B	Place C	Total outflows
Place A – Place B	50	20	70
Place C	10	20	30
Total inflows	60	40	100

Creating functional economic regions

There were a number of key steps involved in creating the FERs for this study.

1. Preparing the data on journey to work flows.

2. Separating states and territories, and separating greater capital city areas from the Intramax procedure.

3. Implementing the Intramax procedure for each state and territory.

4. Aggregating ungrouped areas that had only one-way journey to work flows to a FER.

5. Aggregating ungrouped areas that shared a border with only one FER.

6. Aggregating ungrouped areas to the FER containing their closest service centre.

7. Manual adjustments to FERs.

These steps are discussed in turn. The R programming scripts and data, which can be used to replicate the results, are provided on the Commission's website.

1. Preparing the data on journey to work flows

The key data source used in constructing FERs is a matrix of journey to work flows. In this study, the data used are from the 2011 Census of Population and Housing, obtained from the ABS. Each row and column in the matrix represents a Statistical Area Level 2 (SA2) unit of the 2011 ASGS. These are the smallest units for which Census data can be released. Rows and columns that do not represent geographic areas were excluded from the matrix.[38] A total of 2196 geographic SA2s were used in the construction of FERs (table D.2).

A limitation of these data is that cells with small values were randomly adjusted by the ABS to prevent the possible identification of any particular person. As a result, no reliance should be placed on small cells. For the creation of FERs, a threshold of at least 5 people travelling between two SA2s was used — all cells with a value less than 5 in the original journey to work matrix were replaced with 0. This avoids small adjusted cells from having an undue influence on the Intramax clustering process, especially for SA2s with very small populations. For example, a small SA2 with 10 non-residents working there might happen to have had one worker who resides outside of the FER that the SA2 actually belongs to. Random adjustment could mean that this appeared as 3 people in the matrix. As a result, the SA2 would have a higher chance of grouping with the wrong FER in the Intramax procedure. Reducing small cell values to 0 avoids this possibility. However, a possible consequence is that a sparsely populated SA2 with few but legitimate journey to work flows to and from other SA2s in the same FER might have a lower chance of grouping with the FER it belongs to. Nevertheless, these SA2s could get grouped into an appropriate FER through the additional steps used to aggregate ungrouped areas after the Intramax procedure in this study.

2. Separating states and territories and separating greater capital city areas

Preliminary analysis for this study and past Australian research on FERs (Mitchell and Stimson 2010; Mitchell and Watts 2010; Stimson et al. 2015) showed that conducting the Intramax method on journey to work flows across the whole of Australia leads to the creation of FERs that cross state and territory boundaries. Each state and territory was analysed

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[38] Excluded rows and columns represented people who were in transit, offshore or on board vessels on Census night, people who had no usual address, and people who did not have or did not state a place of work.

separately in this study (with the exception of New South Wales and the ACT, which were treated together). The reason for the separation was to facilitate the development of FERs that could more readily be used for planning purposes. State and Territory governments are a key driver of planning and development, and regions within their boundaries must operate according to their specific rules, regulations, policy frameworks and governance arrangements.

New South Wales and the ACT were analysed together because of the intrinsic links between the growth and development of the ACT and surrounding areas of New South Wales. This is recognised by both the ACT and NSW Governments, who collaborate on proposals for policy change, planning and service delivery initiatives (ACT Government and NSW Government 2016).

In order to enforce the separation between states and territories (except for New South Wales and the ACT) in the Intramax procedure, each was analysed individually with their own journey to work matrices. Other territories that only consisted of one SA2 (Jervis Bay, Christmas Island and Cocos (Keeling) Islands) were not analysed using the Intramax procedure.

The SA2s that constituted greater metropolitan areas of each capital city (except the ACT) were also excluded from the Intramax procedure and instead formed their own FER within each state and territory. This approach was taken because having a single region that incorporates the capital city is more consistent with existing boundaries used by State and Territory governments for regional planning. Metropolitan areas were defined according to the Greater Capital City Statistical Areas (GCCSAs) definition within the ASGS. GCCSAs are designed to represent the socioeconomic extent of each capital city and include the 'people who regularly socialise, shop or work within the city, but live in the small towns and rural areas surrounding the city' (ABS 2010, p. 31). Preliminary analyses using the Intramax procedure tended to split capital cities into a number of FERs and incorporate more regional areas within them, reflecting the journey to work flows between areas outside of the statistically defined GCCSAs and areas closer to the city. Grouping GCCSAs reduced the initial number of SA2s by more than half (table D.2).

Despite the manual separation of states and territories and of GCCSAs, the links between the FERs formed with this approach should be taken into consideration in regional planning.

3. Implementing the Intramax procedure for each state and territory

The Intramax procedure was conducted on each state and territory journey to work matrix using a purpose-built function written in the R programming language and statistical software environment (The R Foundation nd). It allows the stopping mechanism for the clustering process to be altered and has options to include a contiguity constraint and a distance constraint.

For this study, the clustering process was stopped when a specified number of FERs was reached. For each state and territory, the number was chosen to produce a manageable number of FERs for planning purposes, and was informed by existing regional definitions. This approach to stopping the clustering process was taken, rather than the threshold percentage of intra-regional flows approach, because to produce a small enough number of FERs for planning, very high percentages of over 95 per cent would have had to be set. Choosing a number for each state and territory allowed greater flexibility to be more consistent with existing regional definitions. The number of FERs chosen for each state and territory for the Intramax procedure are shown in table D.2.

A contiguity constraint was implemented for most of the clustering process. This constraint restricts mergers to places and regions that are adjacent to each other. Research using journey to work data has found that whether or not this constraint is implemented has little or no effect on the end results — the resulting regions tend to be contiguous in any case (Drobne and Lakner 2016; Masser and Brown 1975, p. 515; Mitchell and Watts 2010, p. 29). However, including the constraint has the added advantage of reducing the number of pairs for which the objective function must be calculated, and therefore reducing the total computation time (Masser and Brown 1975, p. 512). This constraint was imposed for 80 per cent of the iterations in the Intramax procedure to reduce computation time. It was relaxed for the remaining 20 per cent of iterations in order to allow islands to get grouped to the mainland if there were sufficient journey to work flows between them.

A distance constraint was also investigated. This prevents SA2s from grouping at any stage of the iteration process if the centroids (geographic centres) of those SA2s are more than a certain distance apart. A similar constraint had been examined by Stimson et al. (2015) in their creation of FERs, where they excluded journey to work flows if they exceeded a threshold commuting distance of 300 km because it was obvious those people were not carrying out a daily commute. A distance constraint was not included in this study because daily commuting flows were not the only consideration in the development of these FERs, which had a regional planning focus in mind. Some of the resulting FERs span large distances, but appear to be reasonable for planning purposes (particularly in remote areas with few residents) and are similar to existing regional planning boundaries.

A total of 131 FERs were formed following the Intramax procedure (table D.2). This included 53 SA2s that did not get grouped into any FER at all, many because they represent areas with no or relatively few commuting flows between other SA2s. Some of these were grouped into appropriate FERs using other means, described below.

4. Aggregating ungrouped areas that had only one-way journey to work flows

Seventeen of the 53 ungrouped SA2s had only commuting inflows and no outflows (or only outflows and no inflows) with FERs they shared a border with, and were allocated to a FER on this basis (table D.2). These mainly captured SA2s that had few or no residents but were locations of employment. They include industrial areas (such as Port Kembla Industrial), parts of central business districts (Parkes in the ACT), and ports, airports and national parks.

5. Aggregating ungrouped areas that shared a border with only one FER

Eight of the remaining 36 ungrouped SA2s were allocated on the basis that they shared a border with only one FER (table D.2). These SA2s were generally small and contained no external commuting flows, and included areas such as lakes, bays and national parks located within a FER. It is reasonable to assume that any people within these areas would interact mostly with the only neighbouring FER, and that the area provides a source of amenity to the people in the neighbouring FER.

6. Aggregating ungrouped areas according to their closest service centre

Seventeen of the remaining 28 ungrouped SA2s were allocated to FERs that contained the SA2's nearest service centre (table D.2). Many of these SA2s also had a low level of commuting flows, but shared borders with more than one FER, so were not allocated to a FER in the previous step. They include more areas containing national parks, such as the wilderness areas in Tasmania's south west. Some of the SA2s represent self-contained labour markets, where people are only employed within the SA2 they reside in, such as in Indigenous communities in the north of Queensland. The decision to allocate these SA2s to their nearest service centre was based on the assumption that people within these SA2s would travel to their nearest service centre if they require more than basic levels of services. For the SA2s that contain no residents, it is assumed that people from the nearest urban centre would be most likely to utilise the amenity that the SA2 provides.

Service centres were identified using the locations of ASGS Urban Centres, assuming that population density can be used as a proxy for the availability of services.[39] Urban Centres represent areas of concentrated urban development, based on criteria relating to population density and urban infrastructure (ABS 2012a). The smallest Urban Centre category in the classification contains 1000 to 4999 people. A threshold population size of at least 5000 was used for this study to identify areas that are most likely to have more than a basic level of services. Straight-line distances between the centroid of each remaining SA2 and each service centre were calculated, and SA2s were then grouped to the FER that contained its nearest service centre. A number of restrictions were applied. SA2s were not grouped if they had a land size of over 10 000 km^2 because the centroid of the SA2 is less likely to represent where people are located in such a large area. Neither were they grouped if their nearest service centre was more than 600 km away. SA2s that represented islands were not grouped either because the nearest mainland service centre might not necessarily be the most convenient place to access services, depending on the location of bridges and ports.

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[39] This is consistent with how service centres are identified in the construction of the Accessibility/Remoteness Index of Australia (Hugo Centre 2015).

7. Manual adjustments to FERs

Finally, two manual adjustments were made to FERs where it was deemed sensible (table D.2). One ungrouped SA2 was manually allocated to a FER — Jervis Bay (a separate territory) was grouped with the FER in New South Wales that it shares a border with and that contains its nearest service centre. Although it is considered a separate territory, many people who work in Jervis Bay reside in New South Wales. In the Regional Development Australia (RDA) regional boundaries, Jervis Bay is also grouped with the New South Wales region it borders with (DIRD 2017c). Further, Norfolk Island (another separate territory) was added as its own FER. Norfolk Island is not included in the 2011 ASGS but is included in the 2016 ASGS and is acknowledged in the RDA regional structure.

A total of 89 FERs were formed at the end of this process. A correspondence table from SA2s to FERs is provided in Excel format on the Commission's website. The boundaries of each FER are also provided in ESRI Shapefile format.

Table D.2 Number of FERs at each step of the process
By state and territory

Steps in creating FERs	NSW–ACT	Vic	Qld	SA	WA	Tas	NT	Other	Total
1. Original SA2s	648	433	526	170	250	98	68	3	2 196
2. Grouping greater capital city areas	369	152	290	61	77	63	24	3	1 039
3. Intramax procedure	41	16	20	12	18	10	11	3	131
4. Aggregating SA2s with only one-way work flows	33	14	19	11	15	10	9	3	114
5. Aggregating SA2s that shared a border with only one FER	31	14	14	11	15	9	9	3	106
6. Aggregating SA2s to their closest service centre	23	11	11	11	14	7	9	3	89
7. Manual adjustments	23	11	11	11	14	7	9	3	89

Source: Productivity Commission estimates.

Limitations of the methodology

The creation of FERs described above demonstrates a way of developing a regional definition for the purposes of this study, but they should not be used as the definitive regional boundaries for planning and development. Further analysis and consultation between governments and communities is required to take into account additional connections between areas and other considerations (including social and cultural) for planning purposes. Such an analysis might lead to adjustments to the number and composition of FERs. For example, for the purposes of this report, no manual adjustments were made to islands, but it is likely that some of these

interact with mainland areas and could be manually allocated to a FER. Areas could also be grouped based on non-work connections, such as the trade of goods and services. State and Territory governments and local communities are better placed to make these decisions.

Another limitation is that these FERs were constructed based on 2011 Census data because 2016 Census data were not available in time to update the analysis for the report. Conducting the analysis using 2016 data may show that there have been slight changes over time.

FER naming conventions and coding structure

For the purpose of this study, each FER is given a meaningful name. For FERs that represent GCCSAs, these are simply the names of the GCCSAs (for example, 'Greater Sydney'). FERs that are made up of a single SA2 were named according to the SA2 name. For FERs that closely reflect existing regional boundaries of State and Territory governments, RDA regions or SA3 or SA4 regions of the ASGS, the names of these were used to name the FER. Remaining FERs were named according to the major towns or cities within the FER, or according to the compass direction of the FER's location within the state or territory (for example, 'South Tasmania').

Each FER also has a corresponding 3-digit code. The first digit identifies the state or territory to which the FER belongs to (NSW–ACT = 1, Vic = 2, Qld = 3, SA = 4, WA = 5, Tas = 6, NT = 7, Other = 8). The last two digits start at 00 for the FER representing the GCCSA and then increase consecutively for each other FER in the state or territory. A list of FER names and codes and a corresponding map are provided in appendix B.

D.3 Functional economic region maps and comparisons with other regional definitions

This section contains maps of the FERs constructed for this study, and comparisons with other regional boundaries, including ASGS Statistical Area Levels, FERs developed by CofFEE, RDA regions, and regions used by State and Territory governments.

Comparing FERs with ASGS Statistical Area Levels

The boundaries of all FERs and their constituent SA2s are shown in figure D.1. FERs tend to be centred around larger cities and towns, and incorporate surrounding areas that might also include smaller urban centres. FERs also tend to be larger in more remote areas, reflecting the smaller population sizes and fewer urban centres in these areas.

The FER boundaries were compared with the boundaries of SA3 and SA4 regions of the 2011 ASGS (figure D.2). SA3s are clusters of SA2s that have similar regional characteristics, administrative boundaries or labour markets, while SA4s are designed for

the output of Labour Force Survey data and reflect labour markets and population sizes (ABS 2010). There are 333 geographic SA3s and 88 geographic SA4s across Australia.

When compared with SA3s, there are much fewer FERs in urban areas but some rough boundary alignments in regional and remote areas. This reflects how SA3s are constructed: 'SA3s are often the functional areas of regional towns and cities with a population in excess of 20,000 or clusters of related suburbs around urban commercial and transport hubs within the major urban areas' (ABS 2010, p. 25).

There is a similar number of FERs as SA4s, but there are large differences in their composition. Notably, there are more regional and remote FERs and fewer metropolitan FERs compared with SA4s. This is because SA4s were created specifically for the release of regional labour force data. As a result, the population sizes of SA4s have to be large enough to guarantee the quality of data from the labour force sample survey (ABS 2010). This means that SA4 boundaries in more remote areas can be quite large, while metropolitan areas tend to be split into multiple SA4s.
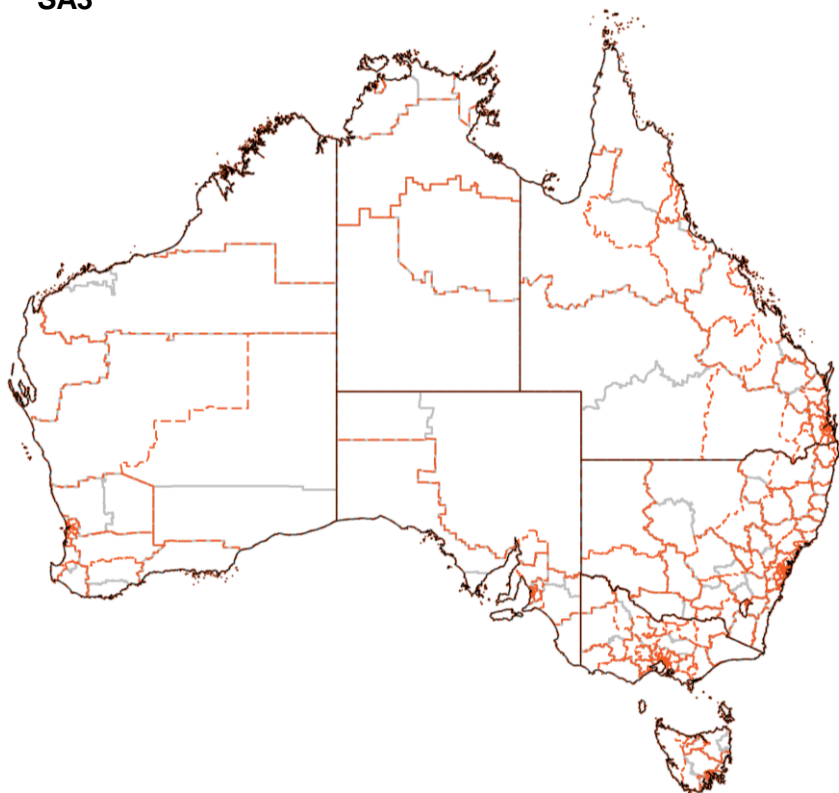
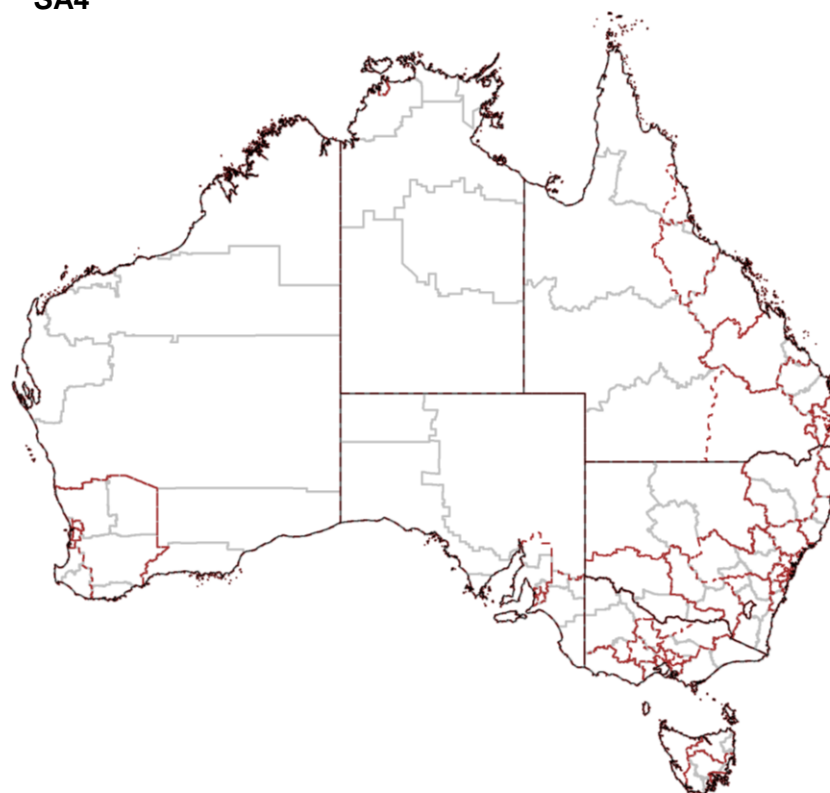Figure D.1   **FERs and constituent 2011 SA2 regions**

——— FER (89)   - - - - SA2 (2197)
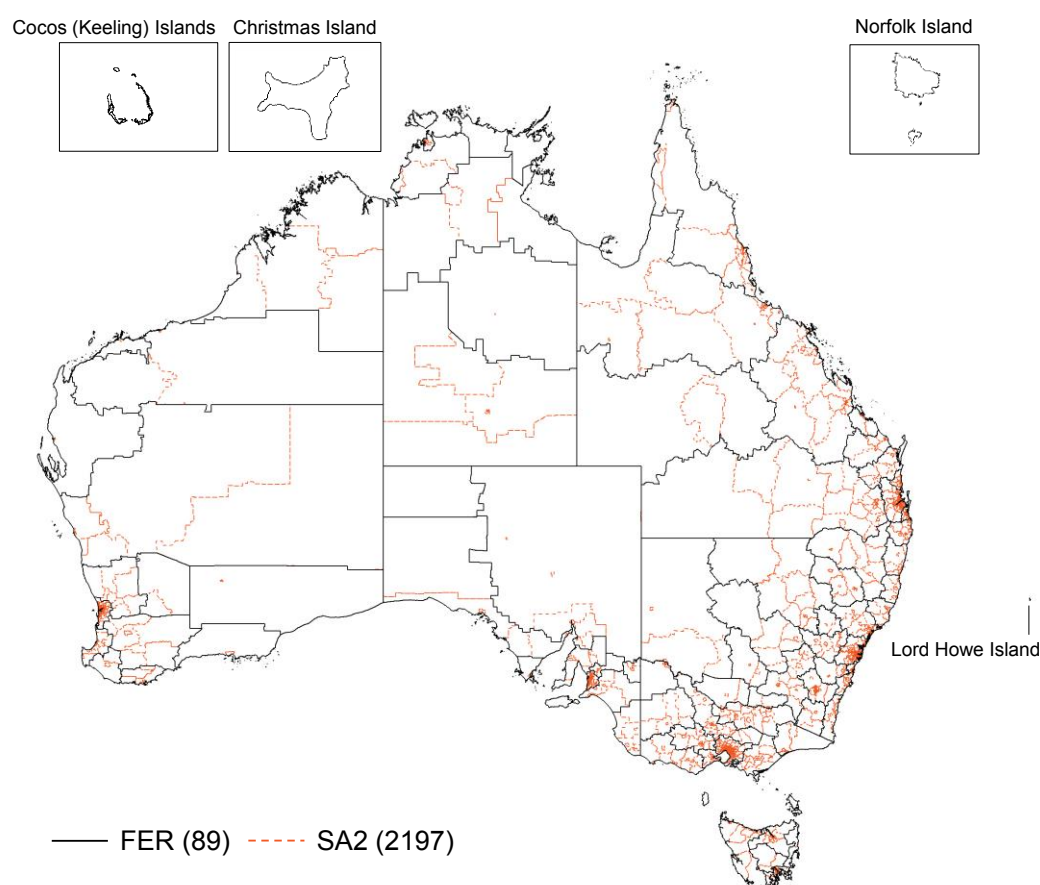
Sources: Productivity Commission estimates; ABS (2010).

Figure D.2   FERs compared with 2011 SA3 and SA4 regions

SA3   **SA4**


——— FER (89)   ----- SA3 (333)   ----- SA4 (88)

Sources: Productivity Commission estimates; ABS (2010).

Comparing FERs with CofFEE FERs

The FERs developed for this study differ to those produced by CofFEE (figure D.3). Although both use the Intramax procedure and journey to work data at the SA2 level from the 2011 Census, there are some key points of difference. The CofFEE FERs were not developed with a focus around governance or regional responsibility, so there are a greater number of CofFEE FERs (159 in total) and they include some that cross state boundaries along the east coast and at the Victoria and South Australia border (Stimson et al. 2015). CofFEE FERs around capital cities are also not restricted to GCCSAs. Furthermore, unlike in the construction of the CofFEE FERs, the FERs developed for this study consider some additional steps beyond the analysis of journey to work flows in allocating SA2s to FERs (section D.2). This means, for example, that some SA2s that constituted self-contained labour markets that were aggregated to a FER for this study remained as individual SA2s in CofFEE's FER structure.

Figure D.3   FERs compared with 2011 CofFEE FERs

FER (89)   CofFEE FER (159)
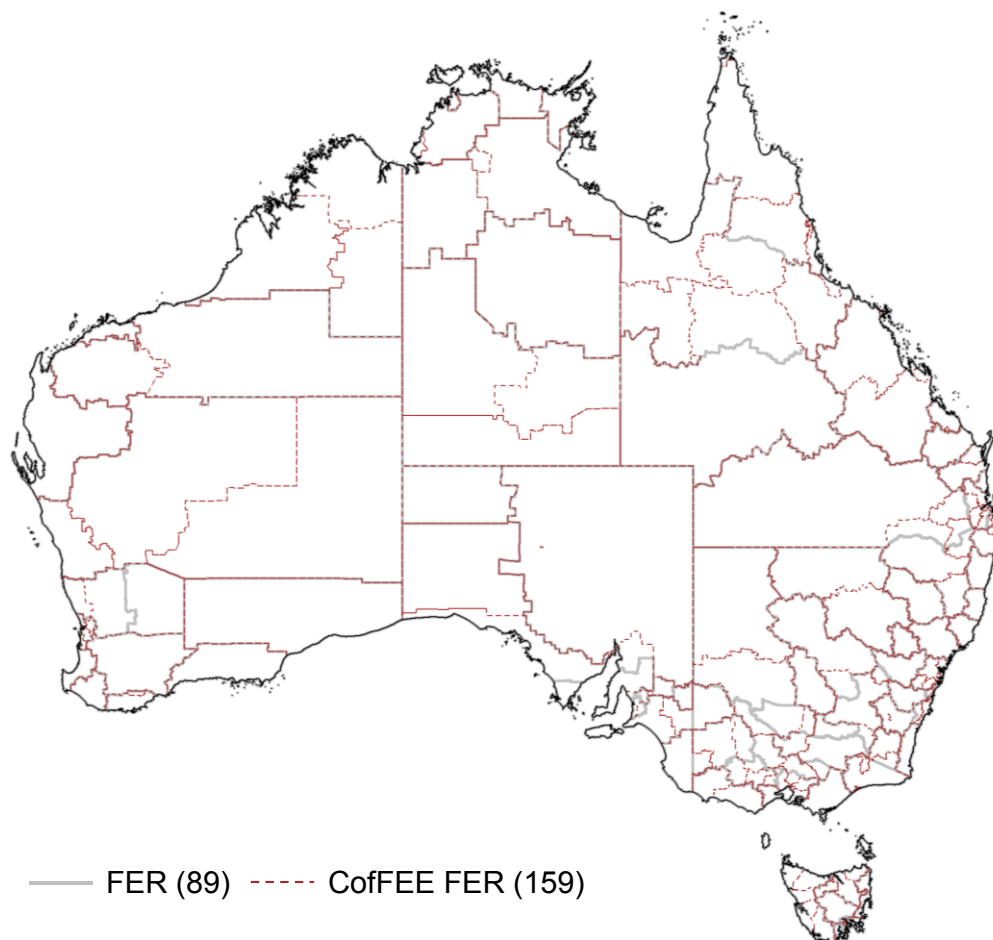
Sources: Productivity Commission estimates; CofFEE (2015).

Comparing FERs with RDA regions

The RDA initiative aims to bring together all levels of government to help support regional planning and development. RDA regions were created by the Australia Government Department of Infrastructure and Regional Development to support this initiative (DIRD 2017c). RDA regions are generally built from LGAs, with some exceptions (for example, some RDA regions in South Australia are defined by the SA Government's previously existing regional boundaries) (DIRD 2017c). They are updated as LGA boundaries change. Prior to changes to the RDA structure announced in August 2017, there were 55 RDA regions.[40]

There are some rough alignments between RDA regions and the FERs produced for this study (figure D.4). Similar to the FER structure, most states have a separate RDA region representing the capital city and a number of RDAs representing regional and remote areas. However, Tasmania and the Northern Territory are each represented by a single RDA region, whereas there are seven and nine FERs representing these areas respectively.

## Comparing FERs with State and Territory government regions

Most State and Territory governments have their own regional boundaries for planning (table D.3). These are often aggregations of LGAs. In some cases, different government departments use different regional boundaries.

The FERs for this study were developed in part by considering the numbers and boundaries of regions already in use by State and Territory governments. The total number of FERs created (89) is within the range of the total number of regions used across all State and Territory governments (63–97). In most cases, the number of FERs within each state and territory is also similar to the number of regions used by each government.

Differences between FER boundaries and existing State and Territory government region boundaries can arise for a number of reasons. First, FERs were created by aggregating SA2 regions, whereas most State and Territory government regions are based on LGA boundaries. Second, the analysis of journey to work flows do not necessarily correspond to existing regional definitions, which may be based on non-work considerations as well. Third, State and Territory governments have different ways of allocating their capital city into regions. For example, Hobart is grouped into the larger southern region of Tasmania, whereas Adelaide is separated into four different regions. Most State and Territory governments consider the capital city to be a single separate region, which is consistent with the approach taken in the creation of FERs. Fourth, as mentioned above, there are a number of islands that have not been allocated to a mainland FER, but that are part of a mainland region in State and Territory government definitions.

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[40] Changes to the RDA structure include the consolidation of four Melbourne regions into one (to take place at the start of 2018), and the expansion of the RDA network to some external territories (Nash 2017b; RDA 2017).

FERs compared with 2015-16 RDA regions

FER (89) ----- RDA region (55)
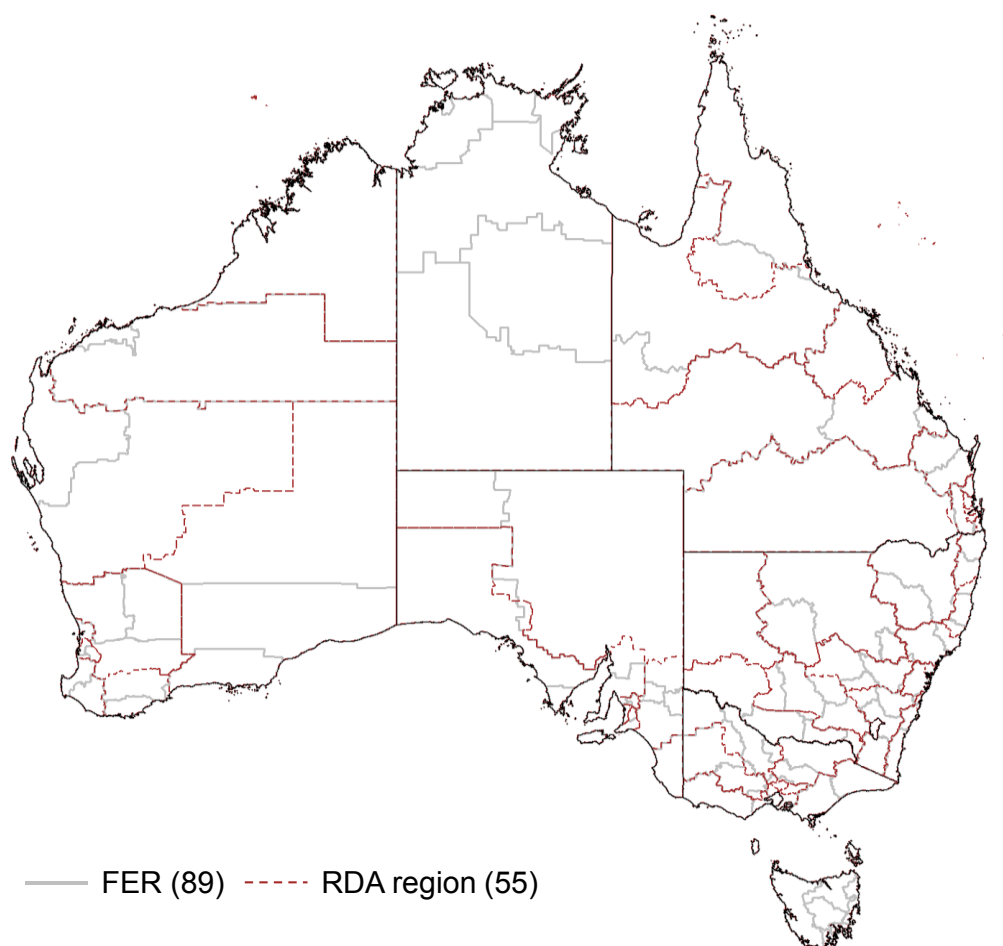
Sources: Productivity Commission estimates; DIRD (2017c).

Summary

There are differences but also similarities between this study's FERs and existing regional definitions, which result from the different purposes for which each were created and the different considerations and methods used in developing them.

The FERs presented here were designed for the specific purposes of the study and are not considered to be definitive regions that should be used for regional planning. The appropriateness of each FER for planning could be investigated with further analysis and consultation between governments and communities. The concept of basing planning and development around FERs remains useful and should be considered by State and Territory governments. Links between FERs and differences in areas within FERs should also be recognised.

Table D.3 State and Territory government regions

State or territory	Number of regions[a]	Brief description[b]
NSW	10–35	Regional growth plans across 10 regions (including Sydney) have been developed (NSW DPE 2017). Regional NSW is working on creating new FERs and developing Regional Economic Development Strategies for each of them. 34 potential regional FERs (excluding Sydney but including some parts of Victoria, Queensland and the ACT) were identified in preliminary analysis (NSW Government, sub. DR71, p. 12).
Vic	6–10	Regional Development Victoria (2016b) maps local government areas into nine regions (excluding greater Melbourne), which can be further grouped into five larger regions. Regional growth plans have been developed for nine regions (including Melbourne) using slightly different boundaries (Vic DELWP 2017c).
Qld	10–11	The Department of Infrastructure, Local Government and Planning has offices across 10 planning regions (Qld DILGP 2017a). The Department of State Development has offices across 11 regions (Qld DSD 2017). Prior to the move to new planning legislation in 2017, regional plans had been developed for 11 regions with different boundaries (Qld DILGP 2017b). All regional definitions include Brisbane.
SA	12	The SA Government (2016) has 12 regions (including four metropolitan Adelaide regions) to facilitate planning, monitoring and service delivery across all departments and agencies. The regions align with local government boundaries, except for the separation of Enfield from the Port Adelaide Enfield Council (SA DPTI 2017).
WA	10–14	There are nine WA regions (excluding Perth), each with their own state Regional Development Commission that facilitates and monitors economic development (WA DPIRD 2017). The Wheatbelt Development Commission (nd) has further separated its region into five sub-regions, each with their own economic planning strategies.
Tas	3	The Tasmanian Planning Commission (nd) separates the state into three regions. The Tasmanian Department of State Growth (2017) also has offices across three regions.
NT	7	The NT Economic Development Framework separates the territory into seven regions (NT DTBI 2017). Some of these regions do not align with local government area boundaries.
ACT	1	The ACT has no separate local governments. The ACT Government collaborates with the NSW Government on developing the ACT and surrounding areas of New South Wales (ACT Government and NSW Government 2016).
Other territories	4	Four other territories are represented by separate 2011 and/or 2016 Statistical Area Level 2 regions (Jervis Bay, Christmas Island, Cocos (Keeling) Islands and Norfolk Island). These are administered by the Australian Government Department of Infrastructure and Regional Development (2017d).
Total	63–97	

a Includes a region representing the capital city if not explicitly covered by the state or territory regional definition. **b** Regional definitions are based on aggregations of local government areas unless otherwise stated.

E   Developing an index of relative adaptive capacity

Described in this appendix are the data and techniques used to construct the single metric of regional adaptive capacity. The approach is based on a statistical technique called principal component analysis (PCA), which has been widely used to create regional indexes of socioeconomic disadvantage, vulnerability, resilience and adaptive capacity (chapter 2).

Although the index of adaptive capacity has been used to rank regions according to their risk of failing to adjust to transitional pressures, it should not be used as a predictor of actual outcomes. The actual outcomes are the result of the strengths and weaknesses (as well as opportunities) within a region, the decisions made by many individual workers and businesses, the type and magnitude of disruptions that occur, and the ways external events continue to change over time. Many of these considerations have not been captured in the index (chapter 2). Consequently, the index has limited value for policy application but can be used as a litmus test to identify regions that might be at risk of failing to adapt to changing economic circumstances.

This appendix presents results for functional economic regions (FERs) (aggregations of Statistical Area Level 2 (SA2) areas, the construction of which is set out in appendix D), and SA2s. Reflecting stakeholder views, FER results are presented as the preferred results (chapter 4).

Section E.1 explains the method and the decisions made in using PCA to construct the index of regional adaptive capacity (including differences between two alternative methods to constructing indexes using PCA — single PCA and nested PCA approaches). Single PCA was chosen as the preferred approach for the adaptive capacity index.

Data sources and data transformations are described in section E.2. In part, the indicators included in the index are based on the five capitals framework outlined in chapter 2, and availability of data. The data for the indicators are drawn largely from the ABS 2016 Census of Population and Housing, the Social Health Atlases of Australia, CoreLogic property sale data, as well as a number of other ABS catalogues.

Section E.3 contains the PCA results for FERs for 2016. The sensitivity of each region's index value was tested using bootstrapping and by examining the effect of excluding variables in the index (section E.4). Differences in the single PCA and nested PCA indexes are also compared. An overview of the results is provided in section E.5, with a detailed discussion in chapter 4.

For completeness, indexes were also created at the SA2 level for 2016 and at the FER level for 2011. These results are presented in sections E.6 and E.7 respectively.

An attachment and some supporting material accompany this appendix. Attachment A contains a referee report produced by Professor Robert Tanton that reviews the methods and results contained in a draft version of this appendix. Some variations of the analysis are included, which incorporate suggestions by the referee. In particular, the results of the nested PCA approach are included. Although the Commission prefers the single PCA approach for the analysis in chapter 4 of the report (reflecting stakeholder comments between the initial and final reports), results from the nested PCA can be considered an alternative. The R programming scripts and data, which can be used to replicate the results, are provided as supporting material on the Commission's website, enabling anyone to verify the results or undertake their own analysis.

Further supporting material includes an Excel workbook that contains index scores for each FER in 2016 under the Commission's preferred approach for constructing the index (single PCA). It includes a breakdown of the factors that contribute to each region's index score, and the 90 per cent confidence intervals of each region's score. Another Excel workbook contains similar spreadsheets for other sets of results described in this appendix, including FER 2016 results under an alternative approach (nested PCA), SA2 2016 results and FER 2011 results.

E.1   Methodology

PCA is a method of summarising data by reducing the number of variables in a dataset into a new dataset with fewer variables (O'Rourke and Hatcher 2013, p. 2). The smaller set of variables can be used to construct indexes. This section begins by first providing a brief introduction to PCA, illustrated using a simple hypothetical example. Then it describes the way in which PCA was applied in creating the index of regional adaptive capacity.

Principal component analysis

PCA summarises data by creating a new set of variables called 'principal components'. These are linear combinations of the original variables that are uncorrelated with each other and capture the total variation in the original dataset. The total number of principal components created is the same as the original number of variables. However, the first principal component accounts for the largest amount of variation in the original dataset, the second principal component accounts for the next largest amount, and so on.

Although principal components are uncorrelated with each other, they are correlated with the original variables. An interpretation of a principal component can be informed by assessing its correlation with the original variables. Insight into which variables are most

relevant to explaining the variation in the data can be gained by examining the proportion of variance explained by a principal component, along with its interpretation.

Provided that the first few principal components capture a sufficiently large amount of the variation in the original data and can be interpreted in a meaningful way, an analyst can choose to retain just these principal components for further analysis (rather than the full set of principal components, or the full set of original data) (O'Rourke and Hatcher 2013, p. 3). The decision of how many principal components to retain is discussed further below.

PCA produces a score (a value for the new variable) for each observation in the dataset for each principal component created. For a PCA using an input dataset of K observed variables, the formula for calculating observation i's score for the pth principal component is:

$$PC_{pi} = w_{1p}X_{1i} + w_{2p}X_{2i} + \cdots + w_{Kp}X_{Ki}$$

where:

- PC_{pi} is the pth principal component estimated for observation i
- X_{ki} is the standardised value of the kth variable for observation i
- w_{kp} is the weight attached to the kth variable of the pth principal component, estimated by the PCA.

A simple illustration

An example of how PCA transforms data is illustrated using a hypothetical dataset on employment and year 12 attainment rates for six regions (table E.1, step 1). The first step illustrates the standardisation of the original variables (by subtracting the mean of the variable from each observation, and then dividing the resultant value by its standard deviation). Standardised variables have means of zero and standard deviations of one. Standardisation ensures that variables with different units of measurement are treated on a comparable basis in the PCA.

PCA is then applied to the standardised dataset to generate the weights on each variable for each principal component (step 2a), as well as the principal components themselves (step 2b). In this example, most of the variation in the data can be represented by the first principal component, which accounts for 97 per cent of the total variation in the data. Therefore, this component summarises most of the variation in year 12 attainment and employment rates. It is highly correlated with both variables, and could be interpreted as a simple human capital index. An analyst could choose to retain just this principal component and capture most of the variation in the original data.

The transformation of data points from the original variables to the principal components is illustrated diagrammatically in figure E.1.

There are a number of options for creating an index from PCA results: using only the first principal component, equally weighting some or all components, or some system of varying weights. The approach adopted for this study weights each principal component by the extent to which that component explains the original dataset's variance. That is, each retained principal component is weighted according to the proportion of variance in the original dataset that it explains. In the example in table E.1, if both principal components were retained, that would mean a much smaller contribution of the second principal component to the total index score. This demonstrates an advantage of the technique in summarising data in circumstances where a few principal components capture most of the variance in the original data.

Table E.1 Principal component analysis — illustrative transformation
Hypothetical dataset on year 12 attainment and employment rates

Step 1: Standardisation

| Region (i)	Original variables (%)		Standardised variables (X_{ki})	
	Year 12	Employment	Year 12	Employment
1	34	22	-1.43	-1.53
2	47	50	-0.74	-0.16
3	55	45	-0.32	-0.41
4	69	51	0.42	-0.11
5	80	77	1.01	1.16
6	81	75	1.06	1.06
Mean	61.00	53.33	0.00	0.00
Std dev.	18.90	20.48	1.00	1.00

Step 2a: PCA weights

Principal components (PCs)	Weights (w_{kp})		Correlations		Cumulative proportion of variance explained
	Year 12	Employment	Year 12	Employment	
PC$_1$	0.71	0.71	0.98	0.98	0.97
PC$_2$	-0.71	0.71	-0.18	0.18	1.00

Step 2b: PCA scores $\left(PC_{pi} = w_{1p}X_{1i} + w_{2p}X_{2i} \right)$

Region	Principal components (PC_{pi})	
	PC$_1$	PC$_2$
1	-2.09	-0.07
2	-0.64	0.41
3	-0.51	-0.06
4	0.22	-0.38
5	1.53	0.11
6	1.50	0.00

Figure E.1 Principal component analysis — illustrative visualisation

Hypothetical dataset on year 12 attainment and employment rates
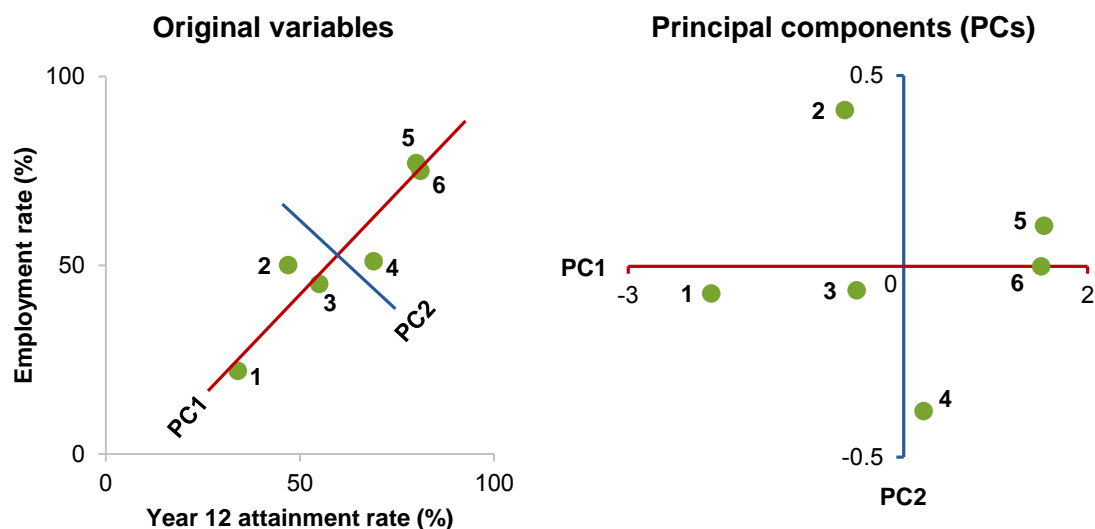
Determining the number of principal components to retain

Choosing the number of principal components to retain from a PCA requires judgment. Although there are guidelines, there are no strict rules on how to make this decision. Four criteria are commonly used (O'Rourke and Hatcher 2013, pp. 22–27).

Scree test

The first criterion is the scree test, which involves plotting the eigenvalues (amounts of variance explained by the principal components respectively) in order from largest to smallest. This plot is known as a scree plot, and a hypothetical example is provided in figure E.2. If there is an elbow-like bend in the plot, with the first set of components before the bend having large eigenvalues (explaining a large amount of the total variation) and the other set of components from the bend onwards having relatively small eigenvalues, then the components in the first set are retained. In figure E.2, the first principal component (the only component before the bend) would be retained. In practice, there might not be clear bends in the plot and other criteria are considered.

Figure E.2   **Example of a scree plot**
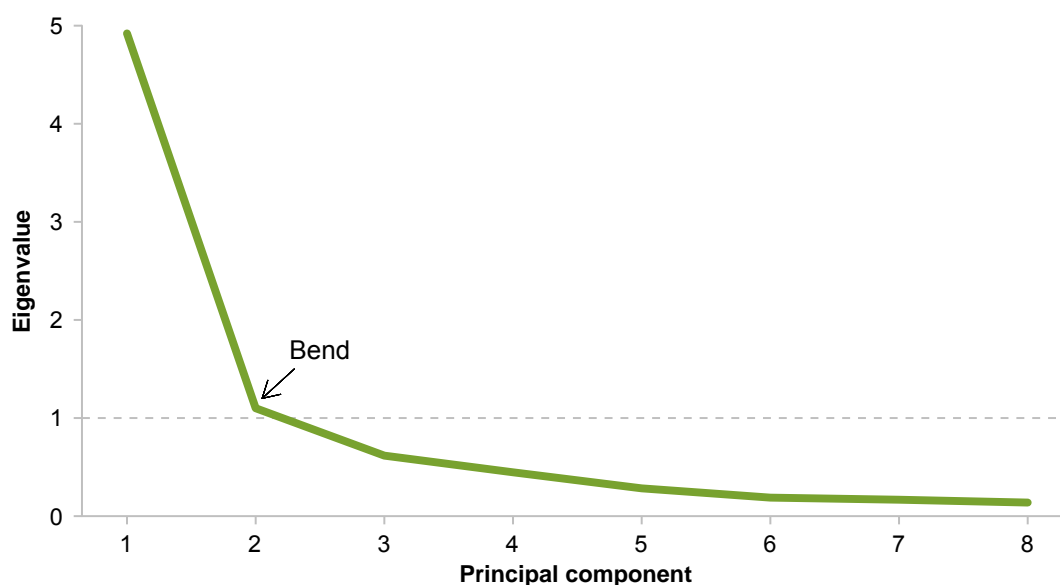
Eigenvalue-one

The second criterion is to retain components with eigenvalues greater than one. Each standardised observed variable contributes one unit of variance to the total variance in the dataset, so any principal component that has an eigenvalue greater than one contributes more than that contributed by any one variable in the original dataset. Applying this criterion to the example used for figure E.2, the first two principal components would be retained because they have eigenvalues greater than one (as shown by the dashed line).

Cumulative proportion of variance explained

The third criterion involves retaining components until the cumulative proportion of variance explained is greater than a given threshold, usually 70 or 80 per cent (O'Rourke and Hatcher 2013, p. 19). Applying this to the example in table E.1, the first principal component would be retained because it alone captures 97 per cent of the total variation.

Interpretability

Finally, the interpretability of each component should be considered. Principal components are retained if the main factors contributing to those components (the variables with the largest weights or correlations, and their signs) can be interpreted in a meaningful way. In the example in table E.1, the first principal component is highly correlated with both year 12 attainment and employment, and could be interpreted as a measure of human capital.

Constructing indexes using PCA

There are two general approaches to constructing indexes using PCA. They each give different weights to indicators included in the index.

The first approach involves running a single PCA that includes all variables in a dataset (a more 'data-driven' approach). An example that uses this approach is the ABS Socio-Economic Indexes for Areas (SEIFA) (ABS 2013b).

The second is a nested PCA approach. This involves applying PCA independently to subgroups of variables in a dataset, then aggregating the results for each sub-PCA to obtain a single score for each observation (a more 'conceptually-driven' approach). This approach has been used in Australia to construct indexes of community vulnerability across the Murray-Darling Basin (ABARE–BRS 2010), potential community economic resilience (Dinh et al. 2016), and adaptive capacity for farms (Nelson et al. 2009a). For the purposes of this report, the nested approach uses a 'five capitals' framework (chapter 2), as seen in the aforementioned studies.

The single and nested PCA approaches offer different advantages and disadvantages. The single PCA approach allows the data to have a greater role in driving the index and rankings. This requires fewer judgments by the analyst in specifying the details of the technique. However, it can complicate interpretation of the principal components. The nested approach imposes a conceptual structure, which can facilitate a more straightforward interpretation of the principal components. However, this can elevate the importance of variables that might not otherwise explain the largest share of the variance in the initial data, and requires a number of prior judgments by the analysts performing the PCA (for example, how variables are classified into subgroups, what the nature of the sub-indexes are, and which variables are excluded altogether).

This study examined both single and nested PCA approaches. Under each approach, PCA was conducted on indicators that were considered important to adaptive capacity. The index of adaptive capacity was created as a weighted sum of the retained principal components. Further details of both methods are described below. The Commission's preferred method for the index is the single PCA approach, based on stakeholder consultation and the more intuitive results it produces, and these results are described in chapter 4. A comparison of results under each approach is provided in section E.4.

A variant of PCA involves 'varimax rotation', which changes the weights on each variable in each retained component and can aid in their interpretation. Varimax rotations were investigated for the current analysis but did not meaningfully improve interpretations of retained components. Therefore, unrotated principal components were used for the index.

Single PCA index construction

Under the single PCA approach for this study, all variables in the dataset are included in a single PCA, regardless of the capital domain the analysts considered they belonged to. Principal components from this PCA were retained based on the criteria described above.

The signs on principal component scores are arbitrary — a principal component explains the same amount of variation even if the signs on each region's principal component score, and each indicator's weight on the principal component, are reversed. As an example, if a principal component came out with a negative sign on the proportion of people who have completed at least year 12 education and a positive sign on the proportion of people with disability, reversing all the signs would not change the interpretation of the component. It would simply change it from a 'negative' direction to a 'positive' direction (that is, high scores, as opposed to low scores, will be considered good for adaptive capacity). However, signs can be important for aggregating multiple principal components together to create an aggregate index because they should all be contributing to the index in the appropriate direction.[41] In this study, signs on retained principal components were reversed where appropriate so that a higher value of the principal component indicated greater adaptive capacity.

A further judgment was made on how to combine multiple retained principal components to form a single index of adaptive capacity. The retained principal components were standardised and then weighted according to the relative shares of variance explained by the components in the PCA. For example, if the first two principal components were retained for the index, and these accounted for 60 and 20 per cent of the total variance in the set of indicators respectively, then the first component was given a weight of $0.6/(0.6 + 0.2) = 0.75$ after standardisation, and the second component was given a weight of 0.25 (the actual weights are presented in section E.3). Similar approaches have been used in constructing indexes in past research where multiple principal components were retained (for example, Krishnan 2010; Nicoletti, Scarpetta and Boylaud 2000). This weighting approach ensures that the principal components that explain a greater share of variance in the initial dataset make a greater contribution to the index. Aggregate index scores were then standardised to have a mean of zero and standard deviation of one. The formulas used to create the index from the retained principal components are presented in box E.1.

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[41] The PCA technique will be indifferent to the 'direction' that a component points. For example, looking at figure E.1, a component explains the same degree of the variation whether it is read 'left-to-right' (positive) or 'right-to-left' (negative). In constructing an aggregate index, it is important that components that are beneficial for adaptive capacity be considered as 'positive'. This can necessitate reversing the sign of a particular component (that is, reading it 'left-to-right' instead of 'right-to-left').

Box E.1　Formulas for constructing the adaptive capacity index

Single PCA index construction

A simple index can be constructed by running a single principal component analysis (PCA) on all of the indicators. Under this approach, retained principal components were standardised by subtracting the mean and dividing by the standard deviation, and then weighted according to the relative shares of variance explained by each component. As the mean of a principal component is zero by construction and the variance is simply the square of the standard deviation, the formula can be simplified as follows.

$$Raw\ Single\ PCA\ Index_i = \sum_p^Q \left(\frac{PC_{pi} - \overline{PC_p}}{s(PC_p)} \times \frac{V(PC_p)}{\Sigma_p^Q V(PC_p)} \right) = \sum_p^Q \left(PC_{pi} \times \frac{s(PC_p)}{\Sigma_p^Q V(PC_p)} \right)$$

where:

- PC_{pi} is region i's score on the p'th principal component

- Q is the total number of retained principal components

- $\overline{PC_p}$, $s(PC_p)$ and $V(PC_p)$ are the mean, standard deviation and variance respectively of the p'th principal component.

Nested PCA index construction

A simple index can be constructed by aggregating sub-indexes from several independently constructed PCAs. A sub-index was formed for each capital domain by weighting retained principal components from the PCA for that capital domain, in a way similar to the single PCA approach. The adaptive capacity index was formed by taking the equally weighted sum of the standardised sub-indexes for each domain.

$$Domain\ Index_{di} = \sum_p^Q \left(PC_{pi} \times \frac{s(PC_p)}{\Sigma_p^Q V(PC_p)} \right)$$

$$Raw\ Nested\ PCA\ Index_i = \sum_d^D \frac{Domain\ Index_d}{s(Domain\ Index_d)} \times \frac{1}{D}$$

where d refers to a particular capital domain, and D is the total number of domains.

Raw index scores from both single PCA and nested PCA approaches were further standardised to have a mean of zero and standard deviation of one to aid comparability and interpretability.

An advantage of the single PCA approach is that it requires fewer prior judgments by the analyst about how variables in the original dataset should be assigned to subgroups prior to applying the PCA. On the downside, interpretation of principal components, and decisions about whether the signs on principal components should be reversed, can be difficult. This is because a principal component could be relatively strongly correlated with multiple indicators under different domains that might be expected to have opposite relationships with adaptive capacity.

Nested PCA index construction

Under the nested PCA approach, PCA is conducted separately on different subgroups of variables. The exact approach to nested PCA was revised following feedback from the referee (attachment A).

For this study, variables are categorised based on the five capitals framework described in chapter 2. Separate and independent PCAs were performed on variables in each subgroup — human, financial, physical, natural and social capital. As per the referee report, the aim then was to reduce the variables under each capital domain to only include those that had a relatively large correlation with the first principal component, and then retain only the first principal component from each domain to create the index. Specifically, after examining the results of each sub-PCA, the indicators that had a correlation of less than 50 per cent with the first principal component were dropped from the analysis. The PCAs for each subgroup were performed again with the reduced set of indicators, and the first principal component from each was retained.

In addition to these retained principal components, three other indicators were included in the index (which Commission staff considered were not relevant to any pre-existing capital domain). These are measures of industry diversity, working-age population growth, and interregional mobility. These indicators together formed an 'other' domain. PCA was not conducted on the 'other' domain, but each indicator was given equal weighting within the domain.

As in the single PCA approach, signs on these other indicators and retained principal components were reversed where necessary so that a higher value indicated greater adaptive capacity. The index of adaptive capacity was formed through a weighted sum of these indicators and principal components. These raw index scores were then standardised to have a mean of zero and standard deviation of one (box E.1).

Another decision involves weighting each of the five capital domains and the 'other' domain in the index. Noble et al. (2003, pp. 35–36) describe various possible approaches to weighting scores across different domains to form an aggregate index. These include approaches driven by theory, empirics, policy relevance and consensus of opinion. In terms of adaptive capacity, the relative importance of a type of capital is likely to differ depending on the type of shock that a region is adjusting to. Balance between the five capitals is also an important consideration because minimum levels of one capital type might be needed to effectively use another type (Nelson et al. 2009a, p. 20). For these reasons, each domain was equally weighted. In effect, this means that each capital domain index was summed. Equal weighting approaches have been used in many other studies that construct indexes of similar concepts (for example, ABARE–BRS 2010; Dinh et al. 2016).

An advantage of the nested PCA approach is that it makes interpretation simpler, by aligning the subgroups to the analyst's conceptual framework. The contributions of each factor to a capital domain can be examined, as well as the contribution of each capital domain to the

overall index. However, indicators within capital domains that have few or no other indicators might also get disproportionately large weights in the overall index.

E.2   Regional data and adaptive capacity indicators

In constructing the index, the original dataset contained indicators that are considered to measure or proxy factors relevant to adaptive capacity, and that are available for all SA2 regions in Australia.

There are challenges in obtaining suitable data on regional-level indicators that meet these criteria. Although various organisations and government departments collect data at a regional level, these data are not necessarily consistent, both in terms of the geographical boundaries of regions and in the definitions of particular indicators. This limits the data that can be included within a single metric for all regions in Australia.

A key source of data that do meet these criteria is the ABS Census of Population and Housing. The most recently available Census data are from 2016. A number of other data sources were also used to obtain measures of factors considered relevant to adaptive capacity. These data sources and the indicators included in the index are discussed below, following a description of the regions included in the analysis.

Regions included in the index

The analysis was conducted for a level of geography created for this study, called functional economic regions (FERs). FERs are designed to better reflect economic linkages between people across geographic areas, and are more suitable for examining regional transitions. FERs were created by aggregating SA2 regions of the 2011 Australian Statistical Geography Standard (ASGS) (appendix D).[42]

This study has divided Australia into 89 FERs. However, 12 FERs were excluded from the analysis because of insufficient data. These were predominantly islands and other sparsely populated FERs.[43] The analysis was conducted on the remaining 77 FERs.

Creating the index of adaptive capacity at the FER level has the potential to hide differences in indicators between the SA2s within FERs. For completeness, the index is also created at the SA2 level, with a map of results presented in section E.6 to illustrate the differences.

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[42] The 2016 ASGS includes updated SA2 regions that differ slightly from those under the 2011 ASGS. Unless otherwise indicated, references to SA2 regions in this appendix refer to 2011 SA2 regions.

[43] The FERs excluded from the analysis were: Lord Howe Island, French Island, APY Lands, Kangaroo Island, King Island, Tiwi Islands, West Arnhem, East Arnhem, Anindilyakwa, Christmas Island, Cocos (Keeling) Islands and Norfolk Island.

Data sources

Access to the 2016 Census of Population and Housing was crucial to obtaining consistent data on many of the indicators included in the index of adaptive capacity. The Commission had an in-posted officer at the ABS to access Census data on particular indicators of adaptive capacity at the SA2 and FER level for the analysis in the report. The Commission greatly appreciates the ABS's contribution in this regard, as without the valuable information contained in the Census, the analysis contained in this report would not have been possible.

Other sources of data used to obtain indicators include:

- ABS.Stat (which includes a range of ABS statistics as well as some data that the ABS has obtained from other organisations, such as the Department of Social Services) (ABS 2017a)

- other ABS catalogues, such as those containing the ASGS remoteness structure and estimates of homelessness

- the Australian Urban Research Infrastructure Network (AURIN) Portal (which contains data submitted by a range of organisations, including government, research organisations and universities) (AURIN nd)

- the Social Health Atlases of Australia, produced by the Public Health Information Development Unit (PHIDU) of Torrens University (PHIDU 2017e)

- CoreLogic property price data.

To ensure consistency with the 2016 Census data, 2016 data from other sources were also used wherever possible. For indicators for which 2016 data were not available, the most recently available data were used.

Adaptive capacity indicators

The adaptive capacity index summarises the data on factors and endowments that the analyst considers important in terms of a community's responsiveness to changes in economic conditions (chapter 2). These factors can be grouped into human, financial, physical, natural and social capital categories, with a separate category for other indicators deemed to be important to adaptive capacity (chapter 2).

A number of steps were involved in preparing the set of indicators for the index. Data for some FERs were assigned from a different level of geography and some indicators required various transformations (such as calculating proportions or taking logarithms). The list of indicators was also refined following preliminary analysis. These steps are described below. The indicators included under each domain in the index are then discussed.

Attributing data from different levels of geography

Data were obtained at the SA2 level wherever possible, and aggregated up to the FER level for inclusion in the dataset used for the PCA.

However, some data were not available for SA2s. In some cases, the relevant indicators were only available for aggregates of SA2s instead (such as the Statistical Area Level 3 (SA3) of the ASGS or Public Health Areas (PHAs) used by PHIDU). These data were attributed to the SA2 level, assuming that the SA3 or PHA data provide a reasonable proxy for the SA2. The SA2-level data were then aggregated for FER-level analysis. In some other cases, specific SA2s were missing data within the dataset. Where possible, missing data were imputed by taking population-weighted averages of the indicator for the SA3 or SA4 and assigning it to the SA2 within the SA3 or SA4 region. These attributions may affect results to the extent that they do not accurately reflect the SA2s (that is, variation between SA2s might not be adequately captured). The implications are likely to be smaller for FER-level analysis, because some FERs incorporate whole SA3s, SA4s or PHAs.

Transforming indicators by calculating ratios or proportions

Basing the analyses on ratios or proportions ensured that regions with different population or land sizes, or different numbers of dwellings, were analysed on a comparable basis. Most indicators were constructed by calculating ratios or proportions of people, dwellings or land in a region that met the criteria of the particular indicator. For example, the proportion of working-age people who had completed at least year 12 in each region was used, rather than the number of people who had completed at least year 12.

For Census indicators, the denominators used to calculate proportions were populations according to the Census. People who did not answer the relevant question in the Census were excluded from both the numerator and denominator in the calculation of proportions.

For many non-Census indicators that concerned people in a region, ratios were created using ABS estimated resident populations as the denominator. These are the official estimates of the Australian population, which correct for undercounting in the Census and take into account other factors, such as births and deaths over time (ABS 2017l).

Ratios at the FER level were generally calculated by taking population-weighted averages of the values of the indicator for constituent SA2 regions. Using population weights rather than simple weights provides a greater sense of the value of the indicator for the people in the region, and makes it less affected by SA2s with small numbers of people.

Transforming indicators by taking natural logarithms

Some variables were also transformed using a natural logarithm. This was done where:

- a variable, after examining a plot of all observations, appears to have a log-normal distribution, meaning that the logged data will be closer to being linear

- the logarithmic transformation stabilises the variance of the variable, giving outliers approximately equal weight in the case of highly skewed data (the outliers and skewness distorts results)

- it gives more intuitive and easily interpretable results (the logged data will affect the final index values).

These points, taken together, show that a variable will be logged where it has a heavily skewed distribution that looks more normal when logged, and in the absence of such a transformation would place undue emphasis on particular observations from the skewed variable.

The way in which taking the log of the indicator would affect the PCA depends on how the outliers affect the indicator's correlation with other variables in the PCA. To illustrate, consider a simple hypothetical dataset containing data on year 12 attainment and the proportion of Indigenous people for six regions (figure E.3). Suppose that region 6 is a positive outlier with a relatively high proportion of Indigenous people. Taking the log of this indicator brings the value of region 6 closer to that of other regions, while still remaining higher than other regions (both before and after standardisation). It increases the correlation between the two variables, indicating a stronger linear relationship. If the original indicator of Indigenous population was used in a PCA containing the two variables, the first principal component would explain 95 per cent of the total variation in this example. Taking the log of the Indigenous indicator increases this to 99 per cent.

To the extent that a small number of observations are outliers for a particular variable, the PCA process will identify the primary source of variance in the data as being between the small number of outlier observations and *everything else* (for example, region 6 vis a vis regions 1 through 5 in figure E.3). When the data are logged, the PCA technique can reflect the degree to which there is variance in all observations, while still reflecting the fact that the outliers are furthest from the central cluster.

The other consideration is how taking the logarithm of an indicator affects index values. Recall that to create principal component scores, the weights of indicators in the PCA are multiplied by indicator values that have been standardised (section E.1). This standardisation does not change the relative position of regions on the indicator — outliers will remain outliers (figure E.3). If, for example, the logarithm of the Indigenous indicator was not taken, for regions that have particularly high Indigenous populations, this indicator might overwhelmingly dominate other indicators' contributions to the principal component, and therefore the index. Taking the log moderates the contribution of the indicator to the final index score for regions that have high values of the indicator, effectively assuming diminishing returns (or diminishing losses) to adaptive capacity. That is, as the proportion

of Indigenous population gets higher, each additional percentage of Indigenous population has a smaller influence on the region's adaptive capacity.

Figure E.3   Example of relationships between variables before and after taking logs

Hypothetical dataset on year 12 attainment rates and Indigenous population
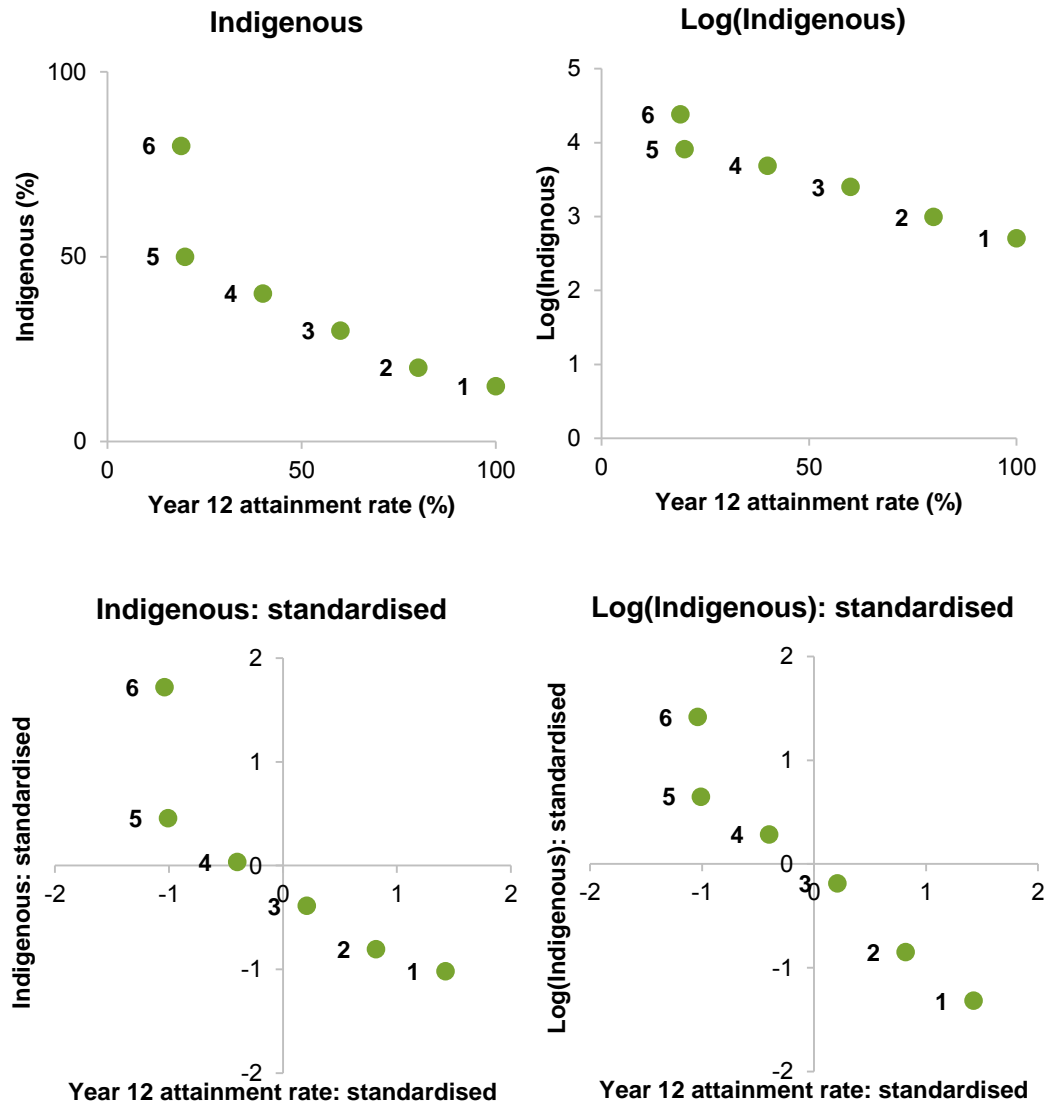
Refinement of indicators

The initial set of available indicators was refined following an examination of correlations between variables and initial PCAs. Variables were excluded if they were highly correlated with, and captured similar concepts to, other variables in the same capital domain. This was

based on judgment, rather than a specific correlation threshold. For example, the proportion of people who had completed at least year 12 and tertiary qualification attainment rates both captured education under the human capital domain and had a correlation of over 0.9, so only the year 12 indicator was included in the analysis. As another example, the year 12 indicator had a high correlation with the proportion of households that accessed the internet. Although they may be related, the year 12 variable is intended to capture education (an indicator of human capital) while the internet variable is intended to capture access to telecommunications infrastructure (an indicator of physical capital). Both the year 12 and internet variables were kept in order to capture both these aspects of adaptive capacity.

Variables were also excluded if they explained relatively little variation in initial PCAs. For example, a measure of distance from the middle of a region to the nearest large- or medium-sized airport was initially included as a measure of physical capital. However, in examinations of early PCA results, this variable was not strongly correlated with any of the principal components that would have been retained according to any of the four criteria described in section E.1. Therefore, the indicator was dropped from the index.

Indicators included in the index

Indicators that were included in the index are presented below, along with their means and standard deviations at the FER level. For indicators where the natural logarithm was taken before inclusion in the PCA, means and standard deviations displayed are for the original indicators.

The direction of the relationship between some indicators and adaptive capacity is not always clear (for example, home ownership and industry diversity, described below). For the index, only one direction is considered, based on relationships with other indicators and how the indicators are most commonly viewed in the literature or by stakeholders. Index values could be sensitive to the chosen direction of indicators, in addition to the other sources of sensitivity examined during sensitivity testing (section E.4).

Human capital

Human capital captures the knowledge, experiences and capabilities of people in regional communities that can be used to take advantage of positive economic events, or to help counter negative events. Measures of skills, education and health are included in the index because they influence the ability of individuals to adapt to changes in their circumstances, for example by pursuing alternative work opportunities (table E.2). These factors are also used to access and develop other types of capital (Dinh et al. 2016, p. 5). Demographic variables such as age and Indigeneity might be expected to have an influence on a region's capacity to adapt as they are related to the supply of labour (Department of Employment, sub. DR75, p. 23). Measures of innovation (ratios of patent and trademark applicants to the population) and business dynamism (business entry and exit rates) in the index provide an

indication of the ability of people to make the most of economic opportunities and to adapt in a dynamic environment (KPMG 2015, p. 16).

Table E.2   **Human capital indicators included in index**

Indicator[a]	Description	Mean	Std dev.
yr12plus	Proportion of people aged 15–64 who have completed year 12 or a higher qualification	0.66	0.07
youtheng	Proportion of people aged 15–24 fully engaged in work or study	0.64	0.08
skill1to3[b]	Proportion of employed people in high- to medium-skilled occupations (loosely corresponding with a Certificate III or IV qualification or above)	0.53	0.03
emptolf	Proportion of the labour force who are employed	0.93	0.02
participation	Proportion of people aged 15–64 who were working or looking for work	0.75	0.05
ltnewstart*[c]	Ratio of long-term Newstart Allowance recipients (receiving income support for over a year) to population aged 15–64	0.05	0.02
wkage	Proportion of people aged 15–64	0.63	0.04
indig*	Proportion of people who identify as Indigenous	0.08	0.12
patents*[d]	Ratio of patent applicants to 1000 people in the population	0.16	0.12
trademarks*[d]	Ratio of trademark applicants to 1000 people in the population	1.09	0.90
bsnsentryrate*[e]	Business entry rate	0.11	0.03
bsnsexitrate*[e]	Business exit rate	0.11	0.02
dsp[c]	Ratio of Disability Support Pension recipients to population aged 15–64	0.07	0.02
selfhealth[f]	Estimated proportion of people aged 15+ who self-assessed their health as better than fair	0.84	0.02
psychdistress[f]	Estimated proportion of people aged 18+ with high or very high psychological distress	0.11	0.01
comprisk[g]	Estimated proportion of people aged 18+ with at least one of four health risk factors (current smoker, high risk alcohol consumption, obese, no or low exercise in the previous week)	0.81	0.04

a Data sourced from the 2016 Census of Population and Housing unless otherwise indicated. **b** Based on five skill levels in the Australian and New Zealand Standard Classification of Occupations (ANZSCO), defined in terms of formal education and training, previous experience and on-the-job training (ABS 2005). **c** Sourced from ABS.Stat, with data provided by the Department of Social Services (ABS 2017e). **d** Sourced from ABS.Stat, with data collected by IP Australia (ABS 2017e). Data were available at the SA3 level for 2015. **e** Sourced from ABS.Stat, based on ABS data on Counts of Businesses, Entries and Exits (ABS 2017e). **f** Sourced from the AURIN Portal, with estimates modelled by PHIDU using data from the Australian Health Survey from 2011 to 2013 (PHIDU 2017c, 2017b). **g** Sourced from the Social Health Atlases, with estimates modelled by PHIDU using data from the 2014-15 National Health Survey. Data were available at the PHA level (PHIDU 2017d). *** The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

Financial capital

Financial capital influences the capacity of regional communities to draw on savings and credit in response to changing economic circumstances. Although measures of savings and credit are not available at the SA2 level, they have been proxied by other indicators that reflect a regional community's scope to save and access credit, particularly income and wealth-related variables (table E.3).

The influence of home ownership on adaptive capacity is contentious. On the one hand, a home is a source of wealth that people could draw down on in the face of a crisis. On the other hand, home ownership could also act to limit adaptive capacity by reducing people's mobility.

Another indicator that was included was a measure of housing stress. Households that spend more of their income on housing have less income available for investments and savings (Augustine et al. 2015, p. 5; KPMG 2015, p. 14). A commonly used measure of housing stress is the 30:40 indicator, which identifies households with income levels in the bottom 40 per cent of the income distribution that are paying more than 30 per cent of income in housing costs (AHURI 2016). It is assumed that for households that are on higher incomes, paying more than 30 per cent on housing has less of an impact on their capacity to consume and save in other areas.

A housing stress measure was calculated from Census data as the proportion of households in the region that met the 30:40 criteria, based on equivalised household income.[44] A limitation of the Census data is that income is reported in income ranges rather than dollar figures. Income figures earned by households within each income interval were approximated by the medians earned by those within the income interval according to the ABS Survey of Income and Housing 2015-16. These approximations are imprecise, as households within each income interval could be earning an amount of income anywhere between that range, and the distribution of households within each income interval can also differ across regions. This would affect index results if it changes the relationships between estimated housing stress and other indicators.

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[44] Equivalised household incomes are adjusted by household size and composition. It is an indicator of the income that would be needed by a lone person household to enjoy the same level of economic wellbeing as the household (ABS 2011a).

Table E.3   Financial capital indicators included in index

Indicator[a]	Description	Mean	Std dev.
highinc*	Proportion of households with equivalised household income greater than $1250 a week[b]	0.26	0.12
invinc[c]	Ratio of total investment income ($'000) to population	2.60	1.04
govtpyts[d]	Ratio of government income support recipients to population (payments include Age Pension, Carer Payment, Disability Support Pension, Parenting Payment – Single, Newstart Allowance, Youth Allowance)	0.24	0.07
propprice*[e]	Weighted average of median house and unit sale prices ($'000)	325.18	134.74
ownhome	Proportion of households who live in an owner-occupied dwelling with or without a mortgage	0.66	0.11
housingstress	Estimated proportion of households that are in the bottom 40 per cent of the distribution of equivalised household income and are paying more than 30 per cent on their mortgage or rent	0.12	0.03

a Data sourced from the 2011 Census of Population and Housing unless otherwise indicated. **b** A high income threshold of $1250 was chosen. This compares to a threshold of approximately $1000 in equivalised household income capturing the top 20 per cent of households in 2011 (ABS 2013b, p. 12), and $1150 in equivalised disposable household income capturing the top 20 per cent in 2015-16 (ABS 2017g). **c** Sourced from ABS Estimates of Personal Income for Small Areas, 2011–2015, with data provided by the Australian Tax Office (ABS 2017f). Data were available for SA2s as defined under the 2016 ASGS and were converted to 2011 ASGS SA2 data using a purpose-built concordance table. **d** Sourced from ABS.Stat, with data provided by the Department of Social Services (ABS 2017e). **e** Monthly data sourced from CoreLogic. Average house and unit prices for 2016 were calculated as the average of monthly medians. These were then weighted by sales volumes for each property type. * The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

Physical capital

Physical capital captures a region's capacity to access infrastructure, equipment and technology, which influences their capacity to engage in external markets, and hence their ability to adapt to economic change. Indicators of broadband connectivity, building approvals and ease of access to transport were included (table E.4). An indicator of regional remoteness, based on the ABS Remoteness Structure and the Accessibility/Remoteness Index of Australia, was used as a measure of access to services and infrastructure.

Indicators such as the distance between the middle of a region to the nearest airport or port were investigated. However, they have limitations as indicators of access to infrastructure because the middle of a region might not necessarily be where people are located, nor where an airport or port should be located for a region. As these measures did not explain much variation in the data in initial investigations, they were excluded from the analysis.

Table E.4   Physical capital indicators included in index

Indicator[a]	Description	Mean	Std dev.
remoteness[b]	Remoteness based on accessibility/remoteness index (0 to 15)	..	..
internet	Proportion of households that access internet from the dwelling	0.79	0.05
buildappvalpp*[c]	Ratio of mean value of non-residential building approvals over 2014–16 ($'000) to population	1.23	1.03
accesstransport[d]	Estimated proportion of people aged 18+ who do not find it difficult getting to places needed with transport, including housebound	0.96	0.01

a Data sourced from the 2011 Census of Population and Housing unless otherwise indicated. **b** Sourced from the ABS Remoteness Structure. This is a categorical structure based on unpublished values of the Accessibility/Remoteness Index of Australia (ARIA) (Hugo Centre 2015). Index value thresholds for each remoteness category are published by the ABS. An indicator of remoteness was created by attributing the midpoint of the range of each remoteness category's index values to each SA2 within that category. A FER-level indicator was created by taking a population-weighted average of SA2 values. Summary statistics are not included in the table due to the underlying categorical nature of the variable. **c** Sourced from ABS.Stat, based on ABS data on Building Approvals (ABS 2017e). The average value of non-residential building approvals over three years was taken because investment in infrastructure lasts multiple years. **d** Sourced from the Social Health Atlases, with estimates modelled by PHIDU using data from the 2014 General Social Survey. Data were available at the PHA level (PHIDU 2017d). * The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

Natural capital

Natural capital captures a region's natural resources, such as the quantity and quality of land that can be used for production (agriculture and mining) and national parks and nature reserves (potential sources of tourism). These natural endowments can provide regional communities with a source of comparative advantage and opportunities for undertaking economic activities. However, natural assets can also present risks. For mining regions, for instance, a lack of economic diversity in a region can present a challenge as it could leave the community exposed to disruptions that negatively impact the value of mining activity.

The proportions of people employed in agriculture and mining industries were used as proxies of the agricultural and mining resources available to a region (table E.5). Agricultural land and mine location data were also investigated. However, there were issues with these indicators. For example, agricultural land for a business in the ABS Agricultural Census was attributed to the business' office location rather than the location of the land, leading to some anomalies in the data. An indicator of the number of mines in a region could be calculated from mine location data, but this did not capture the size of mines or quality of mining resources. Indicators based on shares of employment also have limitations, as some people might be working in these sectors but not living in the region where the natural resources activity is based. Similarly, some people employed in construction for the mining sector, for example, might be classified under construction rather than mining (Department of Employment, sub. DR75, pp. 24–25). In the end, shares of employment in agriculture and

mining were used in the index as they were deemed to better reflect the quantity and quality of these natural resources in regions, despite their limitations.

Table E.5   **Natural capital indicators included in index**

Indicator[a]	Description	Mean	Std dev.
agind[b]	Proportion of employed people working in agriculture industry	0.10	0.08
miningind*[b]	Proportion of employed people working in mining industry	0.04	0.07
nature*[c]	Proportion of land as national parks or nature reserves	0.10	0.09

[a] Data sourced from the 2011 Census of Population and Housing unless otherwise indicated. [b] Based on the Australia and New Zealand Standard Industrial Classification (ANZSIC). [c] Sourced from ABS.Stat, with data from the Collaborative Australian Protected Areas Database maintained by the Department of Environment. Data were available for 2014. * The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

Social capital

Social capital captures regional community connections and social cohesion. Communities with strong social capital are better able to share ideas and work towards common goals, and thus form a community response to economic adjustment pressures.

The rate of volunteering was included as an indicator of social capital, and provides some information about how connected people are to their local communities (DIRD 2016, p. 66) (table E.6). Five additional indicators of community strengths come from the Social Health Atlases. Community strengths contribute to a community's resilience, and capture how people feel about their neighbourhood and their participation in opportunities to shape their community (PHIDU 2017a). A measure of homelessness was also included because of its association with social disengagement. The Queensland Government (sub. DR77, p. 20) stated that it is a factor that could better illustrate economic dislocation and engagement, local economic sustainability and the social welfare of regions.

Table E.6   Social capital indicators included in index

Indicator[a]	Description	Mean	Std dev.
volunt	Proportion of people who volunteered in the past 12 months	0.18	0.04
getsupport[b]	Estimated proportion of people aged 18+ who are able to get support in times of crisis from persons outside the household	0.94	0.01
providesupport[b]	Estimated proportion of people aged 18+ or their partner who provide support to other relatives living outside the household	0.31	0.03
safeatnight[b]	Estimated proportion of people aged 18+ who felt very safe or safe walking alone in local area after dark	0.54	0.10
discriminated[b]	Estimated proportion of people aged 18+ who felt they had experienced discrimination or unfair treatment in the past 12 months	0.20	0.04
culturalacceptance[b]	Estimated proportion of people aged 18+ who do not disagree with acceptance of other cultures	0.94	0.01
homeless*[c]	Estimated proportion of people who are homeless (based on adequacy of dwelling, security of tenure, and control of and access to space for social relations)	0.01	0.02

a Data sourced from the 2011 Census of Population and Housing unless otherwise indicated. **b** Sourced from the Social Health Atlases, with estimates modelled by PHIDU using data from the 2014 General Social Survey. Data were available at the PHA level (PHIDU 2017d). **c** Sourced from ABS estimates of homelessness from 2011 Census data (ABS 2012b). * The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

Other indicators

Three other indicators were included in the index — industry diversity, working-age population growth, and interregional mobility. These factors are considered to have a positive influence on adaptive capacity, although it is contentious.

A diversified economic base is generally considered to have a positive effect on economic performance and adaptive capacity (but, as discussed in chapter 2 and further below, promoting diversification for its own sake is not always better and its inclusion in the index is contested). Industry diversity is considered to positively contribute to a region's adaptive capacity because the more diverse a region's economy, the more flexible its allocation of resources is likely to be, allowing it to more effectively adjust in the face of disruptive events (Dinh et al. 2016, p. 5). Further, the greater the diversification, the less susceptible a region is to any shock affecting a specific sector (ABARE–BRS 2010, p. 11).

Industry diversity might have a positive effect on adaptive capacity in general, but there is a question about whether the relationship is strictly increasing — some specialisation is likely to be beneficial but too much may leave a region vulnerable. In addition, different regions might have different optimal levels of diversity based on size and geography.

Industry diversity was captured in the index of adaptive capacity through the Herfindahl index (table E.7). This has been used as a measure of industry concentration in other studies that

examine regional resilience and vulnerability (for example, Alasia et al. 2008, p. 16; Hill et al. 2011, p. 12). The Herfindahl index was calculated for each region as the sum of the squared shares of employment in each of the 3-digit industry subdivisions of the Australia and New Zealand Standard Industrial Classification. Regions that have a higher score on the Herfindahl index have a less diverse mix of industries. For the purposes of the adaptive capacity index, the log of this variable was taken, and the sign was reversed so that a higher value indicated greater industry diversity.

An indicator of the change in the working-age population over five years was also included to capture a dynamic aspect of regions. Regions that had been experiencing recent population growth may be more likely to be able to see through an economic shock than one that had been experiencing continual decline (RAI, sub. DR57, p. 6). Population decline can result in the loss of a community's social and cultural life, and local leadership expertise and skills (chapter 3). Nevertheless, population decline may be a sign of the region adapting.

Finally, an indicator of interregional mobility was included, as measured by the proportion of travel to work flows that were interregional. This captures the mobility of labour. Regions with more mobile workers might be expected to be more adaptive in the face of an economic disruption. However, people in regions that are strongly connected to other regions might also be more susceptible to shocks experienced by those other regions.

Table E.7   **Other indicators included in index**

Indicator[a]	Description	Mean	Std dev.
herfin[b]	Herfindahl index of industry diversity	0.05	0.02
wkagechange[c]	Proportional change in population aged 15–64 over five years	0.01	0.05
interflows*	Proportion of travel to work flows that are interregional	0.24	0.18

a Data sourced from the 2011 Census of Population and Housing unless otherwise indicated. **b** For the principal component analysis, the natural logarithm of this indicator was taken and the sign was reversed so that a higher value indicated greater industry diversity. **c** Sourced from ABS estimates of populations (ABS 2017l). * The natural logarithm of this indicator was used in the principal component analysis.

Source: Productivity Commission estimates.

E.3   Principal component analysis results

Single PCA approach

Table E.8 displays PCA results under the single PCA approach. The correlations between indicators and principal components are presented in the table, as well as the cumulative proportions of total variance captured by the principal components, and eigenvalues. These results were used to determine the number of principal components to retain, according to the criteria set out in section E.1. Retained components are presented in bold font within the tables.

Five principal components were retained according to two main criteria: the cumulative proportion of variance explained being greater than 0.7, and interpretability. Under the eigenvalue-one criterion, seven principal components would have been retained, but the extra two principal components only explained an additional 6 per cent of the total variation, and did not have a strong interpretation.

The five retained principal components do not exactly correspond to the five types of capital in the literature. Many principal components are correlated with factors from multiple capital groupings.

- The first principal component (which captures 27 per cent of the total variation) is most strongly correlated with factors relating to socioeconomic status, health and infrastructure.

- The second principal component is correlated with factors relating to remoteness, Indigenous population, wealth and community strengths.

- The third principal component is correlated with employment, agriculture, volunteering and industry concentration.

- The fourth principal component is correlated with skills and providing support.

- The fifth principal component is correlated with national parks and nature reserves.

Some individual principal components have strong correlations with indicators in the opposite direction to that expected for adaptive capacity. For example, although the first principal component is positively correlated with factors such as skills and education, it is negatively correlated with agriculture, which is also proposed to be a positive influence on adaptive capacity. The fourth principal component is negatively correlated with mining, which might be interpreted as capturing the challenges faced by regions with high mining employment when there is a disruption to the mining sector.

As described in section E.1, the index was created through a weighted sum of the retained principal components. Therefore, an individual indicator's total contribution to the index depends on its weight across each retained principal component, and the relative amount of variance explained by each retained principal component. The weights of each indicator to the final index are presented in table E.9. The indicators with the largest weights are largely factors associated with socioeconomic status and have the expected signs. Although the sign of the weights on a few indicators (such as mining) are in the opposite direction to expected, they have smaller contributions to the overall index. Nevertheless, this may have a large impact on those regions that have high employment in mining.

The weights on each indicator were aggregated by capital type to provide an indication of the contribution of a type of capital to the adaptive capacity index (table E.10). Human capital indicators represent over half of the index, which partly reflects the large number of human capital variables included. Social and financial capital variables make the second largest contributions, followed by physical, natural and other variables.

Table E.8 Single PCA — PCA correlations[a,b,c]

	PC1	PC2	PC3	PC4	PC5	PC6
Correlations						
yr12plus	**0.90**	0.34	0.01	-0.05	0.02	0.04
youtheng	0.48	**0.79**	0.20	-0.02	-0.15	-0.10
skill1to3	**0.59**	-0.26	0.12	**0.59**	0.16	0.01
emptolf	0.32	0.43	**0.65**	-0.02	-0.05	-0.14
participation	**0.64**	0.17	**0.59**	-0.29	-0.17	0.12
ltnewstart	**-0.79**	-0.28	-0.41	0.06	0.15	0.06
wkage	**0.60**	**-0.70**	0.11	-0.05	-0.14	-0.08
indig	-0.33	**-0.83**	-0.11	-0.03	-0.06	0.03
patents	0.48	**0.54**	-0.12	0.09	0.03	0.01
trademarks	**0.56**	**0.63**	-0.13	0.07	-0.12	0.14
bsnsentryrate	**0.71**	-0.34	-0.45	0.00	0.02	-0.10
bsnsexitrate	**0.74**	-0.26	-0.29	-0.32	0.03	-0.15
dsp	**-0.77**	0.23	-0.41	0.06	0.11	-0.27
selfhealth	**0.65**	-0.11	0.26	0.42	0.16	0.18
psychdistress	-0.27	0.31	-0.17	-0.22	0.38	0.41
comprisk	**-0.71**	0.25	-0.15	-0.05	-0.33	0.07
highinc	**0.73**	**-0.59**	0.23	0.00	-0.05	0.08
invinc	0.18	**0.67**	0.36	0.29	0.27	0.30
govtpyts	**-0.75**	0.41	-0.42	0.01	0.12	-0.10
propprice	**0.71**	0.19	-0.49	0.15	0.16	0.09
ownhome	-0.26	**0.88**	-0.01	0.04	0.08	-0.04
housingstress	0.07	**0.71**	**-0.57**	-0.23	0.05	0.18
remoteness	-0.31	**-0.81**	0.32	0.04	0.05	0.05
internet	**0.86**	0.37	-0.01	-0.19	-0.03	0.03
buildappvalpp	**0.61**	**-0.51**	0.04	-0.12	-0.06	-0.14
accesstransport	0.00	**0.63**	0.06	0.18	-0.45	0.17
agind	**-0.66**	0.11	**0.63**	0.16	-0.04	0.11
miningind	0.02	-0.37	0.26	**-0.62**	0.08	0.33
nature	0.20	0.22	-0.07	-0.05	**0.77**	0.03
volunt	-0.40	0.48	**0.68**	0.15	0.04	0.10
getsupport	-0.03	0.23	0.44	0.10	0.45	-0.37
providesupport	-0.20	-0.25	-0.17	**0.66**	-0.08	0.13
safeatnight	-0.18	**0.68**	0.33	0.08	0.09	-0.31
discriminated	-0.01	**-0.76**	0.23	0.10	0.33	0.34
culturalacceptance	**0.59**	-0.13	-0.30	0.35	0.00	-0.42
homeless	-0.05	**-0.86**	-0.29	0.24	0.02	0.07
herfinneg	0.16	0.39	**-0.69**	-0.12	0.07	0.04
wkagechange	**0.57**	0.32	-0.40	0.15	0.04	0.24
interflows	0.01	-0.19	0.31	-0.37	0.36	-0.32
Cumulative proportion	0.27	0.52	0.64	0.70	0.75	0.79
Eigenvalues	10.49	9.73	4.86	2.30	1.84	1.42

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** For brevity, only the first six PCs are displayed. **c** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Table E.9   Single PCA — weights of indicators in index
Ordered from largest to smallest in absolute value

Indicator	Weight in index	Indicator	Weight in index
invinc	0.116	propprice	0.047
selfhealth	0.089	remoteness	-0.046
indig	-0.088	wkagechange	0.043
emptolf	0.086	miningind	-0.041
youtheng	0.085	govtpyts	-0.041
ltnewstart	-0.082	culturalacceptance	0.034
yr12plus	0.079	accesstransport	0.027
getsupport	0.078	highinc	0.021
skill1to3	0.078	agind	0.013
nature	0.070	herfinneg	-0.013
patents	0.067	wkage	-0.012
trademarks	0.066	interflows	0.008
internet	0.065	discriminated	-0.007
safeatnight	0.064	bsnsexitrate	-0.007
comprisk	-0.064	bsnsentryrate	-0.003
volunt	0.062	buildappvalpp	-0.003
homeless	-0.061	psychdistress	0.002
participation	0.060	housingstress	0.002
dsp	-0.051	providesupport	-0.002
ownhome	0.048		

Source: Productivity Commission estimates.

## Table E.10   Single PCA — contributions of each capital domain
Ordered from largest to smallest contribution

Capital domain	Contribution to index (%)
Human	50.30
Social	16.83
Financial	14.98
Physical	7.69
Natural	6.73
Other	3.47

Source: Productivity Commission estimates.

For the presentation of results, regions were grouped into four categories according to their index value. Regions in the most adaptive category (10 regions) and the least adaptive category (13 regions) had index values greater than one standard deviation away from the mean. The remaining regions were classed into above average (27 regions) and below average (27 regions) categories. A map of regions by their adaptive capacity category is presented in figure E.4. The results are discussed in section E.5.

Figure E.4   **Single PCA — relative adaptive capacity of FERs, 2016**

Legend:
- Least adaptive
- Below average
- Above average
- Most adaptive
- Not estimated
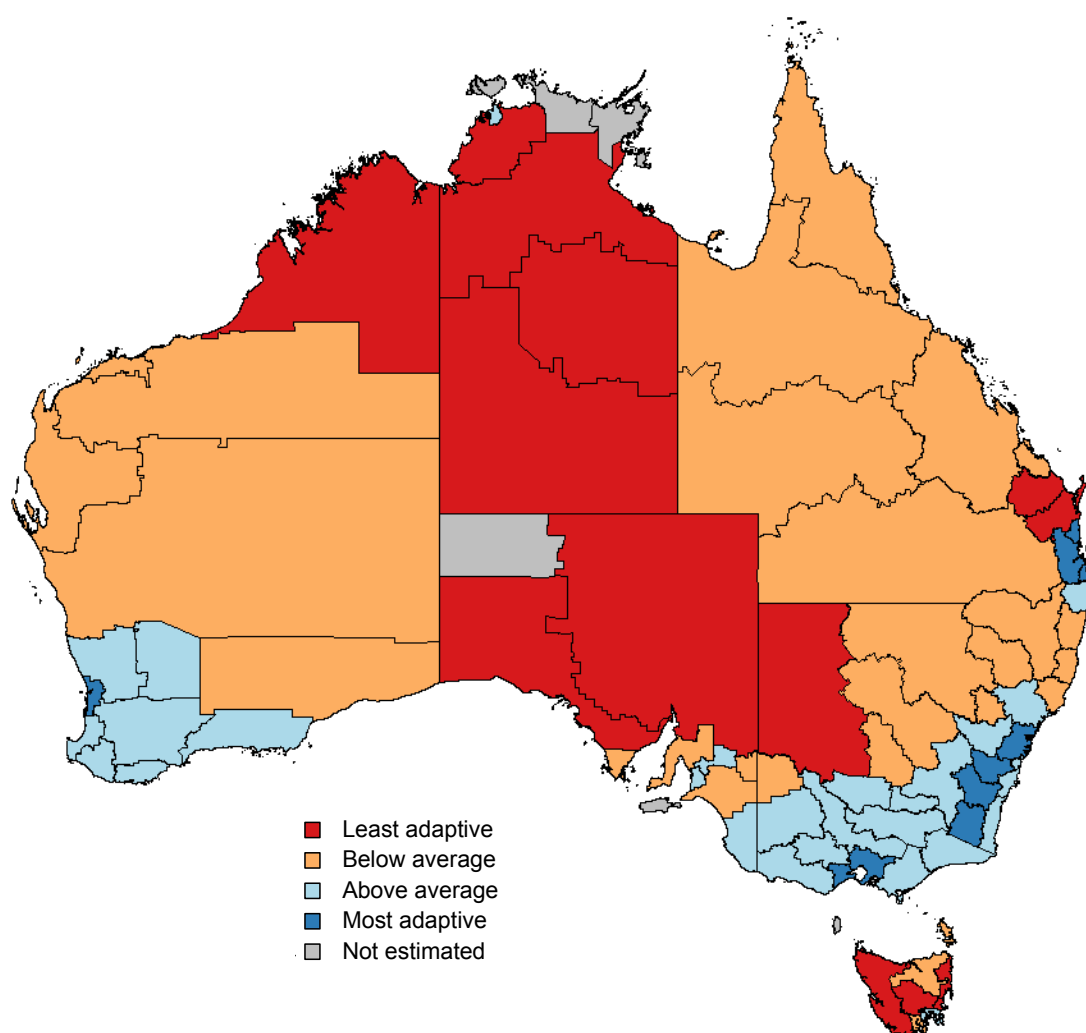
Source: Productivity Commission estimates.

Nested PCA approach

As described in section E.1, under the nested PCA approach, separate PCAs for human, financial, physical, natural and social capital indicators were first conducted. Indicators were then removed if they had a correlation of less than 50 per cent with the first principal component within their capital domain. This led to the removal of a total of nine indicators, representing the working-age population, Indigenous population, psychological distress, investment incomes, property prices, building approvals, mining, providing support and cultural acceptance.

PCA was performed again for each capital domain with the reduced set of indicators, with the results presented in tables E.11 to E.15. Across the capital domains, cumulative proportions of variance explained by the first principal components range from 47 per cent (for human capital) to 71 per cent (for financial capital). Although only the first financial capital component meets the 70 per cent threshold of variance explained, the indicators in each PCA all have correlations greater than 50 per cent with their respective first principal components. The first principal component from each PCA was retained, and can be interpreted as representing indexes of each capital type. (For example, the first principal component in the human capital PCA can be interpreted as a human capital index.)

It is noted that the removal of some indicators under this approach means that some factors that are thought to be important, have large weights in the single PCA approach or are highly correlated with the second principal component in the initial capital domain PCAs (such as investment incomes, property prices and mining) are not captured in the index.

Table E.11   Nested PCA — human capital PCA correlations[a,b,c]

	PC1	PC2	PC3	PC4	PC5
Correlations					
yr12plus	**0.93**	0.03	-0.23	0.03	-0.07
youtheng	**0.67**	0.64	-0.21	0.01	-0.07
skill1to3	**0.55**	-0.48	0.17	-0.52	-0.22
emptolf	**0.56**	0.62	0.32	0.06	-0.27
participation	**0.78**	0.30	0.39	0.28	0.09
ltnewstart	**-0.89**	-0.21	-0.16	-0.14	-0.08
patents	**0.58**	0.23	-0.53	-0.38	0.16
trademarks	**0.66**	0.33	-0.50	-0.08	0.00
bsnsentryrate	**0.50**	-0.68	-0.35	0.20	0.08
bsnsexitrate	**0.57**	-0.53	-0.28	0.46	-0.02
dsp	**-0.76**	0.24	-0.42	-0.14	-0.27
selfhealth	**0.67**	-0.25	0.31	-0.49	0.25
comprisk	**-0.66**	0.49	-0.10	0.00	0.39
Cumulative proportion	0.47	0.66	0.77	0.85	0.88
Eigenvalue	6.13	2.42	1.43	1.03	0.47

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** For brevity, only the first five PCs are displayed. **c** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Table E.12　Nested PCA — financial capital PCA correlations[a,b]

	PC1	PC2	PC3	PC4
Correlations				
highinc	**0.94**	0.30	-0.02	0.17
govtpyts	**-0.89**	-0.38	0.21	0.15
ownhome	**-0.83**	0.21	-0.52	0.05
housingstress	**-0.71**	0.63	0.31	-0.01
Cumulative proportion	0.71	0.88	0.99	1.00
Eigenvalue	2.86	0.68	0.41	0.05

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Table E.13　Nested PCA — physical capital PCA correlations[a,b]

	PC1	PC2	PC3
Correlations			
remoteness	**-0.88**	-0.05	0.47
internet	**0.77**	0.55	0.31
accesstransport	**0.73**	-0.65	0.23
Cumulative proportion	0.63	0.88	1.00
Eigenvalue	1.90	0.73	0.37

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Table E.14　Nested PCA — natural capital PCA correlations[a,b]

	PC1	PC2
Correlations		
agind	**0.76**	-0.65
nature	**-0.76**	-0.65
Cumulative proportion	0.57	1.00
Eigenvalue	1.14	0.86

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Table E.15   Nested PCA — social capital PCA correlations[a,b,c]

	PC1	PC2	PC3	PC4
Correlations				
volunt	**0.72**	0.45	-0.42	-0.31
getsupport	**0.55**	0.58	0.60	-0.01
safeatnight	**0.88**	-0.02	-0.13	0.40
discriminated	**-0.63**	0.66	-0.28	0.24
homeless	**-0.88**	0.24	0.11	-0.02
Cumulative proportion	0.55	0.76	0.89	0.95
Eigenvalue	2.76	1.03	0.65	0.31

a Bold font indicates the principal components (PCs) that were retained and the indicators with the highest correlations with these components. **b** For brevity, only the first four PCs are displayed. **c** The signs of retained PCs were reversed where appropriate so that a higher value indicates greater adaptive capacity.

Source: Productivity Commission estimates.

Each capital domain index and the 'other' domain were combined through an equally weighted sum to form the index of adaptive capacity. The weights of each individual indicator to the nested PCA index are presented in table E.16. As expected from this method, capital domains that have few indicators get disproportionately large weights in the index. The natural capital indicators (the domain with the fewest indicators) have the largest weights in the index, while the human capital indicators (the domain with the most indicators) have the smallest weights.

Table E.16   Nested PCA — weights of indicators in index
### Ordered from largest to smallest in absolute value

Indicator	Weight in index	Indicator	Weight in index
agind	0.110	discriminated	-0.038
nature	-0.110	getsupport	0.033
remoteness	-0.077	yr12plus	0.025
internet	0.068	ltnewstart	-0.024
accesstransport	0.064	participation	0.021
herfinneg	0.056	dsp	-0.021
wkagechange	0.056	youtheng	0.018
interflows	0.056	selfhealth	0.018
highinc	0.055	trademarks	0.018
safeatnight	0.053	comprisk	-0.018
homeless	-0.053	patents	0.016
govtpyts	-0.052	bsnsexitrate	0.016
ownhome	-0.048	emptolf	0.015
volunt	0.043	skill1to3	0.015
housingstress	-0.042	bsnsentryrate	0.014

Source: Productivity Commission estimates.

The total contribution of human capital in the nested PCA index is much lower than in the single PCA index (17 per cent compared with 50 per cent). The total contribution of social and financial capital are about the same, while the contributions of all other capital domains are larger due to the equal weighting of domains with few indicators.

Like the index formed from the single PCA, regions were grouped into four categories according to their index value — most adaptive (11 regions), above average (31), below average (21) and least adaptive (14). A map of regions by their adaptive capacity category under the nested PCA approach can be found in figure E.5.

Figure E.5   **Nested PCA — relative adaptive capacity of FERs, 2016**
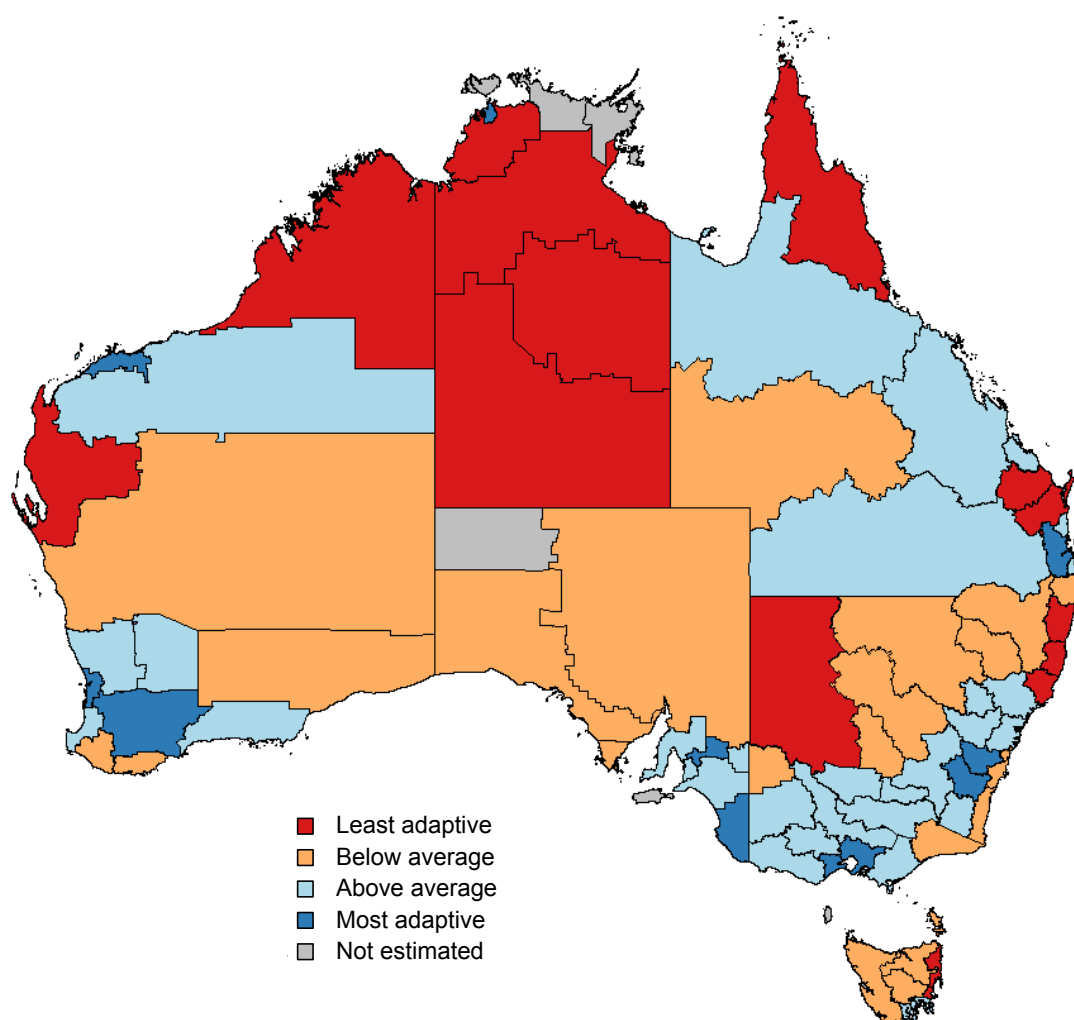
Source: Productivity Commission estimates.

E.4 Sensitivity testing

Sensitivity testing was conducted to see how much each region's index values varied in response to:

- creating the index using the single PCA approach or the nested PCA approach

- changes in the regions included in the analysis

- changes in the indicators used to assess adaptive capacity.

Comparing single PCA and nested PCA approaches

There are a number of differences and similarities between the PCA results for the two approaches. The correlation between the two indexes was 83 per cent. About 69 per cent of the regions that were in the least adaptive category under the single PCA approach were also in the least adaptive category under the nested PCA approach. For the most adaptive category, this was 60 per cent.

Figure E.6 charts each region's index score on the nested PCA approach against their score on the single PCA approach. The 45 degree line indicates where regions would be positioned if their scores under both approaches were the same. Regions with lines extending upwards (downwards) from the 45 degree line have a higher (lower) score under the nested PCA approach than the single PCA approach. The horizontal and vertical grey lines indicate the category of adaptive capacity (least adaptive, below average, above average, most adaptive). Regions change adaptive capacity categories across single and nested PCA approaches if the line representing their index scores crosses one of the horizontal grey lines.

As an example, Barkly (represented by region A in figure E.6) has a line that extends upwards from the 45 degree line, but it does not cross a horizontal grey line, indicating that it remains in the same category (least adaptive) under both approaches. Central Tasmania (region B) has a higher nested PCA index score than single PCA index score, which takes it from the least adaptive category to below average. Greater Sydney (region C) has a lower nested PCA index score than single PCA index score, which takes it from the most adaptive category to above average. Overall, the regions that change categories are mainly in the above average or below average categories.

Figure E.6   **Comparison of index scores under single and nested PCA**
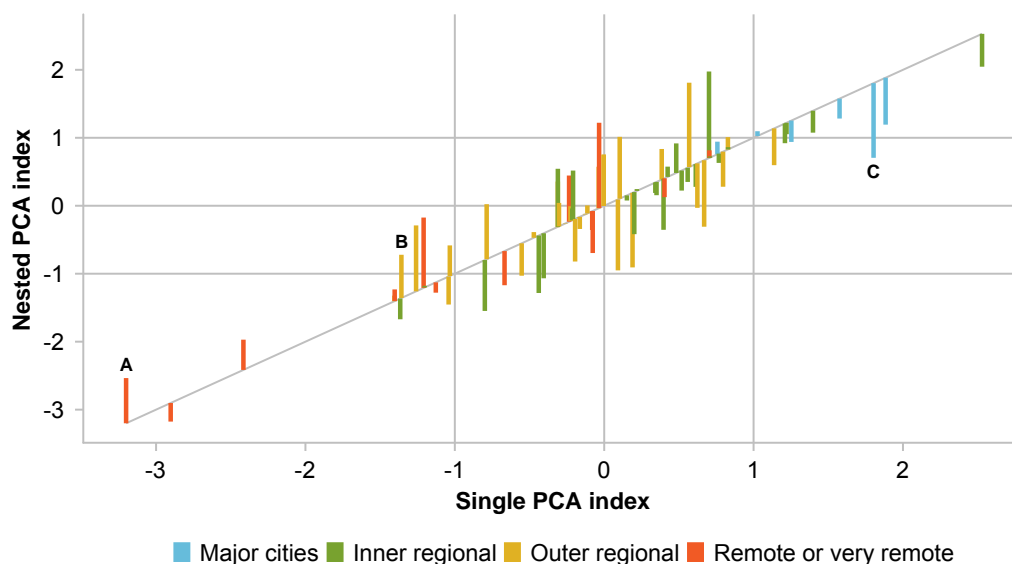
a The horizontal and vertical grey lines indicate the category of adaptive capacity (least adaptive, below average, above average, most adaptive).

Source: Productivity Commission estimates.

Comparing the maps of regions by adaptive capacity category under single PCA and nested PCA approaches (figures E.4 and E.5), there are notable similarities. For example, some remote areas (such as those in the Northern Territory, and the Kimberley region) have relatively low adaptive capacity across both indexes. Capital city regions tend to have relatively high adaptive capacity and regional areas of New South Wales and Victoria appear similar across both indexes.

However, there are some differences in mining and agricultural regions, due to the differences in weights attributed to mining and agriculture indicators in each index. In the single PCA index, mining has a negative weight, whereas in the nested PCA index, mining is omitted. Therefore, some regions with high mining employment (such as Karratha, Port Hedland – Newman and Mackay regions) appear as having at least above average adaptive capacity in the nested PCA index, whereas they were below average in the single PCA index. Agriculture has a larger positive weight in the nested PCA index compared with the single PCA index, which makes some agricultural regions (such as South Wheatbelt, Darling Downs–South West Queensland and Yorke Peninsula regions) appear to have higher relative adaptive capacity under the nested PCA index.

Changes in regions and indicators

The last two aspects of the sensitivity testing were done concurrently for the single PCA index through a bootstrapping technique. The true adaptive capacity of a region as well as the standard deviation of its estimated adaptive capacity is unknown, and both would be expected to be a function of the regions in the PCA as well as the variables included. The bootstrapping technique involves running the same analysis many times on multiple new samples of data that are constructed by random sampling with replacement from the initial dataset. These new samples have the same number of observations as the initial dataset. (This means that the new samples will likely have multiple observations of a particular region, while other regions may not appear in a particular sample at all.)

In the current analysis, 1000 bootstrap samples were formed, and the sensitivity of the index results to these changes in the sample of regions was examined. For each of the 1000 bootstrap samples, one indicator of adaptive capacity was removed from the analysis each time in order to assess the effect of small changes in the set of indicators on the index results. The removal of every indicator was tested in turn (that is, the sensitivity of the index results to each indicator individually was tested). As there were a total of 39 indicators, that means there was a total of 39 000 calculations of the index for each region using this bootstrapping technique.

Constructing indexes from PCA requires a degree of judgment in selecting the number of principal components to retain and examining whether the signs should be reversed (section E.1), but it is impossible to apply the same level of scrutiny to each PCA in each of the iterations of the bootstrapping analysis. Therefore a number of assumptions were made. It was assumed that decisions about the numbers of principal components to retain across all iterations are the same as in the calculation of the original single PCA index. It was also assumed that the main two indicators that contributed to the interpretation of each principal component were the same as in the construction of the original index, and signs of principal components were reversed where necessary, so that they were in the expected direction for those indicators.

The distribution of each region's index values from the bootstrapping analysis was examined to see how sensitive the results were, and the 5th and 95th percentiles of each region's distribution of index values were plotted. The chart for the single PCA approach is presented in figure E.7. It was found that many regions had particularly large intervals, indicating greater uncertainty in their index values and relative rankings.

Under the single PCA approach, the rankings of more remote regions tend to be more sensitive to changes in indicators, and they are more likely to change categories with the removal of various indicators. This is especially the case for Port Hedland – Newman (region A in figure E.7) and Karratha (region B) regions in Western Australia, which both have relatively high mining employment. Both of these regions are categorised as being below average in adaptive capacity, but would be placed in the least adaptive category based on their lower confidence limits, and in the most adaptive category based on their upper confidence limits.

Figure E.7 **High uncertainty in the rankings of adaptive capacity**

Index values for each FER and their 90 per cent confident intervals, sorted from lowest to highest[a]

Legend: Major cities · Inner regional · Outer regional · Remote and very remote
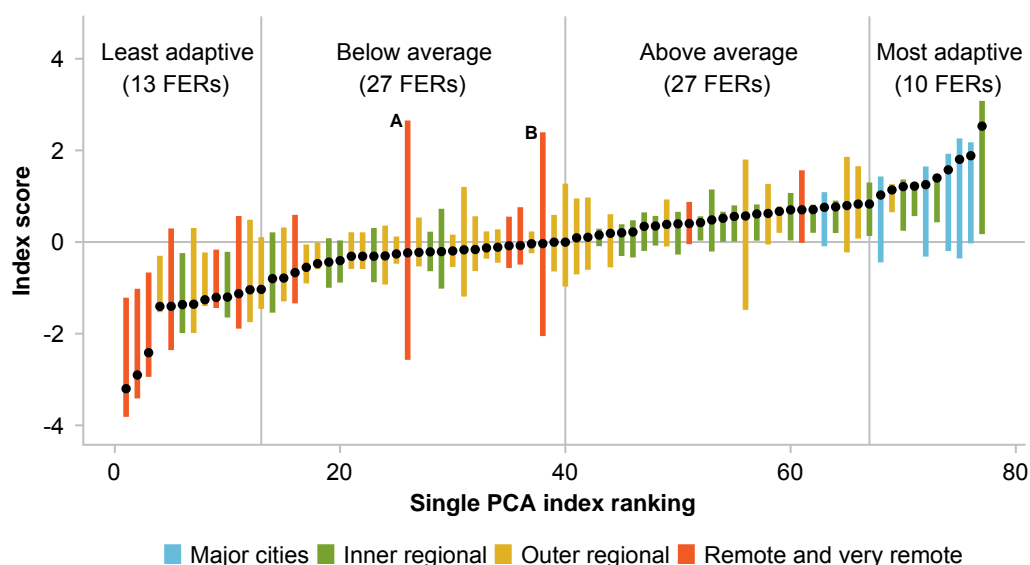
a The least and most adaptive regions are defined as those above and below one standard deviation of the mean index value of adaptive capacity across all regions. Regions are ordered based on their index value, where the whiskers represent the upper and lower 5 percentiles (90 per cent confidence intervals) of the region's index value across bootstrapping analysis. Black dots represent the original index value.

Source: Productivity Commission estimates.

Regions in the least adaptive category tend to have positively skewed intervals, whereas regions in the most adaptive category tend to have negatively skewed intervals. For the exclusion of any indicator to dramatically increase (decrease) the score of a region identified as most (least) adaptive, the value for that indicator would have to be significantly worse (better) than most other regions' values for that indicator. Regions identified as most (least) adaptive are unlikely to have many indicators with these properties (thus a short positive (negative) tail of their distribution).
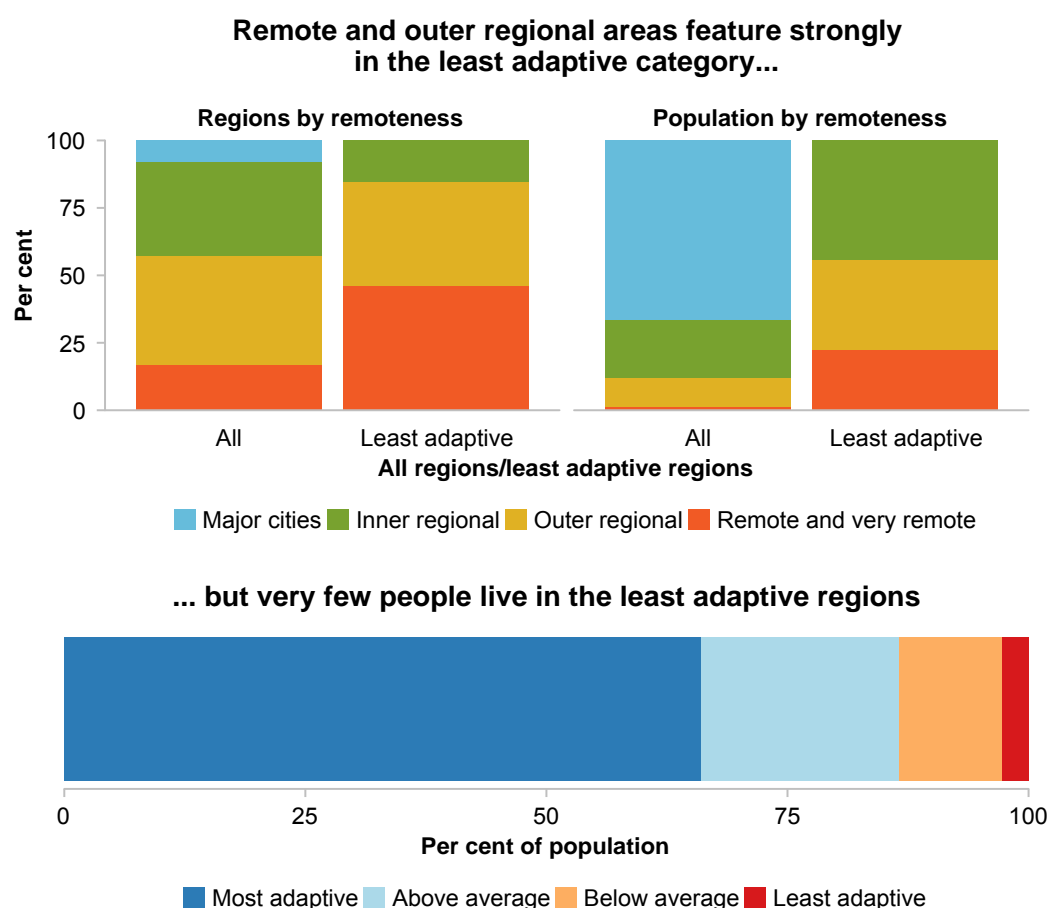
Sensitivity testing results are discussed further in chapter 4. A spreadsheet of index scores for each region, as well as their 90 per cent confidence intervals based on the bootstrapping analysis, are provided as supporting materials on the Commission's website.

E.5   Results discussion

This section provides a brief overview of the results from the Commission's preferred index of adaptive capacity, using the single PCA approach. A more detailed discussion can be found in chapter 4. In addition, appendix B contains a list of regions by their ranking and category of adaptive capacity.

The least adaptive regions tend to be concentrated in more remote regions of Australia, while the most adaptive regions tend to be in major cities (figure E.4). This is further illustrated in figure E.8. There are no major city regions within the least adaptive or below average categories. In terms of population sizes, a relatively larger share of people in the least adaptive regions are living in regional or remote areas, compared with the share of people in those areas among the whole of Australia (figure E.8). However, in terms of the whole population, the number of people living within the least adaptive regions is small, due to the relatively sparse populations in these areas when compared with the populations in major cities (figure E.8).

Figure E.8   **Regions and population by relative adaptive capacity and remoteness**

**Remote and outer regional areas feature strongly
in the least adaptive category...**

... but very few people live in the least adaptive regions

Source: Productivity Commission estimates.

E.6 SA2 adaptive capacity results for 2016

Creating the index of adaptive capacity at the FER level has the potential to hide differences in indicators between the SA2s that make up the FERs. Therefore the index was also created at the SA2 level, using the single PCA approach. A total of 2070 SA2 regions were included in the calculation of the index. 126 were excluded due to missing data.

The indicators that were included in the analysis were the same as for the FER analysis, but at the SA2 level. There are a few exceptions — the measures of industry diversity and interregional flows are at the FER level for the SA2 analysis. These variables are more appropriate to consider at a larger level of geography than SA2s because people live, work and consume services across multiple SA2s (particularly in urban areas).

Weights of each indicator in the SA2-level index are presented in table E.17 and the contributions of each capital domain are presented in table E.18.

Table E.17 **Single PCA for SA2 regions, 2016 — weights of indicators in index**

Ordered from largest to smallest in absolute value

Indicator	Weight in index	Indicator	Weight in index
safeatnight	0.103	accesstransport	0.048
invinc	0.097	trademarks	0.042
providesupport	0.091	bsnsexitrate	-0.042
ownhome	0.090	bsnsentryrate	-0.039
volunt	0.086	buildappvalpp	-0.038
nature	0.082	psychdistress	-0.035
indig	-0.080	yr12plus	0.034
skill1to3	0.077	remoteness	-0.033
youtheng	0.077	agind	0.030
selfhealth	0.075	internet	0.029
homeless	-0.071	highinc	0.026
propprice	0.071	dsp	-0.026
wkage	-0.068	miningind	-0.024
housingstress	-0.064	interflows	-0.023
comprisk	-0.060	wkagechange	-0.019
ltnewstart	-0.057	govtpyts	-0.017
getsupport	0.053	herfinneg	0.009
emptolf	0.053	discriminated	-0.009
culturalacceptance	0.051	participation	-0.005
patents	0.049		

Source: Productivity Commission estimates.

Single PCA for SA2 regions, 2016 — contributions of each capital domain

Ordered from largest to smallest contribution

| Capital domain	Contribution to index (%)
Human	41.30
Social	23.43
Financial	18.38
Physical	7.47
Natural	6.86
Other	2.55

Source: Productivity Commission estimates.

Human capital factors have the largest contribution to the index at 41 per cent (table E.18). However, this is smaller than the contribution of human capital to the single PCA index for FERs (50 per cent). Social capital factors make a larger contribution to the index for SA2 regions than FERs (23 per cent compared with 17 per cent). The contributions of financial, physical, natural and other factors to the SA2 index are similar to that of FERs.

After grouping SA2 regions into categories according to their index scores, 309 were classified as least adaptive, 740 as below average, 710 as above average and 311 as most adaptive. However, similar to the FER results, region's index scores are sensitive to changes in the sample of regions and indicators included in the analysis.

Figure E.9 presents a map of SA2 regions by their relative adaptive capacity, according to each region's index score. A comparison of figures E.4 and E.9 shows that large remote and regional areas tend to have relatively low adaptive capacity at both the FER and SA2 level. However, there are pockets of lower adaptive capacity within major cities that are not obvious at the aggregate FER level.

For the single PCA index for SA2 regions, the share of people in more remote regions within the least adaptive category is larger than the national share of people in more remote regions (figure E.10). However, most people within the least adaptive category of SA2s live in major cities. These people were masked in the FER results, because they reside within a FER that had relatively high adaptive capacity overall.

Figure E.9   **Single PCA — relative adaptive capacity of SA2 regions, 2016**

Least adaptive
Below average
Above average
Most adaptive
Not estimated
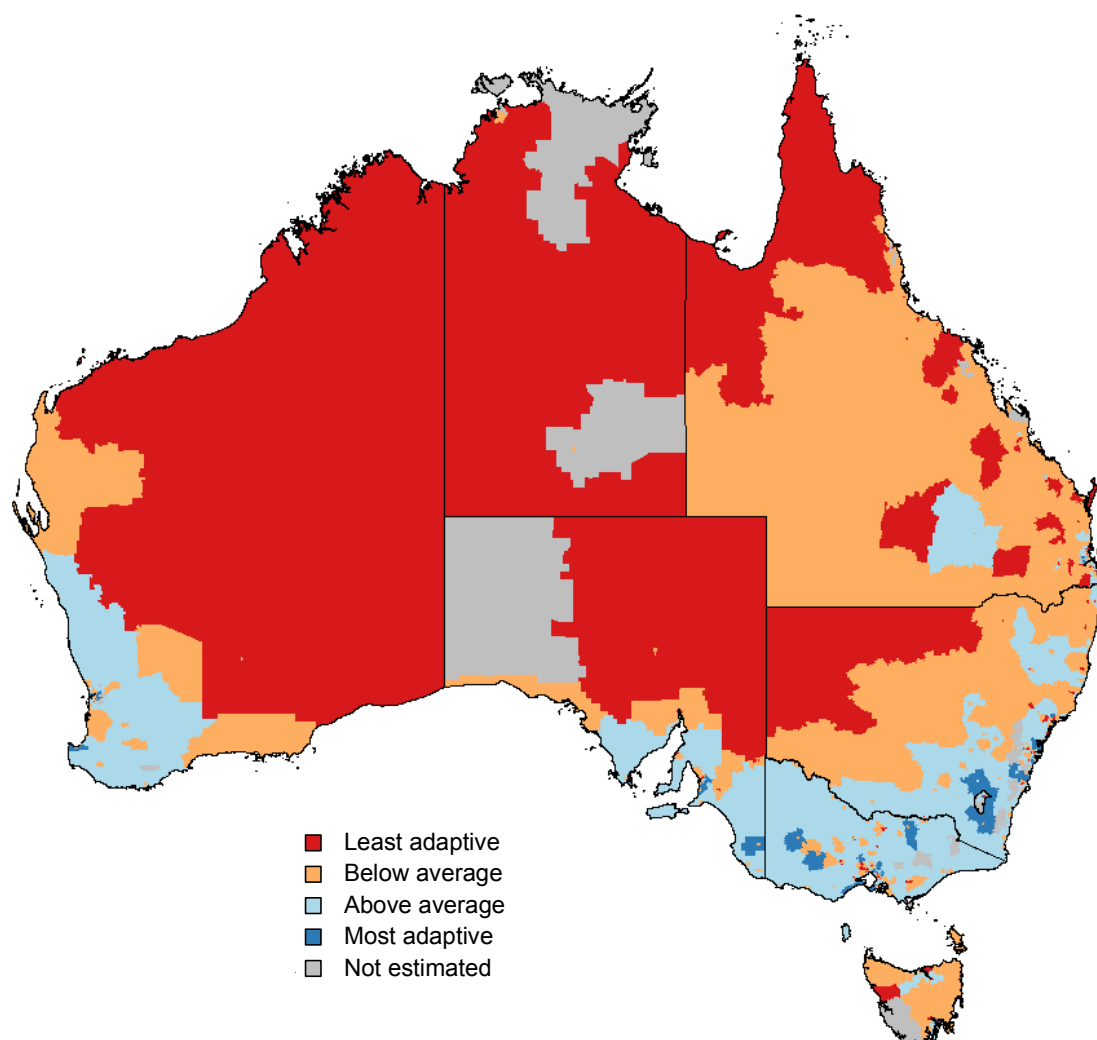
Source: Productivity Commission estimates.

E.7   FER adaptive capacity results for 2011

The analysis was conducted for FERs using 2011 data. For indicators where 2011 data were not available, data were used from the closest available year.

Although the results are displayed here for completeness, index results for each region at different time periods cannot be used to assess change, for a number of reasons.

Figure E.10 **Many people in the least adaptive SA2s live in major cities**
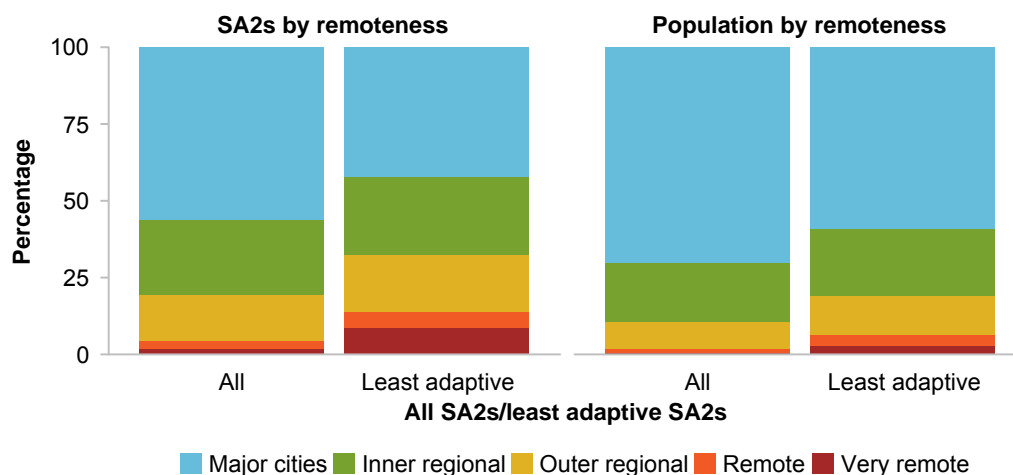
Source: Productivity Commission estimates.

First, the indexes are relative measures of adaptive capacity. They do not show whether a region has high or low adaptive capacity, only whether they have higher or lower adaptive capacity than other regions. Therefore, all else equal, a decrease in a region's index ranking could mean that the region's adaptive capacity has actually declined, or that other regions that used to have lower adaptive capacity have improved.

Second, changes in index scores could be due to changes in the value of indicators or changes in the weights on indicators in PCAs across years. An indicator of adaptive capacity for a region might have improved over time, but if the weight on the indicator has decreased, then it might still have the same contribution to the index.

Third, there are issues with obtaining consistent data on indicators over time. Not all indicators are available for each year, and some values of the indicators used are the same for both 2011 and 2016 indexes. Changes in rankings might be partly due to indexes not being able to take into account data for the correct year. Even where data are available, the definitions of indicators can change over time, which can add further difficulty when making comparisons.

As a result, no clear conclusions can be made about how a region's adaptive capacity has changed over time.

For the adaptive capacity index for 2011, weights of each indicator are presented in table E.19 and the contributions of each capital domain are presented in table E.20. Comparing the contributions of each capital domain to the FER index for 2016 and 2011 (tables E.10 and E.20), human capital indicators contribute over 50 per cent of the index in both years (though the weights on individual indicators differ). Human and financial capital indicators make a slightly larger contribution to the 2011 index than the 2016 index, whereas natural and social capital indicators make a slightly smaller contribution.

Table E.19   Single PCA for FERs, 2011 — weights of indicators in index

Ordered from largest to smallest in absolute value

Indicator	Weight in index	Indicator	Weight in index
skill1to3	0.110	patents	0.039
selfhealth	0.104	herfinneg	-0.034
comprisk	-0.100	youtheng	0.034
govtpyts	-0.085	indig	-0.033
dsp	-0.084	wkagechange	0.029
emptolf	0.083	psychdistress	-0.028
yr12plus	0.082	bsnsentryrate	0.028
ltnewstart	-0.080	accesstransport	-0.019
participation	0.071	ownhome	-0.018
getsupport	0.070	trademarks	0.017
highinc	0.069	safeatnight	0.017
invinc	0.065	bsnsexitrate	0.016
internet	0.062	volunt	0.016
buildappvalpp	0.058	homeless	-0.008
wkage	0.053	agind	-0.008
propprice	0.051	miningind	-0.007
housingstress	-0.049	remoteness	0.004
nature	0.048	interflows	-0.003
culturalacceptance	0.044	providesupport	0.001
discriminated	0.041		

Source: Productivity Commission estimates.

Table E.20   Single PCA for FERs, 2011 — contributions of each capital domain

Ordered from largest to smallest contribution

Capital domain	Contribution to index (%)
Human	54.33
Financial	19.08
Social	11.17
Physical	8.07
Other	3.78
Natural	3.57

Source: Productivity Commission estimates.

A map of the adaptive capacity of FERs in 2011 is presented in figure E.11. The most adaptive regions include most greater capital city regions, as well as some major mining regions (Karratha, Port Hedland – Newman, and Goldfields regions of Western Australia). The boom in mining activity boosted incomes and employment in these mining regions, which positively contributed to these regions' human and financial capital and their adaptive

capacity index score for 2011 (which was during the height of the mining boom). Despite being in more remote parts of Australia, these regions also had relatively high levels of physical capital due to the construction during the mining boom years. The least adaptive regions are in inner regional to remote areas, and are characterised by low levels of human and financial capital (such as poor education and skill levels and low incomes).

Figure E.11   **Single PCA — relative adaptive capacity of FERs, 2011**
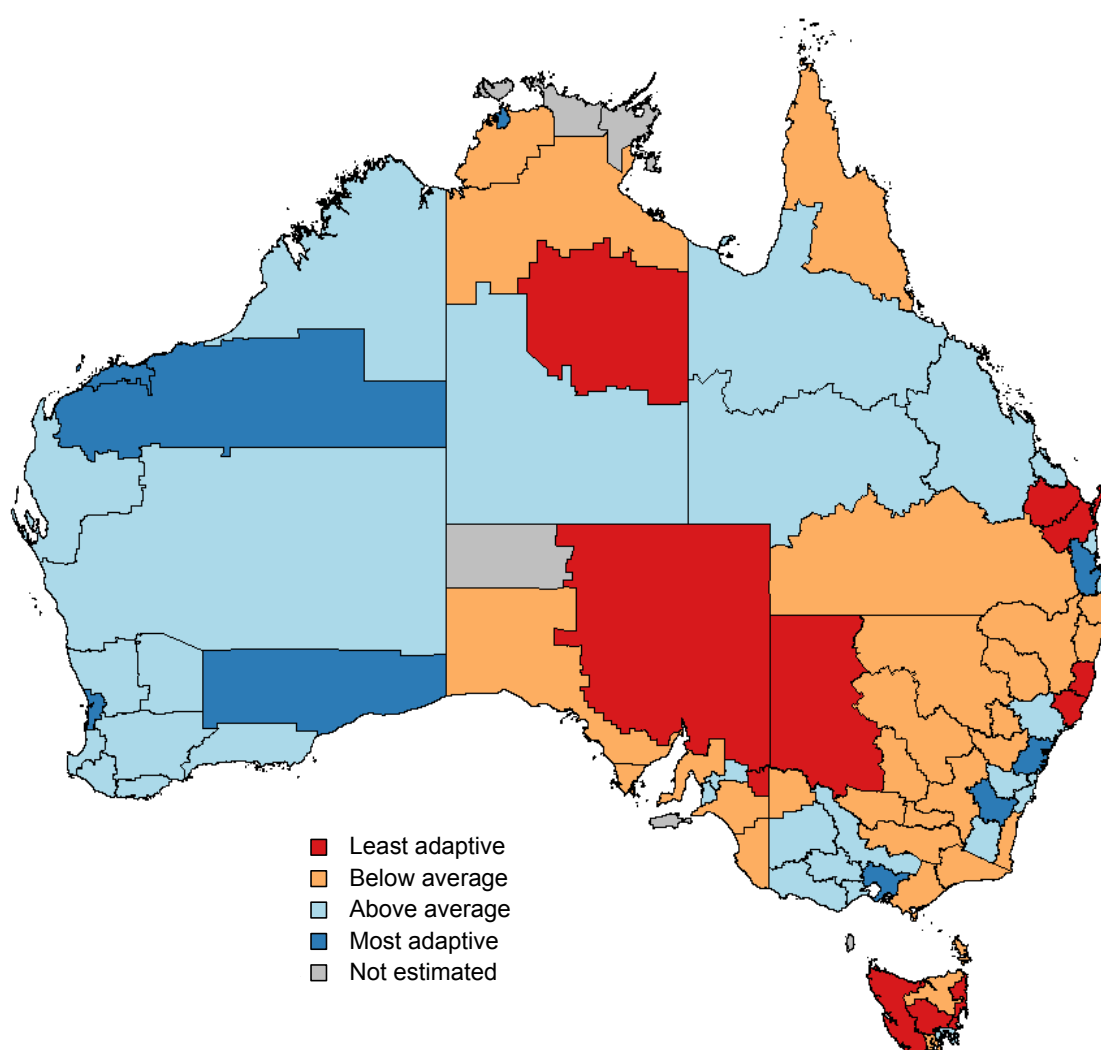
Source: Productivity Commission estimates.

Attachment A: Report on Productivity Commission Index of Adaptive Capacity

By Professor Robert Tanton

This report has been written by Professor Robert Tanton, who has worked on a number of similar indexes to that developed by the Productivity Commission for the report on Transitioning Regional Economies. These indexes have included the 2001 ABS Socio-Economic Index for Areas (SEIFA); and the National Centre for Social and Economic Modelling child social exclusion index, youth social exclusion index and the index of wellbeing for older Australians.

It is clear that the Productivity Commission consulted widely as they developed the index of adaptive capacity, and talked to experts in the field, as well as holding workshops to discuss the index between the draft and final reports.

The method used by the Commission is a standard method of creating summary indexes called principal components analysis (PCA). This method takes a number of indicators, and summarises these into a set of uncorrelated components (indexes). A number of summary indexes are calculated using this process, and the first summary index explains most of the variability in the data. Further indexes will explain smaller proportions of the variability, and there is therefore some judgement in deciding how many indexes to retain.

Principal components analysis has been used by the ABS for the SEIFA indexes (Australian Bureau of Statistics, 2013); the New Zealand indexes of deprivation (Atkinson, Salmond, & Crampton, 2014); the UK indexes of child deprivation (Bradshaw et al., 2008); the South African indexes of child disadvantage (Barnes, Noble, Wright, & Dawes, 2008); and many other indexes (Dinh, Freyens, Daly, & Vidyattama, 2017; Vidyattama, Pearson, Tanton, & Mohanty, 2017). Most of these indexes only retain the first component as the index, given that this component explains most of the variation in the original data.

As an example of the method used, the ABS SEIFA index includes all indicators in the model; the principal components analysis is run against all the indicators; indicators which aren't strongly associated with the first component (the ABS uses a criteria of 0.3 for this) are removed; and as the first component explains most of the variability in the indicators, this is the only component used for the index.

More recently, Bradshaw et al (2008) used a theoretical framework to define a number of domains, and then estimated indexes for each of these domains. This domains based approach was used for the second set of NATSEM child and youth social exclusion indexes. Using this approach, indicators are placed in domains; and then principal components analysis is used to derive a single index for each domain. Again, only the first index in each domain is used; and indicators with low loadings are removed. The domains are then added using a log transformation, to derive the final index.

The Productivity Commission has used both these approaches, to enable a comparison between these two methods. However, the Commission has diverged from these approaches by using a number of indexes, and bringing together these indexes, rather than just using the first index.

The other step the Commission has conducted is a log transformation for some of the indicators. Given the PCA technique assumes a linear relationship between the indicators, this is a reasonable approach.

For the single index approach, the Commission had 39 indicators. This is a very large number of indicators to measure one concept (adaptive capacity), and it is therefore probably not surprisingly that the first index explained only 28% of the variability in the indicators. The 2011 ABS SEIFA index of Disadvantage has 20 variables with the final index including only 16 of these due to the removal of some indicators due to low loadings, and the first component (the final index used by the ABS) and explained 44% of the variability of the indicators (Australian Bureau of Statistics, 2013).

While it is possible to run PCA as a data mining approach on thousands of variables, the index that the Productivity Commission requires is one of adaptive capacity, so the selection of variables needs to start from a theoretical framework and select indicators based on this framework. This is not a data mining approach. This framework is outlined in the main report, and this report has informed the selection of indicators in the index (although I would question the inclusion of the large number of indicators in an index of adaptive capacity – this concern is outlined further below).

Because the Commission had so many indicators, and a low explanatory power of the first index, the first 5 indexes were used for the final index. This diverges from the normal procedure for developing these indexes, where the first index only is used. However, the eigenvalues and scree plot do suggest that more than the first index was important (again, this result was possibly driven by the large number of indicators), and therefore there is some judgement required to choose the number of indexes. Personally, my judgement would have been to take the first 2 indexes, possibly the third. With these first 2 indexes, 51% of the variance in the indicators is explained, similar to the 44% deemed appropriate by the ABS for the SEIFA indexes. The third component adds 13 percentage points to the explanatory power, so could have been included. The scree plot, a standard way of determining how many indexes to retain, is shown in Figure 1 and suggests that the first 3 components be kept – it levels out at the 4th component.

Figure 1: Scree plot for Index of Adaptive Capacity
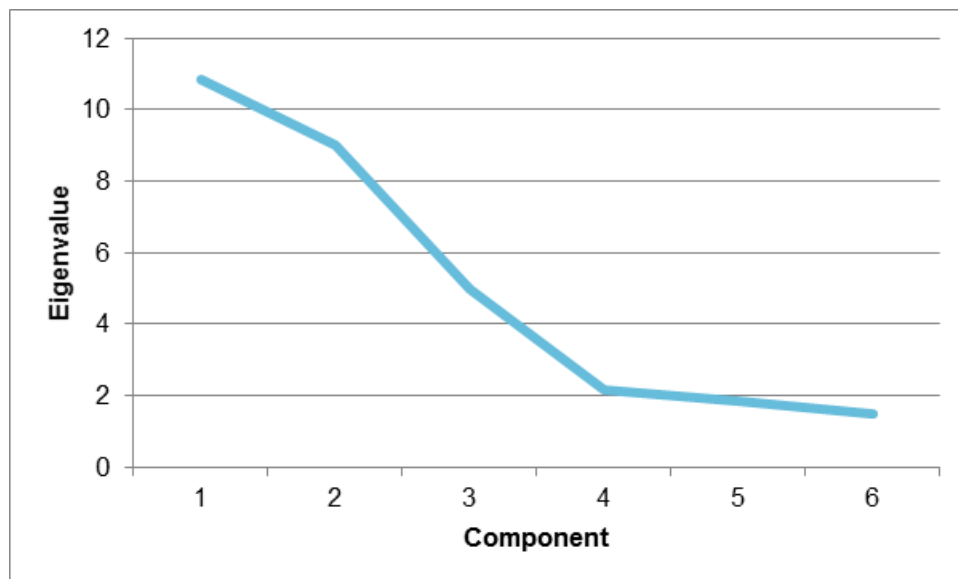
The fourth and fifth components only added 5 percentage points each to the explanatory power. Keeping all five components also meant no indicators were removed due to low loadings, which would have reduced the number of indicators.

The main problem that the Commission faces with keeping 5 indexes is that they only want one index, so how do they go from the 5 indexes to one index? The solution that the Commission has used is to weight each of the indexes by the % explained, standardize them, and then add them. This is a technique that has been used in other literature (Krishnan, 2010; Nicoletti, Scarpetta, & Boylaud, 2000). Both of these reports used varimax rotation to minimise any cross loadings (where one indicator will load strongly onto two indexes).

The problem with this technique for the Commission is that their final index had a high level of cross loading (see Table E.8). For example, looking at the indicator wkage, it loads onto the first index with a loading of 0.76; and loads onto the second index with a loading of -0.53. The first and second indexes have similar contributions to the final combined index (the first index is 0.28 and the second is 0.23), so these two nearly offset each other. Table E.9 shows the impact of this across all the indexes – the weight for wkage in the final index is 0.007.

Using a varimax rotation should reduce the cross-loadings (as seen in the Krishnan and Nicoletti papers). Table 4 in the Krishnan paper shows no cross-loadings; and Tables 7 to 10 in the Nicoletti paper shows no cross loadings. This means adding the indexes (with some adjustment to standardise and weight them) works better than when there are cross loadings.

The impact of not using a rotated matrix can be seen in Table E.9 in the report, where the final weights for each indicator are shown. The overall weights in the final index are very low – indicators in the SEIFA index and NATSEM indexes which only uses the first component are removed as low loading if they have a loading (weight) of less than 0.3. The weights in the final Productivity Commission index are all close to or less than 0.1. This then

raises the question why bother including many of the indicators – for example, the indicator psychdistress had a weight in the index of 0, and agind had a weight of -0.002. These are not adding anything to the final index.

This issue has been discussed with Commission staff, who provided results for a varimax rotation, which showed more cross loadings than before rotation. This is an interesting result, and one that needs to be investigated further, as rotation should in theory result in fewer cross-loadings. I expect this may have something to do with the number of indicators included.

In the nested PCA approach, the number of indicators in each domain was fewer, and the first index tended to explain the majority of the variation in the indicators. In all these domains, the Commission could be justified in only keeping the first index (scree plots are shown in Appendix 1 which certainly justify keeping the first index for human capital; financial capital; and social capital. Physical capital and natural capital were harder to identify the levelling of the scree plot). This first index explains a good proportion of the variation in the original indicators (remembering that the ABS keeps the first component of SEIFA with a % explained of 0.44).

Again, any indicators with correlations less than 0.5 onto the first index could be taken out. The index from the each domain can then be added, once they have been standardised. Noble's log transformation is typically used for this (Noble et al., 2004) but other transformations, as used by the Commission, are suitable.

The Commission has then conducted extensive testing on the index, which is commendable. The results for Karratha and Port Hedland, which swapped from least adaptive to most, is concerning, and may be due to the method used that brings together the different components. The method has resulted in some very low weights, and a few indicators with higher weights (0.099 for selfhealth), which means a few indicators will have a large impact on the final index. The weight of 0.099 for selfhealth is 50 times the weight of -0.002 for agind. If only the first index had been used, the weight for selfhealth would have been 0.66 and the weight for agind would have been -0.66, so there isn't the large 50 times difference between them – they directly offset each other.

One of the other outcomes of the approach of using multiple indexes for each domain is that the interpretation of the indexes is difficult. For example, the first social capital index is strongly associated with safety at night, discriminated, getsupport, homelessness and volunteering. This is a difficult mix to interpret – what is the link between all of them so that we can determine what this first index is measuring? The second index is slightly easier – discriminated and cultural acceptance may be about discrimination in an area.

Looking at the final maps, they seem to make sense in terms of areas being closer to cities having a greater capacity to adapt. Recent work at NATSEM has found this, using fewer indicators (9 in total); and bringing together three domains, but the first index from each domain. This paper was initially provided to the commission as a draft which brought together two indexes in each domain, using a varimax rotation so there were no cross

loadings; however the final published version, after peer review, only used the first index, and used a total of 9 indicators, 3 in each domain (Vidyattama et al., 2017).

In terms of the clarity of exposition, I think the Commission has explained the method of PCA well, and has explained the concept of adaptive capacity. I think that describing the different indexes (what they represent) wasn't as clear, but I think this is due to the number of indicators used, as outlined above.

Overall, the Commission has conducted a thorough investigation of the methods for deriving indexes, and has consulted widely. The results look reasonable, but I would probably argue that the approach taken has been over-complicated and could be simplified by rethinking the conceptual basis for adaptive capacity, and reducing the number of indicators. 39 indicators in one index has meant that each index in the one index method, and each domain in the nested method, is difficult to interpret, and a number of indexes have come up in the analysis, which then need to be combined.

Using a more concise and targeted set of indicators would mean that cross loadings would be reduced, and a varimax rotation could be used to reduce these cross loadings further. Multiple indexes in each domain should also be easier to interpret, although I would suggest that the nested approach could use the first index in each domain only, looking at the eigenvalues.

If the Commission does consider that they have a strong theoretical basis for including all 39 indicators (and this is suggested in the report), then I would argue that there is reasonable justification for using the nested approach, and only including the first index in each domain and removing any indicators with weights less than 0.5 (the cutoff the Commission has used in the single PCA). This is based on the scree plots shown in Appendix 1. Some of the indicators in the single PCA, which don't load onto the first three components (so don't have a weight of 0.5 on any of the first three components) could also be removed, and the first two or three components (depending on the scree plot of the re-run results with low loading indicators removed), with this reduced set of data and a varimax rotation (tested to reduce cross loadings), could be used for this index.
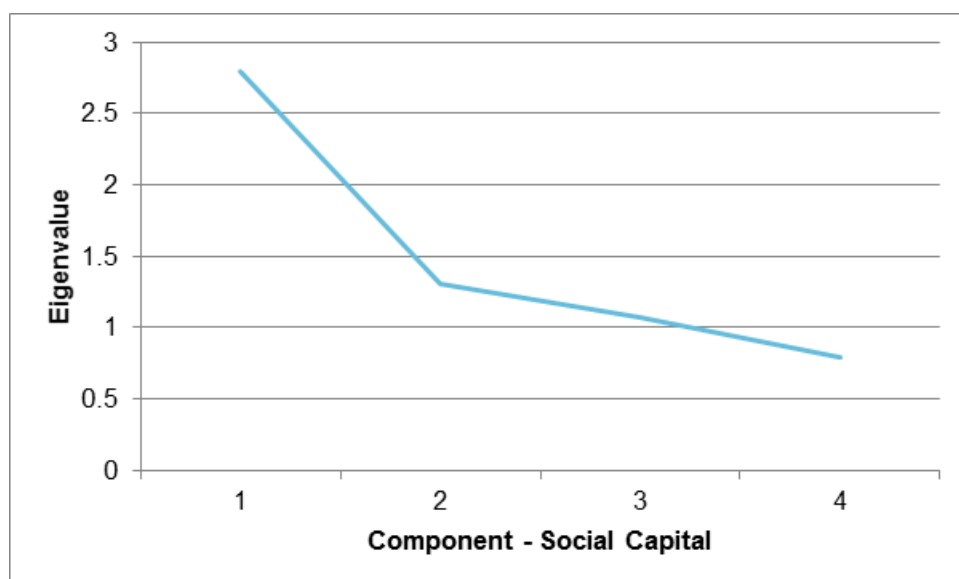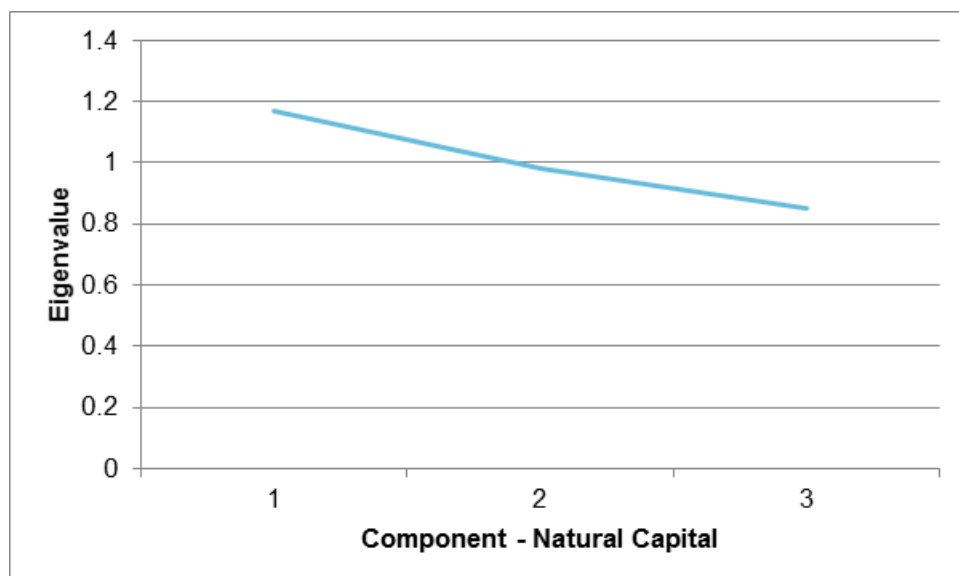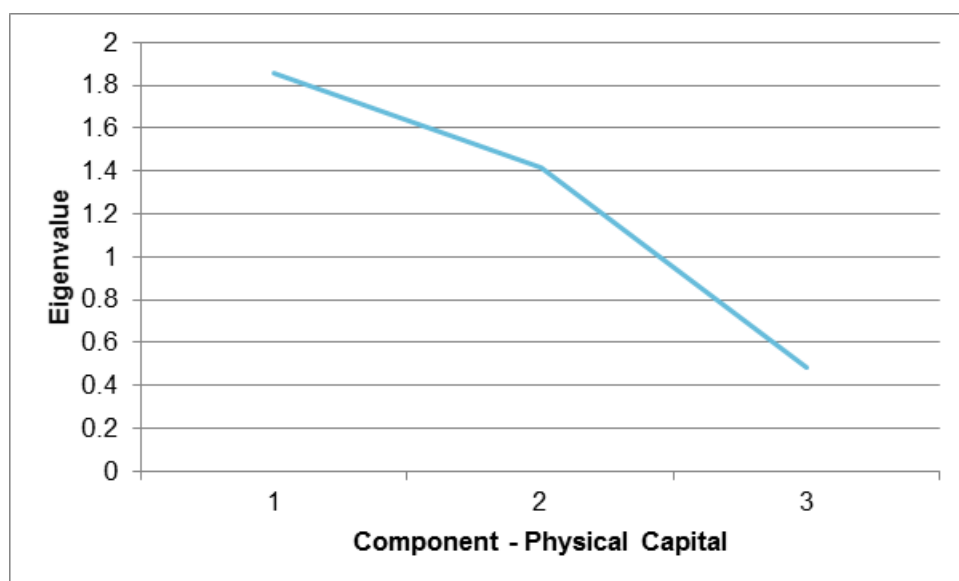
Robert Tanton

Professor Robert Tanton

13 November 2017

Appendix 1: Scree plots for each domain
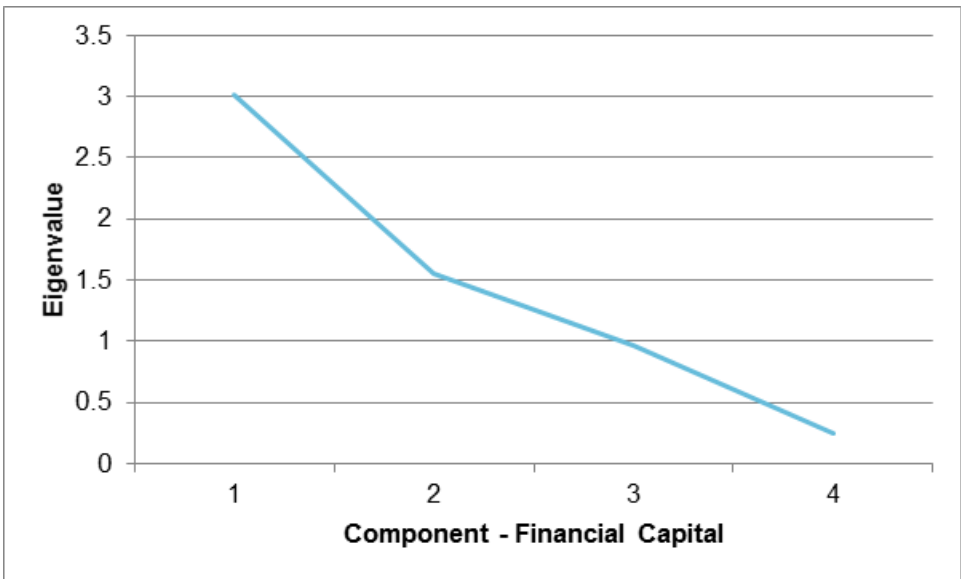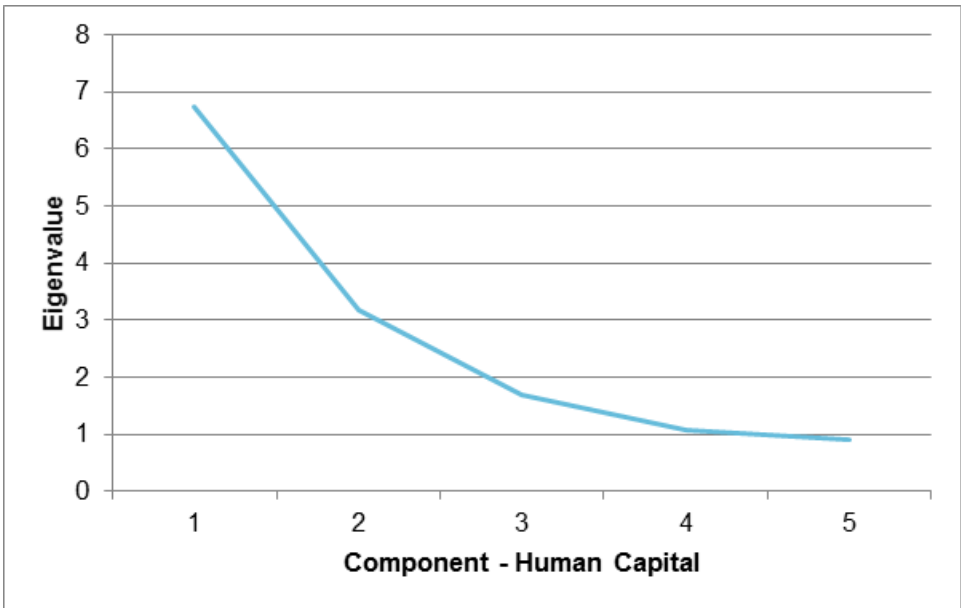
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