3

Infrastructure services for users

Across all sectors, users share expectations of easy access, high quality and low cost. We expect infrastructure to be available when we need it, and for it to be provided efficiently, securely and sustainably. To help Australia grow and prosper over the coming years, our infrastructure will need to ensure our vital needs are met, while offering greater personalisation of services to unlock our full potential as a nation and compete in increasingly connected and competitive global markets.

This chapter outlines Australians' end-to-end infrastructure needs according to where they live, and summarises the key trends influencing the nationally significant networks, assets and services on which we all rely.


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9514
CASTLE HILL
EXPRESS
M61
HEALTH COMES FIRST

3.1 Introduction

Infrastructure is meeting many users' needs, however will need to continue to evolve to meet future needs

In most parts of the country, users' needs are being met relatively well. Most Australians are broadly positive about services in their area, with most people we surveyed reporting that the infrastructure they use is largely good quality and easy to access. Across most services, particularly mobile and broadband services, Australians expect quality to improve over the next five years.[1]

But our infrastructure can do better:

- Across all parts of Australia, users feel infrastructure is adding to cost of living pressures. Many users identified energy affordability as a particular concern,[2] but other sectors also place a significant impost on users. The average household spends over $300 each week on infrastructure – or $16,000 annually.[3] These costs comprise almost a third of total disposable income for lower-income earners.[4]
- One of the most visible indicators of infrastructure quality, congestion, is growing. These costs in fast-growing cities detract from productivity benefits and reduce liveability. Road congestion and public transport overcrowding is estimated to cost the Australian economy $19.0 billion in 2016, and without action, is expected to double by $39.6 billion by 2031.[5]
- Poorer access to services in many outer-urban, regional and remote communities are reinforcing disadvantage, eroding confidence in the long-term viability of some communities, and concentrating economic opportunities in fewer parts of Australia.

Services have improved for many users, but outcomes vary

The size of our country and the diversity of our needs present challenges for ensuring all users receive infrastructure services that are accessible, affordable and good quality. This infrastructure underpins our success as a nation. Almost all Australians have safe, reliable running water and wastewater services in their homes.[6] They are connected to electricity grids that meet 99.998% of expected customer demand.[7] There is near-nationwide access to broadband internet, and we have one of the most extensive transport networks of any country. Most Australians have access to education,[8] health,[9] and other social services that compare favourably with most other countries.

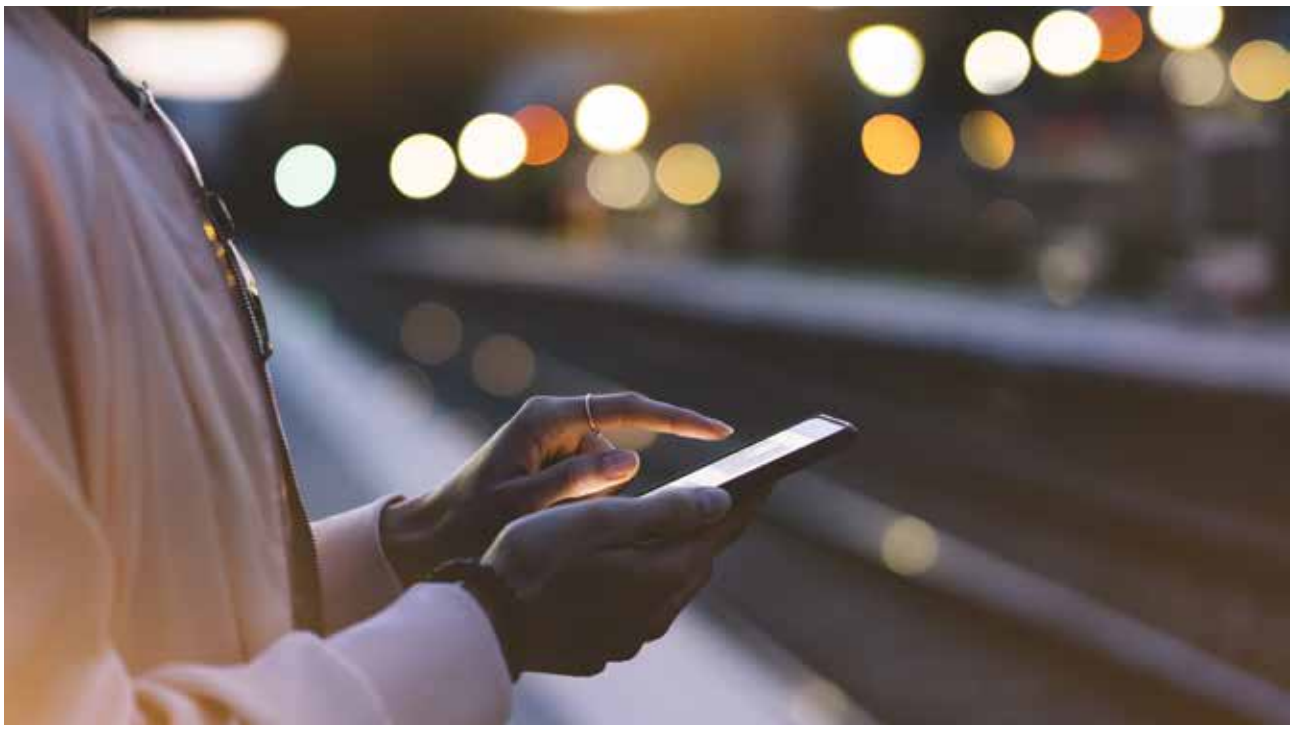
However, the outcomes our infrastructure provides for users have varied greatly. Users in our cities have typically have access to high-quality infrastructure at affordable costs. However, the pace of growth and change in our fast-growing cities have put many legacy networks under strain, leading to rising costs of congestion and crowding, and diminishing green space in many suburbs. Many governments are investing heavily in new infrastructure to meet demand. However, these changes pose a risk to the liveability and productivity of our cities if not adequately addressed.

Service quality in regional centres and remote communities has often lagged the cities, with limited access to services and little or no choice of supplier. Improvements in digital connectivity have helped, providing access to essential services and greater economic opportunities. However, many areas outside cities still suffer poorer service quality and reliability. Failure to address these service gaps could drive growing inequality and threaten the viability of some small towns and rural communities.

Since the last Audit, technologies and investments have brought some improvements

In the four years since the first *Australian Infrastructure Audit*, some infrastructure services have evolved considerably, driven by the availability of new technologies and large-scale investments by the public and private sectors.

Developments in technology have put users at the centre of infrastructure markets. For example, ridesharing and carsharing have provided new travel options for our cities. Household solar and storage technologies have enabled millions of Australian households to produce their own energy, export it to the grid, and reduce their bills.



Increasingly rich information that informs infrastructure use is now at users' fingertips. Real-time data on congestion, transport timetables and public transport vehicle capacity, as well as energy usage and a range of health and education services, are being delivered online, such as via smartphones. Operators are using this data to better meet the needs of users, and offer greater choice of services to more people.

However, other services have not improved, or face pressures. Energy prices have risen by over 50% in the past decade – and by much more for some users – putting increasing strain on household budgets.[10] Congestion on our roads and crowding on public transport has worsened in many of our fast-growing cities. Some Australians still do not have access to high-speed internet, reliable mobile coverage or clean drinking water and sanitation. Within this patchwork, many Australians find it difficult or impossible to access the services they need. Those on the outskirts of our cities or in the regions typically experience a worse standard of transport services than those in inner-urban areas.[11] Almost half of Australians aged over 65 do not use the internet, limiting the range of services they can access.[12]

Our infrastructure needs are diverse but share common objectives

Users share common needs for infrastructure to be accessible, affordable and high-quality. But beyond these high-level outcomes, needs differ greatly between people, places and industries. Australians require infrastructure that responds to local and national needs.

While Australia has evolved as a federated country of eight states and territories, these boundaries bear little relevance for the different needs of people in each jurisdiction. Instead, the scale of each city, town and community provides a better guide for the needs of its users. Drawing together settlements of a similar size, there are often common user needs and roles for infrastructure, providing opportunities for benchmarking and sharing effective solutions.

But across many parts of the country, and most sectors, there is a lack of reliable and user-focused information. This makes tracking progress against these user-focused outcomes difficult. A lack of user-oriented evidence also means that decisions may fail to focus on the long-term interests of users, or may be based on evidence that does not accurately forecast future demand for services.

We need services to be more flexible, personal and support our broader aspirations – including improving sustainability and reducing emissions. Advances in technology are helping to facilitate these changes, but there is a growing role for governments to provide leadership on how and when these changes are integrated in infrastructure markets. Leadership is also required to set how changes in infrastructure markets help us to meet our broader vision for Australia, and the role we want infrastructure to play in that future.

In this chapter

This chapter sets out the broad national areas of focus for Australia's infrastructure. Its focuses is on framing infrastructure services through the eyes of users, drawing out the trends and evidence from across the country. It touches on a number of topics that are explored in more detail in later chapters that focus on individual sectors, and identifies challenges and opportunities that require a national response.

3.2 Infrastructure that works for users is a key theme that is echoed throughout the Audit, particularly through references to the primary user outcomes of access, quality and cost. New forms of service delivery and technologies offer promise for improving user outcomes, and extending benefits to more Australians, but may not immediately be available for all users.

3.3 Costs and affordability highlights issues for households. Examining the total impact of infrastructure costs, this shows that the average Australian household's total infrastructure bill is rising, with costs hitting some of the most disadvantaged Australians hardest.

3.4 Infrastructure for fast-growing cities looks at services in Sydney, Melbourne, Brisbane and Perth that have provided Australia with immense opportunities, but may be struggling to keep pace with growing and changing needs, and how it may need to adapt over coming years.

3.5 Infrastructure for smaller cities and regional centres discusses that many of these places have room to grow and take some pressure off infrastructure in fast-growing cities, and act as service hubs for surrounding regions.

3.6 Infrastructure for small towns, rural communities and remote areas looks at the final geographic area, where services play a vital role in providing connections to economic and social opportunities. It notes that service quality does not meet an adequate standard for many of Australia's most remote regions.

3.7 Infrastructure to support regions and unlock growth in northern Australia takes a different perspective. This explains how the right infrastructure in the right place at the right time can catalyse growth and unlock opportunities, and help industries to overcome distinct challenges in regional areas.

Performance of the sector

Access

Australians are most optimistic about access to to mobile and broadband services, with

35%

of people expecting improvements [13]

Cost

Australian households spent on average

$314.39

on infrastructure per week [14]

Quality

Australians are least positive about the quality of social and public housing, rated as poorest of all sectors, and least likely to improve [15]

Quality

Without action, road and public transport congestion could double to nearly

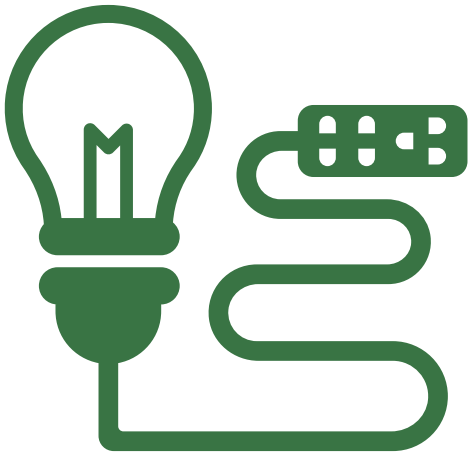
$40 billion

by 2031 [17]

Access

99%

of Australians are connected to electricity [16]



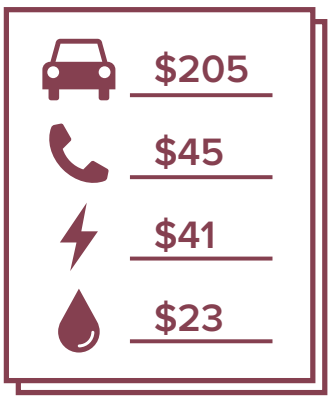
Cost

13.8% vs 16.8%

South Australians spend the least of their income on infrastructure costs, while Victorians spend the most [20]

Cost

Average Australian household's weekly infrastructure spend [18]



Quality

7 in 10 Australians

are concerned about the level of **population growth** in their area [19]

Access

99.4%

of Australian premises have mobile coverage [21]

Scale of the sector

Industry

Smart TVs

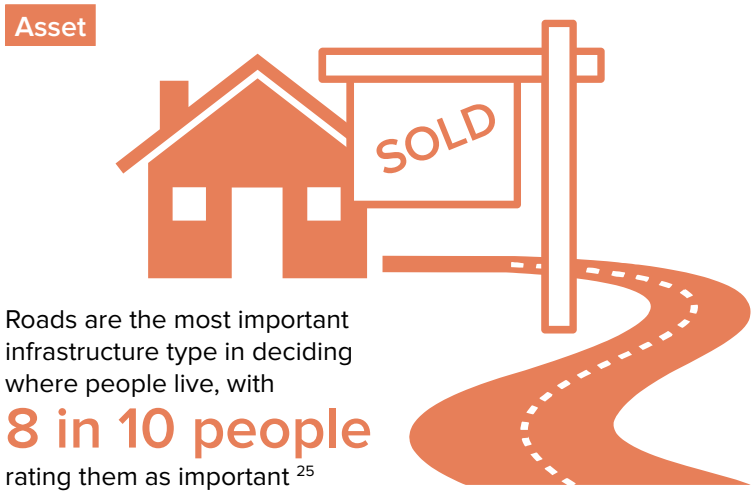
are the most commonly used smart household appliance, with **more than one third** of Australians using one in 2018 [22]

Customer

Better functioning cities and towns could deliver a **$29 billion increase** in GDP in the long-term [23]

Asset

877,651 kilometres of roads in 2018 [24]



Asset

Roads are the most important infrastructure type in deciding where people live, with **8 in 10 people** rating them as important [25]

Customer

4 in 5 Australians believe it is extremely or very important to **consider the views of the community** when planning and investing in major infrastructure [26]

Customer

2,550,697 domestic, and

753,098 international flights over the past four years [27]

Industry

Annual electricity emissions have fallen

by 15 Mt CO_2-e since 2005, but this has been more than cancelled out by **rises in transport** (20 Mt CO_2-e) and **fugitive emissions** (16 Mt CO_2-e) [28]

Industry

Community opposition has contributed to the delay, cancellation or mothballing of more than **$20 billion** of infrastructure projects in the last decade [29]

Asset

For **27% of people,** access to mobile and fixed communications is the most important infrastructure type when choosing to locate their business [30]

3.2 Infrastructure that works for users

At a glance

Infrastructure is only as good as the user outcomes and quality of service it delivers. This section explains how our infrastructure can focus on users by looking at their key priorities: access, quality and cost.

Service levels vary by location, and governments are working to distribute access more evenly. Technology can help, but may also worsen inequality as cities adopt changes faster than regions.

We also look at how:

- new technologies can offer more personalised service
- users can change their behaviour to make better use of our infrastructure
- the infrastructure sector can address barriers to digital access so changes do not leave some users behind.

Reporting on infrastructure does not always match users' needs

Infrastructure is not an end in itself. It is not so much an engine of growth as an enabler of growth.[31] It exists to provide services to users in a way that best meets their immediate and future needs. Focusing on improving user outcomes helps to crystallise decisions to invest in infrastructure or reform the way it is governed and delivered.

Just as Australians' lives differ greatly across the country, so do our infrastructure needs. Meeting the needs of users varies greatly across the different parts of the country, both in terms of what users require, and what is equitable and efficient to provide. However, there are similarities between what users seek. These outcomes fall into three broad categories:

- **Access:** the availability of services for households and businesses, and how easy it is to use them
- **Quality:** the standard of the service provided, covering capacity, reliability, efficiency and customer experience
- **Cost:** the total cost impact on users, including upfront and ongoing charges for users, as well as the draw on taxpayer funds.

While much is changing across the country, we know that these outcomes will be just as important in 20 years' time as they are today, and as they were 20 years ago. That helps to provide clarity and focus when planning for the future.

However, public reporting on infrastructure, when it does occur, often does not reflect users' experiences and is rarely described in terms that are meaningful to individuals.[32] This makes assessing the performance of assets, networks and services difficult, and limits opportunities for households, businesses and political representatives to make informed choices about the infrastructure we use.[33]

A lack of adequate performance data also makes it difficult to track the impacts of infrastructure on the wellbeing of communities. This is an issue across all sectors, compromising our ability to prioritise investment for the long-term common good. Where reporting does occur, variations in definitions between jurisdictions limits the ability to draw meaningful comparisons. Responsibility in addressing this lies with the governments and regulators that oversee each form of service delivery.

1. Challenge

Governments and service providers do not always adequately measure and report on access, quality and costs for users. Insufficient user-focused data makes it difficult for users and policy makers to make decisions that improve user outcomes.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

In the past, location has defined service levels

Australia's population is highly urbanised and concentrated around coastal regions. In many ways, this pattern of settlement has defined how users' infrastructure needs have been met since early European settlement, and is likely to continue to define infrastructure networks' capacity to meet our future needs.

For the fast-growing cities of Sydney, Melbourne, Brisbane and Perth, meeting users' needs has become easier over time. Higher population densities have enabled efficiencies through scale in service delivery, and the creation of competitive markets for services across most sectors. Users in these cities have grown to expect high levels of access to services, while competition has driven improvements in quality and cost in many markets.

However, growth in these cities is leading to declining infrastructure outcomes in some areas – particularly in outer suburbs. Rising congestion and crowding on transport networks is eroding access for many users, and adding to the costs of doing business. Areas that are affected by this trend include Sydney's western suburbs, the north western suburbs of Melbourne and the coastal strip of Perth. Many hospitals and schools have reached capacity or are showing signs of age, requiring the construction of expensive new and upgraded facilities, especially in inner-urban areas. One example of this the Queensland Children's Hospital, which received $20 million from the Queensland Government to increase the number of beds.[34]

In more remote parts of the country, access to services has historically been limited for many users. The challenges of service provision, such as vast distances between communities and a lack of scale, have driven up costs, while reliability and efficiency of remote networks have also been generally poor. In many parts of the country, service provision remains below equivalent services in more developed areas, and below what is acceptable for a highly developed nation that prides itself on a fair go for all.

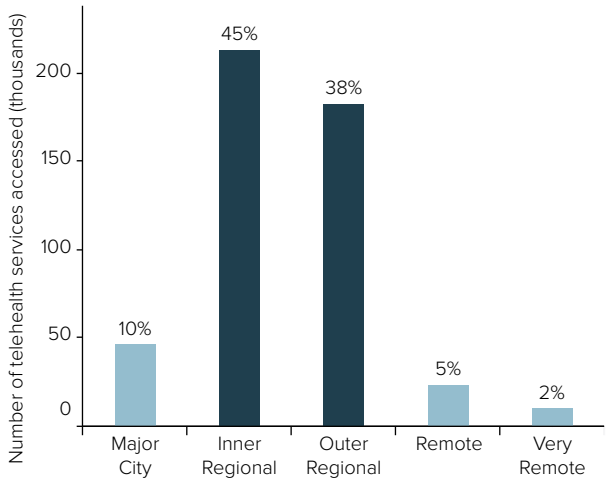
Technology can help to overcome the challenges of geography

In the past, infrastructure has typically been provided as a top-down, one-size-fits-all proposition. Service offerings were often inflexible, inefficient or unreliable, and operators seldom adapted their approach to better meet the needs of individual customers or groups of users. This service model has evolved, with operators becoming more responsive and increasingly prioritising outcomes that matter to users. The personalisation of infrastructure ownership, for example, installation of rooftop solar or access to ridesharing services, has allowed the pace of change to be dictated from outside established centralised regulators, market operators or asset owners. New technologies have partly enabled this trend, for example:

- Ridesharing services and on-demand public transport in some cities also offers users greater flexibility, choice and convenience, while extending the reach of legacy networks to poorly serviced areas.
- Real-time congestion data has helped motorists to avoid unnecessary delays, and helped businesses to reduce transport costs through improved efficiency.
- Household battery storage has helped users in small towns, rural communities and remote areas manage their energy bills, and offered these users more flexibility and choice about how they consume or export their electricity.[35]

These developments have enabled some of the relative disadvantages for service provision outside of cities to be partially overcome. For example, telehealth has allowed some of Australia's most remote communities to receive specialist advice and treatment for almost half a million patients without needing to travel vast distances (Figure 1).[36]

Figure 1: Telehealth has improved access to health care services for many regional users



Source: Department of Health (2016)[37]

2. Opportunity

Technologies can help to overcome barriers to service access as a result of distance or location. Better access to services through improved technology can bring economic and social opportunities for users outside of fast-growing city centres.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

New technologies can bring personalised services

Infrastructure users are increasingly being provided with a greater choice of services. This change is, in part, being made possible by new technologies, including smartphone applications, but also connected devices, individualised customer identifiers, smart tokens, smart meters, GPS trackers, and Internet of Things-enabled connectivity on household appliances.

This technology enables personalisation and targeting of service offerings, live updates of service times, service delays, cancellations, outages and capacity, as well as providing ways of redistributing and rebalancing supply and demand through third-party applications. New technologies can also improve personal safety and security of users by tracking their journeys, alerting others to their location, or contacting operators or authorities to raise alerts about problems with the service or emergencies.

Many applications generate and collect vast amounts of data on users, including their habits and preferences. Much of this data is used by operators to improve their services over time. However, increasingly technologies are developing to improve on and adjust service demand in real-time. For example:

- Sydney Trains uses customer smartphone data and third-party apps to show carriage capacity and to direct waiting customers to empty carriages.[38]
- The Australian Renewable Energy Agency has funded demand response trials, where utilities notify users through smartphones or smart meters of an incentive to reduce energy use during peak periods – an approach that is already mandated in countries such as South Korea.[39]
- Google Maps uses GPS-determined location data to track traffic conditions and road congestion in real time, generating live traffic maps for users

How this data is collected, monitored and used lack sufficient regulation and is hidden from users. Users also expect that their data will be kept secure and that their privacy will be safeguarded both from cybersecurity risks, and from unwanted and unauthorised use by third parties. The Australian Government's new Consumer Data Right gives Australians a right to direct their transaction, usage and product data to competitors and comparison services, if they choose to do so.[40] The Consumer Data Right will first be applied in banking, but could be extended to include infrastructure services.

With the convergence of an increasing number of connected and geo-located devices, infrastructure services consumer data is a large potential pool with significant uses.

Using Wi-Fi data to improve transport services in London

In late 2017, Transport for London undertook a four week pilot scheme which collected anonymised Wi-Fi data from Tube travellers. The trial logged more than 500 million Wi-Fi connection requests from around 5.6 million customer devices.[41] Users were informed about details of the trial through publicity and advertising to address privacy concerns.

Tracking user movements across the network enabled analysis of customer behaviour and preferences under a range of scenarios. These insights are being used to enhance customers' experiences through more focused decisions to manage service supply and demand.

Data on route choice and the effects of delay on user demand will assist Transport for London to optimise service allocation and frequency. Tracking how customers move around train stations can aid in understanding the effects of congestion and travel delays on users' travel experience. And Wi-Fi data can provide a more accurate picture of events on the ground compared to touch-in data from travel cards.[42]

Changing user behaviour can improve infrastructure utilisation

Governments around the world are increasingly turning to behavioural economics and behavioural psychology as tools to support the better use of infrastructure and improvement of service delivery through relatively cheap and expedient operational charges. Behavioural insights techniques have the potential to add significant value to helping to maintain access to infrastructure services through managing demand.

Australian governments have embraced these tools. An initial arrangement between the New South Wales Government and the London-based Behavioural Insights Team led to the formation of the NSW Behavioural Insights Unit in 2012.[43]

Other jurisdictions have followed, including the:

- Behavioural Economics Team of the Australian Government (BETA)[44]
- Victoria's Behavioural Insight Unit.[45]

In particular, travel behaviour change projects can have a big impact on congestion and crowding on public transport.[46] A survey conducted by Infrastructure Victoria found that one in four surveyed peak period drivers could change their time of travel, while one in three said they could change their mode of travel.[47] The Western Australian Government has, since 1997, run localised travel behaviour change programs. The Your Move program currently focuses on a different town or city each year.[48]

3. Opportunity

User data and customer insights can enable innovation to better meet users' needs. Better understanding users' needs can help operators to improve user experience, attract more users and provide services more efficiently.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Changing technology risks leaving some users behind

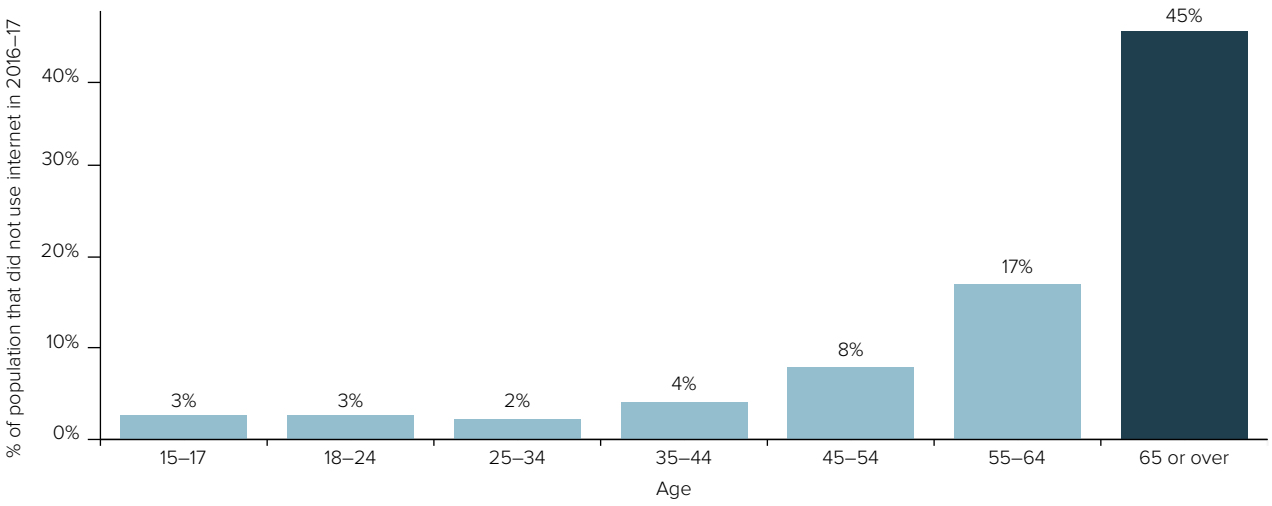
While increased use of technology in infrastructure brings immense benefits, not all users are alike, and some developments have not benefited all types of users, including children, older people, people with disability, or other disadvantaged customers. Also, not all technologies are available to all users.

Changes in technology have delivered improvements to service effectiveness and efficiency. Contrary to some assumptions many changes have also reduced human interaction with service staff who can respond to individuals' needs. In some cases, a minimal level of technical competency is required to use new services.

Improvements in technology also increase barriers to entry, in terms of skill and knowledge, for those who have not accessed services in the past. Some users do not own a smartphone, or have insufficient digital literacy to access services such as ridesharing applications. Many infrastructure operators lack meaningful targets for improving access and quality for all users, or publicly available plans and strategies for achieving improvements. Digital inclusion can unlock improvements in outcomes for users at little or no cost, while connecting more users to online services can lower the costs of provision.[49]

Advances in telecommunications are not reaching all Australians. Internet usage is lowest among older and lower-income Australians (Figure 2). However, there is also evidence that it is these groups who stand to benefit most from affordable access to the internet. Older Australians, who are connected, are more are likely to use the internet for educational purposes. For example, 79% of NBN users over the age of 65 are engaged in non-formal education, compared with 52% of non-NBN connected older Australians.[50]

Figure 2: Older generations are more likely to be disconnected from the Internet



Source: Australian Bureau of Statistics (2018)[51]

4. Challenge

Users that are disadvantaged, such as those with low digital literacy or people living with disability, may be unable to access infrastructure services provided through new technologies. Not extending the benefits of change to all Australians is likely to increase inequality and reduces quality of life by limiting access to services for some members of the community.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.3 Costs and affordability

At a glance

The affordability of infrastructure services is one of three key user metrics, alongside quality and access, that Infrastructure Australia has used within the Audit. We have considered how costs and affordability vary across our cities and regions, how vulnerable groups are impacted, as well as changes over time, and user perception of those changes.

The Audit has identified that:

- Average Australian household total infrastructure costs have risen in real terms
- However, on average, infrastructure costs decreased as a proportion of household incomes
- There is a lack of current and accurate data available to piece together the impacts of infrastructure costs on households
- Community perceptions on the scale of infrastructure cost rises do not always align with what they are actually paying
- Infrastructure costs are regressive and hit lowest-income households hardest.

Australian's total direct infrastructure cost have been rising in real terms

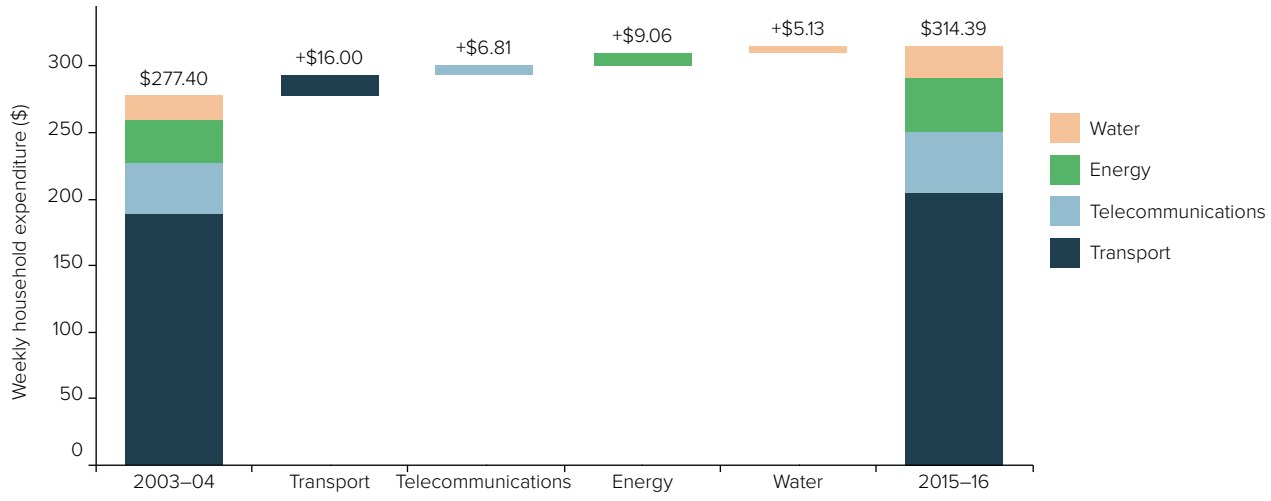
Infrastructure affordability is a concern for Australians across all sectors. This is why we have worked with the University of NSW City Futures Research Centre, and Astrolabe Group, to present a total infrastructure bill for an average Australian household. This analysis focuses on costs for transport, telecommunications, energy and water, but does not include social infrastructure costs.

Cost increases for infrastructure and related services are generally presented as individual items. However, due to the potential to substitute some infrastructure services, such as gas for electricity, or telecommunications for transport, what matters most is the total financial impact of these costs, combined with access to and quality of the services.

In 2015-16, Australian households spent on average $314.39 on infrastructure costs per week (Figure 3). This comprises 15.6% of average disposable income and 21.9% of average total household expenditure. Household total infrastructure costs have increased 13% in real terms from 2003-04, when they were $277.40 per week. However, infrastructure costs as a proportion of household expenditure have fallen slightly, from 22.9% in 2003-04 to 21.9% in 2015-16.

The fastest increase in costs are seen in the energy and water sectors (Table 1). Transport costs have risen slowest, but they comprise by far the largest portion of total infrastructure costs. This is primarily due to vehicle-related costs (such as purchases, registration, insurance, and servicing). Vehicle fuel, petroleum and diesel also comprise a major component of the cost.

Figure 3: Household infrastructure costs have increased



Note: Values are inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[52]

Table 1: While weekly household infrastructure costs have risen the fastest for water and energy, transport still accounts for the largest share

Sector	2003–04	Proportion of total	2009–10	Proportion of total	2015–16	Proportion of total	Change (2003–04 to 2015–16)
Transport	$189.11	68%	$216.27	70%	$205.11	65%	+8.5%
Telecommunications	$38.50	14%	$38.21	12%	$45.31	14%	+17.7%
Energy	$31.48	11%	$36.46	12%	$40.53	13%	+28.8%
Water	$18.31	7%	$19.01	6%	$23.44	7%	+28.0%
Total costs	$277.40		$309.95		$314.39		+13.3%

Note: Values are average weekly household expenditure, inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[53]

5. Challenge

Limited reliable data exists to allow government, regulators and users to understand the total costs of infrastructure. Poor data limits the ability for government to understand the affordability of infrastructure services and cost of living pressures.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Households in the Northern Territory and the Australian Capital Territory bear the largest infrastructure costs

Across Australia, households in the Northern Territory and the Australian Capital Territory pay the largest infrastructure costs (Table 2). In the Northern Territory, this is driven by higher water and sewerage costs, which are between $8 and $17 per week more expensive than other states and the ACT. Northern Territorians also pay the greatest costs for energy and telecommunications. Meanwhile, households in the Australian Capital Territory pay the highest transport costs and the second highest energy costs.

South Australian, Tasmanian and Western Australia households have the lowest costs. This is driven by lower fuel and vehicle-related costs compared to other states. South Australians and Tasmanians also have the lowest telecommunications costs.

When taking into account either household income or total household expenditure, Victorian households have the greatest burden (16.8% of disposable income, 23.1% of total household expenditure). South Australia and Western Australia have the lowest burdens of infrastructure costs when viewing through both these measures.

Table 2: Households in the Northern Territory and Australian Capital Territory have the largest average infrastructure costs, but Victorian households pay the highest proportion of income

State	Transport	Energy	Water	Telecommuni-cations	Total costs	Total as % of household expenditure	Total as % of disposable income
NSW	$215	$39	$24	$46	$324	21.2%	14.9%
Vic	$218	$46	$21	$47	$331	23.1%	16.8%
Qld	$205	$35	$28	$46	$314	22.8%	16.5%
WA	$180	$40	$30	$44	$293	20.4%	14.0%
SA	$160	$44	$27	$39	$270	20.1%	13.8%
Tas	$177	$43	$21	$38	$279	22.3%	16.5%
NT	$217	$49	$38	$53	$357	20.7%	16.5%
ACT	$222	$47	$23	$46	$338	20.3%	15.0%
Aus	$205	$41	$23	$45	$314	21.9%	15.6%

Note: Values are average weekly household expenditure in 2015-16, inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[54]

Calculating the cost of infrastructure to households is complex

The total household infrastructure bill has been constructed using data from the Australian Bureau of Statistics Household Expenditure Survey (HES) and from the Bureau of Meteorology National Performance Report. There are few other publicly available data sources available to infer meaningful trends on how infrastructure costs have changed over time.

The available public data have several known limitations. Firstly, the latest HES was performed in 2015-16, so it does not capture very recent price increases. Secondly, aside from transport, which has a wealth of subcategories, the other sectors have limited detail within the HES in terms of types of costs, especially water. The Bureau of Meteorology National Performance Report's 'Typical residential bill' was used instead for water costs as it is derived from actual water bills. Thirdly, due to how data have been collected historically, it is not possible to compare how infrastructure costs have changed over time for all states individually.

The Household, Income and Labour Dynamics in Australia (HILDA) longitudinal survey is a well-known data source of household income and expenditure. While it is an annual survey and has considerable detail in its metrics on income and household factors, its expenditure data is less robust due to its simple methodology.

6. Opportunity

Improved collection of data, including by third parties (such as financial institutions) could support improved decision making using big data. Partnering with data owners to support the collection of detailed, up-to-date data, will allow better decision making. However, data privacy will need to be managed.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Government infrastructure expenditure is also a cost to households

In addition to direct costs, Australian households also indirectly fund infrastructure provision through taxation and non-infrastructure charges. These charges facilitate part of general government expenditure. All levels of government levy taxes and charges in order to meet infrastructure costs.

The costs recovered by government through tax and charge revenue vary depending on where people live, their household composition, nature of tenure, levels of expenditure, and a range of other factors.

The variations across locations are often opaque, with the majority of revenue derived by jurisdictions not hypothecated to specific uses. However, in other circumstances, considered steps have been taken to ensure the use of indirect revenue for infrastructure purposes is more transparent. One such example is the Gold Coast City Council, which applies a series of infrastructure specific levies:

- Transport Levy – which has been used to fund Council contributions to the Gold Coast Light Rail (G:link), and other transport projects
- Open Space Levy – for the maintenance and preservation of natural public spaces
- Recreational Space Charge – for the acquisition of open space for recreational purposes
- Waste Management Levy – for the collection, processing and disposal of solid waste, including recyclables.[55]

Some state and local jurisdictions levy specific on-off fees and charges on third parties, which are ultimately used to fund infrastructure. These fees and charges are eventually passed through to consumers in the form of increased costs of final products. One of the most significant uses of these charges is developer contribution. These levies apply to the property industry for infrastructure costs associated with delivering new or increased density development. These fees and charges ultimately form part of the upfront costs of property purchases.

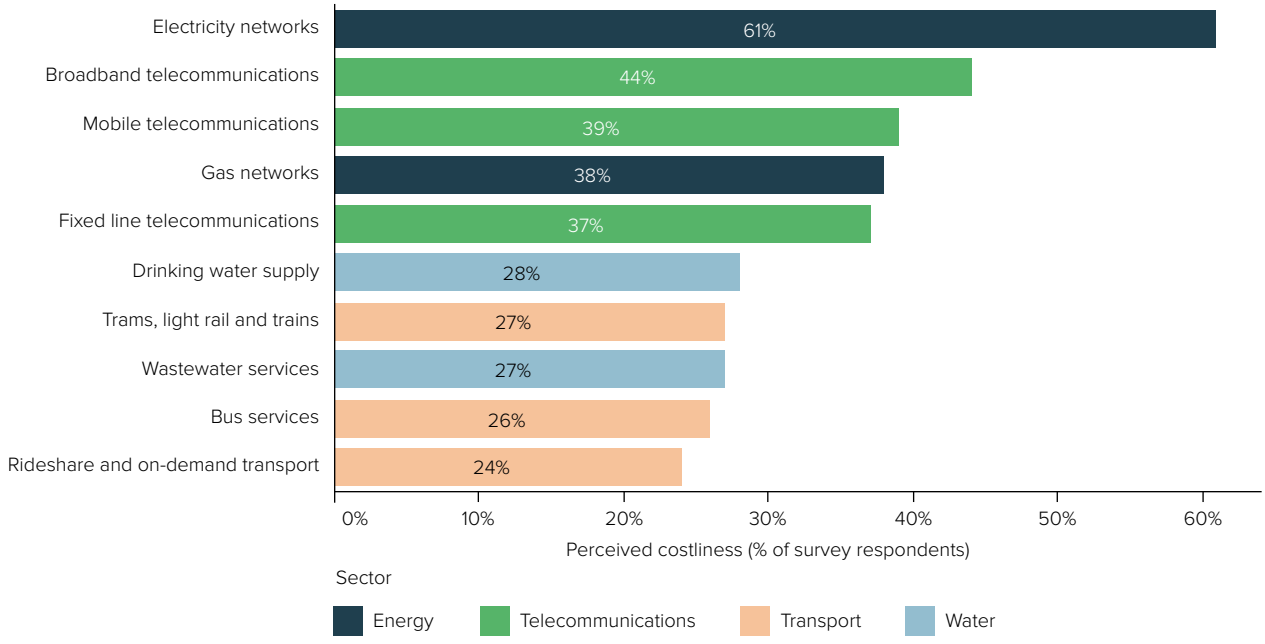
While these one-off charges create impediments to understanding infrastructure costs, the structure of whole-of-life charges can also be opaque. For instance, unlike other utilities such as electricity, property owners meet the direct water and rates (local infrastructure provision) costs of their tenants. Charges are then passed on through increased rent costs.

These myriad of charges applied through general taxes and through third-party charges obscure the true cost of infrastructure provision to users.

Community perceptions of infrastructure costs and usage patterns do not align with actual expenditure

Of all infrastructure sectors, transport is perceived as being the most affordable (Figure 4), which is in contrast to it being by far the most expensive.

Figure 4: Energy is perceived as the most costly infrastructure sector, while transport is perceived as the most affordable



Note: Values are share of survey respondents who answered 'costly' or 'very costly'.

Source: JWS Research (2018)[56]

This may be influenced by transport spending being somewhat discretionary, in so far as it relates to vehicle purchase decisions, which is a large driver of the cost of transport spending. Australians have access to a wide range of vehicles, and subsequently discretionary consumer preference plays a large role in the selection of cars. For some Australians, cars are seen as practical tools, while for others, they are partially seen as a status symbol, so the decision to purchase an expensive car is therefore potentially driven by factors other than necessity.

This is less likely for other infrastructure sectors, however consumer preferences are an increasingly emerging trend in influencing other infrastructure-purchasing decisions. This will add further complexity to assessing consumer costs. For instance, many households with connections to water mains are opting to use water tanks. Additionally, electricity consumers are complementing the established centralised electricity grid with small-scale solar, and considering battery technology. Spending on the telecommunications sector is also influenced by mobile phone handset choice and by the types of services consumed using these devices, such as streamed entertainment content, which would historically have been provided using other media.

The proportional reduction of disposable incomes spent on transport between 2009-10 and 2015-16 could reflect changes in consumer preference for discretionary income on transport as a result of broader constraint on household budgets. This is potentially supported by the approximately 20% decrease in vehicle purchase costs from 2003-04 to 2015-16.

Conversely, most Australians feel that transport costs have not changed much in the past five years, and are not likely to change much in the next five years. However, transport costs have risen 8.5% in real terms from 2003-04 to 2015-16, and the nature of this increase differs by type. For instance, as shown in Table 3, falls in vehicle purchase costs have been offset by increases in motor fuel, registration and insurance, and other vehicle charges (including tolls, parking and fines).

Despite Australians consuming less electricity (8% per capita decrease from 2003-04 to 2015-16), and increasingly using solar electricity (6.3% of total electricity usage in 2015-16), they are paying more for household electricity.[57] This is most notable in Queensland, which has seen the greatest reduction in energy usage, and the greatest increase in energy bills.[58] Victorians, who pay the highest combined energy prices, use the most energy per capita. This is despite Victoria having the greatest reduction in per capita electricity usage (21% reduction per capita over 2003-04 to 2015-16).[59]

These rising prices have resulted in most Australians perceiving that electricity has become less affordable in the five years leading to 2018.[60] In contrast, gas is perceived as not having changed in affordability, despite gas prices rising faster on a percentage basis than electricity. Gas comprises a smaller component of residential electricity bills, and is not used by all households, making it less visible for most consumers. This contrast is repeated in perceptions about the future, with most Australians expecting electricity to become less affordable, while almost half of those surveyed expect gas costs to remain the same as today.[61]

Table 3: Falls in vehicle purchase costs have been offset by increases in other transport-related costs

	2003-04	2009-10	2015-16	Change
Public transport fares	$5.27	$5.58	$5.85	11.1%
Total vehicle purchase costs	$73.93	$62.05	$59.26	-19.8%
Motor vehicle fuel, lubricants and additives	$44.24	$57.64	$49.60	12.1%
Vehicle registration and insurance	$32.03	$32.39	$35.55	11.0%
Vehicle parts, servicing and crash repairs	$28.17	$30.31	$27.72	-1.6%
Other vehicle charges	$5.48	$28.29	$27.13	395.0%
Total transport costs	$189.11	$216.27	$205.11	8.5%

Note: Values are average weekly household expenditure, inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[62]

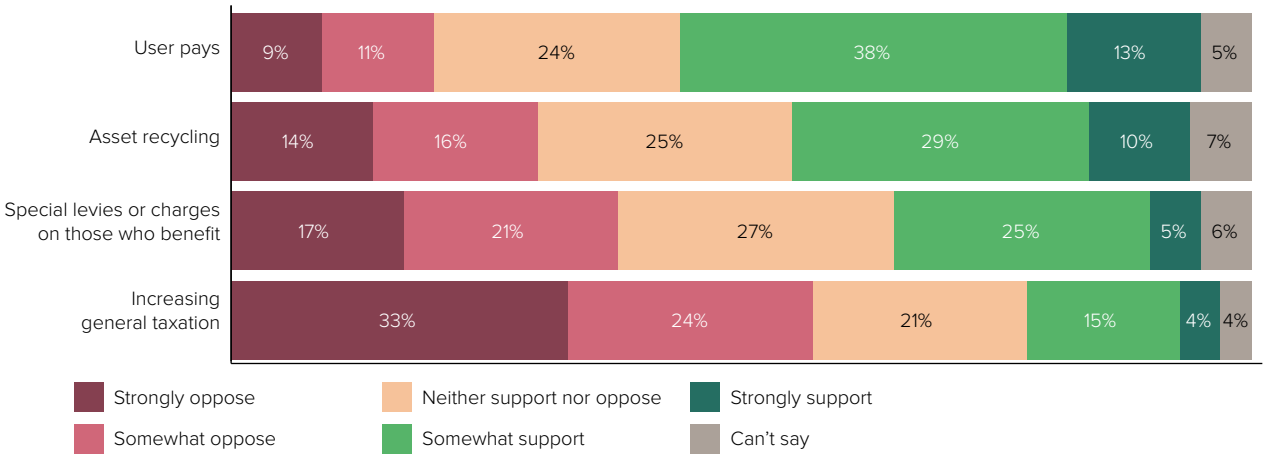
Direct infrastructure charges are preferred, however they are regressive

Research undertaken for the Audit showed that a majority of Australians support user pays as their preferred means for funding infrastructure investment (51%, Figure 5). This level of support is higher than for asset recycling, special levies and charges, and increases on taxation. Only one in five people oppose the application of user pays, while 57% oppose increases in taxation to fund infrastructure.

To analyse the way that infrastructure spending affects households of different incomes in Australia, households are ranked from lowest to highest income, and then divided to five equal groups with 20% of all households in each group (quintiles). The highest-earning 20% is referred to as the highest quintile, while the lowest-earning 20% is the lowest quintile.

While infrastructure costs are lower for households with lower incomes, they are a greater proportional costs to household budgets compared to higher-income households. On dollar terms, households in the highest income quintile spend over three times as much as those in the lowest quintile ($551.19 and $147.29 respectively, Table 4). However, households in the lowest quintile spend 32.0% of their disposable income on infrastructure, which is over twice as much as those in the highest quintile (14.8%, Table 5).

Figure 5: User-pays funding is the most supported means for funding infrastructure development



Source: JWS Research (2018)[63]

Table 4: Households in the highest income quintile spend over three times as much on infrastructure costs than households in the lowest income quintile

Income quintile	2003-04	2009-10	2015-16	Change (2003-04 to 2015-16)
Lowest 20%	$136.83	$143.03	$147.29	8%
Second 20%	$195.46	$205.58	$209.35	7%
Third 20%	$275.13	$284.45	$290.33	6%
Fourth 20%	$347.39	$361.22	$373.74	8%
Highest 20%	$431.69	$555.32	$551.19	28%

Note: Values are average weekly household expenditure, inflation adjusted to June 2016.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[64]

Over time, the size of this disparity has decreased. In 2003-04, households in the lowest income quintile spent 38.9% of household income on infrastructure, which has fallen by 6.9%. For incomes in the highest income quintile, the reduction over 2003-04 to 2015-16 was only 2.2%.

The pattern of infrastructure bill stress for lower income households is repeated when viewing across individual infrastructure sectors. Households in the lowest income quintiles pay above affordability thresholds for all infrastructure costs, and pay considerably more than households in any other quintile for both water and energy costs (Figure 6).

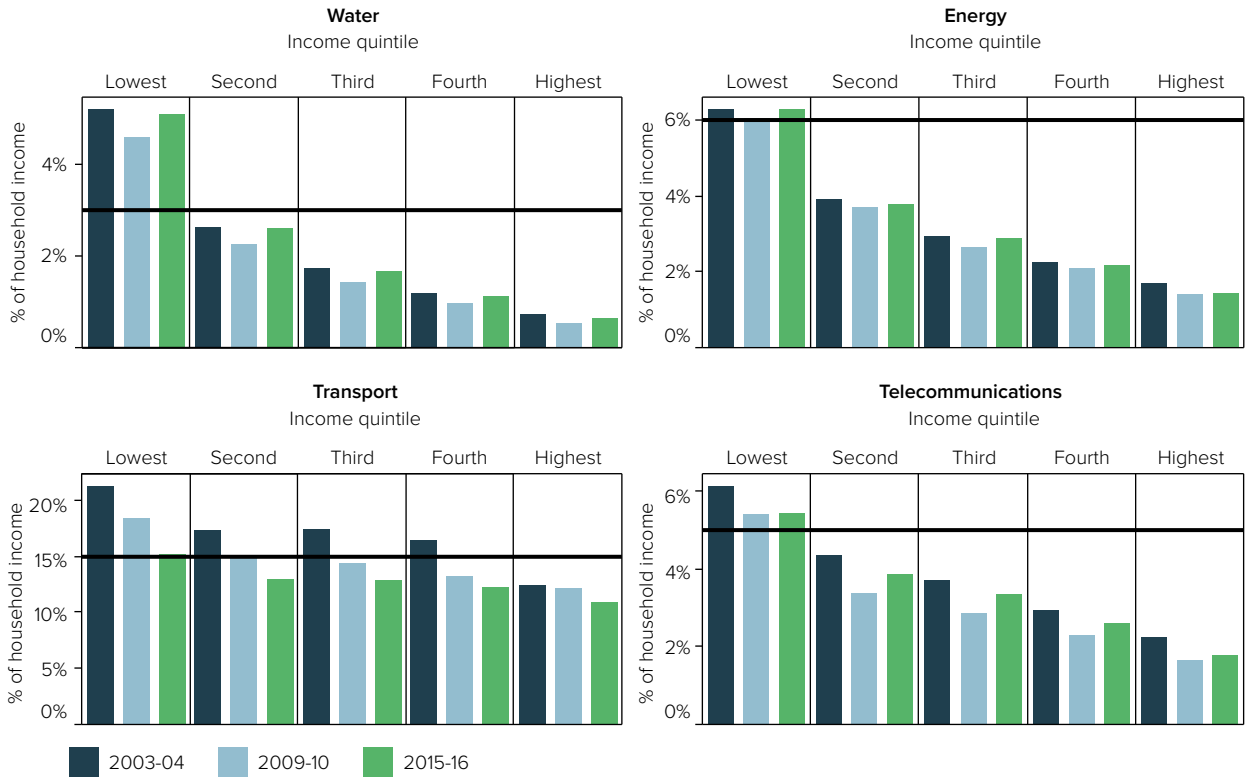
Table 5: Households in the lowest income quintile spend far more of their income on infrastructure costs than households in the highest income quintile

Income quintile	2003-04	2009-10	2015-16	Change (2003-04 to 2015-16)
Lowest 20%	38.9%	34.4%	32.0%	-6.9%
Second 20%	28.2%	24.3%	23.3%	-5.0%
Third 20%	25.9%	21.3%	20.8%	-5.1%
Fourth 20%	22.9%	18.6%	18.3%	-4.6%
Highest 20%	17.0%	15.7%	14.8%	-2.2%

Note: Values are share of household disposable income spent on infrastructure costs.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[65]

Figure 6: Costs across all infrastructure sectors are on or above affordability thresholds for households in the lowest income quintile



Note: Values are share of household disposable income spent on infrastructure costs. The black lines show affordability thresholds for each infrastructure sector, which are informed by international literature.

Source: University of NSW City Futures Research Centre and Astrolabe Group (2019)[66]

7. Challenge

User-pays funding for infrastructure has widespread support within the community. However, its regressive nature disproportionately affects low-income earners. Transport, energy, water and telecommunications infrastructure user costs are above affordability thresholds for our lowest income earners thereby reducing access to services and quality of life.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

A lack of simple information complicates choice for consumers

Transparency of information across infrastructure sectors is not uniform, and the Australian Competition and Consumer Commission has identified complex bills and discounting structures as barriers to user certainty.[67] As a result, levels of consumer engagement with and understanding of infrastructure costs vary substantially. Some consumers actively seek better offers and routinely change service providers, while others are content with their existing services and do not change for many years.

In 2017, the Australian Energy Market Commission found that 37% of residential consumers had neither investigated their energy options in the previous 12 months nor switched energy company or plan within the previous 5 years.[68] Lack of confidence in their ability to find the right plan was cited as a major driver.

Despite user-pays infrastructure, including toll roads, receiving the highest level of support amongst consumers[69], sentiment in some sections of the community regarding toll roads remains negative. This is driven, at least in part, by limited understanding amongst the community as to how tolls are calculated and by whom.[70,71]

Users need to be informed to manage their costs, so it is critical they receive transparent and accurate information, particularly through their bills but also ahead of signing on to long-term plans or commitments.

Improvements in metering, such as smart metering for electricity and water, as well as electronic ticketing for public transport, allow infrastructure users to make more informed choices.

Consumers have growing means to take control of their bills, but some risk being left behind

For users to gain more control of their bills, not only will there need to be improvements in the way in which costs are communicated, but also a necessary increase in alternative options for users to transition away from consuming centralised, grid services.

Some sectors are experiencing a shift from centrally-controlled, publicly-owned infrastructure, towards decentralised, privately-owned, individually-controlled service provision. Much of this is driven by the development of new technologies, along with cost reductions and improvements in existing technologies.

For example, Australia is among the world's largest solar PV generators, with approximately two million installations and over 10 gigawatts of generation capacity.[72] Australia's rate of uptake is world leading, with three quarters of this capacity coming from private residential sources, and penetration exceeding 50% of rooftops in some urban areas.[73]

Supported by government subsidies through the Small-scale Renewable Energy Scheme and generous feed-in tariffs, solar generation has become an integral part of Australian households' efforts to reduce their power bills and lower their emissions.

Beyond solar panels, smartphones, ridesharing and electric vehicles are some of the tools that are increasingly becoming available to households and business. These technologies can provide greater choice and control over infrastructure costs, even allowing some consumers to become net service providers and revenue generators.

However, despite falling costs (particularly for solar PV panels), not all users have the access or the means to afford these new technologies. There is a risk that high upfront costs, or an inability to adopt or invest in them for other reasons, could disadvantage some groups. For example, disadvantaged Australians are more likely to live in a rental property, and are therefore unlikely to install a solar PV.[74]

There is a risk that users who fail to take up new technologies remain reliant on existing networks, and therefore are left to bear an increasing burden of fixed costs of legacy infrastructure. For publicly-owned networks, the risk is that taxpayers will shoulder a growing share of these costs. The challenge for governments is that cost-saving technologies may not be reasonably available to all users, and the benefits of improvements in infrastructure delivery may be concentrated among those who can afford to make large upfront investments.

8. Opportunity

Some users have limited information or understanding of the costs associated with their use of infrastructure, however new technologies will increase information and control for those that can afford them. New technology will increase transparency of infrastructure costs for users and provide the opportunity for consumers to invest in alternatives to substitute or replace traditional services services.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.4 Infrastructure for fast-growing cities

At a glance

Sydney, Melbourne, Brisbane and Perth are absorbing three-quarters of Australia's population growth, which is putting legacy infrastructure networks in these cities under increasing strain.

This section explores:

- the challenge of planning for the future using unreliable population forecasts
- how infrastructure could do more to provide better access to vital services and opportunities for some groups of disadvantaged people, including Aboriginal and Torres Strait Islander peoples

Growth and opportunities in our cities have attracted millions

The scale, dynamism and growth of Sydney, Melbourne, Brisbane and Perth make them unlike other Australian cities or regions. Their success has attracted millions of new residents, drawn by the prospects of employment and opportunities to improve their wellbeing. The scale and pace of growth of cities of these four cities has not been seen in Australia for more than half a century:

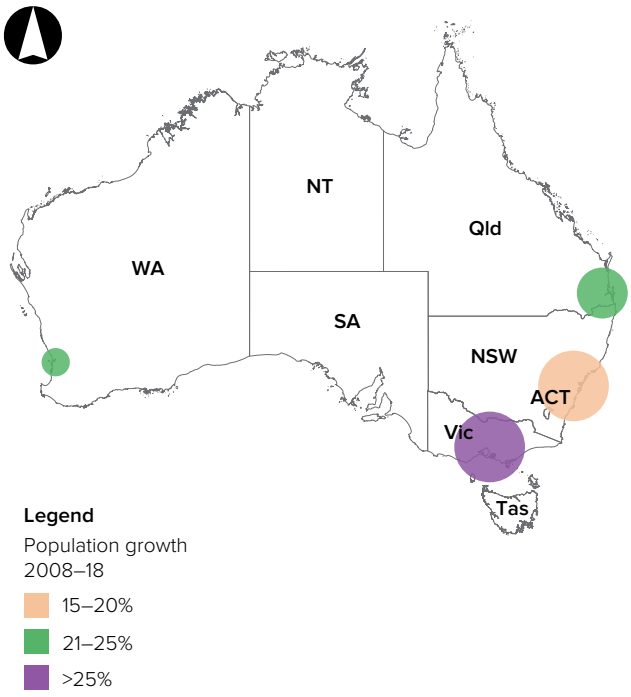
- 59% of Australians now live in these cities.
- Another 11% of the population live within commutable distance of these cities and are able to access the services and opportunities they offer.
- Between them, our four largest cities add more than 280,000 people each year – the equivalent of adding a city the size of Geelong or Wollongong.
- Annual population growth in these cities accounts for almost three quarters of Australia's total.
- This continues a longer term trend, with around 72% of Australia's growth – 2.7 million people – being concentrated in these cities from 2008 to 2018.[75] Over that time, these four cities have grown by 22% (Figure 7).

These cities have developed as our economic powerhouses in the 21st century, accounting for more than 60% of national GDP. Sydney and Melbourne alone account for almost half of the Australian economy's total output by value.[76] Their strength is based on the economies of scale they provide, typically lower costs for goods and services, higher levels of competition and access to services and diverse workforces. People and businesses in cities also benefit from their proximity to others with different skills and knowledge, enabling easier exchanges of ideas and technology, and accelerating improvements in productivity.[77]

Population density of fast-growing cities is also in contrast with the rest of Australia. In 2017, Australia's average population density was 3.3 people per square kilometre, one of the lowest in the world.[78] On the other hand, inner-city Melbourne was the most densely-populated area in Australia, with 20,700 people per square kilometre, while seven of Australia's top ten most densely-populated areas were located in Greater Sydney.[79] Between 2011 and 2016, population density increased by 23% in the city centre of Sydney and by 46% in the city centre of Melbourne.[80]

Growth of our four largest cities is expected to intensify over coming decades, with these cities projected to be home to around 29 million people by 2066 under ABS Series B projections. This would represent 67% of our total population. Sydney and Melbourne would each accommodate around 10 million people, while Brisbane and Perth would be around the same size as Sydney and Melbourne today.[81]

Figure 7: The population of Australia's fast-growing cities of Sydney, Melbourne, Brisbane and Perth increased by 22% over 2008 to 2018



Source: Australian Bureau of Statistics (2019)[82]

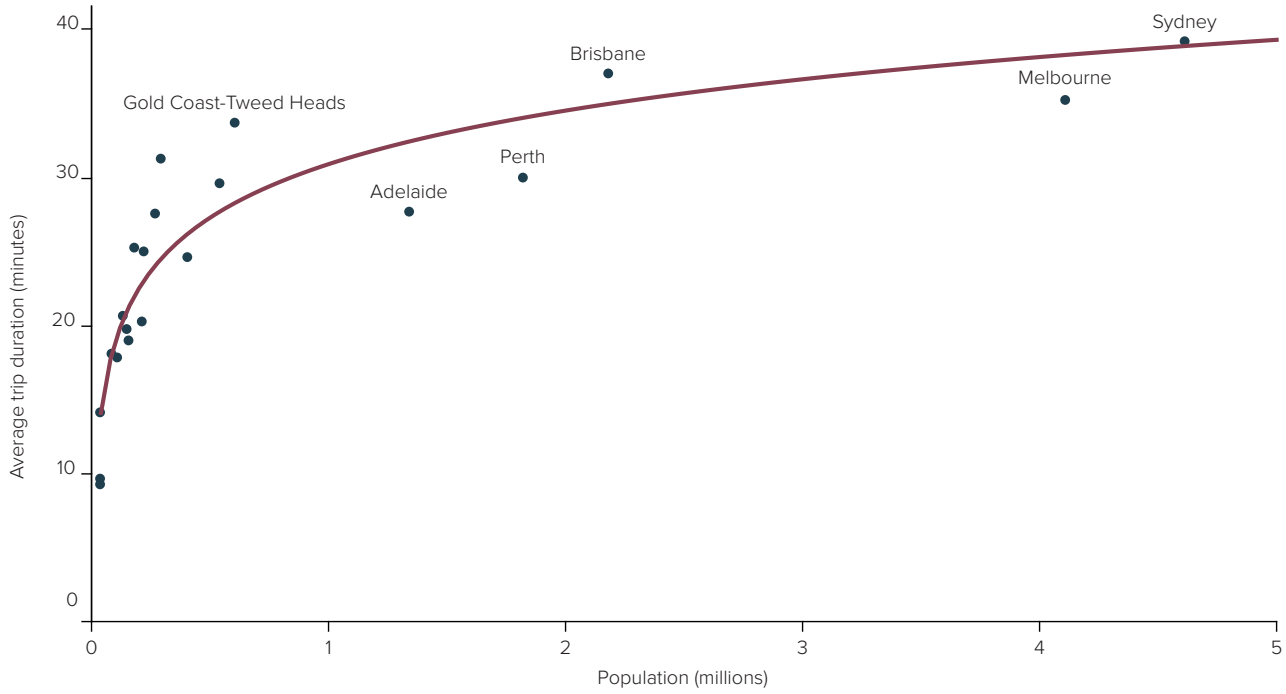
Some urban infrastructure has struggled to keep pace with growth

Australia's urban infrastructure has provided the backbone for much of Australia's growth and transformation over the second half of the 20th century. However, the scale of growth and change in our largest cities requires a rethink of how infrastructure can best meet our needs. This was highlighted in Infrastructure Australia's 2018 *Future Cities* paper.[83] Better functioning cities and towns, which focus their attention on planning, lowering poor investment decisions, reducing congestion and adopting efficient planning and land use policies, could deliver a $29 billion increase in GDP in the long term.[84] Some of the benefits in that report relate to public infrastructure's contribution to economic growth, including incentives to encourage investment and road provision that meets users' needs. Delivering these improvements may not be straightforward. Many networks were designed decades ago and were never intended to support cities of today's scale, or to meet the needs of our modern population.

There are signs that infrastructure in our cities is not keeping pace with growth and change in demand. For urban residents, road congestion and crowding on public transport are the most visible and frustrating example. Over the last 15 years, growth in public transport demand in Sydney and Melbourne has exceeded population growth.[85] The annualised costs of congestion in 2016 in Sydney, the Hunter and Illawarra alone is $8 billion.[86] As Figure 8 shows, commute times are broadly correlated with population size and are lengthiest in fast-growing cities.[87]

Average commutes times have also grown as high-paying jobs have become more concentrated in city centres. This is exacerbated by limited housing supply close to city centres.[88] Road congestion and public transport crowding are estimated to have cost the Australian economy $19.0 billion in 2016, and without action, this figure could grow to $39.6 billion by 2031.[89] Of course, this figure likely fails to capture the full social cost of congestion and crowding, which takes its toll on individual users, as well as the environment.

Figure 8: Commuting times for all modes in Sydney, Melbourne and Brisbane exceed other cities



Source: Bureau of Infrastructure, Transport and Regional Economics (2016)[90]

9. Challenge

Rapid growth in Sydney, Melbourne, Brisbane and Perth has brought many benefits, but has also put legacy infrastructure under increasing strain. Without action, infrastructure constraints will add to economic, social and environmental costs, eroding the productivity of these cities and reducing quality of life for residents.

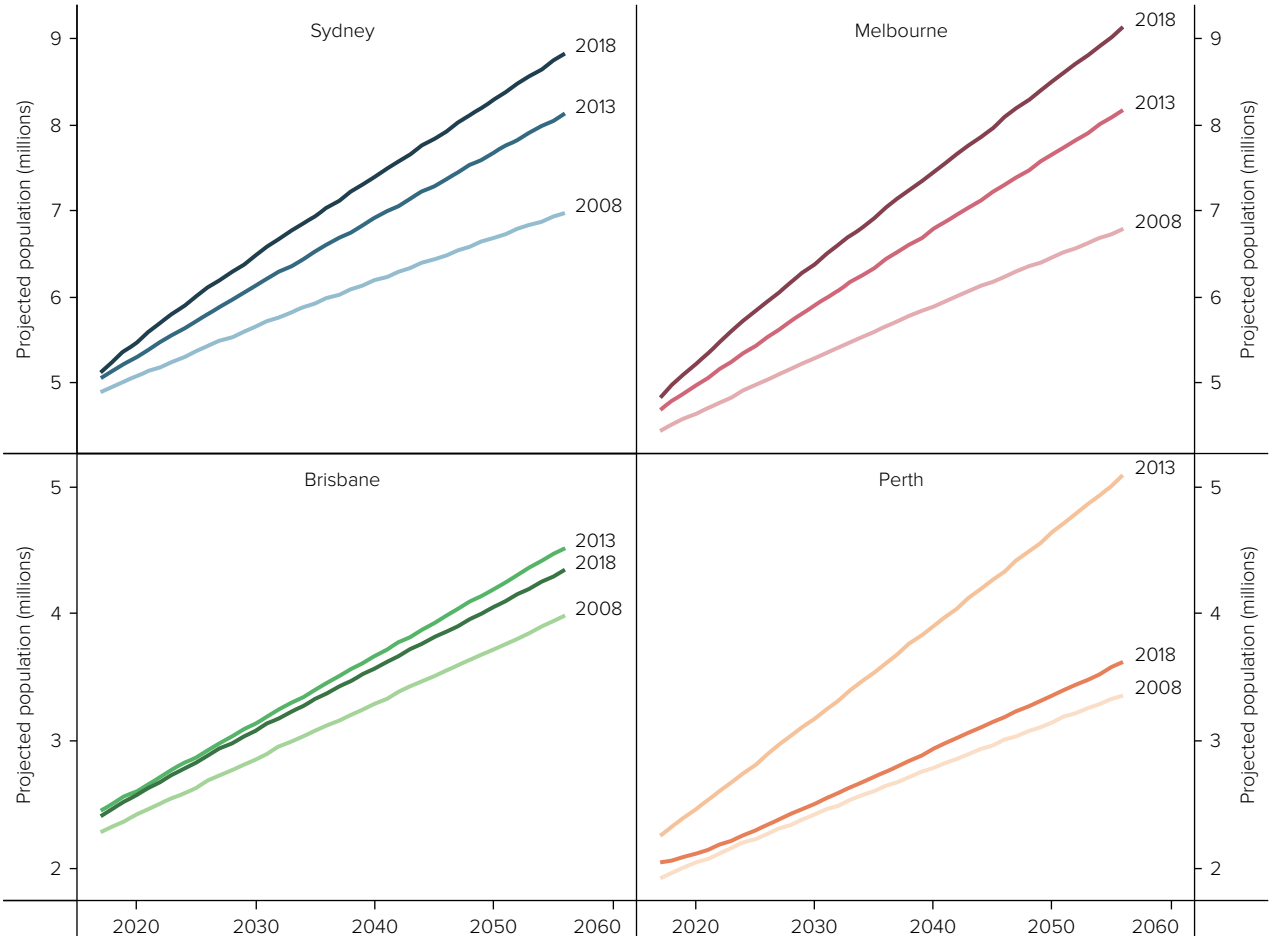
When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Unreliable population forecasts make infrastructure planning difficult

As Figure 9 shows, population projections for Australia's fast-growing cities have shifted substantially over the last 10 years. Projections for Sydney and Melbourne have consistently underestimated the rate of growth in those cities, while the 2013 projection for Perth considerably over-estimated growth, based on the influx of people in the previous years during the mining and resources construction boom.

Figure 9: Population projections for major cities have proven unreliable



Note: Each line refers to an individual edition of the Australian Bureau of Statistics's population. Projections presented are for Series B.

Source: Australian Bureau of Statistics (2008, 2013, 2018)[91]

The lack of reliable and consistent population projections reduces governments' capacities to plan for future infrastructure needs, based on considered spatial planning. Infrastructure Australia has previously identified this issue, and we have recommended that the Australian Government establish a process to better strategically plan for Australia's population, including the ability to map this growth onto local areas.[92] Improved population planning coordination across all levels of government is relevant as all hold important data and levers for decision making. The property sector could also support more informed discussions and decision making. Decisions on infrastructure funding could then be made using a common framework and understanding.

10. Challenge

Unreliable and inconsistent population projections makes planning for future needs difficult. This uncertainty may undermine confidence in infrastructure investments, or delay vital network upgrades to meet future growth, reducing long-term productivity and liveability of our fast-growing cities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Providing accessible and inclusive services in fast-growing cities

Accurate population projections provide an opportunity for governments to consider how to best support all people in our cities. This includes people with disability, those from culturally and linguistically diverse backgrounds, older people, and others who experience disadvantage, many of whom rely on various public infrastructure services to support their lives. Many areas on the outskirts of fast-growing cities contain some of Australia's most disadvantaged suburbs. These areas are some of the most poorly serviced urban areas by transport, and have limited access to social infrastructure, including health, education and green space.[93] For example, 56% of people in the outer suburbs of cities are beyond walking access to medium-to-high frequency public transport.[94] In inner-city sectors this number is just 4%.[95]

Our major cities are also home to over one third of all Aboriginal and Torres Strait Islander peoples,[96] who are over-represented among people experiencing homelessness.[97] However, improving access to health services that are Aboriginal and Torres Strait Islander-owned or managed can assist in achieving health equity, and contribute to culturally appropriate health services.

Infrastructure that connects people to each other through Aboriginal and Torres Strait Islander culture and language can foster greater connections and understanding, as well as providing more business, employment and leadership opportunities for Aboriginal and Torres Strait Islander people.

11. Challenge

In fast-growing cities, many of our most vulnerable or disadvantaged groups, including Aboriginal and Torres Strait Islander people, suffer from poor access to services. This can reinforce disadvantage and limit opportunities for improvements in quality of life through vital links to employment opportunities, education, health, recreational and cultural facilities, and other services.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.5 Infrastructure for smaller cities and regional centres

At a glance

This section shows the unfulfilled aspirations for growth amongst smaller cities and regional centres:

- Satellite cities benefit from being close to larger cities, and can support growth almost at once.
- Smaller cities can be highly attractive, with their liveability encouraging growth.
- Regional centres are becoming increasingly important service hubs, providing employment, health care and other key services for surrounding areas.

Types of smaller cities and regional centres

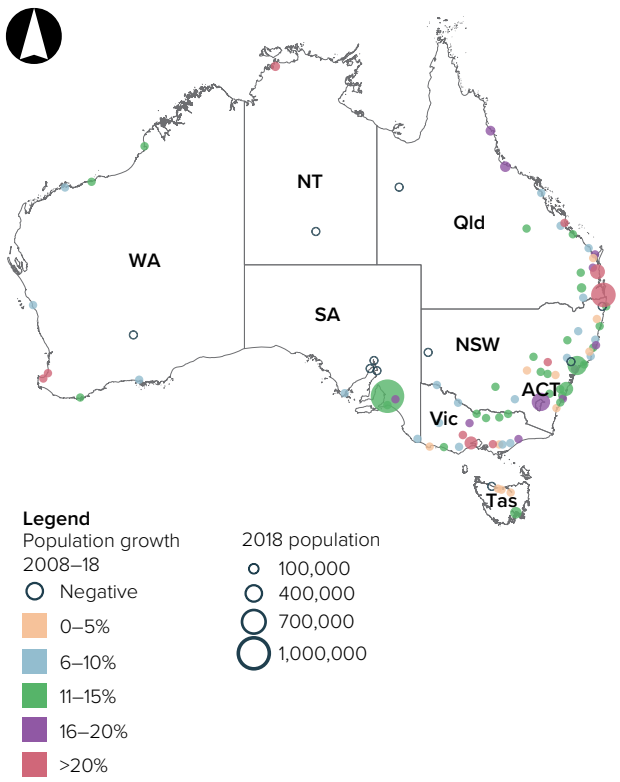
- **Smaller capitals:** Capital cities in lesser populated states and territories – Adelaide, Canberra, Hobart and Darwin – are defined as smaller capitals. These cities generally have lower growth rates than fast-growing capital cities, and have less dynamic economies with relatively fewer dominant industries. These cities service a substantial network of surrounding towns.
- **Satellite cities:** Situated within commutable distance of fast-growing cities, satellite cities typically share major services, such as airports, water supply and major hospitals, with their larger neighbours. Including cities such as Newcastle, Wollongong, Geelong, Sunshine Coast, Gold Coast, and Bunbury, their populations typically decline on weekdays as some locals commute to work in the larger city, and swell on weekends with visitors from the city.
- **Regional centres:** The major service centres in regions are termed regional centres. Many of these places rely heavily on one or two dominant industries, many of which have developed over many decades or centuries. Regional centres include Bendigo, Tamworth, Toowoomba, Alice Springs and Kalgoorlie.

Figure 10 shows where these cities and centres are distributed, as well as their recent population growth.

Smaller capitals and satellite cities have room to grow and develop

Compared to our fast-growing cities, many of our smaller capitals have the capacity to expand their populations without requiring substantial infrastructure upgrades. However, it should be noted that existing infrastructure capacity within these cities can often play a supporting role for the regions surround the smaller capital, so this demand should also be considered. Growing these cities could reduce the strain on cities like Sydney and Melbourne and provide greater sustainability for dispersed regional populations.

Figure 10: Smaller cities and regional centres are dotted across Australia



Source: Australian Bureau of Statistics (2019)[98]

Satellite cities around our major centres could also play an important role in becoming both service centres and new residential precincts for their larger neighbours. In addition to road and rail connections, satellite cities often share other infrastructure networks with major cities. As a result of these connections, it would be less costly to grow satellite cities than smaller cities with less proximity to major cities. Planned well, these satellite cities can be more than dormitory suburbs to larger cities – they can grow into centres of economic and cultural development in their own right.

However, as with fast-growing cities, it is important that growth in our small capitals and satellite cities is well planned and reflective of the community's expectations. This highlights the importance of place-based planning to reflect each area's unique characteristics and comparative advantage. *Greater Geelong: A Clever and Creative Future* is an example of policy-led development of a satellite city. The strategy presents a place-based approach that explicitly builds on Geelong's existing strengths.[99] One of these strengths noted is the city's proximity to Western Victoria and Melbourne, which provides two-way access to markets and investment for the city, and thus underpins the strategy.[100]

12. Opportunity

Smaller capitals and satellite cities have capacity to grow, and in turn take pressure off infrastructure in our fast-growing cities. Satellite cities can support growth by leveraging the infrastructure of their fast-growing neighbours and smaller capitals, through leveraging infrastructure designed to support their surrounding region.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

The liveability of smaller cities is fundamental to their growth

Many of our smaller cities have unique culture, history and identity. The location of smaller cities has been influenced by the settlement patterns of First Australians, early European settlers and our varied natural landscapes and resources. These smaller capital cities and regional centres have since grown around specific industries and purposes. This has forged distinct relationships between local residents, their local environment and their place in Australian society.

Although some smaller cities are becoming increasingly attractive for residents, better infrastructure services are crucial to support further growth. This is not always easy to provide, as many regional centres are disconnected from major cities and therefore lack scale and competition in infrastructure markets. Over time, this could lead to a growing gap of liveability in some areas, where some communities risk being left behind.

For example, water in regional centres is essential for a range of purposes, including agriculture, recreational parks, the natural environment and citizen's health. If these cities have lower levels of water security than fast-growing cities due to their smaller scale, then they are at greater risk of water restrictions. Over time, this could lead to declining amenity and health outcomes and significantly impact the liveability of smaller cities.

Broome Growth Plan 2017

Broome is a strategic regional centre located in the north of Western Australia, with a population of approximately 16,000 people. In 2015, the Western Australian Government identified Broome as a tranche 1 regional centre that was required to support its own growth and provide links as a spatial network across the State. The *Broome Growth Plan* presented an opportunity for Broome to define its future, using the framework provided by the State Planning Strategy 2050. The Broome Growth Plan also aligns with Recommendation 4.1 of the 2016 *Australian Infrastructure Plan*, which states that state and territory governments should deliver long-term regional infrastructure plans.[101]

The Growth Plan is a unique strategy and action program that provides an evidence-based 'operating manual' to achieve sustainable economic growth and generate strong jobs growth in Broome. It aligns with existing state and local government policy and local Yawuru community plans, and fits within the overarching framework for state and regional planning.

The Plan contains clear and considered measures and metrics of success, and identifies four pathways for the implementation of the initiatives listed above: building small enterprise, connecting to governance structures, connecting initiatives and enablers, and infrastructure required. These pathways are used to show what specific activities need to be undertaken in the short and medium term, to achieve the long-term outcomes.

Source: Kimberly Development Commission[102]

Regional centres are becoming increasingly important service hubs

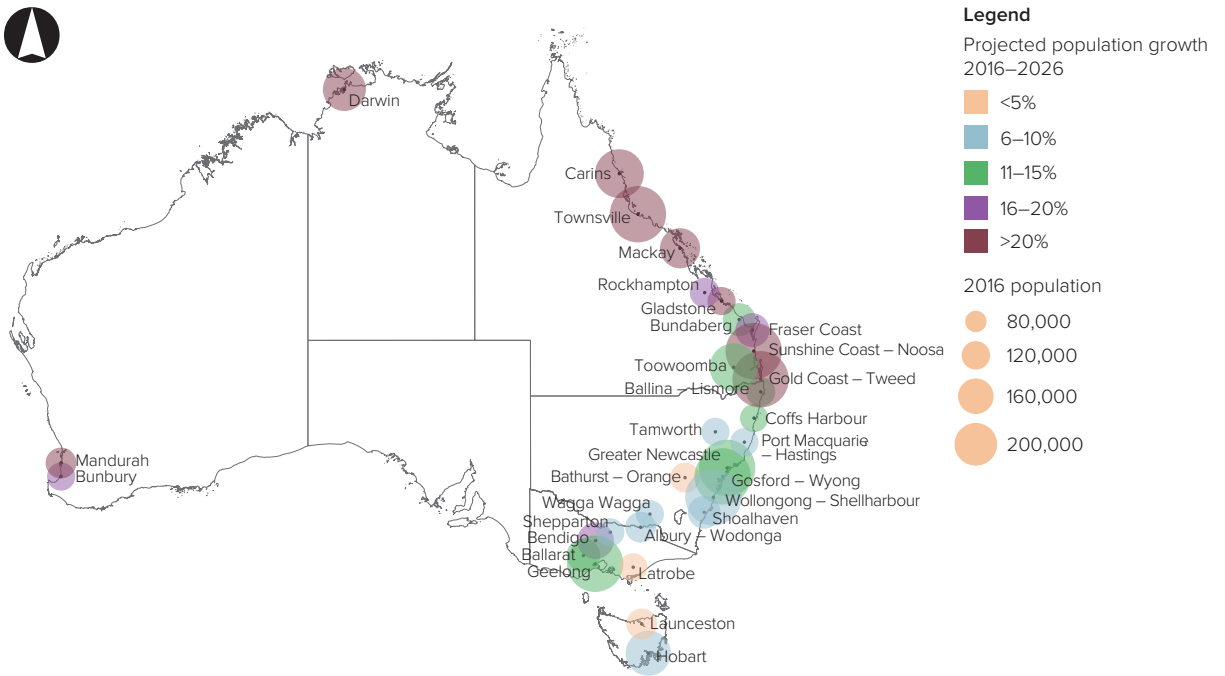
Regional centres provide essential services for local residents as well as surrounding regions. This has been a growing trend, driven by increasing service complexity and specialisation, which is reliant on access to specialised skills and resources, as well as adequate demand levels to warrant and sustain their provision.

As service hubs, regional centres provide centralised access to infrastructure, employment, education, health care and services for the surrounding region. Over recent years, many regional centres have become increasingly important to their surrounding regions, driven by increased specialisation and rationalisation of service delivery across a number of sectors, and enabled by advances in digital connectivity. In many areas, this hub-and-spoke model has improved the flow of workers, service users and consumers between regional centres and surrounding towns. This will help many regional centres to grow strongly in coming years (Figure 11).

Canberra is an example of a regional hub that services a broader surrounding region, including southeastern New South Wales. Canberra is a hub for employment, transport, services and business opportunities and is continuing to grow. However, given the role that Canberra plays in providing services to the surrounding region, including to people who live outside the Australian Capital Territory, planning for adequate infrastructure and identifying relevant investment is difficult and future requirements are hard to quantify.

Key infrastructure in regional centres can also help attract businesses and other service providers to particular regions. For example, regional universities and regional hospitals contribute to the local skilled worker population, and contribute to economic growth. They attract private sector business, such as research institutions, other private education or health services, and other population supporting activities such as hospitality and retail.

Figure 11: Many regional centres are projected to grow strongly over the coming years



Note: Projected population growth figures are sourced from state projections.

Source: Regional Capitals Australia (2017)[103]

The economic characteristics of many smaller cities are changing

Infrastructure has forged a role in supporting the growth and development of smaller cities:

- In cities that have developed around resource-extraction, such as Ballarat, Maitland, Kalgoorlie and Emerald, infrastructure has provided the means of transporting goods to local, national and international markets.
- Freight networks have also been essential for the development of centres forged on agricultural ties, such as Armidale.
- For cities with a history in manufacturing, such as Whyalla and Wollongong, infrastructure has provided much-needed energy for factories and heavy industrial processing.
- In more isolated cities, such as Broken Hill and Mount Isa, infrastructure has provided essential connectivity to and communication with other towns, people and markets.

However, many of these cities are undergoing structural changes as the Australian economy continues to move away from goods-producing industries and shifts towards service-oriented industries. The smaller scale of economic activity in these cities, and their ties to a single, dominant local industry presents challenges in managing economic fluctuations or structural changes, and providing sustained employment for local workers.

Many businesses are taking advantage of new export opportunities, while others are becoming more exposed to the forces of international competition and globalisation, especially those that are competing for imports. Businesses across a range of industries are also experiencing disruption by new and existing competitors. In response, many businesses are investing in more efficient technologies to improve productivity, though this often comes at the expense of demand for local labour. As a result these labour market dynamics and shifts in population are causing a shift in population, and the infrastructure needs of some regions are changing.

So while growth in the Australian economy has provided opportunities for employment across a range of regional areas, some have been left behind. Consequently, populations have tended to move away from smaller regional communities into larger towns or capital cities. This has obvious implications for the long-term sustainability of local government revenues and the funding of equitable levels of some infrastructure services.

Transition in Traralgon, Victoria

Traralgon is located in the Latrobe Valley, southeast of Melbourne. For many years, Traralgon and surrounding towns have relied on the power generation industry as the major source of employment.

Private owners of the Hazelwood Power Plant announced in 2016 that the plant would be closed in March 2017. Closure of the power station resulted in significant local job losses for residents in Traralgon and other towns in the region.

The closure of Hazelwood has prompted Traralgon to reconsider the infrastructure it requires to support its future. The Latrobe Valley Authority was established in 2016 by the Victorian Government to manage the transition to a more diverse business sector in the region, and bring together the strategies and plans for future development across the region.

In addition, the Latrobe Valley Supply Chain Transition Program was established to support businesses and workers to transition following the Hazelwood closure. Federal government assistance was also provided to the region to support infrastructure provision, re-skill workers and diversify the regional economy.[104]

13. Challenge

Developments in the economy, regulation, technology and service delivery mean our infrastructure needs are changing, leaving some regional centres at risk of being left behind. Lags in infrastructure quality and access to services in smaller cities and regional centres could lead to a growing gap in productivity and liveability, relative to larger cities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.6 Infrastructure for small towns, rural communities and remote areas

At a glance

Over 3.2 million people live in remote areas. Their infrastructure needs are vast and varied, and service quality is often poor. Connecting these people to the rest of the country is vital to their lives and economies, especially in Aboriginal and Torres Strait Islander communities that face entrenched inequality.

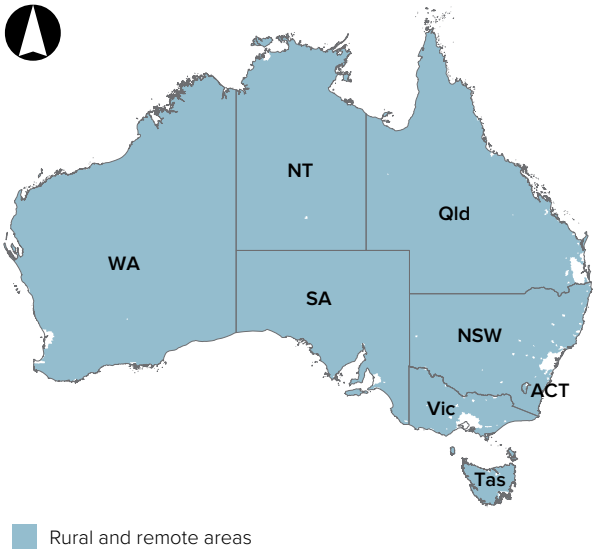
This section finds that remote infrastructure can be improved by consulting communities, designing services based on their needs and setting integrated service policies to improve wellbeing.

Few people live across much of the country

Small towns, rural communities and remote areas are defined as having populations of fewer than 10,000 people, as well as those areas between communities, where small pockets of population often reside on small tracts of land. These places cover most of Australia's land mass (Figure 12).

This geographical classification is broad, and the needs within these towns and communities are diverse. For example, it includes Castlemaine, which is about a 30-minute commute to satellite city Bendigo in Victoria. This category also includes Kiwirrkurra, a community of around 150 people in the Gibson Desert of Western Australia, which is about a 15-hour drive to its nearest regional centre of Alice Springs – one of the most remote communities in Australia.

Figure 12: Small towns, rural communities and remote areas cover most of Australia's land mass



Note: This map shows all land excluding all Significant Urban Areas,[105] and the four Greater Capital City Statistical Areas for Sydney, Melbourne, Brisbane and Perth.[106]

While most Australians live in fast-growing cities (59%) or smaller cities and regional centres (29%), over 3.3 million Australians (12%) live outside these urban centres.[107] One in ten Australians live in small towns with populations of fewer than 10,000.[108] At the time of the 2016 Census:

- 88 towns had populations of 5,000 to 9,999, and were home to 613,500 people
- 526 towns had populations of 1,000 to 4,999, and were home to 1,147,400 people
- 1,088 communities had populations less than 1,000, and were home to 518,600 people.[109]

Outside our cities, infrastructure needs are vast and diverse

The nature of many of Australia's smaller towns has changed dramatically over their history since European colonisation. Over recent decades, a range of factors has diminished economic opportunities in many of these towns.

Shifts in Australia's industrial composition, in addition to technology and productivity advancements, have led to a loss of employment in many areas. Many rural and remote regions have declining populations in contrast to the modest growth in the majority of Australia's smaller cities and regional centres.[110] In many smaller towns, services that urban residents take for granted have consolidated to larger regional centres, driven by a range of factors, including changing demand, technological change and improved digital connectivity.[111]

Remote infrastructure faces distinct risks and challenges, including:

- **High costs of construction**, sometimes compounded by vast distances with low population density, limited local workforces, and significant challenges of attracting workers to remote projects,[112] leading to reduced competition in the market.
- **Difficulty producing compelling economic modelling** to justify investment, especially as costs are higher, and potential users are fewer and more dispersed. Forecasting future demand is more difficult due to uncertainty and exposure to external forces, such as changes in consumer preferences, exchange rates, trade flows, and agricultural and mineral commodity prices.[113]
- **Exposure to extreme climate and weather events**, including drought, bushfire and flood, bringing considerable resilience risks. Rural and remote areas can be more vulnerable to the risks of natural hazards, and greater investment may be required to protect or maintain these assets.
- **Reliance on single assets and networks**, with limited choice for users and increased likelihood of redundancy or asset failure.

Connectivity is essential for remote communities

Connectivity, both in a physical and digital sense, is perhaps the most pervasive and critical issue for remote communities and people in rural areas. The access, quality and cost of transport and telecommunications links – or perceived risks of future deterioration – can influence decisions to set up new businesses or invest in regional areas.

Connectivity and access to services also has a major role in influencing decisions by individuals and households to move to or stay in regional areas. Young people with poor access to employment opportunities, education and entertainment may not see a future for themselves in regional areas, depriving regional businesses of their skills. Also, older people without access to health facilities or telehealth services may not feel comfortable staying in regional areas, depriving regional communities of service employment opportunities, as well as their contribution to local communities through experience and cultural activities.

Service quality in many small towns and remote communities is poor

The cost, quality, and accessibility of services is fundamental to community wellbeing, and has a direct relationship to the productivity of its local economy. When small towns are supported, communities can more successfully meet economic challenges and better adapt to structural change.[114] For younger generations to see a future for themselves outside our major cities, they must also see that these places will offer similar high-quality services, and not have to compromise on liveability or connectivity. However, gaps in service delivery between major cities and many small towns are widening.[115]

Providing accessible and continuous health care is a challenge in rural and remote areas. These areas also have limited access to specialist's acute care and the infrastructure to support these services.[116]

Other services, while accessible, may be unreliable or low quality. For example, the *2018 Regional Telecommunications Review* found that, for some people, the NBN Co satellite service, Sky Muster, is falling well short of their current needs and expectations.[117] The provider's service quality expectations also lowered with increasing remoteness, with 10% non-supply deemed acceptable in rural areas.[118] On average over the last five years, this represents approximately 10,000 premises annually, which could equate to 30,000 people impacted each year.

Transport infrastructure has profound effects on settlement patterns. However, the vast distances between communities in many rural areas mean that many users suffer poorer quality services and reduced physical connectivity.

For example, the operation of regional aviation services is more challenging than for routes between capital cities, principally due to difficulties in achieving economies of scale in regional markets.[119] This is particularly important given regional airports had on average a 6% funding gap between their expenditure required to operate the airports and revenue collected in 2014-15,[120] and nearly 40% of regional airports expect to experience persistent budget deficits in the 10 years.[121]

In part, this issue is addressed through the Regional Aviation Access Programme, which provides support for aerodrome infrastructure and air services to remote areas where they are not commercially viable.[122] However, many regional destinations, particularly in northern Australia, have higher airfares and far less frequent connections than regional areas in the south.[123]

14. Challenge

Infrastructure is more expensive to provide per unit of consumption in low population density areas, but communities and businesses in these areas are also more reliant on available infrastructure for their productivity and wellbeing. Poorer infrastructure services in small towns, rural communities and remote areas could lead to limited opportunities for growth and may undermine the long-term viability of some communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Challenges in regional areas hamper infrastructure delivery

Infrastructure provision to support regional industries comes with distinct challenges, including:

- Low population densities and vast distances between communities
- Higher costs of construction, operation and maintenance of assets, and greater scale of assets required to connect communities
- First-mover disadvantage for regional businesses to invest in new or upgraded infrastructure, and a lack of capacity among existing communities and industries to fund projects.

These factors increase risks for regional proponents and may undermine the economic case for investment in regional infrastructure. Even where investment per capita in regional infrastructure exceeds the cities, this may not be sufficient to overcome the impact of these challenges. As a result, access, quality and cost of infrastructure required for regional industries across many parts of the country have suffered. For example:

- Poor mobile reception that does not extend beyond places of residence, and low-capacity, unreliable broadband, limiting capacity to embrace data-reliant technologies on farms
- High transport costs, driven by large distances, poor supply chain efficiency, and limited access for heavy vehicles on some routes due to weight restrictions and ageing bridges
- Poor transport reliability with roads and railways susceptible to flooding and deterioration
- Little or no public transport, and high costs of air travel, limiting access to workers
- Limited access to potable water and wastewater services, or reliable and secure water to support agriculture, mining and manufacturing
- High energy costs, limited access to reliable fuel sources and, in some cases, a need to truck in diesel for generators
- Limited access to adequate and modern health, education, housing and other services.

15. Challenge

Regional infrastructure faces a range of unique challenges and risks, which make it difficult to efficiently provide services that support growth in regional industries. Failure to overcome the challenges and risks facing regional infrastructure raise costs and barriers for investment in regional industries, limiting opportunities for employment and growth, and eroding confidence in the future viability of some areas.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Infrastructure is critical to supporting Aboriginal and Torres Strait Islander communities

Australia is the home of the oldest continuous culture on the planet, with evidence that Aboriginal and Torres Strait Islander people inhabited the land for at least the past 65,000 years. Over this time, First Australians cared for country by using land management that worked with the environment. Using traditional practices, they were able to create a system that was sustainable and supplied them with the food and resources they needed.

Infrastructure decision makers can learn from the traditional owners of the land, in terms of sustainability, managing our footprint and harnessing our natural habitat. However, providing infrastructure to support Aboriginal and Torres Strait Islander peoples – particularly in remote communities and areas – remains one of Australia's most considerable, and long-lived infrastructure challenges. Infrastructure can help to overcome the disadvantage and inequality suffered by these communities, and improve their welfare through better health and education, while providing opportunities for employment and the development of local industries.

While the largest concentration of Australia's Aboriginal and Torres Strait Islander population are found in urban areas, there are more Aboriginal and Torres Strait Islander people than other Australian living in remote areas. Approximately 20% of all Aboriginal and Torres Strait Islander peoples live in rural and remote areas, compared to only 1.7% of other Australians.[124] The Australian Bureau of Statistics estimates that the 2016 Census undercounted Aboriginal and Torres Strait Islander peoples by 17.5%, or 137,750 people.[125]

More than a decade ago, the Council of Australian Governments committed to decreasing inequality between Aboriginal and Torres Strait Islander peoples and other Australians through the Closing the Gap targets.[126] However, only two targets, early childhood education and Year 12 attainment are on track to be met. Targets in relation to child mortality, school attendance, life expectancy, reading and numeracy, and employment are not on track.[127] Improved infrastructure services are critical to providing the necessary services to address this disadvantage.

Peninsula Development Road, Cape York, Queensland

The single integrated 527 kilometre Peninsular Developmental Road between Lakeland and the Rio Tinto Boundary, south of Weipa, aims to improve access to regional and remote Cape York communities. The $276 million project began in 2014, and is jointly funded by the Australian Government and the Queensland Government.[128] When completed, the road could help unlock the potential of local industry, increase the liveability of the area, increase road safety standards, improve freight efficiency and strengthen the local economy.

The project will also provide $50.5 million for targeted assistance for the development of Indigenous businesses and infrastructure.[129] This includes infrastructure identified by the Torres Cape Indigenous Council Alliance including road, barge, boat ramps and sewerage infrastructure.[130] Embedding indigenous participation into this infrastructure project has increased economic development and helped local people find employment. In 2018, it was estimated that 54% of the workforce on the Peninsula Development Road were Aboriginal or Torres Strait Islander, and 27 Aboriginal or Torres Strait Islander businesses were involved.[131]

16. Challenge

Infrastructure can do more to support Aboriginal and Torres Strait Islander peoples in remote communities and rural areas, and to underpin progress towards local and national objectives for improving quality of life. Failing to improve services for First Australians in remote communities and rural areas undermines potential improvements in quality of life and reinforces gaps in inequality and disadvantage.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.7 Infrastructure to support regions and unlock growth in northern Australia

At a glance

The right infrastructure can unlock growth in regional industries, but delivery can be challenging due to low populations, challenging weather, changing markets and high building costs. Boom-and-bust economic cycles add more difficulty, but adaptive infrastructure can help stabilise them.

Northern Australia is particularly prone to these challenges, yet it has significant economic potential. Infrastructure can help access this opportunity. Governments can support development by drawing on:

- current research, including from CSIRO and Geosciences Australia
- lessons from past development efforts.

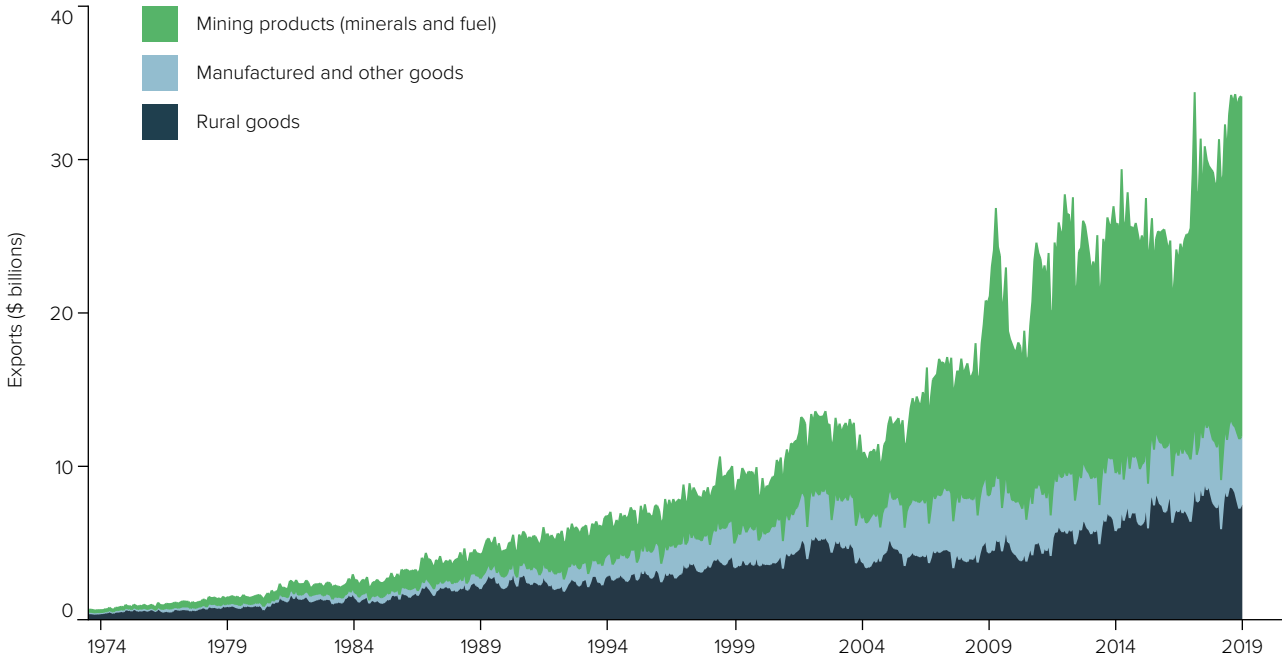
Infrastructure provides vital links for regional industries

Beyond providing services to users, infrastructure also supports industries. The right infrastructure in the right place at the right time can catalyse industry growth by improving connectivity and competitiveness. These areas encompass smaller cities, regional centres, small towns, remote communities and the areas in between. Many regional areas rely on few dominant local industries, which often provide a large proportion of local jobs and income.

Regional infrastructure has been driven by its economic history. Drawn by the opportunities provided, regional Australia in 1911 was home to 60% of the population, with 45% of Australians living in towns of greater than 200 people, and 15% in small localities and rural areas.[132]

Many of Australia's regions are highly productive and prosperous. Average incomes can often be higher than cities, especially in mining regions, providing high levels of tax revenue. In the year to November 2018, over 85% of Australian goods exported were rural goods or mining products. Figure 13 shows how exports for these industries have grown rapidly in recent decades.

Figure 13: Exports from mining and rural goods have grown dramatically over recent decades



Source: Australian Bureau of Statistics (2019)[133]

Infrastructure can support regions in transition

Infrastructure's role as a supporter of industrial activity is especially important in regions where the dominant source of jobs and output is changing.

Despite facing a number of ongoing long-term economic challenges, regions across Australia have, on the whole, shown resilience and generated growth and employment. 77% of regions have experienced positive employment growth over the past five years,[134] and unemployment in regional Australia is lower than the EU average.[135,136]

However, many regions are facing drought, global competition for goods and services, structural economic shifts, and new technologies that have displaced some workforces.[137] Employment growth in capital cities consistently outperforms the rest of the state,[138] and some regions – particularly those in very remote locations – have struggled to adapt in a changing economy. While real wage growth has been fairly similar across capital cities and regional areas, wage levels are generally higher in capital cities than in regional areas. On average, since 1995–96, those who live in capital cities have earned 17 to 22% more than people who live in the rest of the country.[139]

Infrastructure can unlock opportunities for growth and employment where structural changes have hit hardest, and where the effects of economic change are proving the most stubborn to overcome. In some regions, existing infrastructure networks may be able to adjust to the changing needs of local industries. Across many regions, however, strategic investments and reforms may be required to help local businesses and communities adapt to change, and bring new opportunities for growth and development.

Infrastructure can help to smooth economic fluctuations and cycles

Growth in regional industries can bring employment, income and vibrancy to local communities and surrounding areas. However, this growth can also come with its own challenges and risks for the sustainability of opportunities, especially where growth is driven by a single industry.

The cyclical nature of demand for regional industries, particularly for natural resources, and the sensitivity of demand to global prices and our exchange rate, mean not all growth is long-lived – unlike the infrastructure required to support it. This raises the risks of stranded or underutilised assets that can be a financial burden when activity declines.

Seasonal variations in economic activity also present challenges for efficient and sustainable infrastructure service provision. Some forms of production require specialist labour or assets, which may require additional investment in infrastructure that, due to seasonable variations in demand or production inputs, may be under-used. For example, some regions reliant on irrigated agriculture have undergone significant changes to their land use and crop choice.[140] The shift away from lower-value bulk commodities affects the utilisation of local processing infrastructure, and changes industries' needs from supply chain infrastructure to carrying goods to port or market.

Infrastructure can help to smooth peaks and troughs. Common-use infrastructure that provides digital and physical connectivity, such as roads, airports, mobile towers and broadband access, can boost social capital and support a diversity of growth sectors, including tourism and other tertiary services that tend to be more resilient to economic fluctuations. Education facilities can help to boost local human capital, provide ongoing skills to local businesses and help workforces retrain through structural shifts in the economy.

17. Challenge

Fluctuations in economic activity in regional industries make it difficult for infrastructure to efficiently and sustainably underpin long-term growth and development. Failure to keep pace with growth can reduce productivity and output during boom years, while underutilised assets raise costs in areas with declining populations, undermining the long-term social and economic viability of regional communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

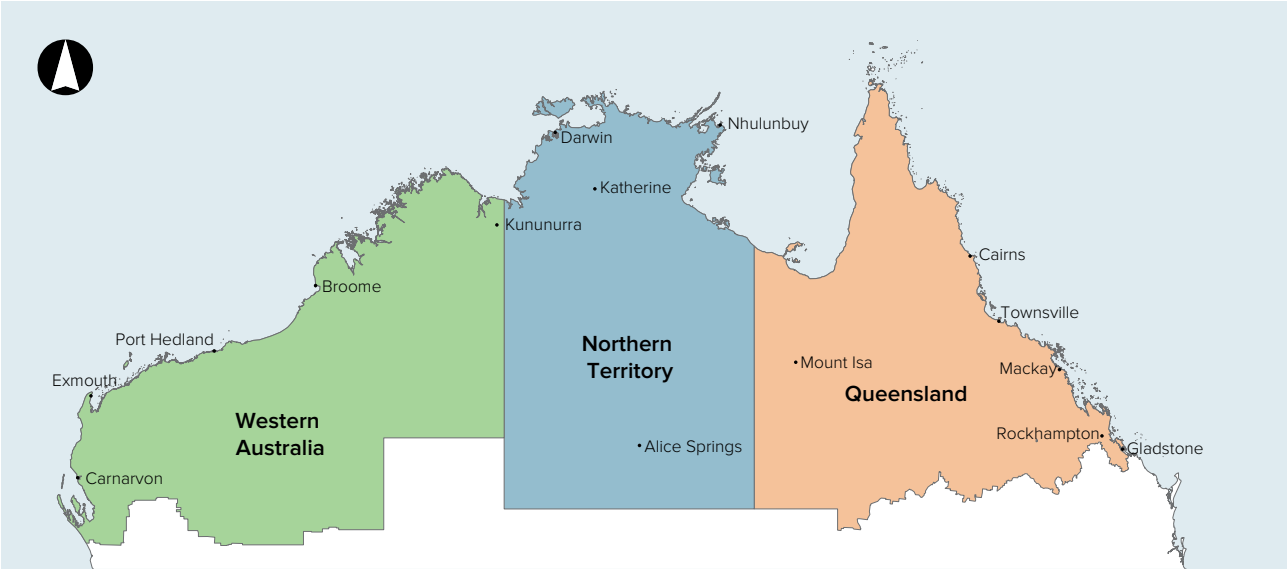
Northern Australia faces distinct challenges

Many of the challenges faced by other parts of regional Australia are amplified in northern Australia, which extends across a large proportion of Australia's land mass (Figure 14). In particular:

- Exposure to more extreme weather and climate impacts, including high temperatures, high seasonal and variable rainfall in tropical regions, and events such as cyclones and floods
- Higher costs of living and doing business, driven by remoteness, lack of scale, and lack of historical investment in transport and essential services
- Higher levels of risk and barriers to investment in some regions, including significant first-mover disadvantage for proponents seeking to establish or extend supply chains to new areas
- Historical lack of coordination in planning and investment across jurisdictional boundaries, resulting in disconnected transport and energy networks and inefficient supply chains
- Higher rates of mobility, as workforces follow projects rather than settle in communities
- Large variation in the quality of life and diversity of needs from infrastructure, particularly in the most remote parts of the country and among Aboriginal and Torres Strait Islander peoples.

These challenges have deterred or slowed development and investment across many northern regions. The combined impact of these challenges is also reflected in the slow rate of population growth in northern regions, particularly since the end of the mining construction boom.[141] In 2017-18, the Northern Territory was the only state or territory to experience negative growth, with a rate of -0.1% and a net population decrease of 190 people.[142]

Figure 14: Northern Australia extends across Western Australia, Northern Territory and Queensland



Note: These boundaries are as per the definition of northern Australia in the *Northern Australia Infrastructure Facility Act 2016 (Cth)*.

There is untapped potential for growth in northern Australia

Despite the challenges facing northern Australia – or perhaps because of them – there are significant, largely untapped opportunities for development. Some of our least populous and most remote regions also hold the greatest potential to grow. This is particularly true of regions in northern Australia, where a range of factors contribute to immense potential:

- An abundance of natural resources, including deposits of natural gas, uranium, lead, gold, zinc, silver, tungsten, bauxite, oil, iron ore, metallurgical and thermal coal, and rare earths, as well as other environmental assets
- Large tracts of undeveloped land in a tropical climate, much of which experiences high seasonal rainfalls during the wet season of December to March
- Proximity to rapidly growing and developing Asian markets, with strong demand for our agricultural and mining products, as well as services including education, health and tourism
- Natural beauty, with geographic and topographic features unlike anywhere else on earth, with 65 sites listed in World, National and Commonwealth Heritage Lists, including the Great Barrier Reef, and the Kakadu, Uluru-Kata Tjuta and Purnululu National Parks
- Rich Aboriginal and Torres Strait Islander history, traditions and sites of cultural significance.

This potential was highlighted in the Australian Government's *White Paper on Developing Northern Australia* in 2015.[143] In support of this work, Infrastructure Australia released the *Northern Australia Infrastructure Audit* in the same year.[144] The process initiated by the White Paper is four years into a 20-year commitment by governments to transform northern Australia and to unlock its substantial potential.

Infrastructure can unlock growth across the northern economy

Infrastructure can play an essential role as a catalyst for growth in northern industries. Improvements in physical and digital connectivity, as well as the development of gateways for trade with domestic and global markets, can also help to open new parts of the country for development. Opportunities for growth include:

- **Agriculture:** A range of forms of production, including pastoral, irrigated and broadacre farming, as well as aquaculture and fisheries
- **Resources:** Further exploration and extraction of existing minerals deposits and natural resources, including iron ore, natural gas, gold and bauxite, as well as new sites containing rare earths that are integral components for batteries and green technologies
- **Energy:** Beyond oil and gas, renewable energy has the potential to grow enormously, both as a supplier of intermittent energy for the domestic market and for the provision of energy for export by connection with growing Asian markets through export of hydrogen,[145] or directly through a high voltage direct current cable to Indonesia[146]
- **Tourism:** Expansion of facilities and service offerings for local, domestic and international tourists, including growing links with cruise routes through south-east Asia, and development of tourism to showcase local Aboriginal and Torres Strait Islander knowledge, food and traditions
- **Other services:** Provision of services through educational institutions, specialist health care, professional services, and scientific research, particularly in the field of tropical health
- **Space and aerospace:** Potential to grow sites for launch, research and testing of satellites, space and aerospace craft.

Infrastructure needs across these sectors vary, but common outcomes sought are resilience, reliability and efficiency. Given the vast distances between communities and exposure to a volatile and seasonal climate, northern regions need improved connectivity through upgrades to transport and telecommunications networks. Investments in ports, airports, remote aerodromes and other elements of supply chains, such as storage and refrigeration facilities, can open new domestic and export markets for businesses and give local producers opportunities to get their goods to expanded markets more quickly and cheaply.

Improving connectivity for exports can have flow-on benefits for regional areas and their communities. More agricultural exports by air would improve the finances of inbound tourism flights and increase the productivity of other airport infrastructure. Also, improvements in broadband and mobile coverage can support growth of service industries, as well as enhancing access to social services such as remote education and telehealth. These can enhance the liveability of regional communities, helping to attract and retain residents.

Many of these were highlighted in Infrastructure Australia's *Northern Australia Infrastructure Audit*, which provides a comprehensive, ongoing reference guide for infrastructure priorities in northern regions.[147]

18. Opportunity

Infrastructure can help to catalyse growth across northern Australia, and unlock development across a range of industries. Improving the resilience, reliability and efficiency of northern infrastructure could help to capitalise on the immense potential of northern regions, and improve the productivity, quality of life and competitiveness of its people and businesses.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

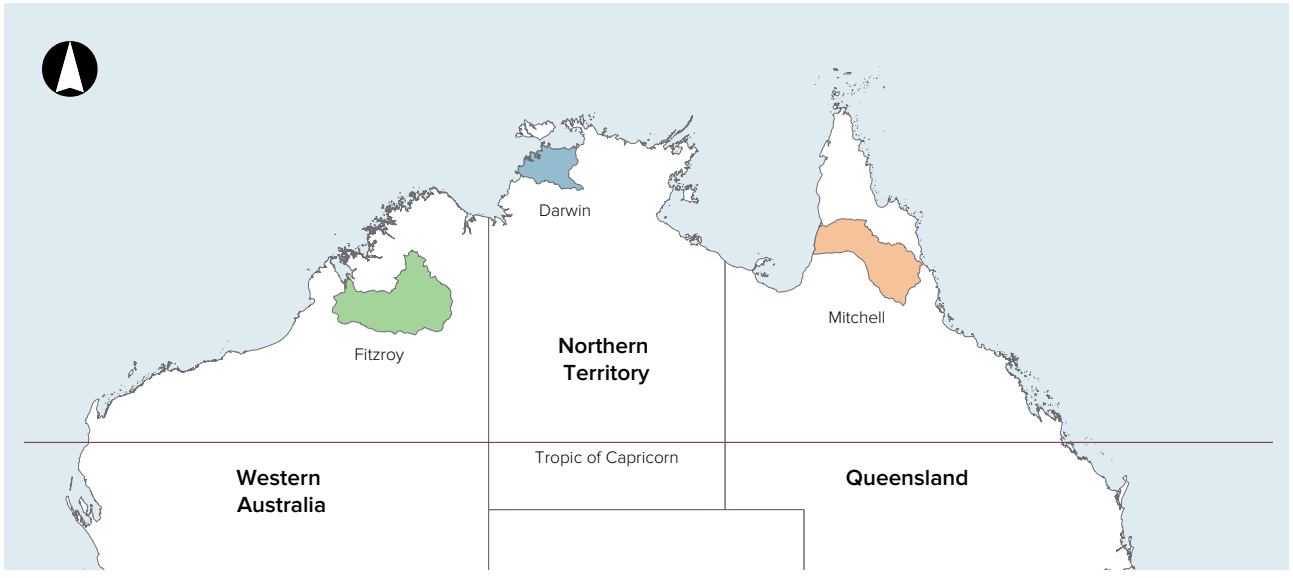
Further evidence can support development in the north

Given the finite resources of governments, it is important to undertake studies to understand how infrastructure can unlock strategic opportunities, and can deliver improvements in outcomes such as improving productivity, sustainability and quality of life, or reducing socioeconomic disadvantage. Examining the economic, social and environmental benefits of potential projects can help to support efficient investment in underdeveloped regions. Supporting this analysis with scenario testing using a range of external factors, such as changes in exchange rate, climate change, and developments in technology can ensure these opportunities are resilient to potential future changes.

Work such as the Northern Australia Water Resource Assessments undertaken by the CSIRO is an example of investigation of the economic prospects of potential development zones and the infrastructure required to support future growth. These studies looked at the Flinders and Gilbert catchments in Queensland in 2013,[148] and the Fitzroy (Western Australia), Darwin (Northern Territory) and Mitchell (Queensland) catchments in 2018 (Figure 15).[149] This research provides an evidence-based platform for decisions on infrastructure and investment by industry and governments in northern regions.

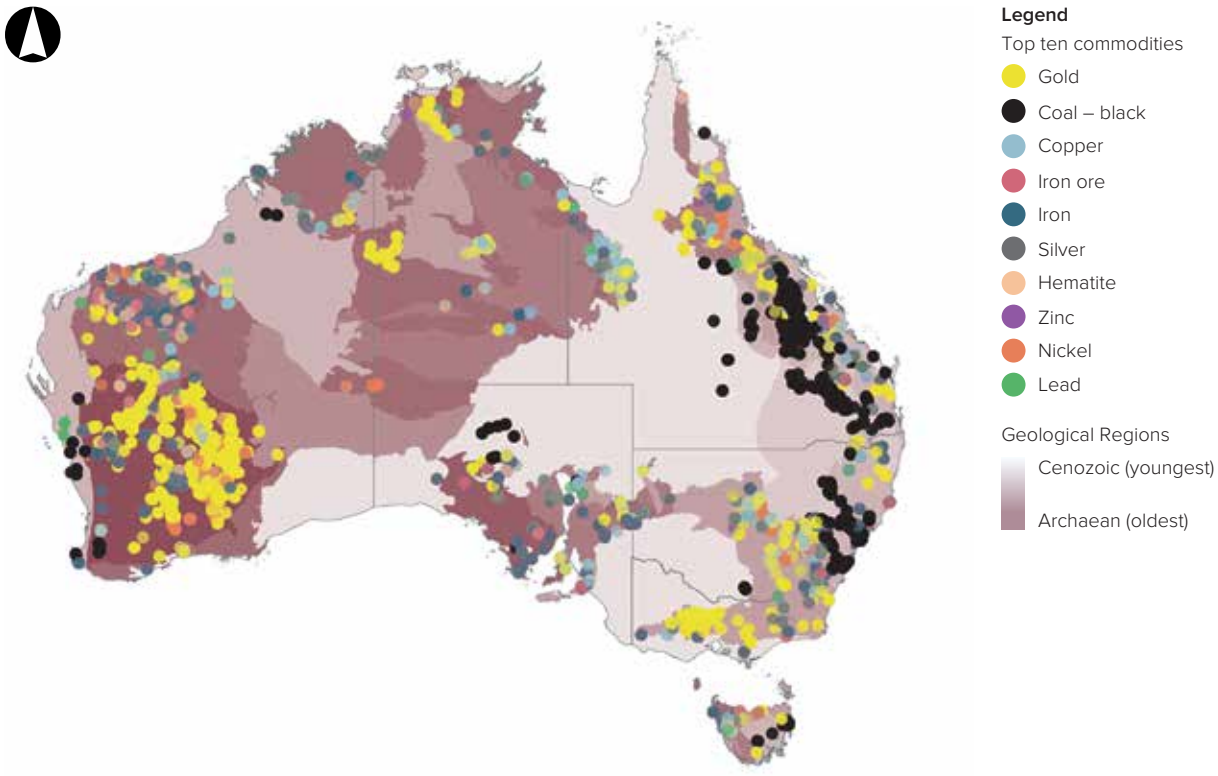
Similarly, work by Geosciences Australia is helping to identify future resource zones by building information on potential mineral, energy and groundwater resources concealed beneath the earth's surface through the Exploring the Future program.[150] This allows businesses and governments to identify and plan for infrastructure to support development and de-risk a range of private sector investments. As shown in Figure 16, Australia is home to a large variety of resource deposits, many of which are clustered in northern Australia.

Figure 15: Studies by the CSIRO in 2018 investigated opportunities for development of three regions across northern Australia



Source: Commonwealth Scientific and Industrial Research Organisation (2018)[151]

Figure 16: Australia's mineral deposits are spread across the continent, with many clusters in northern Australia



Source: Geoscience Australia (2013)[152]

Past development efforts provide lessons for the future

Governments have committed considerable funding to reinforce the critical infrastructure of rural and remote regions over many years.[153] A significant proportion of these funds are directed to regional social and economic infrastructure projects. As of May 2017, the Australian Government had committed in excess of $20 billion in expenditure on regional programs – likely to be a conservative estimate as it excludes projects such as the National Broadband Network and Inland Rail.[154]

However, some investments to unlock growth and further investment may have yielded limited benefits. The Productivity Commission criticised ad hoc financial assistance to regions as rarely effective at facilitating transition or long-term development.[155] Other programs may have provided mixed results. For example, between 2008 and 2017, the WA Government's Royalties for Regions program directed over $6.9 billion of royalties from the state's mining and onshore petroleum activities into more than 3,700 infrastructure and community projects.[156] An independent review found that despite a broad but clear objective to enhance WA's regional areas, it was not clear that the program supported any significant or consistent economic or social progress in WA's regional development areas.[157] These views were reflected by the WA Auditor-General in an earlier inquiry.[158]

Understanding local needs is also important for ensuring development is supported by local communities, especially where developments occur on Aboriginal and Torres Strait Islander lands or impact those communities. Diversity of needs among regions and communities, including distinct cultures, traditions and values of Aboriginal and Torres Strait Islander communities and native title holders, limits the impact of broad, one-size-fits-all approaches to regulation, funding and policy.

Applying place-based thinking to understand these local needs and values often takes time and cost. Frequently overlapping titles, procedures and legislation relating to land use and land title, including different land tenure regimes for mining rights, Aboriginal and Torres Strait Islander land rights, and tenure relating to water access and biodiversity offsets can raise barriers for accelerated investment. While place-based thinking requires more initial investment to design and establish, funding and projects typically have substantially higher success rates and positive outcomes representing substantial value for money outcomes as compared to ad-hoc broad based approaches.

Cape Leveque Road, Western Australia

The Dampier Peninsula, situated north of Broome in Western Australia's Kimberley Region, is a unique location with significant environmental, cultural and heritage values. It is home to 1,500–2,000 people, across four main Aboriginal communities (Ardyaloon, Beagle Bay, Djarindjin and Lombadina) and around 50 small settlements or seasonal camps.

A $65 million jointly State-Commonwealth funded project is currently underway to upgrade the partially-sealed, 205-kilometre Broome to Cape Leveque Road, which provides the main transport link through the Dampier Peninsula, enabling vehicle access to the Aboriginal communities, tourist destinations, pastoral stations and businesses.

Sealing the Broome to Cape Leveque Road will open up the Peninsula to a much larger range of visitors than is currently possible due to the low quality of the current road and flooding during the wet season. This access is a significant catalyst to unlocking the Peninsula's economic potential. In particular, it will provide new opportunities for Aboriginal people and businesses, pastoralism, aquaculture, and the oil, gas and tourism industries. This is one of the first projects to implement the Western Australia's Aboriginal Procurement Policy. On average, the project has employed 35 Aboriginal peoples, of which 30 are local.

While this project is likely to bring further economic and employment opportunities in the area, the sealing of the road also opens the Peninsula to a range of potential negative environmental, cultural and social impacts from the greater number of unmanaged visitors and access. Further collaboration with local Aboriginal communities will be important to address these concerns, and improvements to local infrastructure will be needed.

Work is underway to address both the potential impacts and economic opportunities of sealing the Broome to Cape Leveque Road. This highlights the need to consider infrastructure investments both strategically and holistically to maximise the benefits they deliver, particularly in remote and regional areas. Understanding these values and preferences at the outset of the project could have enabled this information to help shape project design and support sequencing of development on the Dampier Peninsula to ensure local communities support the project and are ready to capture the opportunities it brings.

19. Opportunity

Development in northern regions could benefit from more detailed information and evidence-based studies of economic opportunities, as well as a better understanding of local needs and values, particularly of local Aboriginal and Torres Strait Islander peoples. Better information on opportunities and local needs can support more efficient investment and greater benefits for northern communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

3.8 Challenges and opportunities

Infrastructure that works for users

1. Challenge

Governments and service providers do not always adequately measure and report on access, quality and costs for users. Insufficient user-focused data makes it difficult for users and policy makers to make decisions that improve user outcomes.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

2. Opportunity

Technologies can help to overcome barriers to service access as a result of distance or location. Better access to services through improved technology can bring economic and social opportunities for users outside of fast-growing city centres.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

3. Opportunity

User data and customer insights can enable innovation to better meet users' needs. Better understanding users' needs can help operators to improve user experience, attract more users and provide services more efficiently.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

4. Challenge

Users that are disadvantaged, such as those with low digital literacy or with disability, may be unable to access infrastructure services provided through new technologies. Not extending the benefits of change to all Australians is likely to increase inequality and reduces quality of life by limiting access to services for some members of the community.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

Costs and affordability

5. Challenge

Limited reliable data exists to allow government, regulators and users to understand the total costs of infrastructure. Poor data limits the ability for government to understand the affordability of infrastructure services and cost of living pressures.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

6. Opportunity

Improved collection of data, including by third parties (such as financial institutions) could support improved decision making using big data. Partnering with data owners to support the collection of detailed, up-to-date data, will allow better decision making. However, data privacy will need to be managed.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

7. Challenge

User-pays funding for infrastructure has widespread support within the community. However, its regressive nature disproportionately affects low-income earners. Transport, energy, water and telecommunications infrastructure user costs are above affordability thresholds for our lowest income earners thereby reducing access to services and quality of life.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

8. Opportunity

Some users have limited information or understanding of the costs associated with their use of infrastructure, however new technologies will increase information and control for those that can afford them. New technology will increase transparency of infrastructure costs for users and provide the opportunity for consumers to invest in alternatives to substitute or replace traditional services.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

Infrastructure for fast-growing cities

9. Challenge

Rapid growth in Sydney, Melbourne, Brisbane and Perth has brought many benefits, but has also put legacy infrastructure under increasing strain. Without action, infrastructure constraints will add to economic, social and environmental costs, eroding the productivity of these cities and reducing quality of life for residents.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

10. Challenge

Unreliable and inconsistent population projections makes planning for future needs difficult. This uncertainty may undermine confidence in infrastructure investments, or delay vital network upgrades to meet future growth, reducing long-term productivity and liveability of our fast-growing cities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact: 

11. Challenge

In fast-growing cities, many of our most vulnerable or disadvantaged groups, including Aboriginal and Torres Strait Islander people, suffer from poor access to services. This can reinforce disadvantage and limit opportunities for improvements in quality of life through vital links to employment opportunities, education, health, recreational and cultural facilities, and other services.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Infrastructure for smaller cities and regional centres

12. Opportunity

Smaller capitals and satellite cities have capacity to grow, and in turn take pressure off infrastructure in our fast-growing cities. Satellite cities can support growth by leveraging the infrastructure of their fast-growing neighbours and smaller capitals, through leveraging infrastructure designed to support their surrounding region.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

13. Challenge

Developments in the economy, regulation, technology and service delivery mean our infrastructure needs are changing, leaving some regional centres at risk of being left behind. Lags in infrastructure quality and access to services in smaller cities and regional centres could lead to a growing gap in productivity and liveability, relative to larger cities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Infrastructure for small towns, rural communities and remote areas

14. Challenge

Infrastructure is more expensive to provide per unit of consumption in low population density areas, but communities and businesses in these areas are also more reliant on available infrastructure for their productivity and wellbeing. Poorer infrastructure services in small towns, rural communities and remote areas could lead to limited opportunities for growth and may undermine the long-term viability of some communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

15. Challenge

Regional infrastructure faces a range of unique challenges and risks, which make it difficult to efficiently provide services that support growth in regional industries. Failure to overcome the challenges and risks facing regional infrastructure raise costs and barriers for investment in regional industries, limiting opportunities for employment and growth, and eroding confidence in the future viability of some areas.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

16. Challenge

Infrastructure can do more to support Aboriginal and Torres Strait Islander peoples in remote communities and rural areas, and to underpin progress towards local and national objectives for improving quality of life. Failing to improve services for First Australians in remote communities and rural areas undermines potential improvements in quality of life and reinforces gaps in inequality and disadvantage.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

Infrastructure to support regions and unlock growth in northern Australia

17. Challenge

Fluctuations in economic activity in regional industries make it difficult for infrastructure to efficiently and sustainably underpin long-term growth and development. Failure to keep pace with growth can reduce productivity and output during boom years, while underutilised assets raise costs in areas with declining populations, undermining the long-term social and economic viability of regional communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

18. Opportunity

Infrastructure can help to catalyse growth across northern Australia, and unlock development across a range of industries. Improving the resilience, reliability and efficiency of northern infrastructure could help to capitalise on the immense potential of northern regions, and improve the productivity, quality of life and competitiveness of its people and businesses.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

19. Opportunity

Development in northern regions could benefit from more detailed information and evidence-based studies of economic opportunities, as well as a better understanding of local needs and values, particularly of local Aboriginal and Torres Strait Islander peoples. Better information on opportunities and local needs can support more efficient investment and greater benefits for northern communities.

When this will impact: 0-5 | 5-10 | 10-15 | 15+

Where this will impact:

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