

Deloitte Access Economics

Development of State Infrastructure Strategy Scenarios

Infrastructure NSW

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Glossary

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CBD	Central Business District
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAE	Deloitte Access Economics
DFAT	Department of Foreign Affairs and Trade
ECL	East Coast Low
GDP	Gross Domestic Product
GSP	Gross State Product
ICT	Information and Communications Technology
ILO	International Labour Organisation
NIU	National Infrastructure Unit
NSW	New South Wales
OECD	Organisation for Economic Cooperation and Development
OEH	Office of Environment and Heritage
RBA	Reserve Bank of Australia
UK	United Kingdom
UN	United Nations

Executive Summary

DAE has been engaged by Infrastructure NSW to assist with developing a set of draft scenarios to inform the analysis underpinning the 2017 State Infrastructure Strategy. Development of the scenarios will be largely qualitative at this stage and will focus on developing clear descriptions and understanding the consequences of each scenario. The scenarios will focus on the period to 2036 and 2056. The engagement also aims to set out potential information sources for the scenarios to assist with further assessment.

Establishing scenarios early in the development of the next State Infrastructure Strategy will enable Infrastructure NSW to share these scenarios with agencies that are also commencing strategic planning. Scenario planning adds value to strategic plans. By moving beyond current assumptions and thinking about different futures, it provides the ability to consider trade-offs that may need to be made.

International Experience

As part of this project we have reviewed a number of Infrastructure plans and related documents from Australia and internationally. The review focused on whether scenarios were considered as part of the strategic planning documents and, if so, the nature of the scenarios considered. The review covered documents from the Commonwealth Government, Victoria, Canada, Hong Kong, Singapore, New Zealand, the United Kingdom, and the United States of America. Overall, the following drivers of scenarios were most frequently referenced in these documents:

- population growth and ageing;
- employment growth, industry change and work patterns;
- economic growth;
- climate change and the environment;
- demand management;
- congestion; and
- technology.

Megatrends, disruptions and outcomes

A scenario describes an “extreme” future situation that is brought about by the interaction of a number of megatrends and disruptive events operating within society, the economy, the environment and technology. The scenarios are “dramatic” paths which exaggerate the scale, time or impact of a megatrend, in order to assess the validity of the base case or identify “road signs”. The megatrends observed are persistent global factors that have significant consequences for society, the environment and the economy in the long term. There are also disruptive events, such as economic downturns, which are temporary, but exert significant influence on the future. For this report, the megatrends that we have identified are:

- population and demographics;
- climate change;
- global economy;

- technology change;
- urbanisation;
- global security; and
- individual and social preferences.

Megatrends and disruptions come together to create scenarios. Each scenario will create impacts that are of importance for society, the economy and policy makers. For the purposes of this report, the key impacts that we have identified are:

- economic growth;
- industry structure and job location;
- home location and type; and
- the role of government (with implications for the State budget).

Base Case

The base case represents a central scenario, where current trends continue along somewhat predictable paths. Some of the major, current documents which form the base case are:

- **Spatial Directions:** spatial directions for NSW are found in strategic land use plans prepared by the Greater Sydney Commission and the Department of Planning and Environment.
- **Population:** long-term population projections are developed by the Department of Planning and Environment. The most recent long term population forecasts were released in 2016.
- **Economic activity:** long-term economic forecasts are produced by the NSW Treasury as part of its Intergenerational Report. The most recent intergenerational report was released in 2016.
- **Employment:** long-term employment projections are produced by the Department of Industry. Forecasts were released in 2016.
- **Climate:** long-term climate projections for NSW have been prepared by the Office of Environment and Heritage (OEH 2016).
- **Technology:** there is no single document which sets out a detailed view, from the Government's perspective, of the extent and nature of future technology change. The best source is qualitative analysis in the NSW Treasury Intergenerational Report (2016).

Scenarios

Based on the megatrends, the scenarios developed upon which State Infrastructure Strategy options will be considered are as follows. It is important to note that these scenarios reflect large departures from the base case and are, extreme possibilities for the future, which exaggerate the scale, time or impact of a megatrend. Further, the events described in the scenarios are not necessarily discrete options – there are plausible future paths which combine elements across the scenarios.

- Asia ascendant:** **Asian economies in transition**

Stronger than expected economic growth in Asia leads to a transition to greater middle-income spending patterns from those countries, in line with dramatic population growth. NSW benefits from higher economic growth for its industries, but could be exposed to greater risks of a temporary downturn in Asian economies, due to Australia’s dependency on Asian demand for its exports.
- The new machine age:** **Accelerated technology change**

Accelerated technology change will make the digital economy an even larger player in how the NSW economy operates. It signifies a dramatic and rapid uptake in technology that is currently on the horizon. Technological advances will affect every facet of life from agricultural productivity, to improved quality of life with improved healthcare models and medical technology, transport and changes in access to education. Globally, there will be winners and losers – locations that are able to embrace and take up digital technology will benefit.
- A major disruptor:** **Climate and natural disasters**

There is a series of significant east coast lows, exacerbated by climate change, that affect coastal NSW leading to extensive flooding and damage to infrastructure in Sydney, Newcastle and the Illawarra. This event disrupts service provision and economic activity, and imposes major costs associated with response and recovery.
- A growing civil society:** **Keeping it in the community**

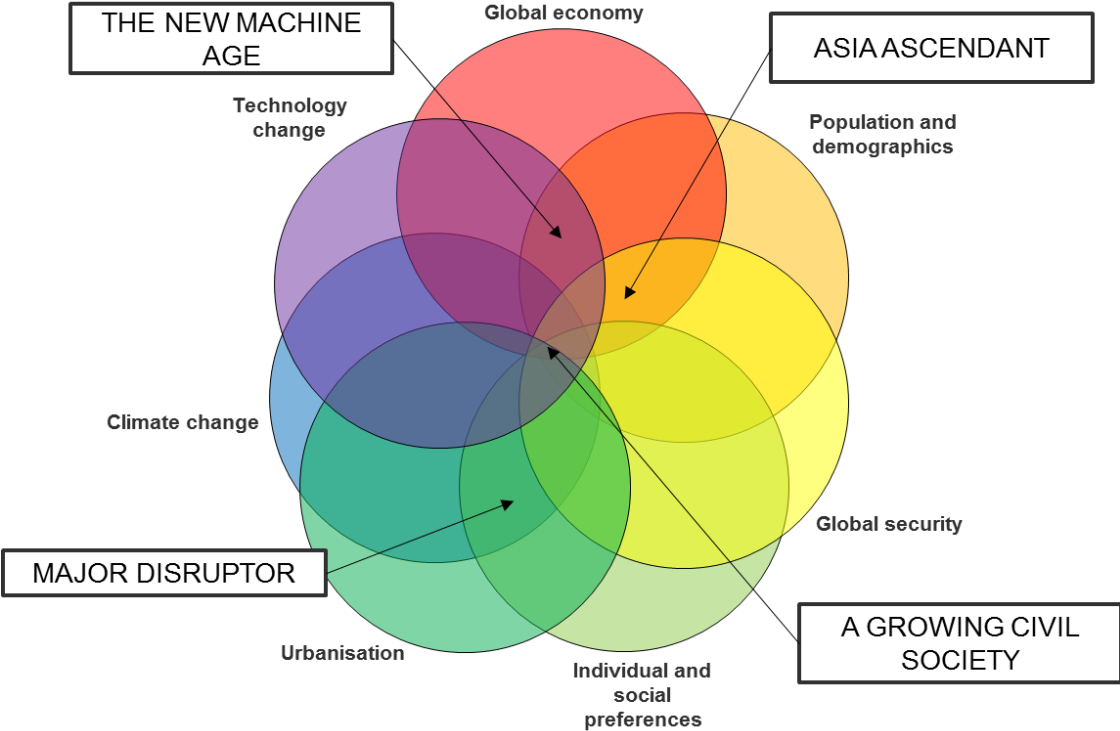
This scenario represents a dramatic industrial and social change, with a significant shift in social values and roles and implications for various systems, including justice and health. There is a change in community values facilitated by more services and goods being brought to the home, more flexible working arrangements and widespread adoption of teleworking. As a result, workers are no longer required to live close to their place of work and make housing choices based on lifestyle and liveability preferences.

Table i: Summary table

Megatrends and disruptions	Scenarios	Impacts
Population and demographics	Asia ascendant	Economic growth
Climate change	The new machine age	Industry structure and job location
Global economy	A major disruptor	Home location and type
Technology change	A growing civil society	Role of Government (and budget)
Urbanisation		
Global security		
Individual and social preferences		

A diagram showing the relationship between scenarios and megatrends is shown below

Figure i: Summary of scenarios and megatrends



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1 Background

DAE has been engaged by Infrastructure NSW to assist with developing a set of draft scenarios to inform the analysis underpinning the 2017 State Infrastructure Strategy. Development of the scenarios will be largely qualitative at this stage and will focus on developing clear descriptions and understanding the consequences of each scenario. The scenarios will focus on the periods leading up to 2036 and 2056. The engagement also aims to set out potential information sources for the scenarios to assist with further assessment. Establishing scenarios early in the development of the next State Infrastructure Strategy will enable Infrastructure NSW to share these scenarios with agencies that are also commencing strategic planning.

Scenario assessment will form part of an overall assessment framework for investment and policy options. The framework comprises:

- strategic alignment;
- triple bottom line assessment;
- scenario assessment; and
- risk assessment.

Options will be considered by sectors and then aligned to strategic land use Regional Plans and District Plans in a place-based manner.

1.1 Role and function of scenarios in strategic planning

Scenario analysis is a common tool used to inform policy makers and businesses when forming strategic plans. Scenarios are evidence-based narratives that consider distinct possible futures.

Generally, scenarios are generated by considering some combination of social, economic, environmental, and technological trends or disruptive events. The scenario is often accompanied by a consideration of associated strategies to meet the opportunities and challenges, and mitigate the risks they present within that scenario.

The development of scenario analysis typically involves the following high-level steps:

1. Identify:
 - a. global trends and disruptive events influencing relevant sector(s);
 - b. underlying drivers of the trends and technologies; and
 - c. the key common outcomes that will be impacted by the scenarios.
2. Underpinned by 1, develop scenarios that include plausible futures that have both favourable and non-favourable characteristics. The scenarios should be tailored to

current needs. For example, a private sector financial business is likely to consider different scenarios to a public sector safety organisation.

3. Assess proposed options under the different scenarios to ensure the robustness of each option for different potential futures, assess potential risks and identify mitigation strategies.
4. Evaluate the performance and resilience of the options to inform option selection and prioritisation.

1.2 Approach for this project

As part of this engagement, we held a workshop at Infrastructure NSW on Monday 29 August 2016. The goal of the workshop was to discuss potential scenarios and develop the details and implications of each scenario in greater detail. This workshop was underpinned by converting desktop research into comparable strategic plans. We also undertook a number of meetings with experts in understanding and developing scenarios to support strategic thinking.

In this report, the scenarios will essentially be qualitative descriptions. In future work, further qualitative analysis could be undertaken and potentially be augmented by quantitative modelling, forecasts and data from various sources. For example, quantitative information could be added on the location of population. This additional information would be useful in further guiding policy decision making.

The report is structured as follows:

- Section 2 contains some initial background research of other planning documents;
- Section 3 provides some background concepts on what a scenario is, the role of megatrends and the impacts that will be the focus of further analysis;
- Section 4 gives details of the Base Case from which the scenarios depart; and
- Section 5 presents details of each scenario.

Finally, Appendix A provides a compendium of potential data sources to be used in further analysis.

2 Experience in other jurisdictions

As part of this project we have reviewed a number of Infrastructure plans and related documents from Australia and internationally. The review focused on whether scenarios were considered as part of the strategic planning document and, if so, the nature of the scenarios considered.

The following sections set out the results of reviewing domestic planning documents, followed by international planning documents.

2.1 Domestic

The domestic planning documents reviewed included documents from Infrastructure Australia and Infrastructure Victoria.

Three documents from Infrastructure Australia were reviewed:

- **Australian Infrastructure Plan (February 2016)**

The purpose of the Australian Infrastructure Plan is to develop a plan that provides a vision and roadmap to address today's infrastructure gaps, and set Australia up to meet the challenges of tomorrow. The base case in terms of population is that, from 2011 to 2031, Australia's population is projected to increase by 8.2 million people. No alternate scenarios are considered as part of the Plan.
- **Australian Infrastructure Audit (April 2015)**

The Australian Infrastructure Audit is the first ever audit of the nation's infrastructure, that examines the current asset base and studies the drivers of future demand. The document also looks ahead to 2031. It examines the impact of increased infrastructure on households (social implications), with low, medium and high growth scenarios of user charges. There are also sustainability considerations with projections of temperatures based on low emission and high emission scenarios. The baseline population projection is built on Australian Bureau of Statistics (ABS) medium level projections to underpin the development of the plan, and the ABS high population growth projection is used to model a high population growth scenario.
- **Northern Australia Audit (January 2015)**

The audit report is Infrastructure Australia's approach to providing a detailed fact base regarding infrastructure that will guide government decisions for Northern Australia. A baseline population growth projection is developed via a continuation of current trends. They consider a scenario of aspirational (high) economic growth against industry opportunities via increased real value of Northern Australia's real agricultural output, more international visitor stopovers, and more energy exports over a specific period. The report also considers a medium economic growth scenario, with a northern population shift in Queensland and Western Australia, and a low population growth scenario with a lower than baseline population growth.

Two documents from Infrastructure Victoria were reviewed:

- **The Current and Future State of Victoria: a spatial perspective**

This report develops a holistic understanding of Victoria's strategic context with a focus on indicators and outcomes across three broad categories: social, economic and environmental.

A matrix of nine population and employment scenarios are generated which consider low, medium and high levels of population and employment growth across three distribution types: Consolidated distribution, business as usual (historic) distribution, and expansion distribution.

- **The Current and Future State of Victoria: a macro perspective**

This report covers both the current state and a selection of possible future states of Victoria's society, economy and environment, and discusses the drivers of infrastructure demand within each one.

It considers three scenarios; stronger population growth in Victoria focused on western Melbourne, technological advances which drive a more productive society, and stronger climate change mitigation activities.

Overall, the following drivers of scenarios were most frequently referenced in these documents:

- Population growth and ageing;
- Economic growth;
- Climate change;
- Demand management; and
- Technology.

2.2 International

We reviewed a range of international planning documents from nations of comparable economic development to Australia. The main reports reviewed are summarised below:

- **Infrastructure Canada – New Building Canada Fund (2014)**

The New Building Canada Plan aims to support infrastructure projects that foster economic growth, job creation and long-term prosperity. No scenarios were considered.

- **Ontario 10 year plan (2014)**

Ontario developed a 10 year Economic Plan to provide the tools for Ontario to become a 'global powerhouse'. No alternate scenarios considered.

- **London Infrastructure Plan 2050 (2015)**

This is the first ever attempt to identify, prioritise and cost London's future infrastructure. It considers how the city might deliver and fund future infrastructure investment, in order to support future growth. The report considers low, central and high population projections for population growth. No other scenarios considered.

- **UK National Infrastructure Plan (2014)**

The plan sets out an infrastructure vision for the next parliament and beyond, reinforcing the government's commitment to investing in infrastructure and improving its quality

and performance. In terms of scenario development, it considers low, central and high forecasts for the amount of congestion on the strategic road network from 2010 to 2040.

- **UK National Infrastructure Plan (2011)**

The plan provides a new strategy for meeting the infrastructure needs of the UK economy. It contains major commitments to invest in infrastructure projects and steps to attract major private sector investment. The sectors covered in the report are transport, energy, communications, environmental and intellectual capital. The report builds on the 2010 UK National Infrastructure Plan by providing a list of the top 40 national infrastructure projects. The report also considers practical matters such as areas for improvement in infrastructure decision making, the approach to funding and financing the investments and ensuring high performance in the delivery of projects. The main data presented in the report are current performance and cost indices. There are no scenarios explicitly considered in the report.

- **Hong Kong 2030 (2007)**

This document presents a long-term planning strategy to guide future development and provision of strategic infrastructure and to help implement government policy targets in a spatial form. The base case scenario involves the population continuing to grow at a slower rate, higher intake of skilled workers over the long term, steady rate of economic growth, employment increasing at 0.6-1.2 per cent, per annum, and higher worker participation rates in older/female age groups. Alternate scenarios considered include, low population growth with moderate economic growth (population less than base case) and a high population growth with high economic growth scenario (both higher than base case).

- **New Zealand National Infrastructure Plan (30 year plan) (2015)**

The Thirty Year New Zealand Infrastructure Plan 2015 provides a new approach to infrastructure management and planning to tackle the challenges of the next 30 years, along with supporting actions. It is intended to provide national direction to infrastructure development in New Zealand and confidence to the private sector.

The plan is underpinned by a number of scenarios developed as part of other New Zealand Government processes. In 2013 the New Zealand National Infrastructure Unit (NIU) developed a set of performance indicators to assess the current state of New Zealand infrastructure, and a set of scenarios to help understand future pressures on this infrastructure.

As part of creating these scenarios, the NIU first identified the major trends that will affect infrastructure in New Zealand over the next 20-30 years, and then held a series of workshops across New Zealand in June 2013 to discuss these trends and to propose scenarios the NIU should consider developing.

The main scenarios identified by NIU are:

- major disaster – including scenarios that affect all of New Zealand, and scenarios that affect only part but with a high level of national impact e.g. closing access routes through an area;
- climate change – sea levels rising, cost of carbon, and changed weather patterns leading to drought and floods;
- natural resources – oil prices becoming too expensive, new oil and gas finds;
- environment – continued degradation and economic impact;
- resource crunch – skills and labour;

- urban/rural changes – land use changes and land constraint; and
- societal changes – increased inequality, poverty.

- **Detroit Future City Plan (2012)**

The Plan involves a strategic framework that considers Detroit's future in the context of city systems, neighbourhood vision, the critical question of vacant land and buildings, and the need for greater civic capacity to address the change necessary for Detroit's success. The framework relies on three sets of 20 year scenarios for the city's employment. These scenarios looked at job growth rates of 1.5 per cent, 4 per cent and 20 per cent over the 20 years.

- **Singapore Urban Redevelopment Authority Masterplan (2014)**

The Singapore Urban Redevelopment Authority Masterplan is largely a planning document and does not consider future scenarios.

Overall, the following drivers of scenarios were most frequently referenced in these documents:

- Population growth and ageing;
- Employment growth, industry change and work patterns;
- Climate change and the environment;
- Congestion; and
- Technology.

Figure 2.1: Main themes in other jurisdictions

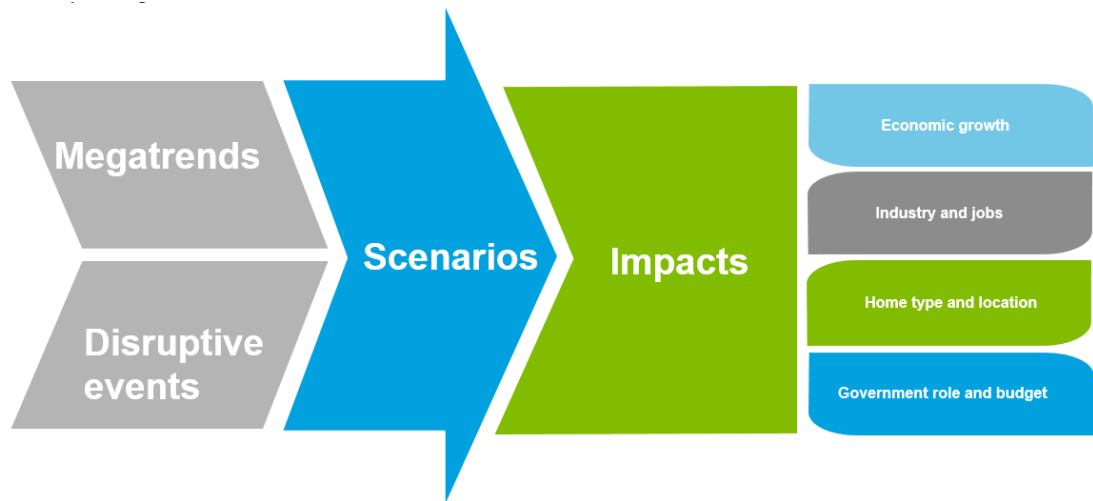


3 Thinking about scenarios

Within the context of this report, a scenario is considered to be a potential future situation that is brought about by the interaction of a number of megatrends and disruptive events operating within society, the economy, the environment and technology. Each scenario will present a plausible future situation that has features distinguishing it from other potential future situations and the current state of society, the economy, the environment and technology.

The unique features of each scenario will have impacts, resulting in outcomes (such as Gross State Product or population location) that have relevance for policy makers.

Figure 3.1: Relationship between megatrends, scenarios and impacts



This section of the report sets out a background on the megatrends that come together to create the scenarios and the resulting key impacts.

3.1 The role of megatrends and disruptions

The development of potential future scenarios requires considering global megatrends and disruptive events. These are the key drivers that bring about and shape the scenario.

Megatrends are observed, persistent global factors that have significant consequences for society, the environment and the economy in the long term. The Organisation for Economic Co-operation and Development (OECD) describes them as large-scale social, economic, political, environmental or technological changes that are slow to form but which, once in place, exercise a large and lasting influence on many human activities, processes and perceptions.

In addition, there are disruptive events which can take a number of forms, such as economic downturns or a natural disaster. These disruptive events are difficult to build into trends. However, disruptive scientific and technological changes are generally incorporated in forward-looking trends as they are unlikely to be one-off events. Consequently, the development of scenarios is built on an understanding of megatrends and disruptive drivers.

Together, megatrends and disruptive events have been analysed by organisations such as CSIRO (2012, 2016), the OECD (2016) and the World Economic Forum (2014). For the purposes of this project we have identified the following important megatrends and disruptive events as key drivers to underpin the scenarios:



- **Generational booms and echoes** **Population growth and change**

Some key facts:

- Sydney often takes in more than 30 per cent of Australia's overseas migrants (ABS 2014, 2016).
- NSW last saw positive net interstate migration in 1979 (id 2016, ABS 2015).
- By 2056, the life expectancy for males will be 88.6 years and for females it will be 91.4 years (Treasury 2016).

Changes in population and demographics are driven by changes in migration (both interstate and international), changes in longevity and fertility rates.

In general, for NSW, long-run population growth is around 1.12 per cent a year, this is around 0.3 per cent lower than the Australian average (ABS 2015). Lower growth rates in NSW reflect the fact that NSW is populous and well established and that NSW's high rate of international migration is offset by a high rate of interstate migration out of the state.

Considering migration first, population growth in NSW was below the national average for much of the last 10 years. However, changes in interstate migration patterns have reversed this trend in recent years with population growing rapidly in Sydney. While a growing urban population supports economic growth, it also creates increased congestion, housing demand and demand for social services. In contrast, many of NSW's regions have had a long-term trend of reducing population share due to migration from regional to urban areas.

Turning to ageing, the average age in NSW is forecast to increase over coming decades with a significant increase in both the number and share of people aged 70 and over (Treasury 2016). The ageing population is fundamentally driven by improvements in life expectancy combined with relatively low birth rates. The ageing population is initially made up of ageing baby-boomers but, by 2045-50 it is the ageing millennial generation that will be becoming prominent. On the other hand, forecasts suggest that the working age population will continue to grow.

Another important structural change will occur. Over the next 40 years, millennials (people born between 1982 and 2000) will make up the largest proportion of the population into the 2030s. As described in the NSW Intergenerational Report, this is partly an echo effect – they are the children of the baby boomers – also migration contributes to this growth too. So while we will need to plan for an ageing population, and a population living longer, the transition of the millennial population into the dominant and aged population will mean that government cannot dismiss the planning requirements for the broader population to support family formation, economic growth and social well-being.

An ageing population presents challenges and opportunities for NSW. In the long-term, there will be fewer people of traditional working age for every younger or older dependent, and this will lead to a reduced working age population share to support the broader population. As the population ages and workforce participation rate declines, the rate of economic growth naturally slows. Further, changes in the age distribution of the population creates a need for changes in the delivery of education and health services.

An ageing population also has implications for spending patterns. There will be increased spending on lifestyle and healthcare services. Longer lifespans will present financial and service delivery challenges, such as pressure on retirement savings, increased spending

on healthcare and the need for accessible transport options. Together, this will change the type and volume of services that are demanded in NSW and the structure of the labour force.

Additionally, the ageing population is likely to usher in significant change in demand for dwelling types, particularly for more appropriate and accessible housing. As a result, there is likely to be a change in the geography of population and demographics with this part of the population moving to areas that have their desired dwelling attributes.

On the whole, more people living longer will be an asset to NSW, providing skills, experience and knowledge which can be a rich resource for business and communities, if used properly. An ageing population will lead to more people retiring later in life, with an increase in gradual transitions from full-time to part-time employment, along with a change in roles and tasks.

In terms of its effect on infrastructure in NSW:

- Relatively high levels of population growth for NSW will necessitate above historical trend investment in the full range of infrastructure, to support the larger population.
- The ageing population is likely to require greater infrastructure spending in NSW on aged-care and health care facilities.
- Changes in the demographic composition in different parts of Sydney, regional cities and regional areas will require changes in the mix of infrastructure provided to those areas.

- **More uncertain climate**

Climate change

Some key facts:

- By 2030 maximum temperatures are projected to rise by 0.7°C.
- Severe Fire Weather is projected to increase across the State.
- By 2030 heatwaves are projected to occur more often (additional 1-1.5 heatwave events each year over most parts) and to last longer (up to 3.5 days more on average) (OEH 2016).

Changing climate systems are producing, on average, higher temperatures as well as resulting in more frequent extreme weather. In terms of temperature, urban areas are particularly affected due to the heat island effect. In addition, changing rainfall patterns, combined with higher temperatures and reduced soil moisture, affect water runoff and availability, and reduce water security in a number of areas.

Much of the state's irrigated agriculture is located in the south-west, where droughts and extensive floods illustrate the increasing variability of water supply and resulting impacts on investment decisions in sectors like agriculture. Reductions in winter rainfall and higher temperatures impact the viability of crops in some areas, resulting in reduced agricultural output, impacts on regional economies and population decline.

The long coastal strip is home to most of the state's population and too many high-value assets that are susceptible to storm surges, rise in sea levels and increased flooding.

Through the implementation of global initiatives such as COP21¹, there will be greater pressure to reduce carbon intensive activities in our economy and this will have significant implications for the way we will be supplying energy for housing, infrastructure and services. Technology is likely to have a transformative role to support the transition to a less carbon intensive economy. Already, some coal fired plants have closed or are scheduled to close with resulting implications for regional jobs. On the other hand, investment in renewable energy capacity (both large scale and decentralised systems) and energy efficiency is increasing, boosting jobs in these sectors.

Growing awareness of climate change impacts increases pressure on NSW businesses and the government to adapt to and mitigate against the effects of climate change for critical infrastructure and services, particularly on the coastal strip which is impacted by sea level rise and increased inundation (particularly in river estuaries). Additionally, climate change is projected to affect low-lying Asia Pacific communities which may drive migration to Australia and NSW in particular.

These changes in climate and resulting pressure on water resources and land use will come at a time where there is also greater demand (due to population growth and community expectations) for high quality water, food and liveability by our communities. Adaptation to and mitigation of the effects of climate change will therefore require efficient use of our State's natural resources and smarter design, which in turn will draw on science and technology to increasingly support the development of adaptation and mitigation solutions.

In terms of its effect on infrastructure in NSW:

- Greater variabilities in water supply will require investment in irrigation systems and dams.
- Greater fire and flood threats will require investment to enhance the resilience of infrastructure.
- Damage resulting from floods and fires will require investment in repairing infrastructure, with the possibility of building back better infrastructure.

¹ The Paris Agreement aims to see global emissions peak as soon as possible and reach net zero emissions in the second half of the century, as well as keeping the global temperature increase well below 2 degrees and to pursue efforts to limit it to 1.5 degrees. It is recognised by the International Energy Agency and others that current government initiatives in response to the Paris Agreement are insufficient to realise this objective, and will result in temperature increases of around 4 degrees. OECD/IEA 2016, *Energy Technology Perspectives 2016: Towards Sustainable Urban Energy Systems*.

- Global economic catch up**
Continued Asian development

Some key facts:

- In 1990, Asia's share in world GDP was 23.2 per cent, increasing to 38.8 per cent by 2014 (Deloitte 2015).
- By 2050, Asia's share of world GDP is expected to exceed 50 per cent (ADB 2011).
- Around 34 per cent of Australia's exports, by value, are to China (ILO 2016).

Australia's recent economic experience has been intimately linked with the economic development of emerging economies. The development of these economies created increased demand for inputs to industrial production (particularly iron and coal) which benefited mineral exports. This has particularly been driven by the fast paced economic development in east and south-east Asia. The composition of global economic output will continue to shift towards emerging economies such as Asia.

However, in recent times this demand has slowed down as China in particular, transitions from an industrial, commodities-based economy towards a consumer-driven economy. World commodity prices have fallen in the last couple of years due to increased supply of commodities from around the global economy. The slowdown in the Chinese economy continues to be a drag on Australia's economic growth.

There are other countries in Asia which, although they have been developing strongly, still have considerable potential for further economic development. Primary among these is India, but also countries like Indonesia and Vietnam, which have large populations, are achieving high rates of economic growth.

People in Asia will continue migrating from rural to urban areas with an accompanying improvement in income and living standards. This transition will look different for different countries. In countries with a young population, there will be an increase in demand for education, while countries with an ageing population will see an increase in demand for aged care services. Some currently developing countries will make a transition from industrial production to a more service focused economy. This will continue to affect the allocation of economic resources in Australia and affect the value of the Australian dollar.

The dynamics of the global economy will create pressure on NSW's industries, which must cope with fluctuations in input costs and international competitiveness. However, the global economy will also present opportunities for NSW's industries, as there will be greater opportunities to export services such as finance, education and healthcare. Particularly, the rise in the Asian middle class will demand the quality of education that NSW and Australia as a whole has to offer. Further, there will be the potential for growing tourism demand via world class cultural institutions, entertainment venues and natural attractions in NSW.

In terms of its effect on infrastructure in NSW:

- The continued increase in trade with emerging economies will likely require ongoing investment in NSW's ports.
- Increased demand for education and tourism in NSW, will mean greater requirements for transport and related infrastructure and services (airports, education facilities and hotels).

- Some industries that benefit strongly from trade will grow faster than others, this may require specific investment to support their growth (such as rail enhancements).

- **Digital disruption**

Ongoing technology change

Some key facts:

- The digital economy contributed \$79 billion to the Australian economy in 2013/14, representing 5.1 per cent of Australia's gross domestic product.
- 22 per cent of employees now work intensively with ICT.
- The digital economy could be worth \$139 billion by 2020 (7.3 per cent of GDP) (DAE 2015).

Technology change – including digital disruption – will be a fundamental driver of change in the NSW economy. New technologies can present significant disruption to well-established businesses and industries, including government. Technology change can also influence patterns of employment, the way communities form, relationships between countries and the role and functions of governments.

Over the coming decades, digital change is likely to manifest itself in two broad trends. First, the transfer of data and information between people, businesses and objects will increase as the network of sensors capturing data grows and the capacity of communications and storage increases. Second, emerging tools for analysing large amounts of data will fundamentally change industrial and social processes. This will see a shift towards data-driven decision making. These outcomes will improve efficiency-enhanced value creation.

Technology will disrupt the provision and the provider of services. Already, drones, electric vehicles, ridesharing, blockchain, energy storage and distribution, medtech and fintech are examples that will have a profound impact on the way government and businesses are providing services to consumers. Overall, technology will allow for more efficient use of existing capital to help deliver services when and where they are needed. The rise of peer-to-peer marketplaces and platform economics in a globalised labour market underpinned by entrepreneurial activity will drive new business models, industries and government systems.

Technology also has the capacity to break through barriers for capital and labour by allowing the free movement of labour and capital, largely through virtual outsourcing.

Advances in medical technology will increase the quality and span of life, which will in turn affect the economy as people live longer and therefore work and engage in the economy for longer.

Digital disruption has the ability to reduce the need for physical travel for commuters, freight and the delivery of services.

Improvements in technology will make it increasingly possible to avoid the challenges of life in a dense urban area by decoupling work and home locations. This will be accompanied by changes in employment patterns as some jobs are lost to automation (driven by robotics and algorithms) while other or new jobs may be created.

These changes in the workplace are likely to be associated with changes the structure of our work. This could result in an increasing role for freelance employment, working from

home or shared workplaces and holding multiple jobs with multiple employers on a part-time basis (portfolio careers).

Developments in technology and digital disruption are likely to have just as large an effect on Government as on the private sector. Traditional sources of Government revenue will be eroded while new sources may grow (Uber is a current example of this). Digital disruption will require new laws and regulations to protect consumers and ensure the benefits of robust competition are achieved. There will also be large-scale changes to the way that Government services are delivered with some services transitioning to digital delivery – possibly at lower cost – and the creation of new services – such as the introduction of new health treatments or technology.

Accordingly, technology has the capacity to drive productivity improvements and so investment in appropriate digital infrastructure and skills will be necessary to support the economy of NSW.

In terms of its effect on infrastructure in NSW:

- Technology change must fundamentally be supported by ongoing investment in communications infrastructure supported by investment in data centres and other facilities.
- Changing patterns of travel, employment and industry structures may mean less or altered investment in areas such as transport or energy.
- Widespread changes in the way that government services (such as health and education) are delivered will lead to changes in the nature and role of government which will have flow on effects for the type of infrastructure required to deliver these services.

- **A Metropolitan world**

Urbanisation

Some key facts:

- Urban dwellers are now over 50 per cent of the world's population (UN 2014).
- By 2050, around 66 per cent of the world's population is expected to live in cities (UN 2014).
- In 2015, China consumed around 500 kg of steel per capita while India and Brazil both consumed less than 200 kilograms per capita (Ernst and Young 2015).

Urbanisation has been one of the major driving forces of the world economy and society over the past three decades. In this time, an additional 10 per cent of the world's population have moved from regional to urban areas with the world urban population now standing at over 50 per cent.

Urbanisation has profound effects on the economy and society. In areas where urbanisation is increasing there is a need for widespread investment in infrastructure to support more housing and a greater population. Urbanisation also, generally, results in improvements in standards of living, productivity and a shift in working patterns from more agricultural work to industrial or service sector roles.

These changes then have flow on effects to other parts of the world economy. For example, much of the mining boom in Australia was in iron ore and coal – two key ingredients in the production of steel. Urbanisation requires large volumes of steel to

construct housing, roads, appliances, vehicles and the like. In this way, even geographically remote urbanisation has had an effect on Australia and NSW.

On the negative side, the rapid pace of industrialisation and urbanisation around the globe can lead to negative consequences – such as congestion, reduced air quality, reduced water quality and availability and social disruption.

Urbanisation is likely to continue to play a strong role in the future with the UN projecting that, by 2050, around 66 per cent of the developing world and 86 per cent of the developed world will be urbanised – giving a total urban population of around 66 per cent of world population.

Considering how this ongoing megatrend will affect Australia and NSW, Australia is already one of the most urbanised countries in the world. Approximately 60 per cent of the population reside in capital cities with around 40 per cent of those living in just Sydney and Melbourne. Overall, Australia's urbanisation rate is around 90 per cent. This can be compared to the United States and United Kingdom where urbanisation is at around 80 per cent. As such, Australia will likely experience lower levels of growth in urbanisation than other nations, although Sydney is projected to continue to grow faster in population than regional NSW (DPE 2016).

Australia and NSW's position as a highly urbanised society may allow for Sydney to act as a leader in urban policy and ensuring that we maximise the best of urban living while minimising the downsides. Further, Sydney may be a leader in Australia in a transition towards a megacity comprising Newcastle, Sydney and Wollongong.

Further, continued urbanisation in Asia is likely to support ongoing strength in demand for Australian mining exports.

In terms of its effect on infrastructure in NSW:

- Continued urbanisation in Asia will generate demand for mining exports which will result in the need for improved ports, roads and transport to facilitate this trade.
- Ongoing urbanisation in NSW will require investment in the necessary supporting infrastructure but this is likely to continue roughly along the same trend as previously experienced.
- NSW may be able to take advantage of high levels of urbanisation to make world leading decisions in infrastructure investment in dense urban areas.

- **Global security**

Some key facts:

- Around 65 million people are currently displaced from their normal country of residence (UNHCR 2016).
- Conservative estimates indicate that approximately 180,000 people were killed in 42 armed conflicts around the world in 2015 (IISS, 2015).
- An estimated one million Australians were victims of online identity fraud in 2014 and cybercrime may be costing the economy as much as \$17 billion annually (Lowy Institute, 2016).

Global peace and security is an ever-present concern but there are a number of issues that have been developing over the past decade, which indicate that changes in global peace and security may be playing a larger role in NSW than previously.

For example, global awareness of extremism has been increasing over the past decade (mostly in the Middle East), there is increasing tension in the South China Sea and, as developing countries continue to urbanise, the number of individuals living in urban areas with low levels of peace will grow significantly. In addition, the unprecedented movement of large numbers of refugees and sectarianism has led to a rethinking of geopolitical priorities and security measures (World Economic Forum, 2016a).

According to the World Economic Forum (2016b), the risk rated most likely to occur among 750 experts and decision-makers was large-scale involuntary migration. The risks with the greatest potential impacts included the failure of climate change mitigation and adaptation, and weapons of mass destruction (World Economic Forum, 2016b).

In terms of technology, the age of digitisation has been associated with the arrival of the empowered citizen (World Economic Forum, 2016b). The use of technology including social media empowers people to find information, connect more quickly and organise with other like-minded individuals around common issues. This in turn has made it more difficult for governments to maintain trust with a more informed, connected and demanding people (World Economic Forum, 2016b).

This digital age has also brought a different avenue of security threats through cyber space. Approximately 90 per cent of Australians are now online, including 84 per cent of small and medium businesses (Lowy Institute, 2016). For example, the danger of losing intellectual property and state secrets in cyber-attacks represents a significant problem for Australia's competitive position and its capacity to defend itself (Lowy Institute, 2016). The Federal Government's cyber security strategy to maintain cyber safety is aimed at broadening opportunities presented by the connected world and making Australia a preferred place to do business (Commonwealth of Australia, 2016).

Therefore, collaboration across countries, areas of expertise and stakeholder groups is necessary to effectively address global risks (World Economic Forum, 2016b). Governments will be required to consider various options to address the evolving global security threats.

In terms of its effect on infrastructure in NSW:

- Enhancing the resilience of infrastructure to intentional attacks will likely grow in importance.
- De-centralisation of critical infrastructure and building in redundancy to critical infrastructure systems will be increasingly important.

- On the cyber space front, the NSW government will need to be vigilant with digital infrastructure and ensuring that potential infrastructure connected via the internet of things are protected from attacks.

- **Individual and social preferences**

Some key facts:

- Over the last decade the majority of Sydney's housing development has been in 'inner' suburbs (id 2014).
- Outward commuting is the fastest growing commute type in Sydney (BITRE 2015).
- Currently, around 20 per cent of consumers are willing to pay a 10 per cent premium for personalised services (Deloitte University Press 2015).

Recent years have seen large and somewhat unexpected changes in individual's preferences for home, work and travel. Construction in infill areas in Sydney has far surpassed expectations; and there has been stagnating car use per capita in most developed countries and an increase in active and public transport use. In addition, the oft-prophesied telecommuting revolution has failed to materialise with a seeming preference for close collaboration and maintaining physical networks of industry contacts.

Although difficult to measure quantitatively, there seems to have been an ongoing shift towards a stronger preference for safety and security. Some of this is a natural result of economic development – as wealth increases so does the safety of the vehicles we use – while some seems to be a consequence of changing social preferences. The latter can be seen in outcomes such as the NSW prison population growing by 18 per cent between 2011 and 2015, largely due to increased levels of sentencing rather than increased levels of criminal activity. Perceptions of safety and security lead to changes in levels of incarceration, which in turn, affect expenditure in the justice system and surveillance technology.

In the coming decades, the NSW population will be wealthier on average, with demand for higher quality goods and higher quality services, including more personalised services. People are generally health conscious – thus placing a premium on healthy diets and food products that have been produced in sustainable ways. Other lifestyle choices such as exercise and work-life balance are also a priority for individuals, in order to support well-being and longevity.

The emergence of the sharing economy globally and in Australia has marked a significant change in individual and social preferences. It has been most prevalent in the areas of accommodation, transport and personal services, such as Airbnb, Uber and Airtasker. The sharing economy is enabling a reduction in costs and easier access to these services as people become more connected to each other.

These changes in preferences, when combined with technology change will increasingly drive a desire for highly adaptive and personalised services. This will present challenges for services that are delivered by Government to a large population, such as health, education and transport. This will drive greater emphasis on improving the quality and delivery mechanism of the service, thus improving user or customer experience.

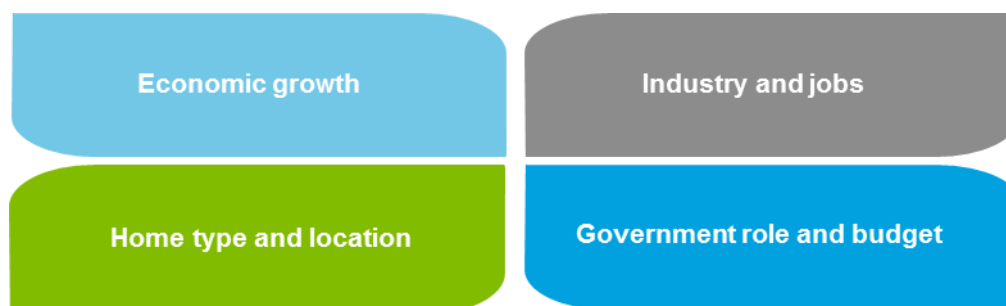
Together this means that infrastructure provision to support services should recognise the trend of increased personalisation of customer and user experiences. Technology will allow customers to continually seek alternative services to satisfy personal needs, with the market driving this process. As a result of people having a greater say in service provision, there will be an increasing need for dynamic responses from service providers, including government.

In terms of its effect on infrastructure in NSW:

- There will be direct effects in demand for the type, location and nature of large infrastructure investments such as roads and public transport.
- There will also likely be changes in areas such as housing, education, health and justice, which will have flow on effects for the infrastructure used to provide these services.
- The quality of infrastructure and services provided will also be required to be of a high standard, including more personalised services, such as more flexible schooling that caters to the needs of different types of families.

3.2 Impacts of scenarios

In the future, the megatrends discussed above may come together in different configurations to create specific circumstances. These circumstances will affect outcomes that are of importance for society, the economy and policy makers. For the purposes of this report, the key outcomes that we have identified are:



- Economic growth:** Economic growth refers to the year on year change in economic activity. Since the early 1990s, Australia has experienced an unprecedented period of sustained economic growth but there is no reason to believe that this will continue indefinitely. The level of economic growth is fundamentally related to the underlying factors of population, participation and productivity. Each of these factors can be affected by the megatrends. For example, climate change can affect the level of migration and so influence population while also altering the amount of water available for agriculture, affecting productivity.
- Industry structure and job location:** Industry structure refers to the size and mix of industries present in an economy. Industry structure affects the standard of living by influencing the types of jobs that are available (and hence wages) as well as affecting what natural resources are used and how goods move within and between economies. Megatrends and disruptive events affect industry structure by promoting or hampering the growth of certain industries. For example, economic growth in Asia has spurred growth in mining and, to a lesser extent, agriculture, education and tourism in Australia, while simultaneously creating a high Australian dollar for a period of time that has hampered manufacturing.

Job location refers to where industries tend to locate themselves within a region and hence, where employment opportunities exist. In general, industries tend to locate near competitors, supply chains and transport networks. These locational decisions can be affected by megatrends and disruptive events. For example, new digital technology could reduce (or boost) the importance of being located close to population centres and hence, affect the locational decision of a particular business – over time this may affect locational decisions of entire industries. There is also a dynamic tension between businesses locating themselves close to workers and workers moving to locations where businesses are located. For larger metropolitan areas, it is generally perceived that there should be a diverse mix of employment opportunities available for individuals regardless of where they choose to live. Other megatrends and disruptive events can also affect the location and type of jobs available. For example, climate change may affect the location or nature of some agricultural work in the long run.

- **Home location and type:** home location and type refers to the geographic location of housing available as well as the range of housing options that are available. A frequent goal for large metropolitan areas is to have available a range of housing options to different groups – such as various sizes of units, townhouses and stand-alone houses with a range of amenities available. Megatrends and disruptive events can affect home location and type as, for example, an ageing population may require greater access to assisted living housing while climate change could create demand for new building standards and technologies to make our housing more efficient in order to adapt to climate change.
- **Government role and budget:** Government budget refers to both the levels of income and expenditure of Governments as well as the balance of the two. Government budgets are an important outcome as, for example, periods of lower income may restrict the choices available to Government both in terms of capital and operating expenditure. Times of budget deficit also create restrictions for future expenditure and taxation that can extend over decades.

Disruptive innovation will create an environment where the market may provide both infrastructure/assets and services that could compete with Government public service and asset provision. We may not be able to predict what specifically will happen as a result of disruptive innovation, but we can provide for policy and frameworks that don't preclude options for Government to seek alternative mechanisms for more than just infrastructure.

An example of how megatrends can affect Government budgets is that market-led business models that give rise to disruptive service provision could shift the extent to which the government is building and operating infrastructure. This could range from the delivery of differing services, potentially offered by third parties such as non-governmental organisations, towards more recurrent spending to pay for services, which could also be delivered as public services by third parties.

4 Base Case

The base case represents a central scenario, where current trends continue along somewhat predictable projected paths. The base case for long-term planning by NSW Government is not one single document but is, rather, a series of forecasts and assumptions spread across a number of documents, Departments and clusters. Some of the major, current documents which form the base case are summarised below:

- **Spatial Directions:** spatial directions for NSW are found in strategic land use plans prepared by the Department of Planning and Environment.

The most recent strategic planning for the metropolitan area is being driven by the Greater Sydney Commission's District Plans and the update to 'A Plan for Growing Sydney' (2014), both to be completed over 2017. The strategic planning involves a city with three CBDs, with Sydney CBD remaining as Australia's premier commercial market and its continued expansion to compete on the world stage as the Australian hub for global trade and commerce. Greater Parramatta is developing as Sydney's second CBD underpinned by administration activities and a super health and education precinct. Badgerys Creek Airport will emerge as a third CBD by 2056 with this city driven by advanced logistics, defence, robotics, tourism and hospitality, security, food processing and supply chain activities. This area links with Penrith, Liverpool, Campbelltown – Macarthur and Leppington.

For regional areas, a number of Regional Plans are under development and will be published over 2016-17. These Plans set regional planning priorities and provide a framework that will guide the preparation of detailed land use plans, determination of development proposals and inform infrastructure funding decisions. Newcastle and Wollongong have been identified as regional "metropolitan cities". High growth regional cities have been identified as focuses for investment. These cities include Albury, Armidale, Bathurst, Coffs Harbour, Dubbo, Gosford, Griffith, Orange, Port Macquarie, Tamworth, Tweed Heads and Wagga Wagga. Additional detail on some of these areas includes:

- The Hunter is the largest regional economy in the State and is already home to around 430,000 people. Over the next 40 to 50 years, the population of Newcastle and its hinterland is expected to grow to around 750,000.
- The Central Coast region is at the centre of the State's fastest growing corridor from the northern edge of Sydney to Newcastle. The projected population along this corridor is estimated to be 1.1 million by 2036.
- In the North Coast region, around 67 per cent of the growth for the region is projected to occur in Tweed, Coffs Harbour and Port Macquarie–Hastings.
- In the Central West region, Bathurst and Orange local government areas are growing strongly, and Dubbo is the Orana region's regional city.
- In the Illawarra region, the urban areas of Wollongong and Shellharbour form a contiguous community that is likely to be home to around half a million people by 2050.
- In the South East region, over half of the projected demand for new housing is expected to occur within commuting distance of Canberra, requiring close collaboration with the ACT.

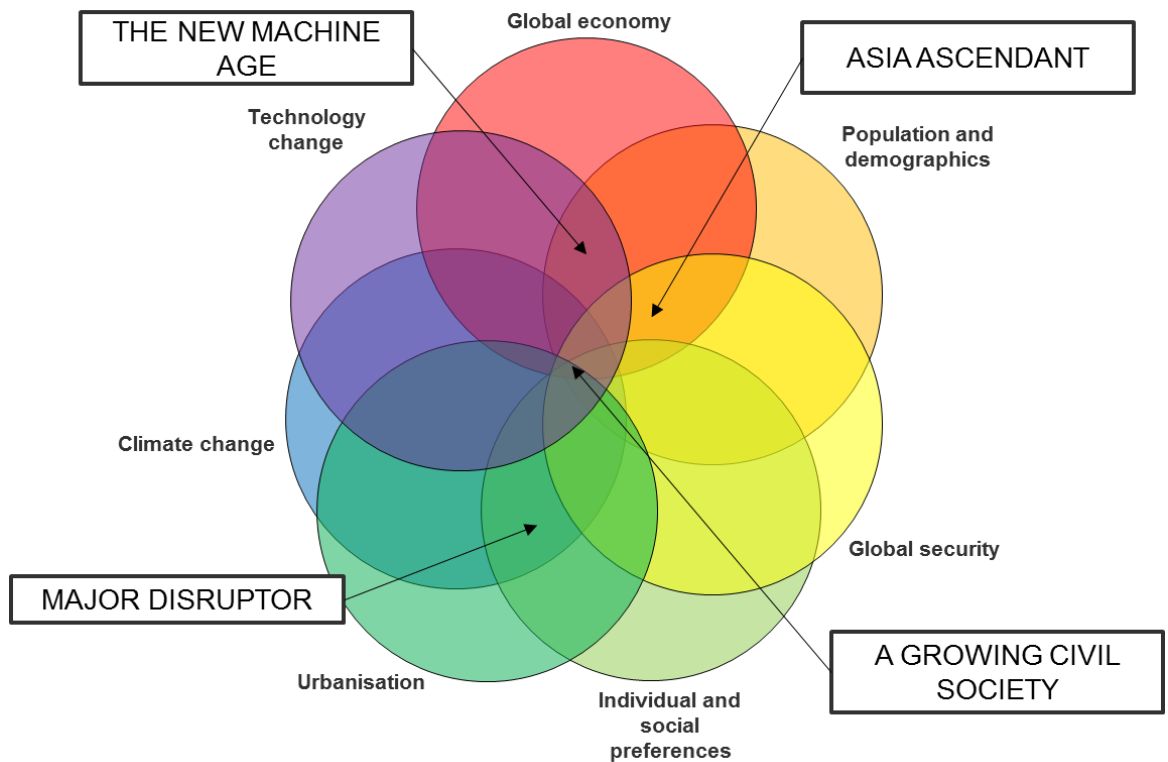
- **Population:** Long-term population projections are developed by the Department of Planning and Environment. The most recent long-term population forecasts were released in 2016 and contain population and housing projections for small statistical areas at 5 year intervals to 2036. The Department has released the base case figures and scenarios based on faster or slower population growth. Some of the important parts of the projections are:
 - Total NSW population is expected to grow by around 37 per cent between 2011 and 2036 to nearly 10 million people;
 - Areas of high growth tend to be in Western Sydney (2.3 per cent per annum) and South-west District (1.9 per cent per annum) area;
 - Many regional areas are expected to experience slower population growth (1.1 per cent per annum on average across regions), particularly far West, which is expected to experience negative growth (-0.4 per cent); and
 - Housing is expected to grow faster than population, indicating a continued decrease in average household size from 2.58 to 2.49.
- **Economic activity:** long-term economic forecasts are produced by the NSW Treasury as part of its Intergenerational Report. The most recent intergenerational report was released in 2016 and contains projections to 2056. Key findings of the report are that:
 - Average age is expected to increase from 37 to 41 over the period to 2056;
 - Real per capita Gross State Product (GSP) growth will average 1.3 per cent a year, entirely due to productivity improvements (assumed to grow at 1.5 per cent a year);
 - GSP will reach around \$1.3 trillion by 2056 (Australian Gross Domestic Product is currently around \$1.6 trillion a year);
 - Labour force participation will decline by 0.20 per cent per annum on an hours worked basis; and
 - The fiscal gap (the difference between NSW Government revenue and expenditure) will reach 3.4 per cent of GSP by 2056.
- **Employment:** currently, long-term employment projections are produced by the Bureau of Transport Statistics within Transport for NSW – although this role is shifting to the Department of Industry and new employment forecasts are currently being developed. The latest release of this data is from 2016 and covers 5 year intervals to 2051. Some of the major findings of the report are that:
 - The shares of employment within Sydney’s metropolitan regions are likely to remain fairly stable over the forecast period but with an overall increase in the level of employment of around 30 per cent;
 - Areas which are expected to grow more quickly than average are mostly located within Western Sydney; and
 - Areas with expected low rates of employment growth are mostly located in the coast (except Hunter and Illawarra regions) and the Far West.
- **Climate:** high resolution (10km grid) regional climate projections for NSW have been developed by the Office of Environment and Heritage. These provide climate projections for 2030 (2020-2039) and 2070 (2060-2079) and include analysis of variables such as temperature, rainfall, bushfire weather, extreme weather events and biophysical changes. Some key findings are that:

- By 2030, maximum temperatures are projected to rise by 0.7°C and continue to rise by 2.1°C by 2070, with the greatest increases in the north-west of the state in summer;
 - Autumn rainfall is projected to increase across the entire State, whereas a decrease in winter and spring rainfall is projected for the southern parts of NSW;
 - Severe Fire Weather is projected to increase across the State;
 - By 2030, NSW is projected to experience an average of 9 more days above 35°C per year and continue to rise to 26 more days per year by 2070;
 - By 2030, NSW is projected to experience an average of 6 fewer nights below 2°C per year and continue to decrease to 17 fewer nights per year by 2070;
 - By 2030, heatwaves are projected to occur more often (additional 1-1.5 heatwave events each year over most parts) and to last longer (up to 3.5 days more on average);
 - By 2070, heatwaves are projected to be hotter, occur more often (2.5-4.5 more events per year) and last longer (2-11 days longer on average);
 - By 2030, change in land use has the potential to double the temperature increases caused by climate change in urban environments, with temperatures projected to be 0.5°C – 0.9°C warmer;
 - East Coast Lows (ECLs) are projected to shift in frequency and intensity, with potentially less small to moderate ECLs, but an increase in extreme ECLs in the warmer months; and
 - Increases in rainfall intensity will lead to increased impacts on soil erosion, while changes in seasonality will lead to increases in recharge and run-off. In some areas and seasons, rising temperatures and reduced soil moisture are expected to reduce run-off and water availability.
- **Technology:** Technology change is somewhat different from other aspects of the base case, as there is no single document which sets out a detailed view from the Government's perspective of the extent and nature of future technology change. There are a number of important documents relating to technology change (such as the NSW Government ICT Strategy) but the best source is qualitative analysis found in the NSW Treasury Intergenerational Report. While technology change is assumed to support productivity growth at 1.5 per cent per year, some of the ways in which the Intergenerational Report sees technology affecting Government, society and the economy are:
 - Technology and the growing 'virtualisation' of the workforce could be an enabler of the regions, enhancing their connectivity;
 - There will likely be growth in jobs related to engineering, artificial intelligence, robotics, nanotechnology, 3D printing, genetics and biotechnology with the potential for declines in other industries;
 - New technologies will be implemented in the health sector leading to higher spending, increased life expectancy and increases in the average childbearing age;
 - Technology and data will be big factors in more effective, customer-centric Government services;

- Technology will dramatically change the way students learn in the future, increasing both access to education and its quality; and
- Spending on information technology infrastructure will continue to be an important focus for Government investment.

5 Scenarios

The megatrends and disruptors described above come together to create scenarios. The scenarios are dramatic paths which aggregate one or more megatrends. The events described in the scenarios are not necessarily discrete options – there are plausible future paths which combine elements across the scenarios. The diagram below shows how the megatrends come together to create the scenarios.



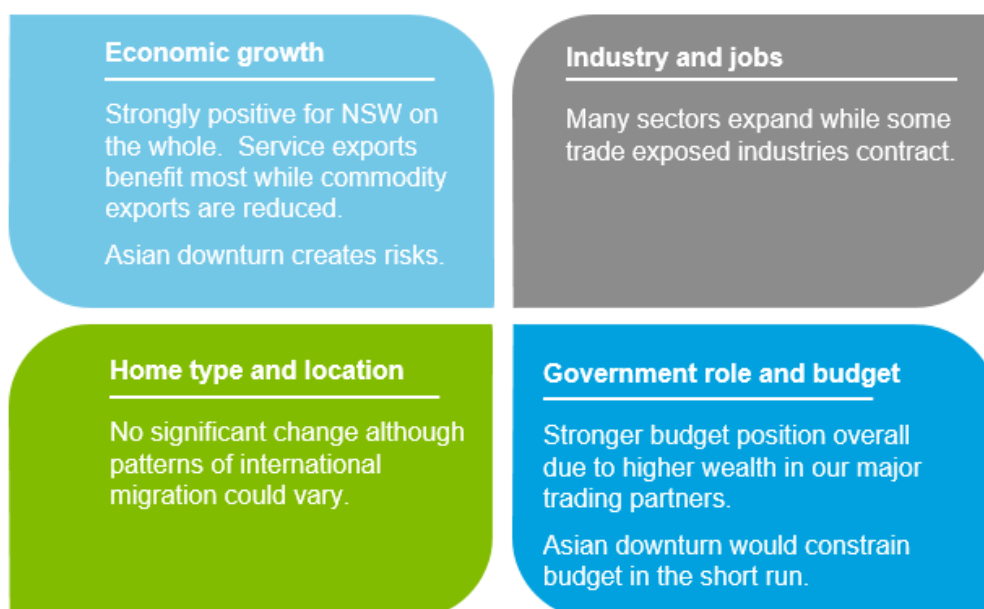
When considering the scenarios it is also important to keep in mind that each scenario has positive and negative aspects. For example, the new machine age will boost productivity but will also displace some workers; Asia ascendant will see longer-term economic growth for NSW but with a risk of downturns along the way; A major disruptor will have widespread negative effects on people and property in the short run but may help develop a more resilient society and set of infrastructure in the longer run, while a growing civil society will see the development of stronger social and community bonds, but at the cost of significant changes to our existing approaches to providing many important services such as education, health and justice.

5.1 Asia ascendant

The role of emerging economies

Stronger than expected growth in Asia leads to a transition to greater middle-income spending patterns from those countries. NSW benefits from higher economic growth for its industries but could be exposed to greater risks of a temporary downturn in Asian economies.

Impacts



Description

The Asian economies are undergoing a significant transition with the major player, China, planning to move from an investment-led economy towards a consumer driven one. Asia is experiencing rapid growth rates as global economic output continues to shift more towards Asia.

As incomes rise in Asia, the longer-term trend is that people will transition out of rural settings and move to urban areas where the major change will be people moving into the middle-income range. In this scenario, the transition will occur faster than in the base case, due to higher levels of growth. The accelerated rise of middle-income earners will create greater demand from consumers in these new and developing cities.

The interconnectedness of the Australian economy with Asia means that, as Asia experiences high economic growth, the NSW economy is also likely to experience strong positive economic growth. Strong demand for Australian exports may mean that the value of the

Australian dollar remains high by historic standards, and if so, there will be pressure on NSW industries to maintain international competitiveness.

The increased demand for Australia's education exports by the middle-income group in Asia is likely to see more students travelling to study in Australia. Industries in NSW, including education and tourism are likely to be positively impacted as a result of greater numbers of students, and the quality of these services offered by NSW. There may be growth in some unexpected areas, for example, an increased middle-income population in China combined with ageing of the population may result in demand for health technology developed in Australia.

The overall effect on migration from Asia to Australia is unclear, a longer-term period of strong economic growth in Asia might mean lower migration of skilled individuals to Australia, with more opportunities at home. Alternatively, there may be an increasing cosmopolitanism of high skilled workers within Asia, including Australia.

Accelerated economic development in Asia is likely to increase greenhouse gas emissions in the short term. In the very long run, as Asian economies transition out of industrialisation and into post-industrial activities, their emissions intensity may decline.

This period of stronger growth is also likely to lead to a greater feeling of domestic and international security in Asian countries and significant gains in the rule of law. As a result, greater security is likely to attract many individuals and businesses to Asia and increase investment inflows from around the world.

However, it is not inconceivable that a downturn shock could occur in the Asian region around this long-term trend of accelerated development. If this were to occur, then Australia would also experience lower economic growth for a period of time, but would likely perform better than other Asian countries. In turn, the NSW economy would experience lower economic growth. It is unclear how an Asian economic downturn would affect overseas migration patterns, however, NSW would be particularly exposed to fluctuations in overseas migration patterns as it has typically experienced strong migration from Asian countries.

A severe economic downturn in Australia's major trading and financial partners in the region such as China would have implications for trade and foreign direct investment. It would be expected that Asia will experience an eventual recovery. However, in the time of the downturn, trade is likely to reduce with key Asian markets lowering their demand for Australian exports. As a result, trade-heavy NSW industries are likely to be negatively impacted, with potential effects on their structure and locations.

A downturn in the Asian region may present a period of heightened safety and security concerns by those within the region and those outside. This scenario might trigger increased demand for migration from Asia to 'safer' countries such as Australia, along with greater investment diverted to Australia. Again, NSW has typically been seen as a prime destination for overseas migrants, and will be likely to experience greater population growth from overseas migration.

Role of megatrends

- Population and demographics: Longer-term growth in Asian economies with rise in middle-income population, might affect migration patterns into Australia from overseas. However, the overall impact on migration is unclear. A disruptive downturn in Asia could mean a temporary increase in demand for migration to Australia from countries in the region, if Australia is less impacted than the rest of Asia. There is also potential for increased interstate migration to NSW away from States with more affected resource industries.
- Climate change: A faster middle income transition in Asia has the potential to result in higher greenhouse emissions, making it harder to achieve global emission reduction objectives.
- Global economy: Rise in middle income population means stronger economic activity in Asia, thus a slightly stronger scenario from the base case. A disruptive economic downturn in Australia's major trading and financial partners in the region, including China, could create a short-term shock that will diminish over time, but it could last around 5+ years.
- Technology change: No difference from base case.
- Individual and social preferences: No difference from base case.
- Global security: The rise in the middle-income population and associated development will lead to a feeling of greater security in Asia and less concern about security around the globe. During a temporary downturn, this long-run trend could be temporarily reversed.



Impacts

The longer-term economic growth in Asia driven by the growth in the middle-income population will mean strong growth in Australia as well. The NSW economy is likely to be buoyed by this growth with the increased demand for our services. In particular, the rise of the Asian middle-income group is likely to attract more demand for Australia's higher education, meaning more students coming to Australia. The quality of education and tourism services in NSW is likely to attract many of these students.

The Asian middle-income transition will lead to more competition in certain industries, especially professional services. This could lead to changes in the growth of these industries, and where they locate themselves. For example, the employment level in regional areas is likely to be slightly stronger than the base case, as demand for regional exports increases and industries in regional areas of NSW prosper. Changes in job location and type are likely to be minor in line with industry structure and location. The type of housing and locations are likely to be unchanged. Lastly, a stronger economic performance is likely to mean an increased income for the government, but expenditure is unclear.

A short-term downturn in Asia is likely to mean much lower economic growth for Australia. As a result, NSW would likely enter a recession, along with the rest of the Australian economy. There will be negative implications for industry exposed to Asia, particularly the resources and commodities sectors. It is likely that while NSW will be impacted, it will not be to the extent of those industries operating in trade heavy states such as Western Australia.

A decrease in Asian demand for Australia's key exports will mean less revenue for these industries, and a scaling back, or closure of many businesses. As a result, certain industries will re-locate to different areas, depending on the relative success of the new locations. As industry structures change, there could be an increase in businesses setting up in NSW.

Jobs will be impacted in a similar way with employment moving away from certain industries located in regions with a high level of exposure to trade. As a result, NSW may experience higher inflows of interstate migration from people seeking different types of employment.

Home location and type is unlikely to be different to the base case, under the scenario of a downturn in Asia. People are likely to continue living in the same type of housing, and will continue to seek living in metropolitan areas for greater access to work etc.

A short-term downturn in Asia and a resulting downturn in economic activity in Australia may mean that NSW Government receipts are temporarily reduced. Choices available to the NSW government both in terms of capital and operating expenditure will be restricted for some time.

Information sources relevant for this scenario

- OECD Economic Outlook: Statistics and Projections
- ABS Catalogue No. 5206.0
- Commonwealth Treasury 2015 Intergenerational Report: Australia in 2055
- ABS Catalogue No. 5368.0
- DFAT Trade Statistics
- ABS Catalogue No. 6291.0.55.003
- RBA Exchange Rates
- ABS Catalogue No. 3412.0

Key assumptions that will be required:

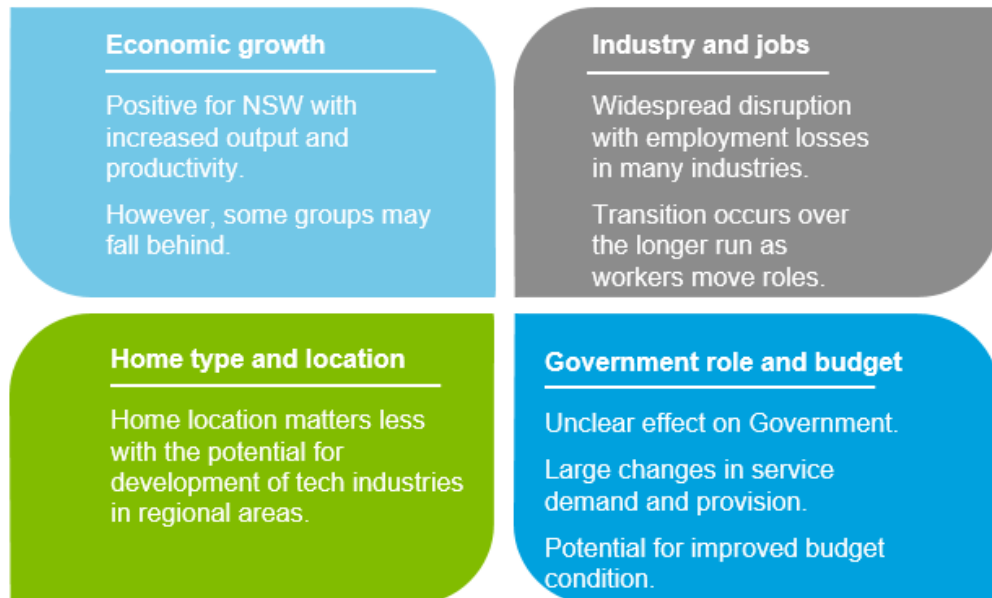
- Growth rates of developing Asian nations.
- Depth and length of any economic downturn.

5.2 The new machine age

Accelerated technology change

Accelerated technology change will make the digital economy an even larger player in how the NSW economy operates. Technological advances will affect every facet of life from agricultural productivity, to improved quality of life with improved healthcare models and medical technology, transport and changes in access to education. Globally, there will be winners and losers – locations that are able to embrace and take up digital technology will benefit.

Impacts



Description

While technology change is factored into the base case, this scenario considers a significant acceleration of the anticipated trends and their impacts on the Australian and NSW economies. For example, in this scenario, the growth in employment in industries connected to new technological trends such as artificial intelligence and robotics is likely to come to the fore much earlier. Accelerated technology change will make the digital economy an even larger part of the overall economy and will also boost the pace of economic growth.

Accelerated technology change could arise through a faster than expected convergence of advanced software, increased data gathering and analysis, and the ongoing expansion of the Internet of Things. The Internet of Things refers to sensors, devices and machines being able to connect to each other, thus, enhancing their capabilities. With these technological changes coming together there is a potential for rapid developments in areas such as artificial intelligence and automation. This could play out in terms of accelerated adoption of

driverless cars, integration of robotics across all industrial sectors and the application of artificial intelligence to practical business problems.

The current rate of improvement in software will make certain routine-heavy jobs redundant. However, a potential outcome in this scenario is a much more radical achievement in terms of the capabilities of artificial intelligence and robotics. This leads to consequences such as the alteration of significant portions of employment in both manufacturing and service industries. In particular, we could see significant changes to much of the legal, recruitment, accounting and finance professions as a result of artificial intelligence or peer to peer models of service delivery through digital platforms. Changes in these industries may be similar to recent experience in data entry and call centre roles. These types of industries are currently the backbone of employment in the Sydney CBD, and a significant disruption to their employment structure is likely to lead to widespread loss of employment – for some, temporary, and for others, permanent. As a result, there could be a movement of workers in these industries to other industries or out of the labour force. This could mean finding employment opportunities outside Sydney.

It is certain that driverless cars will be adopted at some stage in the base case, especially when the technology is already available and currently being tested. However, one potential source of change in this scenario is that within 15 years, there is a full adoption of driverless vehicles by society. One result of this would be the rapid geographic expansion of cities, akin to expansions that occurred when trains and cars were first introduced. This expansion would have significant consequences for where people live and work in NSW, with longer distance travel becoming far more convenient due to the accelerated adoption of new technology.

The rapid adoption of automated vehicles is likely to lead to a loss of employment in the road transport industry, taxi industry, and the delivery industry, to name a few. The convenience of driverless cars is likely to impact the number of people using public transport in NSW. There is likely to also be an increase in vehicle sharing and on-demand services with commensurate reductions in vehicle ownership rates. This will create the potential for a vast reduction in demand for public transport which will lead to stranded assets and overcapacity on assets such as bridges, some roads and train tracks, as driverless cars become more widely adopted. Automated vehicles will also impact the delivery industry with less employment, as a result of the potential cost-savings and time-efficiency gains which will have flow on effects for the retail industry.

Although advances may not be as rapid, there may also be accelerations in development and commercialisation of battery-based power storage. This may particularly be the case if electric vehicles make up a larger portion of the vehicle stock than expected. Widespread use of battery technologies combined with distributed electricity generation could have significant impacts for existing electricity transmission and distribution infrastructure. Some existing assets may no longer be required while rapid investment in new areas of the network may be needed.

There are likely to be changes to how practices in farming, mining and engineering are carried out, for example, with increased automation as a result of the increased connectivity of devices. In addition, the advances in bioengineering will see increased productivity in agricultural production due to improved changes in practices, stock and crops.

Advances in automation could mean that much of the manufacturing and light industrial employment in NSW could be replaced by robotics. A potential benefit of this would be that industrial production would move closer to areas of consumption as labour costs become far less important. This means that some industrial production may locate within Australia, however, the massive boost in productivity enabled by robotics means that increases in industrial output are unlikely to be associated with large increases in employment. Employment in specialised industrial roles with a high level of interaction with machinery may benefit.

This will result in substantial changes to the compensation of workers in many industries. There are likely to be some workers who benefit and some who do not. For example, some workers may be displaced from current roles and will need to find work in new industries, while there may be significant gains to those people who have skills that complement the machines.

Another key area that is likely to be impacted by rapid technological change is the life/health sciences area. Medical breakthroughs resulting from advances in technology will lead to increases in life expectancy. While life expectancy has been steadily increasing in NSW, accelerated change in technology might see an acceleration or even a discontinuous jump in life expectancy in the next 40 years. A higher life expectancy with more healthy, productive years would create upward pressure on the retirement age, with people working longer in the future, thus reducing the burden of population ageing.

Globally, accelerated technology change will create both winners and losers – locations that act as complements to digital technology will benefit while those that compete with digital technologies will fall behind. For example, countries that are still on the path to development will find it challenging to follow the traditional path to development through industrialisation, due to the accelerated technology growth. This will have implications for some of Australia's trading partners as some geographically close neighbours may fall into the group of winners while others may fall into the group of losers.

In Australia, and particularly NSW, economic growth is likely to be stronger overall than the base case with increased output resulting from an increase in worker productivity. Industry structures will change, particularly in industries such as manufacturing and in a range of professional jobs, due to the efficiencies gained in output per worker. Overall, this suggests that some sectors will suffer while others will experience significant growth. Accelerated technological advancement will mean businesses can be run outside traditional areas (i.e. more regional businesses may emerge) and the location of jobs will matter less with people opting to work from home – or wherever their current location is. Therefore, there is potential for growth of home location and jobs in regional areas.

Role of megatrends

- Population and demographics: Potential for longer average lifespan due to impacts of improved health technology.
- Climate change: No difference from base case.
- Global economy: The overall effect is unclear as there will be winners and losers. Hardware will be increasingly commoditised but software producers and owners of intellectual property will benefit. As a result of rapid technological growth, many developing countries will miss out on the traditional path to development via manufacturing.
- Technology change: A rapid technology change will mean that the growth of this space will be much faster than expected.
- Individual and social preferences: Technology enables the individualisation of services.
- Global security: Increased risks from cyber-security threats.



Impacts

The effect on economic growth is likely to be positive, and output is likely to increase as measured productivity per worker increases with the advancement in technologies. It is unclear what will happen to the distribution of income, but it is possible that there will be a split in income levels between high and low income, due to the impact of technology, which may necessitate a stronger redistribution role for government. That said, new technology often lowers barriers to entry in many parts of the economy, which may act to level out the distribution of income as new players take market share from established operations.

Many industries will experience a reduction in the cost of their measured output, as they can provide goods and services at dramatically lower cost, due to the efficiencies gained from rapid technological development. This is likely to affect transport, light manufacturing, and many professional services. It is highly likely that there will be a decentralisation of economic activity. As technology advances, transport costs decline, and telecommunication becomes more effective enabling businesses to be run outside of traditional working areas. That sees potentially more businesses operating in regional NSW.

There is a transition from jobs in transport, manufacturing and professional services to jobs in service-based industries that rely on forming social or emotional connections. Advancement in telecommunications and other technologies will mean that the location of jobs will matter far less. Home location will matter much less to people as transport is far less costly and telecommuting becomes more effective, enabling people to work from home.

It is unclear what effect this scenario would have on the Government. It is clear that there will be significant changes in the nature of services delivered by Government. There is likely to be less need for some large infrastructure projects (such as CBD focused transport). Service delivery may also become more geographically dispersed – increasing costs. Effects on the budget are unclear, there is the potential for greater income from a stronger economic performance arising from technological efficiencies, but this is highly uncertain.

Information sources relevant for this scenario

- ABS Catalogue No. 6291.0.55.003
- ABS Catalogue No. 8146.0
- World Development Indicators - eg. Internet users per 100 people and High Technology exports

Key assumptions that will be required:

- Increase and type of productivity improvement that will occur, broken down by industry.
- Identification of industries that might decline in measured output.

Data gaps

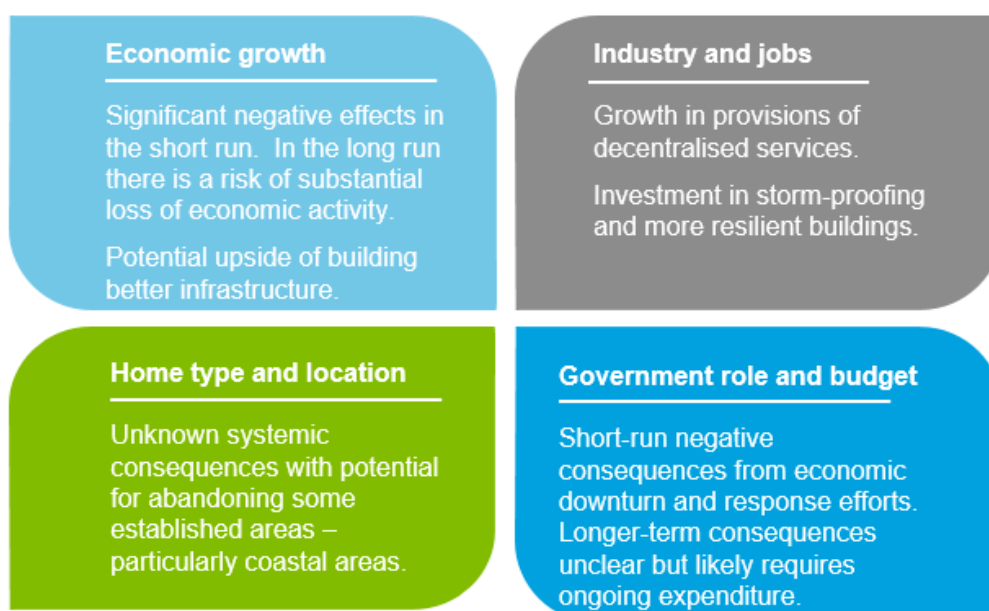
- Quantification of how technology change will affect different industries.

5.3 A major disruptor

Climate and natural disasters

A dramatic, unexpected event occurs. In this case, there is a series of significant east coast lows, exacerbated by climate change, that affect coastal NSW leading to extensive flooding and damage to infrastructure in Sydney, Newcastle and the Illawarra. This event disrupts service provision and economic activity and imposes major costs associated with response and recovery.

Impacts



Description

In this scenario, a number of East Coast Lows (ECL) take place in quick succession, impacting Sydney, the Hunter region and Illawarra. ECLs occur in subtropical regions off the coast of NSW and south-east Australia and can produce cyclonic weather conditions. Each season there are a number of ECLs, but they have varying intensity and impacts. For example, in 2016 an ECL combined with a king tide to result in severe coastal damage to Narrabeen, Collaroy and Coogee. In 2007 there were five ECLs with the most notable being the June 2007 Hunter Region and Central Coast storms, which resulted in the grounding of the MV Pasha Bulker at Nobbys Beach in Newcastle, ten deaths and insurance claims of well over \$1 billion (Jones 2013).

In this scenario, warmer than usual surface ocean temperatures contribute to more intense storms than experienced in the past and the final storm in the series coincides with a king tide. This series of ECLs also takes place in the context of rising sea levels due to climate change – which amplifies the resulting damage to infrastructure.

As this scenario involves a series of storms, many structures previously weakened by earlier storms fail completely. In some areas, coastal erosion is more than double that associated with the storms of 1974. Up until now, the storms of 1974 have historically been used to estimate the maximum measured storm erosion. However, reconstructions of past climatic events indicate that, in some areas, erosion in storms before 1974 has been more than double that in the largest recorded events.

The result is extensive damage to and even failure of infrastructure already weakened by previous storms. For example, following the failure of a sea wall, there would be significant damage to infrastructure that is left unprotected – such as roads, drainage and electricity supply. Coastal inundation and record wave heights result in significant loss of coastal infrastructure. Potential infrastructure affected includes the South Coast railway line north of Kiama and major roads adjacent to Sydney's northern beaches.

The series of storms will also result in hundreds of thousands of homes losing power due to high winds. Some homes could lose power on multiple occasions within the one storm season. Due to the scale of damage to the network, electricity distributors are unable to restore services promptly to all areas. Damage to roads and other supporting infrastructure also hampers the restoration of electricity supply to residential areas.

Wide areas are also affected by hail storms. The result of this includes the collapse of some large warehouses in Western Sydney and elsewhere under the weight of large hail stones (as occurred in April 2015). Hail storms are also highly destructive of personal property – likely causing billions of dollars of damage primarily to roofing and automobiles.

Reminiscent of the 2014 ECLs, a tanker breaks its moorings at Port Botany, causing damage to port infrastructure. Fuel supplies and other imports are disrupted due to the inability of ships to dock in Sydney and Newcastle due to repeated periods of strong winds and increased wave height. This prompts considerable community concern, leading to shortages of fuel and impacting the availability of food, medicines and some emergency supplies, such as bottled water.

Sydney and Newcastle airports are closed on a number of occasions due to high winds and damage to infrastructure. Signalling failures and localised flooding interrupt rail services, including on the Airport, East Hills and Olympic Park lines. Further, landslides may affect a number of rail services – particularly to the north (around Berowra), and south of Sydney (around Coalcliff).

Inadequate drainage contributes to flash flooding in many areas, hampering evacuation efforts and resulting in fatalities.

Water utilities up and down the coast are affected by the storms. Water services fail in many areas due to loss of power and flooding of treatment plants and pump stations. Sewerage infrastructure in several areas is unable to function due to loss of power and localised flooding, and sewage overflows give rise to public health concerns. Some water utilities are better prepared than others but, due to the wide area affected by the storm events, there is insufficient back-up generator capacity to enable service continuity or to allow for prompt restoration of services in all areas. Restoring services in some smaller communities takes weeks, a problem exacerbated by damage to roads. Stormwater infrastructure in coastal and

estuarine areas is unable to cope with the combination of intense rainfall and storm surges and many areas experience flooding.

The mix of consequences for water utilities and storm water means that water quality is impacted (as in 1998), resulting in high turbidity and contamination with pathogens. Sydney's water supply eventually fails to meet national public health standards. 'Boil water' alerts are put in place across a number of coastal catchments in response to non-compliant water quality; this compounds existing issues such as lack of access to electricity and water supply.

Role of megatrends

- Population and demographics: No significant change from base case.
- Climate change: Climate change is projected to increase the frequency of high intensity summer ECLs.
- Global economy: No change from the base case.
- Technology change: No change from the base case.
- Urbanisation: No change from the base case.
- Individual and social preferences: Residents are increasingly aware of the disruption risks posed by severe weather and start to increase their household preparedness for such events.
- Global security: No change from the base case.



Impacts

Economic growth is negatively impacted due to supply chain disruption, and the need to divert significant resources into response and recovery efforts. There is a short-term downturn in tourism due to the extent of infrastructure damage and safety concerns, water quality etc. Insurance premiums rise for government and businesses, negatively impacting productivity. On the upside, infrastructure is 'built back better' (and in appropriate locations), with improved capacity to withstand future extreme events.

In terms of industry structure and job type and location, companies providing decentralised services (such as power and water) grow in response to a stronger community desire to improve their independence from the water and power grid. This in turn negatively impacts the financial position of network businesses such as electricity distributors. There is also an increase in demand for storm-proofing of housing and in building more resilient infrastructure.

Considering where people live and the types of homes that they live in, some residents will likely move away from coastal and estuarine areas in response to shoreline recession and damage to infrastructure following the storms. This will result in some abandoned housing and stranded infrastructure.

The Government budget is negatively affected in the short term due to both lower economic activity and greater expenditure required for response and recovery. In the longer term there is an ongoing negative effect from expenditure on adaptation to new climatic

conditions and disaster preparedness. Resilience to natural disasters is likely to become a heightened concern for future Government policy.

Information sources relevant for this scenario

- OEH climate change projections available from NSW Climate Data Portal
- OEH research re ECLs available at <http://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/East-Coast-Lows>
- Outputs from the Eastern Seaboard Climate Change Initiative (ESCCI) including for example Goodwin, I.D., Burke, A., Mortlock, T.R., Freeman, R., Browning, S.A. (2015), Technical Report of the Eastern Seaboard Climate Change Initiative on East Coast Lows (ESCCI-ECLs) Project 4: Coastal System Response to Extreme East Coast Low Clusters in the Geohistorical Archive. Marine Climate Risk Group, Climate Futures at Macquarie. A report prepared for the Office of Environment and Heritage NSW.
- Mortlock, T.R., Goodwin I.D., and Roche, K., Coastal impacts of the June 2016 East Coast storm for Sydney, accessed at https://www.riskfrontiers.com/Briefing_Notes/Briefing_Note_319.pdf on 24 October 2016.

Key assumptions that will be required:

- Cost and effectiveness of adaptation strategies over time.
- Insurance costs and adoption over time.
- Rate residents' preference away from coastal and estuarine housing.

Data gaps

- Translation of climate change effects (such as changed rainfall and storm activity) into economic consequences.
- Government policy reaction to accelerated climate change.

5.4 A growing civil society

Keeping it in the community

There is a change in community values facilitated by more services and goods being brought to the home, more flexible working arrangements and widespread adoption of teleworking. This results in dramatic changes to social and industrial structures. As a result, workers are no longer required to live close to their place of work and make housing choices based on affordability, lifestyle and liveability preferences.

Impacts

Economic growth

Unclear effect on growth. Loss of agglomeration effects in CBD but retention of high wage jobs within Sydney – disbursed geographically.

Industry and jobs

Widespread changes with employment becoming decentralised from the CBDs and spread across cities and regions.

Higher levels of telework.

Home type and location

Work moves closer to home and demand for more varied housing options arises – such as multigenerational housing.

Commuting patterns change.

Government role and budget

Greater demand for specialised and tailored Government services, possibly costing more to deliver.

Description

In this scenario there is a rapid change in individual and social preferences which fundamentally alters how we, as a society, arrange our homes, work, education, recreation and families. This has significant effects in what services are required from Government and how these services are delivered.

In a positive case, this scenario could involve a confluence of events such as the introduction of technologies that alter existing social preferences such as by truly enabling more flexible working arrangements. Alternatively, the introduction of automated vehicles and the growth in the sharing economy could result in changes to how people think about fundamental aspects of their lives (such as ownership and travel). More generally, ongoing economic growth that leads to a greater focus on lifestyle choices for most citizens. Another positive influence on this scenario could be that growing levels of wealth lead to changes in what individuals consider will contribute to their quality of life. Of course, a range of more negative influences may also be active in this scenario. For example, reduced availability of natural

resources or increased security concerns could also act as the external influence of importance.

Broadly, under these driving external factors, this scenario involves a significant and rapid shift in internal individual and social preferences. This change in individual and social preferences could manifest itself in a number of ways including through its effect on housing choices, work choices and approaches to education, health and justice. Although it is difficult to identify precisely what would occur if there was such a change in social and individual preferences, for the purpose of this scenario, the change could be summarised as a growth in civil society with a focus on local areas and communities. Such a change would have widespread impacts on the role and function of Government and what infrastructure and services are provided.

In terms of choices about work and housing, in the presence of more flexible working arrangements and widespread adoption of teleworking, workers are no longer required to live close to their place of work and, as a result, make housing choices based on affordability, lifestyle and liveability preferences. These incentives create suburban 'villages' where communities cluster around local services. These changes also significantly affect the pattern of participation in the workforce, where participation from prime age males may decrease while participation from other demographic groups may increase.

Some degree of decoupling of work from workplaces has been a clear possibility for many workers in NSW for well over a decade but the promise of teleworking has been slow to deliver behavioural change. In this scenario, this behavioural change takes hold on a large scale. For this to happen, there will need to be a confluence of events. First, it will be necessary for there to be improvements in technology so that workers can interact efficiently and effectively at distance. This will need to be supported by changes within businesses so that flexible working arrangements are encouraged – or at least tolerated – as well as a change in individual preferences towards preferring to work outside the traditional workplace.

As these enabling conditions come together in this scenario to decouple home and work decisions, there will be a fundamental change in the nature of metropolitan Sydney – and to a lesser degree in regional cities and centres. Workers will begin to work more from home (or from flexible work locations near their home). This will enable some workers to alter their choice of home location with a greater emphasis being placed on social, environmental and other amenities of location rather than proximity to the workplace or proximity to transport.

The introduction of new technology, increased flexibility in the way people work and changing patterns of participation will also then result in flow on changes to the way in which people live. There may be the ability for family structures to alter with workers playing a closer role in their children's education or caring for the elderly. For example, some people may choose to live in larger family groups, while others may choose to live in smaller houses. This is likely to result in a change to housing preferences with demand for diverse development around differentiated suburban 'villages'. For example, there is likely to be a mix of demand for areas of very-high and very-low density, as well as a mix of demand for housing size. Overall, this will likely result in a greater variety of housing demands in more diverse locations around the Metropolitan area.

As places of work are more distributed and integrated into a network of local areas, the demand for roads and public transport infrastructure will be altered. The types and timing of journeys being made in the metropolitan area will diversify as commuters travel more within their local area and also make more cross-city and multipurpose journeys. Overall, the pattern of travel may look more like current weekend travel patterns – a sustained volume of journeys throughout the day that doesn't quite reach the peaks of weekday rush-hour but creates a myriad of issues for transport networks. This change will reduce the demand for single large transport investment focused on commuters and CBDs and enhance the need for investment that helps communities connect to each other in a true network.

This pattern of home, work and travel will mean that residents will demand services closer to home. As a result, there will be an increase in the intermingling of businesses and residential locations. This will result in growth of demand for smaller business and commercial centres closer to where people live and providing services that are well suited to their needs (which may vary significantly from neighbourhood to neighbourhood). Overall, this is likely to see an increase in vibrancy and activity in suburban areas – although at the expense of larger suburban centres. To support this, there will likely need to be significant changes to planning and zoning regulations. However, many large retail and recreational businesses will continue to prefer to agglomerate in more heavily developed centres.

Similar changes in education, health and justice could also be seen under this scenario. For example, with more flexible working arrangements and a preference for local activity, there may be demand for a more flexible and adaptable education system. This could manifest itself in demand for providing greater school choice, more flexible hours or tailored curricula. In health, such a scenario could involve a preference for localised or in-home care, wherever possible. In the justice system, this may result in changes to incarceration rates or – potentially – even large changes in the types of crimes where incarceration is considered necessary.

This potential change of demand in education, health and justice has significant consequences for how these services are delivered by Government and what investments are required. For example, in education, if there was a movement towards more flexible school hours and schedules, this could actually reduce the need for physical investment in schools but would create the need for large scale reform to how schools operate. Similarly, in health, a move towards more in-home care could reduce capital expenditure in hospitals but increase the cost of delivering health services. In the justice system, changes in incarceration rates have a clear relationship to the need to construct prisons.

Finally, although this scenario considers a rapid shift in individual and social preferences among a bulk of the population, there will certainly be some portion of the community that would prefer to maintain the status quo. This could be a very diverse group, for example, employers may be hesitant to decentralise from the CBD, standardised approaches to schooling may be popular among some parents who are overwhelmed with the number of choices available and some commuters may feel that the public transport services that they use should remain unchanged. A rapid shift in individual and social preferences therefore creates the need for Government to consider and cater to existing preferences, while still allowing a new approach to societal organisation and behaviour to emerge.

Role of megatrends

- Population and demographics: Population levels are the same as the base case but with large changes in the pattern of how people organise their private, work, social and community lives.
- Climate change: No difference from base case but may be active as an external factor.
- Global economy: No difference from base case but may be active as an external factor.
- Technology change: The adoption of teleworking is faster than expected, changing the preferences for living close to employment opportunities.
- Urbanisation: Demand for more varied housing options in NSW.
- Global security: No difference from the base case but may be active as an external factor.
- Individual and social preferences: There is a greater focus on lifestyle and liveability factors, which reduces the desire to live in dense urban areas, and increases the preference for easier commuting, affordability and local services.



Impacts

In this scenario, there are fewer jobs in the CBD and more jobs in suburban areas. This will first affect professional service industry jobs, which will decentralise throughout Greater Sydney. The primary effect of this is to redistribute economic activity to different geographic areas. However, the overall impact on economic growth is unclear. Though there is a potential outflow from CBD areas, workers could relocate while retaining high wage jobs through teleworking and/or more flexible work arrangements.

The change in economic activity will have an effect on industry structure and job location. Sydney CBD will lose its prominence as an employment hub and will likely increasingly embrace residential and recreational services.

As described above, changes in housing location and type may occur but the primary change in home location will be in bringing the places where people work much closer to the places where they live. The number of commuters and overall commute times would decrease and demand would be smoothed throughout the day.

One of the major impacts in this scenario is on the role for, and demand on Government. Citizens will demand a broader array of services delivered in convenient locations. More geographically disbursed service delivery will increase costs of delivering some services, and it is unclear whether this will be matched by any increase in revenue. Government may have to rethink traditional approaches to providing core services such as education, health, transport and justice.

Information sources relevant for this scenario

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- ABS Catalogue No. 6291.0.55.003
- ABS Catalogue No. 8146.0

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World Economic Forum (2016b) "The Global Risks Report 2016" 11th edition http://www3.weforum.org/docs/GRR/WEF_GRR16.pdf

Appendix A: Data summary

This appendix sets out a more detailed list of data that may be relevant for each of the scenarios

Asia ascendant

- International GDP growth forecasts – OECD Economic Outlook: Statistics and Projections, Long-term baseline projections, No. 95 (Edition 2014)
- ABS Catalogue No. 5206.0 Australian National Accounts: National Income, Expenditure and Product, Jun 2016
- Commonwealth Treasury 2015 Intergenerational Report: Australia in 2055
 - Chart 1.19 Average annual growth of real GDP and real GDP per person
 - Chart 1.20 Population, productivity and participation combine to produce GDP per person
 - Chart 1.22 Nominal GDP growth projections
 - Chart 1.23 Average annual growth rates for real GDP and GNI projections
- ABS Catalogue No. 5368.0 – International Trade in Goods and Services, Australia, Jul 2016
- DFAT Australia's direction of goods & services trade – calendar year (from 1987 to present)
- ABS Catalogue No. 6291.0.55.003, Table 05 Employed persons by State, Territory and Industry division of main job (ANZSIC)
- RBA Exchange Rates – Monthly – January 2010 to latest complete month of current year.
- ABS Catalogue No. 3412.0
 - Migration, Australia 2014-15, Net overseas migration, Arrivals and Departures, State/territory, Major groupings and visa – Financial years, 2004-05 to 2013-14
 - ABS Catalogue No. 3412.0 – Estimated resident population, Country of birth, State/territory, Age and sex 30 June 2011

The new machine age

- ABS Catalogue No. 6291.0.55.003
 - Table 04 Employed persons by industry division of main job (ANZSIC)
 - Table 05 Employed persons by State, Territory and Industry division of main job (ANZSIC)
- ABS Catalogue No. 8146.0 Household Use of Information Technology, Australia, 2014-15, Household Internet Access Data Cube
- International technology data – World DataBank, World Development Indicators - eg. Internet users per 100 people and High Technology exports (current US\$)

A major disruptor

- OEH climate change projections, NSW Climate Data Portal
- OEH research re ECLs available at <http://climatechange.environment.nsw.gov.au/Impacts-of-climate-change/East-Coast-Lows>
- International Energy Agency – World Energy Outlook 2016
- International Energy Agency, IEA Headline Energy Data
- Office of the Chief Economist at Commonwealth Department of Industry – Australian Energy Projections to 2049-50
 - Figure 2: Australian energy consumption, by fuel type
 - Figure 4: Australian electricity generation, by fuel type
 - Table 14: Energy Production, by source
- Commonwealth Treasury – Strong Growth, Low Pollution: Modelling a Carbon Price (2011)
 - Chart 1: Gross World product and emissions
 - Chart 2: GNI per person and emissions
 - Chart 3: Sources of emission reductions under the core policy scenario
 - Chart 4: CPI Impact from carbon pricing compared with history
 - Table 1: Headline Australian Indicators
 - Table 3.3: Regional shares of global mitigation, population and GWP in 2050
 - Chart 3.2: Global emission allocations
- Trade statistics split by sector from ABS and DFAT. ABS Catalogue No. 5368.0 – International Trade in Goods and Services, Australia, Jul 2016
- DFAT Australia’s direction of goods & services trade – calendar year (from 1987 to present)
- ABS Catalogue No. 3412.0 – Migration, Australia 2014-15, Net overseas migration, Arrivals and Departures, State/territory, Major groupings and visa – Financial years, 2004-05 to 2013-14
- Outputs from the Eastern Seaboard Climate Change Initiative (ESCCI) including for example Goodwin, I.D., Burke, A., Mortlock, T.R., Freeman, R., Browning, S.A. (2015), Technical Report of the Eastern Seaboard Climate Change Initiative on East Coast Lows (ESCCI-ECLs) Project 4: Coastal System Response to Extreme East Coast Low Clusters in the Geohistorical Archive. Marine Climate Risk Group, Climate Futures at Macquarie. A report prepared for the Office of Environment and Heritage NSW.
- Relevant literature
 - Mortlock, T.R., Goodwin I.D., and Roche, K., *Coastal impacts of the June 2016 East Coast storm for Sydney*, accessed at https://www.riskfrontiers.com/Briefing_Notes/Briefing_Note_319.pdf on 24 October 2016.

A growing civil society

- Transport for NSW
 - Summary Employment Forecasts 2011-2041, September 2014 Release V2.0
 - Travel Zone Employment Forecasts 2011-2041, September 2014, Release V2.0
 - Transport for NSW, Bureau of Transport Statistics, 2011 Journey to Work data, Summary tables for 2011 Centres Analysis V1.5
- ABS Catalogue No. 6291.0.55.003
 - Table 04 Employed persons by industry division of main job (ANZSIC)
 - Table 05 Employed persons by State, Territory and Industry division of main job (ANZSIC)
 - Department of Employment, 2016 Employment Projections, Regional projections
- ABS 2011 Census - Employment, Income and Unpaid Work Database (available via Table Builder)
- ABS Catalogue No. 8146.0 Household Use of Information Technology, Australia, 2014-15, Household Internet Access Data Cube

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