

A network diagram consisting of numerous white squares of varying sizes connected by thin white lines, set against a solid blue background. The lines and squares are scattered across the frame, creating a sense of interconnectedness and digital complexity.

A Snapshot of

# Australia's Digital Future to 2050

**IBISWorld**

WHERE KNOWLEDGE IS POWER

## Preface

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**Phil Ruthven**

Founder and Chairman  
IBISWorld

Broadband is now one of the core economic indicators across the world, and is considered a human right by the United Nations. Superfast broadband of the order of 100+ megabits per second (Mbps) and into the gigaspeed bracket is de rigueur for any nation purporting to be a developed and advancing economy. High-speed broadband has pervasive usefulness that extends across businesses, governments, households and individuals.

Compared with other leading countries, Australia's roll-out of this new-age utility has been slower. But now, superfast broadband is on its way to most Australian citizens and businesses.

We have begun to enter the second stage of the Infotronics Age, which began with the rapid growth of new service industries and the Information and Communications Technology (ICT) Revolution in the mid-1960s. This second stage could be termed a hyper digital era, such is the combined power of ICT enhanced with ubiquitous high-speed broadband plus analytics, learning systems, cognitive computing and more.

Whatever we choose to call this new addition to our arsenal of utilities, it will affect the way society functions, communicates, works, shops and recreates. It will particularly affect businesses, some of which will not survive unless they embrace and harness the era's technological potential. Access to information using high-speed broadband will create a more open dialogue between government and the community, with governments putting more information online and using social media tools to better engage.

Three-quarters of the nation's businesses believe a national broadband infrastructure will increase their ability to engage in the digital economy, according to a recent Nielsen report. For all that, businesses are reportedly struggling to integrate ICT into an overall strategic vision. This second decade of the 21st century needs to be one where Australian businesses and government catch up to today's increasingly borderless and competitive world.



## About the Author

Phil Ruthven is the Founder and Chairman of IBISWorld, an international corporation providing online business information, forecasting and strategic services. He is a board member of the Melbourne Institute, a recent past director of Open Family Australia (a charitable foundation aiding street children), a recent Director of CEDA and an Honorary Adjunct Professor at the University of Technology, Sydney. Phil continues to be one of Australia's most frequent and prolific commentators in demand by the media, and is widely considered the nation's most respected strategist and futurist on business, social and economic matters.

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# Key Definitions

## The New Age

The new age in this report refers to the period 1965 to the late 2040s, often called the Post-Industrial Age. More recently, this age has been variously referred to as the Information Age; the Digital Age; or the Infotronics Age (as IBISWorld has termed it for more than 30 years, in deference to the beneficial role of information and electronics across the economy, industries and society).

A distinguishing feature of the new age is that service industries have come to dominate the economy (> 70% in 2012 versus <50% in 1965), unlike all previous ages of progress in which goods industries dominated.

The timeline for the ages of progress in Australia are as follows:

<b>Hunting and Trapping Age</b>	Up to 1820
<b>Agrarian Age</b>	1821 – 1864
<b>Industrial Age</b>	1865 – 1964 Stages 1 and 2
<b>Infotronics Age</b>	1965 – 2040s Stages 1 and 2

## Utilities through the Ages

There have been enabling utilities (pervasive new systems and technologies for industries and households) in each new age, as follows:

<b>Hunting Age</b>	No pervasive utility (even the wheel was not a pervasive utility)
<b>Agrarian Age</b>	<b>Transport</b> (including the wheel and carts, roads and water transport)
<b>Industrial Age</b>	<b>Mechanical power</b> (water wheel and steam engines) in Stage 1 <b>Electrical power</b> (electricity and telephony) in Stage 2
<b>Infotronics Age</b>	<b>ICT</b> (information communications technology) in Stage 1, to 2006 <b>ICT enhanced with ubiquitous high-speed broadband plus analytics, learning systems, cognitive computing</b> in Stage 2, to the late 2040s

## The new utility

In this report, the new utility refers to the utility enabling the second half of the Infotronics Age from 2007 to the late 2040s: ICT enhanced with ubiquitous high-speed broadband, plus analytics, learning systems, cognitive computing and more.

Progress is being driven by the convergence of cloud computing, analytics, learning systems and ubiquitous high-speed broadband in fixed, mobile and wireless form. These technologies will lead us to a point where a large percentage of Australia's products and services – and work itself – will be strictly digital. This new utility will be as revolutionary in its impact as its predecessors including transport in its many forms; electricity, telephony; water, gas and sewerage.

## Broadband Speeds

In this report, we have adopted nomenclature on broadband speeds as follows:

Broadband	2-25 Mbps
Fast broadband	26-100 Mbps
Superfast broadband	100+ Mbps
Giga-speed broadband	1000+ Mbps (1+ Gbps)
High-speed broadband	Term to capture all above broadband speeds



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**Andrew Stevens**  
Managing Director,  
IBM Australia and  
New Zealand

## Foreword

The unprecedented natural resources boom, together with a low public debt level and prudent banking sector, has buffered Australia's economy from challenging global macro-economic conditions. Consequently, it is easy to overlook the need to address the nation's sustained productivity decline and the importance of securing longer-term prosperity.

IBM believes part of the solution will come from how business and government leverage our increasingly connected and networked world. Commissioned by IBM, *A Snapshot of Australia's Digital Future to 2050*, looks ahead of existing research to examine how Australia can harness ICT enhanced with ubiquitous high-speed broadband to create a sustainable economy.

In doing so it asks: how will the dawn of this digital future further affect our lives, our cities and the way we interact? Which industries will disappear? Which will prosper? And what new industries will emerge?

The report reveals that ICT as we know it, enhanced with ubiquitous high-speed broadband will become Australia's new utility and the most important utility of this century – one as historic as its predecessors.

Australia's digital future will transform some industries, including knowledge industries, health and educational services, which will be underpinned by digitised products and services. From an economic viewpoint, by 2050, this new utility will generate around \$1 trillion in revenue – almost eight times higher than the \$131 billion it generates today. That accelerated leap in projected revenue is just one of the indicators of the criticality of this new utility – not just for revenue, but for the underlying improvements in economic development and quality of life it will bring for Australia.

To make this digital future a reality, businesses and government must decide how best to leverage our increasingly ubiquitous digital infrastructure, and how to help Australia shift from a natural resources-dependent economy to a more diverse 'developed resources'-oriented economy.

I commend Phil Ruthven and IBISWorld on producing *A Snapshot of Australia's Digital Future to 2050* – the first report in the world to rate a nation's industry classes against the impact of the new utility. Given the importance of technology in reversing Australia's productivity decline, opening up new markets, and generating new employment opportunities, this type of discussion is essential. I hope it spurs Australian industries into planning for and investing in a digitally-connected economy and society.

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# Executive Summary

The ubiquitous adoption of high-speed broadband services, in concert with technology, will enable powerful innovations across different sectors of the economy: from business to business, business to the home, and machine to machine. In turn, these applications will help address social and economic challenges of the future.

For every ten percentage point increase in broadband penetration, GDP increases by 1% and doubling an economy's broadband speed increases GDP by 0.3%<sup>2</sup>.

Significant work has already been done to measure the economic potential of high-speed broadband and digital technology. The Australian Government's extensive research has found that high-speed broadband will have countless benefits to everything including small and rural businesses, disabled citizens, Indigenous communities and industrial productivity. The Government's National Digital Economy Strategy<sup>1</sup> is structured based on these findings, which include:

- Between \$2 billion and \$4 billion in benefits per year from wide-scale implementation of telehealth systems;
- Up to \$1.9 billion in savings (and almost 320,000 tonnes less of carbon emissions) if current teleworking goals are met;
- Up to \$2.4 billion in savings for households if internet access increases by 10%.

Already in 2012, ICT enhanced by emerging high-speed broadband and online information is expected to deliver revenue of \$131 billion in Australia. Based on this report by 2050, this new utility will generate around \$1 trillion in revenue. Reports indicate that, for every ten percentage point increase in broadband penetration, GDP increases by 1%; doubling an economy's broadband speed increases GDP by 0.3%<sup>2</sup>. Today, even with our present 'pony express' form of broadband, the value of the internet to the Australian economy rivals iron-ore exports.

However, this report, *A Snapshot of Australia's Digital Future to 2050*, looks ahead of existing research to the likely shape of Australia's digital future by 2050. It is the first report in the world to rate a nation's entire list of industry classes against the impact of ICT enhanced by ubiquitous high-speed broadband (see Chapter 4 for more details of this rating system and the methodology used). In doing so, it covers an ambitious breadth and scope of territory, examining: the macro-environment for Australia; the impact of high-speed broadband in the Infotronics Age; the impact of the digital future on industries; Australia's society of the future (including cities and work); and recommendations on how we can capitalise on our digital future.

The report predicts that, in a future enabled by further investment in superfast broadband we can expect substantial changes to our economy and society. In the community, we will have fewer commuters, smart homes and cost-effective health care. In the economy, 10% of Australia's 509 industries (accounting for 23% of the nation's revenue) will not function without this new utility; a further 17% of industries (also 23% of the nation's revenue) will use it to drive step-changes in their business; and 70% of the industries (accounting for 54% of revenue) will benefit from generalised productivity gains.

## The Macro-Environment for Australia

ICT enhanced with the inclusions of ubiquitous high-speed broadband, analytics, learning systems and cognitive computing is predicted to evolve from a 'value add' to becoming Australia's new utility, after: transport in the Agrarian Age; mechanical power in the first half of the Industrial Age and electricity and telephony in the second half of the Industrial Age

The report also finds that Australia's resource focus will shift from natural resources to developed resources (educated labour force, internet, communications, infrastructure, services and utilities), which account for more than 78% of annual wealth in Australia, and four-fifths of our workforce.

From a macro-productivity perspective, Australia will see a return to its long-term average productivity growth of 1.7% by 2020, compared with the current 0.6% over the past five years. This increase in growth is substantially due to the new utility.

## Future Trends

All surfaces could become potential interface points with computers, devices and networked technology.

The report suggests that by 2020 we will see a massive increase in data usage. Australian consumers will need a monthly data allowance of almost 200GB by 2020 and potentially five terabytes (TB) by 2030.

In terms of devices, the report anticipates that superfast broadband and technology will enable an increase in haptic devices that have the capacity to simulate the sense of touch, based on a virtual 3-D environment.

In addition to these findings, the report looks further ahead to the direction that technology and related applications may take. Some key predictions are:

- **All surfaces could become potential interface points with computers, devices and networked technology.** This is already evident through the invention of electronic contact lenses<sup>3</sup> and the development of devices that allow users to issue computer commands using their own skin as a touchpad<sup>4</sup>. Other developments include epidermal electronic systems (EESs), which are microfilmic layers of electronics that can adhere to the human skin like stick-on tattoos and have already been successfully used to monitor human vital signs. EES technology could soon allow wearers to interface with sensors and devices via proximity or touch<sup>5</sup>.
- **The development of direct neural control over devices and ICT systems.** Brain-machine interfaces (BMIs) have allowed animals to control robotic devices using their brain alone. The same technology is now being tested in disabled patients but could extend its applications to broader human augmentation<sup>6</sup>.

## Industry Impact

Australia's digital future will transform a raft of industries. Industries across 13 divisions (of the nation's 19) within Australia are predicted to be transformed, or to significantly benefit from, the new utility<sup>7</sup>. The total revenue for 2012 of these opportune industries is \$1.25 trillion or 31% of the nation's total revenue of \$4 trillion.

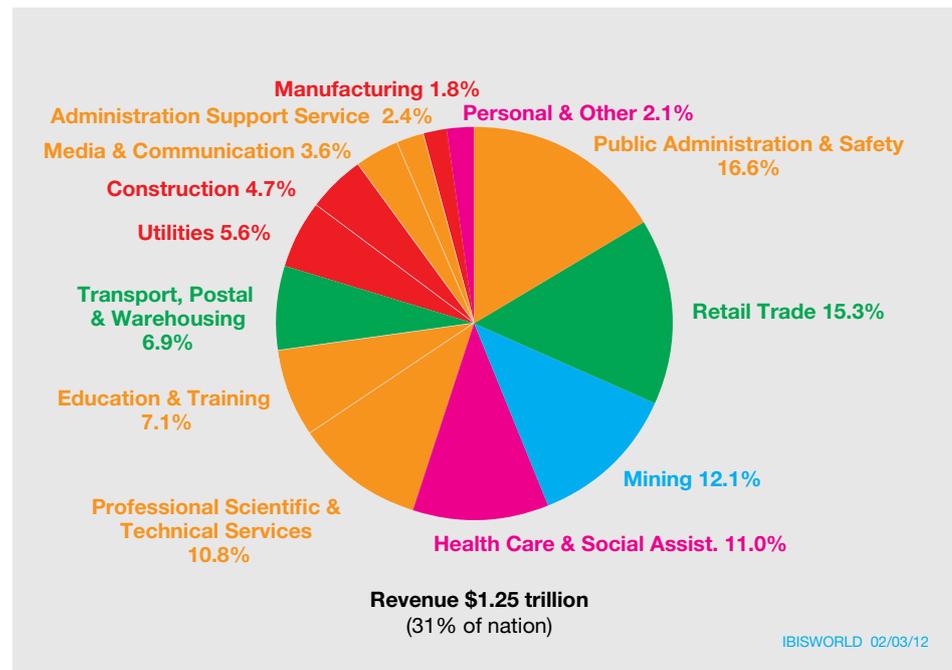
For a detailed breakdown of these industries by revenue, see **Table 4.20** on page 77 of this report.

Fig 1.1  
**Opportune Industries**  
Weighted revenue of  
prospective industries,  
% of total 2012

Graph depicts  
*transformational*  
and *significant* rated  
industries.

Some revenues have  
been discounted from  
tabulated results:  
1) *significant* is  
weighted at two-thirds  
revenue; and 2) Public  
Administration and  
Safety is weighted  
at half due to double  
counting of revenue  
(transfer payments)  
and social welfare.

The proportions do  
not purport to be  
convertible directly to  
ICT spending in the  
same proportions.



### Methodology

The following assessment of the prospects for the 509 classes of industry in the Australian economy over the next 40-50 years, is the work of an Industry Impact Panel comprising: the author, Phil Ruthven; Dr Kate Cornick and Brad Gathercole, IBES; Larry Quick, Resilient Futures; Dr Elaine Miles and Ian McGowan, IBISWorld. The Industry Impact Panel set out to determine which of the 509 classes of industry would, as a consequence of the new utility: likely demise; gain a generalised advantage; experience a significant impact or have a transformational impact.

### Findings

Seven out of the 19 industry divisions that house the 509 industry classes will benefit most from as summarised in **Table 1.1**.

Table 1.1  
Key divisions to benefit  
from the new utility  
and the impact

## Key beneficiaries from the new utility by % of opportune industry revenue

(based on 31% of the nation's \$4 trillion total revenue in F2012)

### 1 Public Administration and Safety

Superfast broadband, analytics and advanced software programs will give us smarter, fast-response emergency services, which will use predictive analytics to forecast and mitigate the impact of natural disasters, among many other innovations.

### 2 Retail Trade

Retail will continue its online revolution, with eBay, Amazon and other diverse product group providers redefining the traditional concept of high street and shopping centre retailing.

### 3 Mining

Smart sensors and machine-to-machine communications will reap productivity benefits for mining by taking out labour costs and increasing efficiency. Superfast broadband will play a very important function in logistics, virtual operations (including robotics), ore grade use optimisation and exploration analyses. This will become much more important as mineral prices pause and fall after the current cycle peaks in the 2020s, if not earlier.

### 4 Health Care and Social Assistance

Poised to become Australia's biggest industry division and employer well before 2050, this division must harness all the power of analytics and the speed and connectivity of superfast broadband to prevent what will otherwise be a massive cost burden by the late 21st century. In this division, superfast broadband will be vital in driving healthcare costs down by faster diagnostics, preventive health systems, partial self-diagnostic services and more efficient systems and operations in hospitals.

### 5 Professional, Scientific and Technical Services

This industry division will grow on the back of more business service function outsourcing, the rise of online information, a massive increase in creative and enabling software, the growth of ICT in the form of cloud computing and many other activities.

### 6 Education and Training

Education must embrace the new paradigms powered by superfast broadband, and new delivery systems (including virtual delivery), if Australia is to become smarter in an increasingly borderless and competitive world. This is particularly important for higher education, which is facing growing competition from the increasingly information-oriented emerging large economies in the Asia-Pacific.

### 7 Transport, Postal and Warehousing

Along with water, energy and gas, Transport, Postal and Warehousing will reap major productivity benefits from the use of smart sensors and machine-to-machine communications that enable automated or more efficient operations.

## Likely demise

The predicted 15 industry classes (out of 509) outlined in **Table 1.2** risk demise, unless they reinvent themselves; for some, successful reinvention appears unlikely within the required timespan. This group represents less than 1% of the current revenue generated by industries. High-speed broadband spells the decline of traditional retailing in the decades ahead. Much of wholesale trade may eventually be cut out of the equation, as the new utility enable producers to target end-consumers without the need for middlemen. Other casualties may include: newspaper, magazine, book and directory publishing – substituted by their online versions; radio, free-to-air TV and cable TV broadcasting – absorbed into internet distribution; and video rental.

Table 1.2  
15 Industries  
Predicted to Demise  
Revenue Guidelines  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry	\$billion	T	S	G	D
Reproduction of Recorded Media	0.2				
Book and Magazine Wholesaling	1.5				
Entertainment Media Retailing	1.1				
Newspaper Publishing	4.9				
Magazine and Other Periodical Publishing	1.3				
Software Publishing	0.9				
Motion Picture Exhibition	1.9				
Radio Broadcasting	1.4				
Book Publishing					
Directory and Mailing List Publishing	2.7				
Other Publishing (except Software, Music and Internet)					
Free-to-Air Television Broadcasting	4.3				
Cable and Other Subscription Broadcasting					
Video and Other Electronic Media Rental and Hiring	1.0				
Photographic Film Processing	0.5				
<b>Total</b>	<b>21.7</b>				

## Australian Business and Society of the Future

Possibly one in four people in the workforce working at least partially from home if not full-time by the middle of this century.

### **Enterprise and workplace of the future**

Medium-sized enterprises, or companies with revenue of \$1 million-\$100 million, will continue to experience the fastest levels of growth due to: the trend to outsourcing by households and businesses, creating new entrepreneurial opportunities; the lower need or demand for capital (being service industries that are the fastest growing); and more flexible lenders.

Teleworking will continue as a key trend, with possibly one in four people in the workforce working at least partially from home if not full-time by the middle of this century. If so, we would have five million working from home at least part of the time – taking millions of commuters off the roads.

As the new utility helps overcome the tyranny of distance, it will reinvigorate regional centres and some rural communities, with teleworking enabling some jobs centred in capital cities to be relocated to the bush. Skilled workers will be able to live anywhere if they so choose, and businesses will be able to source skilled employees across international boundaries.

### **Australian households and cities of the future**

It is likely that communications, including telepresence, will become the 'surrogate transport' by 2050. Australian households could be allocating up to 40% of mobility spending on telecommunications, double that of 2010. This will be partly driven by the use of superfast broadband and technology services to work from home more frequently than we do now.

Household outsourcing will continue as household expenditure is shifting to outsourced chores and activities, which now exceed all retail spending (except motor vehicles, et al). In the future, the new utility will support, if not underpin, many new outsourced services for individuals and households.

Our cities will become smarter, with fully digital infrastructures, enabling us to improve lifestyle and economic success. The focus will be on improving old infrastructure, applying new business models to fund these investments, and enhancing public safety and emergency communications.

## Capitalising on Our Digital Future

The future society is not a singular entity, but a collective of numerous networked communities and individuals.

Australia has already entered a new era over the past five years: the second half of the already-exciting Infotronics Age. It could well prove to be a new golden age for the nation of the sort it has experienced just three times in its two-and-a-quarter centuries of progress, where full employment and a fast rising standard of living were de rigueur.

The transition into the world envisioned by this report will be marked by changes ranging from the subtle to the forcefully disruptive. The boundaries will continue to blur between work and leisure, public and private, technological and human. Businesses will incorporate community and customer collaboration into their very essence, providing immersive cross-channel engagement with their stakeholders based around access to comprehensive real-time data. Social media and networking technologies grow in parallel with an increasingly autonomous and individually-empowered workforce, resulting in more horizontal business hierarchies.

### **Future shapers of change – organisations**

- Deliver business model innovation
- Drive customer and community collaboration
- Integrate cross-channel
- Obtain insights from analytics
- Optimise the digitally-enabled supply chain

The changes wrought on business have greater implications for individuals and their citizenry in future society. Education makes a transition from a mass medium to a pluralism of bespoke yet global offerings, developing new skills and communities around the learning process. The horizontal business exists as part of a horizontal society in which work focuses on objectives rather than spending a specific amount of time in a specific place. As mobility of work and lifestyle increases, the very notion of citizenry evolves to span multiple virtual and physical communities and an even greater variety of cultural practices and norms. The future society is not a singular entity, but a collective of numerous networked communities and individuals.

### **Future shapers of change – citizens**

- Nature of work is changing
- New tribalism
- Longer and healthier lives
- New internationalism

We need to embrace the fast-changing economy and society that this report predicts in this new century and capitalise on the digital future that is underpinning so many of these changes.

# The Macro-environment for Australia

## Key Findings

**The new utility evolves rapidly** – ICT enhanced with ubiquitous high-speed broadband will become Australia's new utility and the most important utility of this century – one as historic as its predecessors.

**Rise in developed resources** – Australia will no longer be known as much for its dependency on the export of natural resources over the next half century as in 2012, but more as an exporter of services such as tourism, business services, health and education services. The export of tourism alone (inbound tourism, lifted dramatically by China and other fast-developing Asian economies) could match the 2012 mineral exports totalling around \$175 billion by 2030.

**Productivity improvements** – By 2020, Australia will return to productivity growth of 1.7% in part due to the new utility, compared with the current 0.6%. By 2050, output for hours worked could double.

**Health becomes the key government challenge** – Health is clearly the next emerging big challenge for government, amplified by our ageing community and accompanied by the other fast growing components of government spending: social security, education and welfare.

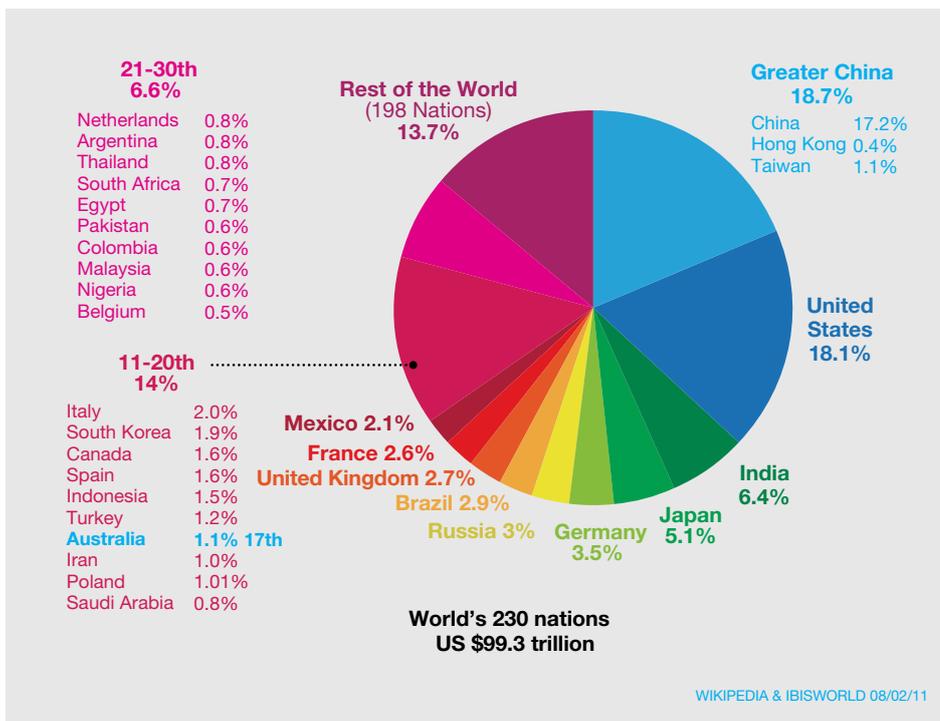
## 2.1 The International Context

Asia's prominence in global economic and political spheres has grown more quickly than once anticipated, and will continue to expand and deepen for the foreseeable future.

Over the past 70 years, world economic growth has averaged 4% per annum, an average it should maintain over the next four or five decades. However, this masks significant changes in the contributors to that growth. The fast growth of the BRIIC cluster (Brazil, Russia, India, Indonesia and China) will offset slower growth in North America and the European Union. The differential growth of the fast and slow-growing nations is changing the ranking order of the Top 20 – see the forecast for 2015 in **Fig 2.1**.

The world of 230 nations is shrinking fast, as countries form themselves into cooperative, if not sovereign, regions for purposes of social integrity, economic benefit and peace. In the 21st century, Australia is in the midst of the Asia mega region – the world's fastest-growing region. Asia's prominence in global economic and political spheres has grown more quickly than once anticipated, and will continue to expand and deepen for the foreseeable future. This rapid development has been driven by cross-national trends, including greater openness and access to global markets, ongoing policy reforms, and increases in knowledge and talent driven largely by communications technology.

Fig 2.1  
**World's 30 Largest Economies**  
 2015 (F) in PPP terms

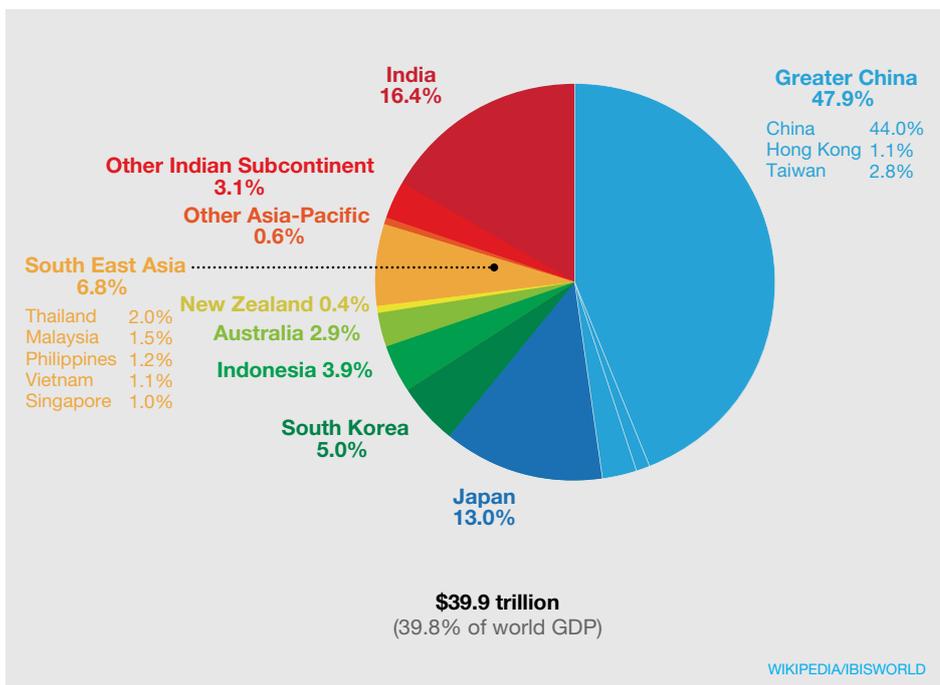


ICT investment and uptake are not only prevalent and accelerating, but often characterised by a high degree of interdependence on shared infrastructure, particularly around national internet and satellite systems.

As a result, cultural and economic borders between Asian-region countries have blurred, including those between Australia and the rest of the region. Demand for natural resources, immigration, and a growing trade in skills and education services now tie Australia closely to China, India and the rest of Asia's emergent forces. These ties are only natural given our geographical proximity, and will offer fast-growing strategic opportunities which, if approached wisely, can be fully realised without compromising existing affinities with the United States and Europe.

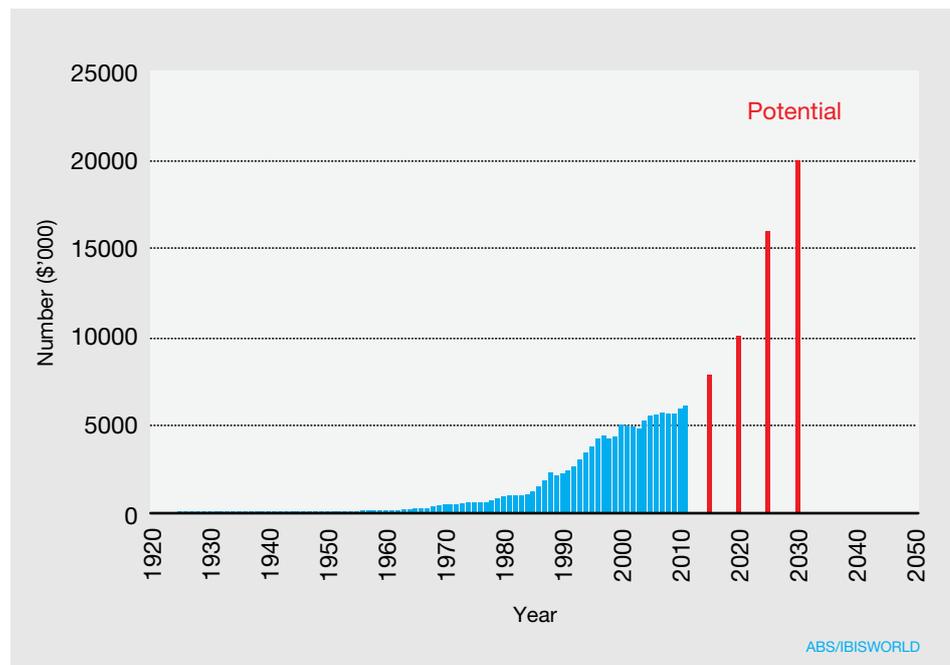
By 2015, the Asia mega region will be dominated by Greater China (48% of the mega region's GDP), India (16%) and Japan (13%), as **Fig 2.2** shows.

Fig 2.2  
**Asia Economy**  
 Asia-Pacific and Indian Subcontinent  
 (PPP terms 2015)



China has already become Australia's largest export destination, overtaking Japan, and it is possible that India and Indonesia will follow suit during this century. These exports will include services alongside natural resources. Australia will no longer be known for being as dependant on the export of natural resources over the next half century as in 2012, but more as an exporter of services such as tourism, business services, health and education services. Indeed the export of tourism alone (inbound tourism, lifted dramatically by China and other fast-developing Asian economies) could match the 2012 mineral exports totalling around \$175 billion by 2030. The potential inbound for tourism growth is shown in **Fig 2.3**.

Fig 2.3  
Australia's International  
Tourism  
Inbound Numbers



The new utility is already playing a big role in many Asia-Pacific nations, notably South Korea and Singapore. The results of these investments not only demonstrate the potential socio-economic benefits of the new utility, but serve to illustrate the successful modus operandi that has influenced its evolution.

The Republic of Korea is typically regarded today as the leading example. South Korea has dramatically higher broadband penetration rates in both urban and rural areas than other nations and around 91 mobile broadband subscriptions per 100 inhabitants, as of 2011. The rapid nation-wide implementation of both wired and wireless high-speed (on average 100 Mbps) broadband was revitalised after the 1997 Asian financial crisis, with the republic viewing infrastructure investment in technology as a key driver of economic growth. As a result, the contribution of telecommunications and broadband to GDP more than doubled between 1995 and 2005, underpinning the country's overall rapid economic growth across numerous sectors. The South Korean government has invested around US\$890 million since 2009 to bring broadband speeds to 1 Gbps.

Quite apart from underpinning South Korea's speed and scope of economic growth, ICT has been a catalyst for major cultural shifts within the country. High-speed broadband is already a cornerstone of Korean cultural identity, from the emergence of electronics firms as symbols of national pride, to the role that internet cafes and online games (such as Starcraft) play as cultural hubs for the majority of Koreans. This contribution to national culture has undoubtedly influenced the South Korean government's focus on maintaining its position as a technology frontrunner.

The NGN is expected to boost Singapore's core financial and professional services industries in a similar fashion to South Korea, with consistent policy efforts designed to ensure universal access to the new infrastructure and its growth potential.

Similarly, Singapore has made its own push towards ubiquitous connectivity. Singapore's Next Generation National (NGN) Infocomm Infrastructure (Next Gen NII) aims to deliver ubiquitous wired and wireless broadband by 2012, with wired speeds of 1 Gbps – on par with those of South Korea. The NGN is expected to boost Singapore's core financial and professional services industries in a similar fashion to South Korea, with consistent policy efforts designed to ensure universal access to the new infrastructure and its growth potential. The government has invested SGD\$1 billion between 2007 and 2008 to deliver 95% wired broadband coverage by 2012, and has already deployed its island-wide Wireless@SG networks with free access to all citizens and permanent residents until 2013. Despite an overall trend towards deregulation, the government is regulating the wholesale rate of wired broadband to be available on a 'non-discriminatory basis', aiming to maximise the cross-strata benefits of hyperdigitisation for Singaporean commerce and society.

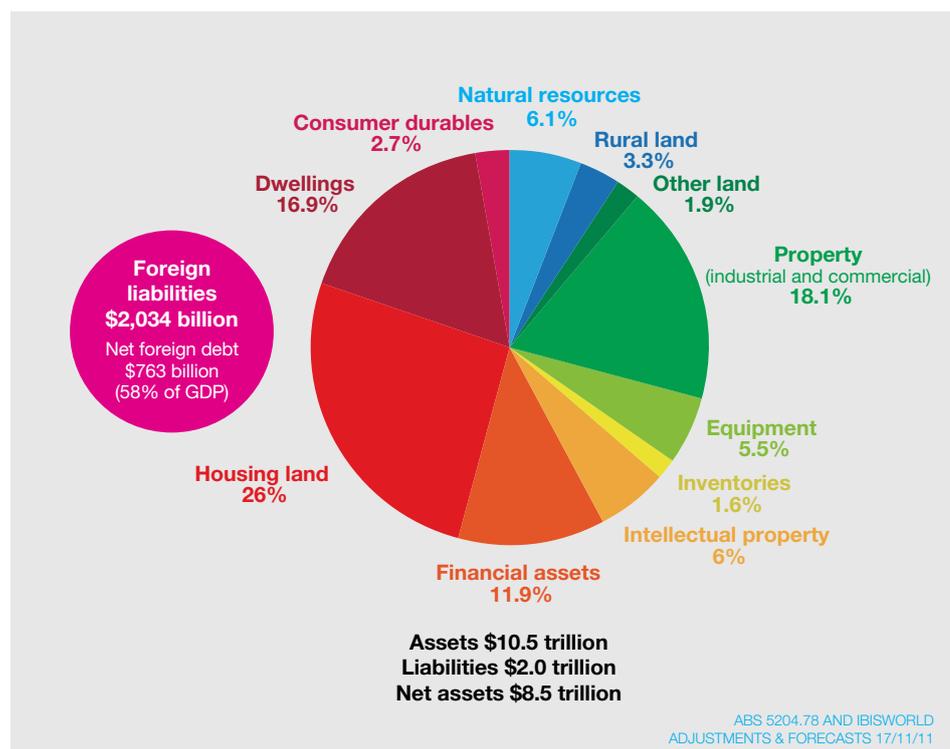
Australia's challenge will be to match these leading economies in the region, for both competitive reasons and the vital communications component of being fellow traders and travellers in the region at large.

We must also be aware of the emergence of hegemony within the mega region as the three most populous nations – China, India and Indonesia are now nearing three billion people, which is more than 120 times our population – exercise economic and political muscle.

## 2.2 National Resources

Our natural resources are a trillion-dollar treasure trove, but their contribution to our wealth is less than an eighth of GDP each year. In fact, natural resources are less than a tenth of our total national assets. As **Fig 2.4** shows, natural resources (subsoil minerals) are valued at just 6.1% of Australia's assets of \$10.5 trillion in 2011, and rural land and forestry is valued at 3.3% of all assets.

Fig 2.4  
Australia's National Resources  
F2011



By contrast, our developed resources (as shown in **Table 2.1**), added to the \$3.5 trillion business assets (33% of the nation's total), produce the lion's share (more than 88%) of annual wealth in Australia. Clearly, it is the developed resources – including utilities – that make nations rich these days, not natural resources. Thus, as an enabler of developed resources, the new utility will be critical to Australia's competitive progress in the increasingly borderless world of this century.

Table 2.1  
Australia's National  
Resources

Developed/developing	Natural
Educated labour force	Locations (part of Asia-Pacific)
The internet	Large and variable landmass
Information and education	Minerals
Banking and other financial	Energy (oil, gas, coal, uranium)
Purchasing and shopping (B2B/C)	Iron ore and bauxite
Computers (high ownership)	Other metallic ores (gold etc.)
Communications	Water resources (top end)
Mobiles, palm-helds, NATSAV	Unique ecology
Broadband, wireless, satellite TV	Flora
Tourism (eco and other)	Fauna
Infrastructure (utilities, transport)	Barrier reef
Medical, bio and nanotechnology	Climate range
Tolerant society	Agricultural and forestry resources

## 2.3 Industries

Based on the Standard Industrial Classification (SIC) system, Australia's industry structure has five industry sectors (new age aggregation), 19 industry divisions and 509 industry classes.

The five sectors are defined as:

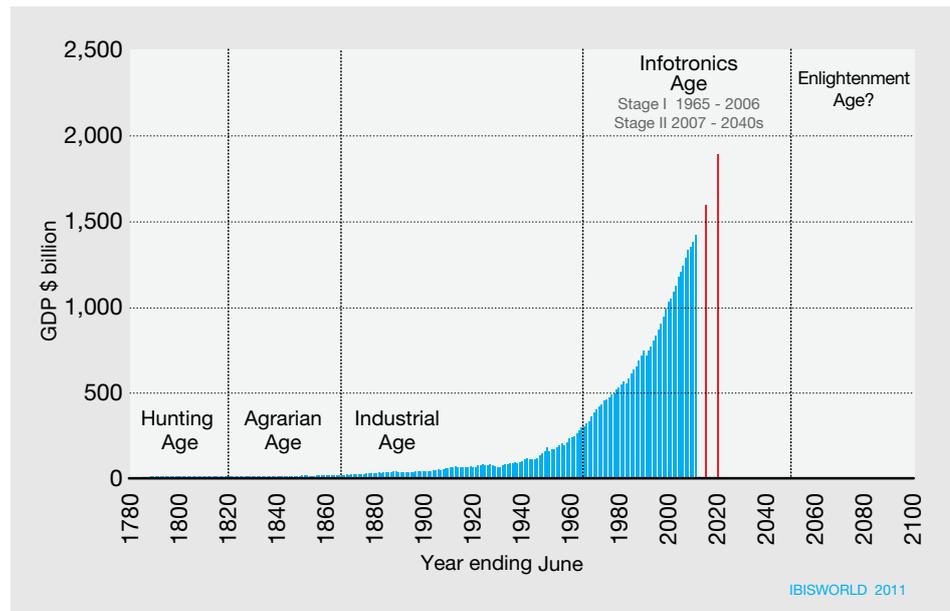
- The **Primary** sector – includes industries that extract or grow natural resources (Agriculture, Forestry and Fishing; and Mining).
- The **Secondary** sector – covers goods made from natural resources (Manufacturing; Electricity, Gas, Water and Waste; and Construction).
- The **Tertiary** sector – consists of industries that distribute primary and secondary goods and passengers (Wholesale Trade; Retail Trade; Transport, Postal and Warehousing).
- The **Quaternary** sector – includes service industries of an information and/or finance based nature (Information Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Public Administration and Safety; and Education and Training).
- The **Quinary** sector – has service industries, mainly outsourced by individuals and households (Accommodation and Food Services; Health Care and Social Assistance; Art and Recreation Services; and Personal and Other Services).

This structure has evolved considerably through several centuries, as shown in **Fig 2.5**, which traces our growing economy as we progressed from one age to another.

At present we are in Stage II of the Infotronics Age, which charts the progress of the ICT evolution. It is dominated by quaternary sector industries that account for 47% of our GDP, with some quinary sector industries such as health industries helping to take the contribution to well over half the nation's wealth production of \$1.5 trillion in 2012.

However, it should be noted that in both stages it has been service industries that have dominated the economy, unlike all previous ages of progress where goods dominated. Interestingly, information-based service industries such as education, professional and other business services, financial services, health and others have led the charge in this direction.

Fig 2.5  
Ages of Economic Progress in Australia  
1788-2011 onwards  
(GDP at constant F2011 prices)



## 2.4 Utility Sectors

The progress of an economy through various ages has always depended on the invention and commercialisation of utilities that assist industries and households alike. A summary of key utilities is shown in **Fig 2.6**.

Fig 2.6  
Utilities Through the Ages

In the **Agrarian Age**, it was **transport** (the wheel, road and water transport) that was the pervasive utility for commerce and households up to the 1860s

In the **Industrial Age**, it was **mechanical power** (water-wheel and steam engine in the first half), then **electrical power** (electricity and telephony in the second stage) up to the mid-1960s

In the **Infotronics Age**, it was **ICT** in the first stage up to 2007, and now a new utility ICT enhanced with ubiquitous high-speed broadband plus analytics, learning systems, cognitive computing in Stage 2, to the late 2040s

IBISWORLD 2011

This means the effect of any utility, existing or new, is primarily horizontal in its effect: it benefits all industries and all households.

Usually, utility sectors emerge in two stages during a new age. In the Industrial Age, mechanical power (water and steam engines), town water, sewerage and gas emerged early to assist industries and (to a lesser extent) households; and was then followed by electricity and telephony in the second half of that age. These second stage additions led to enhanced productivity and were also a boon to households.

In this report, we define utilities as offering pervasive functionality. This means the effect of any utility, existing or new, is primarily horizontal in its effect: it benefits all industries and all households.

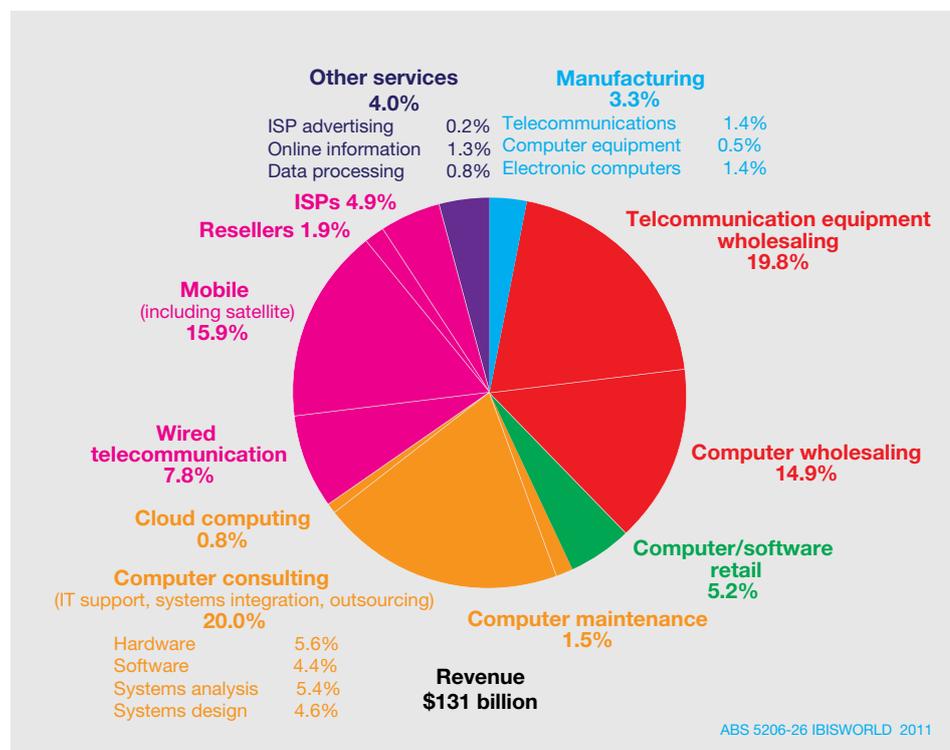
In the Infotronics Age, Information Communications Technology (ICT) – in the form of computers, telecommunications, broadcasting equipment and software – led the new utility sector from the mid-1960s to the mid-2000s.

The second stage turbo-boost has now arrived in the form of digitisation (displacing analog), broadband (cable, fibre and wireless) and advanced software (learning systems, search engine capabilities, and more to come). It will prove a productivity fillip to industry, as did electricity and telephony in the second half of the Industrial Age. It will facilitate the creation of new products and new industries, and as always it will benefit individuals and households as well as industries.

The expected revenue of this new age utility in 2012 is \$131 billion (3.3% of the nation's total revenue of just on \$4 trillion). By 2050, this could be expected to rise to \$1 trillion (in constant 2012 price terms).

The composition of the ICT utility revenue (plus information services) in 2012 is shown in Fig 2.7. Almost 300,000 people (2.6% of the nation's workforce) are now engaged in this utility and its follow-on information services.

Fig 2.7  
The ICT Utility and Services in Australia  
2012 (F)(e)



## 2.5 Economic Outlook

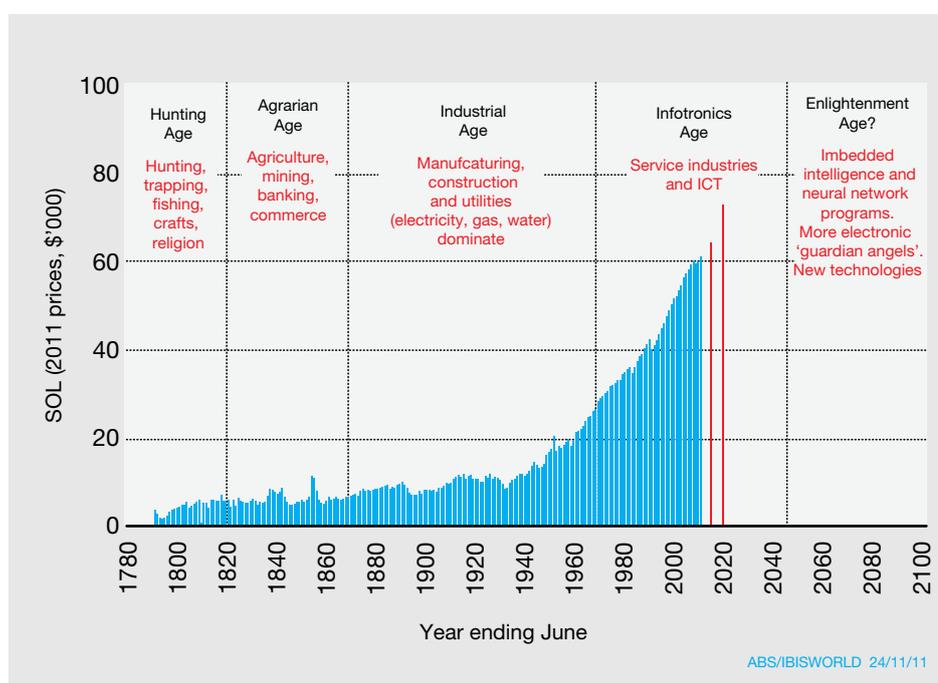
Australia has the seventh highest standard of living (SOL) in the world, having been out of the top 20 three decades ago.

The best may be yet to come for Australia's economy. Looking out to 2050, Australian businesses have more reasons to be optimistic about the nation's economic direction than not. It is likely to provide a sound base for operations and growth, although not matching the growth of our region's emerging economies which have an enormous catch-up challenge to emulate our standard of living (SOL).

### Standard of living and productivity

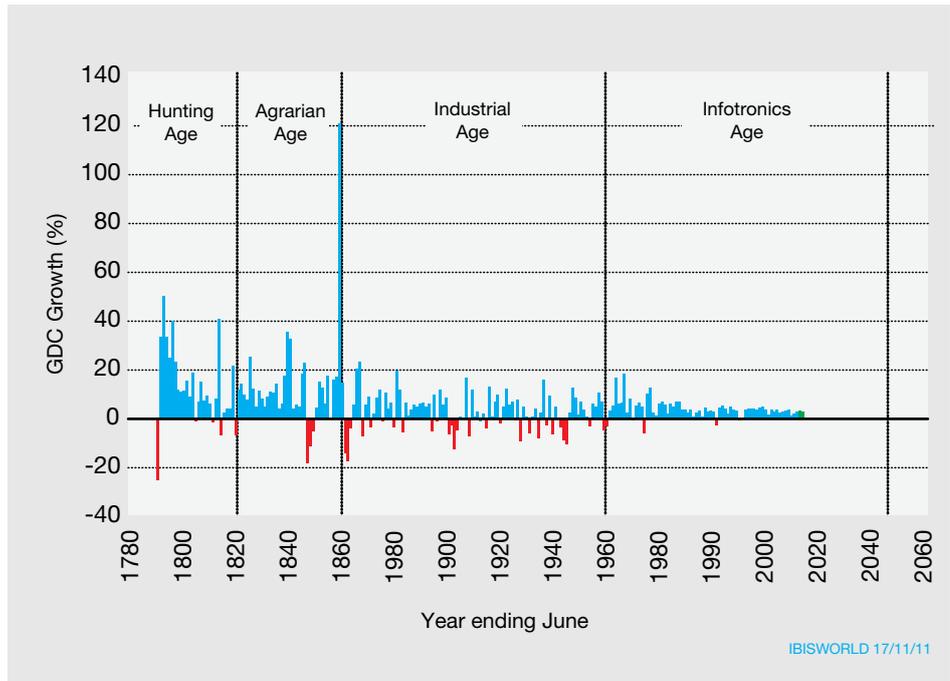
Australia has the seventh highest standard of living (SOL) in the world, having been out of the top 20 three decades ago. The data in **Fig 2.8** suggests that, despite falls in our SOL and GDP (as shown in **Fig 2.9**) from time to time, the trend is encouragingly forward. We could expect to increase our SOL over the next 50 years by about 2.5 to 3 times.

Fig 2.8  
Australia's Standard of Living Growth  
GDP/capita at 2011(F)  
constant prices,  
1788-2011



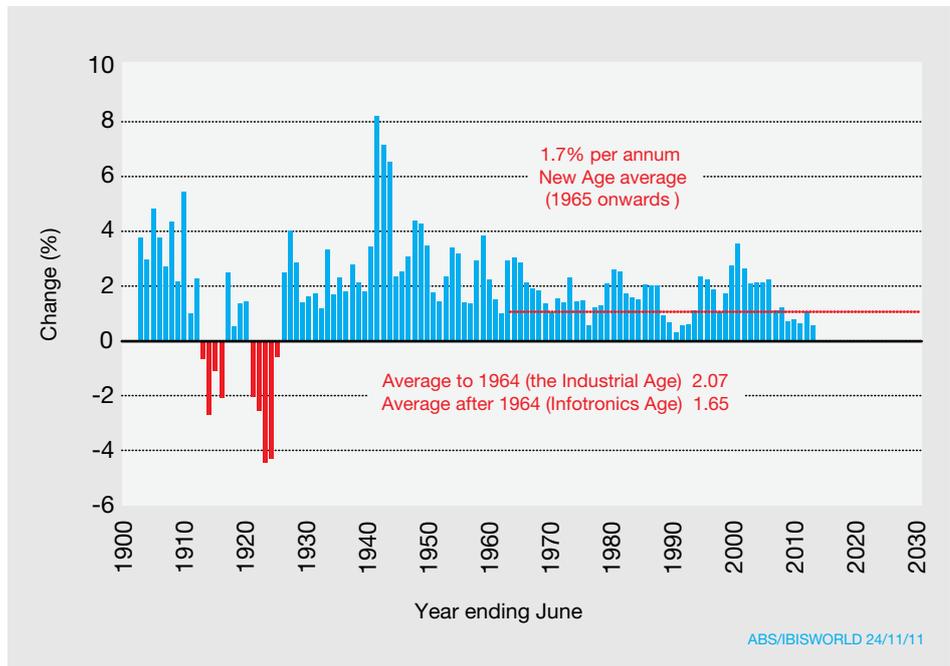
The setbacks in the form of recessions and depressions are clearly diminishing over time as **Fig 2.9** shows. We had six depressions (four major, two lesser) and 25 recessions in the 200 years from white settlement to 1988, but only one recession since then and none for two decades. Most of those were due to domestic problems caused by weather (affecting agriculture) or bad fiscal management, but some were triggered by overseas factors such as price slumps for commodities or depressions that affected our export potential.

Fig 2.9  
**Australia's Economic Growth**  
 1788-2011 + forecasts  
 (GDP at constant F2008 prices)



We could be cautiously optimistic in anticipating a long-term average growth of 3.5% per annum in our economy to the middle of this century, with a SOL growth of 2% per annum. However (shown in **Fig 2.10**), it is our productivity growth that underpins such optimism, and the nation has had little of that over the past decade.

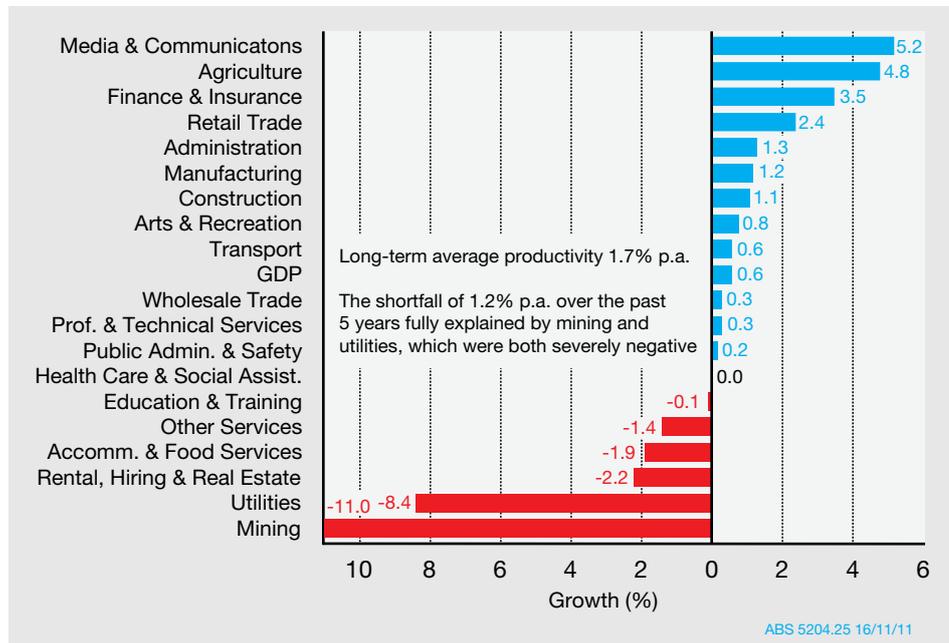
Fig 2.10  
**Australian Productivity Growth**  
 Change in GDP/hours worked 1903-2011  
 (three-year moving average)



During the Industrial Age in Australia, the average annual productivity growth (output per person or per hour worked) was 1.7%, slowing a little to 1.6% in the new Infotronics Age over the past 47 years. Over the past 10 years, productivity grew 1.9% per annum. However, in the most recent five years, growth collapsed to 0.6% per annum (**Fig 2.11**).

Most of these issues are likely to be addressed in this decade with a return to the long-term average before 2020. There is also growing confidence that the broadband rollout (fibre and wireless) during this decade will have a horizontal impact across all industries with measurable increases in productivity.

**Fig 2.11**  
**Australia's Industries Productivity**  
Five-year growth to (F)2011, % p.a.  
(GDP/hours worked)



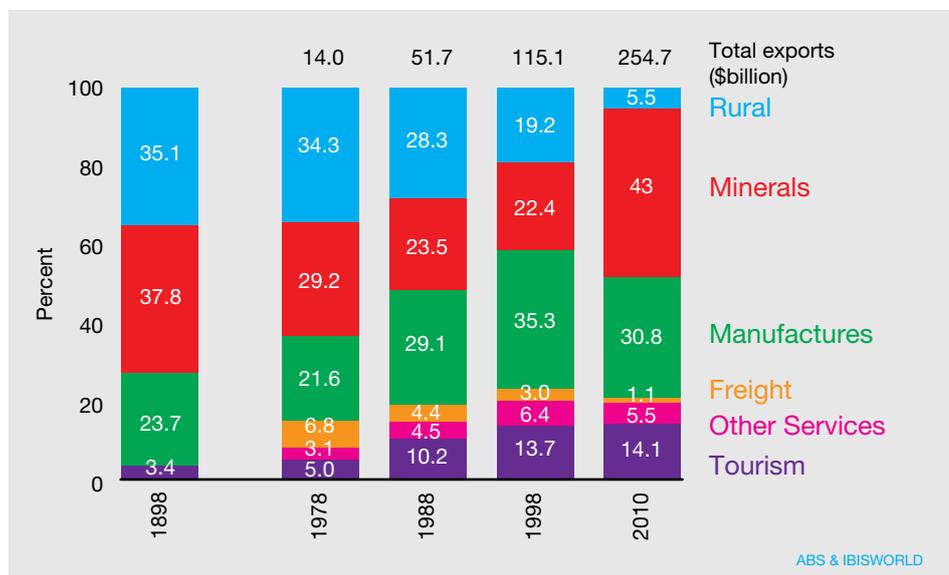
## Exports

By 2050, exports will once again be closer to a quarter of our GDP or more.

Recently, Australia's types of exports have changed dramatically. For most of the nation's 224-year modern history, resource-based exports have dominated in the form of agricultural commodities (more often) and minerals (sporadically, and currently). Manufacturers, however, did dominate for several decades up to the turn of this century.

Today, service exports, in the forms of tourism, education, health, business services and IP, are growing fast – now representing around a fifth of all exports, as is the pattern globally. The new utility will facilitate the continued growth of many of these, especially education, knowledge exports, business services and health. As a result, by 2050, exports will once again be closer to a quarter of our GDP or more, rather than the fifth they are today. The data in **Fig 2.12** traces some of these changes.

**Fig 2.12**  
**Australia's Exports Market**  
By category share of total (%)

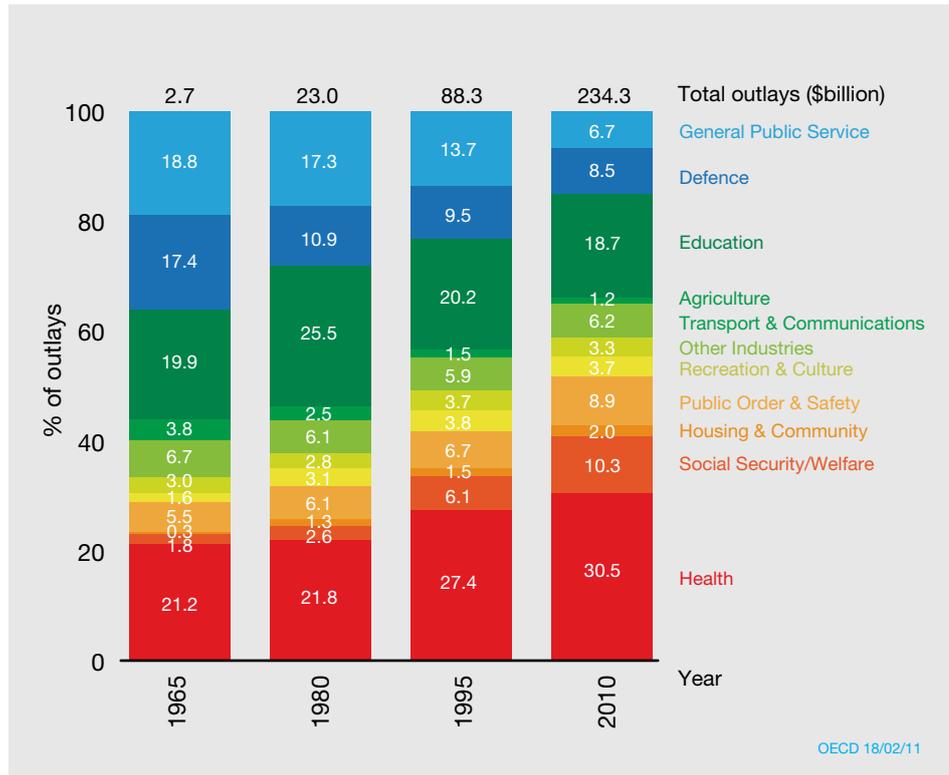


## 2.6 Government Spending

Australian governments are moving through the early decades of this century with some economic advantages over other troubled countries and regions. For example, our public debt is among the lowest in the developed world. However, government resources are stretched to the limit.

Trends in all-government spending over the past half century or more provide some direction as to priorities in the decades ahead for governments. Spending in 15-year gaps from the beginning of the new age in the mid-1960s is shown in **Fig 2.13**.

Fig 2.13  
Australia's Government  
Outlays  
Consumption  
expenditure,  
% of total basis



Government budgeting will not be easy over the next 40 to 50 years, but there are areas of spending (education, health, social security fraud and public safety) that the new utility offers considerable promise of productivity advances.

Health is clearly the emerging big challenge for government. For over a century, costs have been split 1/3 to 2/3, user-paid to tax-paid, and this ratio is unlikely to change significantly. We look at medical applications of the new utility in Chapter 4.

The ageing of the community amplifies the above challenge, as well as the other fast-growing components of government spending: social security and welfare. However, the extension of the official retirement age and the likely increase in the superannuation level to 12% (and possibly 15%) of wages would ameliorate these challenges.

## In Summary

Australia has entered the second stage of the Infotronics Age well positioned to capitalise on its potential. We are in the middle of the world's fastest-growing economic region, with a number of valuable developed resources. If we leverage the new utility to improve productivity and control spiralling health costs, our standard of living and economic prosperity will continue to increase – we will remain the lucky country.

# High-Speed Broadband in the Infotonics Age

## Key Findings

**Massive increase in data usage** – By 2020, Australian consumers will need monthly data allowance of almost 200 GB, and potentially 5 TB by 2030. By 2050, we may need broadband speeds of up to 10 Gbps.

**Device interfaces will merge with the human body** – eventually, we will receive information on contact lenses, our skin will become a touch pad and we will use brain interface machines to command devices via neural control. While in their infancy, breakthroughs in these technologies have already been achieved, laying the foundation for human beings to merge with the digitalised world.

## 3.1 History of Broadband

Early experiments in wireless communications conducted in 1906 led the way for a century of deployment of telecommunications infrastructure.

Broadband is a critical piece of infrastructure for modern-day life and the evolution of the internet, with broadband-enabled services now intimately entwined with national and international economic growth. The United Nations has publicly stated that access to broadband and the internet is a basic human right, initiating the Broadband Challenge with the aim of providing broadband access to half the developing world's population by 2015<sup>9</sup>.

Australia has a long history of being at the forefront of telecommunications. Early experiments in wireless communications conducted in 1906 led the way for a century of deployment of telecommunications infrastructure<sup>9</sup>. The widespread deployment of the copper network in the mid-20th century connected Australian homes and businesses and enabled telephony.

During the 1990s, the number of Australians using mobile telephony grew rapidly as networks matured and the cost of using mobile phones dropped. Around the same time, the transfer of digital data to the home was made possible through the introduction of low-cost modems that enabled 'dial-up' services.

Since that time, fixed broadband technologies such as digital subscriber line (DSL) services, which make use of the existing copper network and hybrid fibre-coaxial (HFC) cable, have become commonplace in the Australian broadband market. In the latter half of the 2000s, broadband was made available to Australians anywhere and at any time due to increased adoption of wireless modems and smartphones that utilise 3G and 4G mobile networks.

However, even with these ongoing technical upgrades to the existing infrastructure in Australia, the quality of services and speeds delivered – particularly on the fixed network – have seen Australia’s place in the global telecommunications market slip. Today, the Organisation for Economic Co-operation and Development (OECD) ranks Australia as 21 on fixed broadband penetration<sup>10</sup>, 22 on price<sup>11</sup>, and 11 on speed<sup>12</sup> (behind the OECD average).

In April 2009, the Australian Federal Government announced its plans to build a National Broadband Network (NBN) that will deliver fibre-to-the-premise technologies capable of providing 100 megabits per second (Mbps) to 93% of homes, schools and businesses.

## 3.2 Where We are Today

Over the next 40 years we anticipate community attitudes to ICT enhanced with ubiquitous high-speed broadband will shift and it will become widely recognised as the new utility.

In 2012, both fixed and wireless broadband networks are widely used to support many different applications and services. Wireless technologies are advantaged by mobility, although speeds are always slower than that achievable over state-of-the-art fixed infrastructure<sup>13</sup>. The insatiable demand for bandwidth means that telecommunications providers seek to off-load wireless traffic onto fixed network infrastructure whenever possible.

However, the reality is that Australia’s copper and HFC networks (like other infrastructures and technologies such as roads, buildings and cars) require ongoing maintenance and are in need of an upgrade. The fibre-to-the-premises network being rolled out by the Australian Government meets this demand and will provide a utility infrastructure well into the 21st century.

The rollout of high-speed broadband services has many parallels with the widespread electrification of households in the Industrial Age. Parallels can be drawn with initial usage and community attitudes. For example, the initial use of electricity in the home was incandescent lighting and there are documented concerns about safety and the need for widespread adoption.

It was not long before a whole host of innovations and developments brought about new and affordable uses for electricity, including washing machines, refrigerators and computing.

The transformation enabled by the utility of electricity led to social changes and drove productivity growth, which in turn led to the advent of the Infotronics Age. Today, electricity is an essential utility supporting every sector of the economy, and developed countries and their economies could not exist without it.

While many today refer to broadband as a utility infrastructure, the fact is that the broader community does not quite see it that way. While most businesses could not operate without email, the concept of broadband to the general consumer is something analogous to a ‘value add’. Broadband’s contribution to the new utility has driven economic and social change, but many in the community do not yet value broadband in the same way that they value gas, water and electricity – absolutely essential for modern-day life.

However, over the next 40 years we anticipate community attitudes to ICT enhanced with ubiquitous high-speed broadband will shift and it will become widely recognised as the new utility.

### 3.3 The Impact on the Economy

The initial use of broadband has been using the internet for information search and email communication. However, the ubiquitous adoption of very high-speed broadband services will enable all sorts of innovations across different sectors of the economy; from business to business, business to the home, and machine to machine. In turn, these applications will help address social and economic challenges.

The impact of broadband on the economy is widely understood by the ICT industries. The 2009 Access Economics report commissioned by IBM predicted that the widespread adoption of smart technologies in the key sectors of electricity, irrigation, health, transport and broadband communications would increase the net present value of Australia's GDP by \$35-\$80 billion over the first 10 years of their deployment<sup>14</sup>.

A recent study report from Ericsson covering 33 OECD countries and found that doubling the broadband speed for an economy increased GDP by 0.3%<sup>15</sup>. This built on a previous report from the same company that found that for every 10 percentage point increase in broadband penetration, GDP increased by 1%.

A recent Deloitte report commissioned by Google found that the value of the internet to the Australian economy rivals iron-ore exports today<sup>16</sup>. The report found that the internet contributed \$50 billion in 2010, equivalent to 3.6% of Australia's GDP, and predicted a growth of 7% over the next few years to reach \$70 billion by 2016.

### 3.4 Future Usage of Broadband and Digital Technology

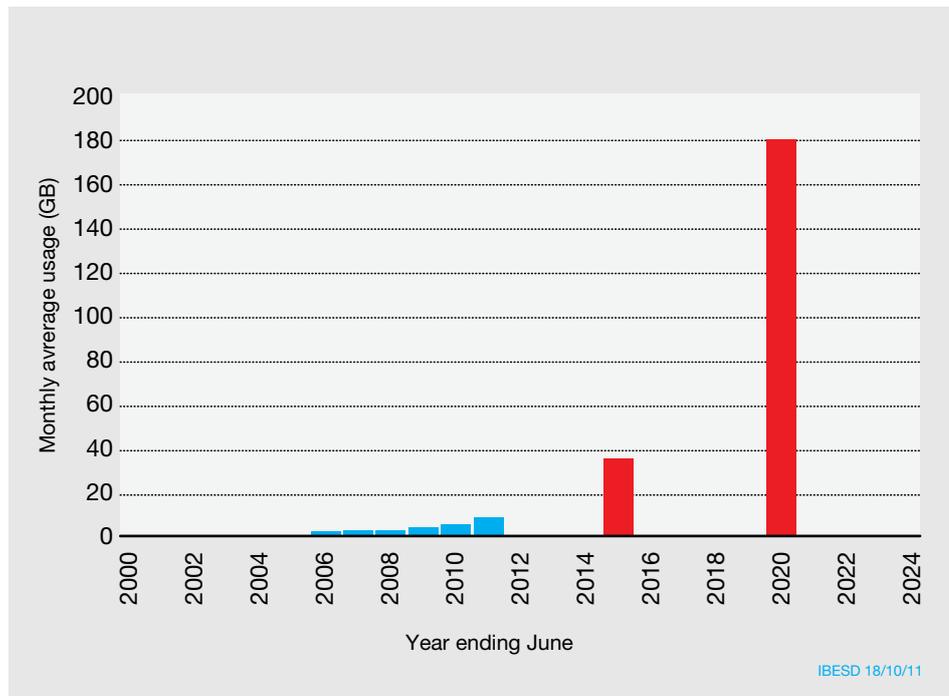
Between 2006 and 2011 the average monthly download volume by Australians increased by a factor of 4.2, from 2.0 GB to 8.4 GB.

Over the past decade the demand for broadband services has grown exponentially. Australian Bureau of Statistics (ABS) data demonstrates that between 2006 and 2011 the average monthly download volume by Australians increased by a factor of 4.2, from 2.0 GB to 8.4 GB.

Usage shown in **Fig 3.1** suggests that by 2020, the average monthly usage will exceed 100GB (at the current rate of growth: more than tenfold growth in a decade). This growth in demand for broadband services is due to the increasing use of applications to meet business needs as well as the social needs of the individual.

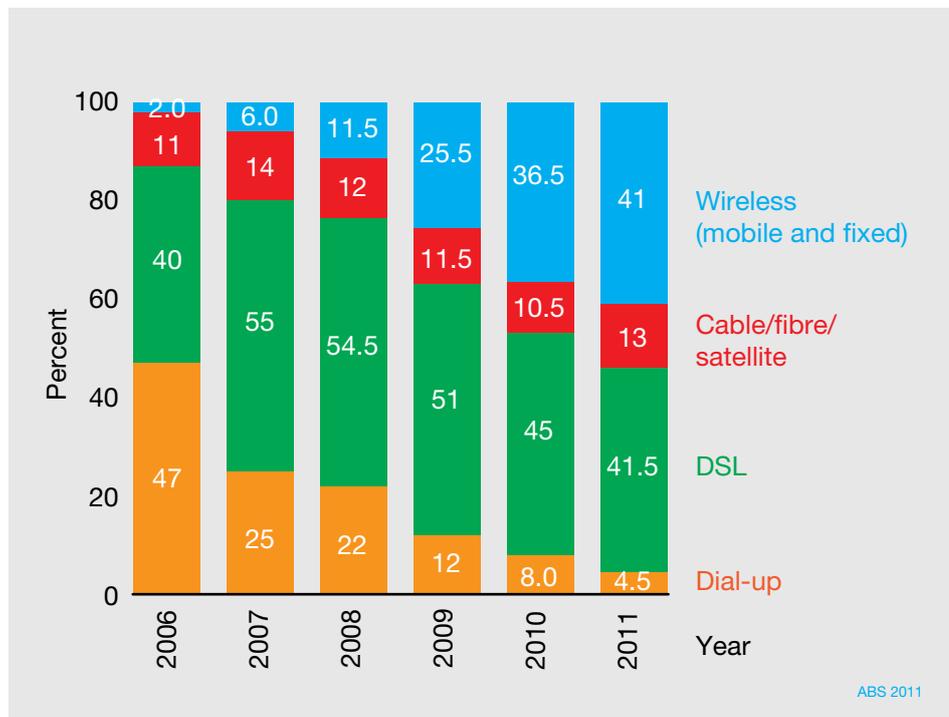
The ABS has been monitoring connection channels since 2006 and separated the download volumes for fixed-cable, wireless and dial-up services. As shown in **Fig 3.2**, the average monthly download volume per fixed-cable user increased from 11.1 GB in 2010 to 15.7 GB in 2011, an increase of 41% over just one year.

Fig 3.1  
**Broadband Usage  
 in Australia**  
 Average (GB/month)



The continuing trend towards more bandwidth-intensive social applications will require higher-capacity networks to support them. However, this is the tip of the iceberg as new applications that are under development, or yet to be dreamt up, are most likely to be multimedia rich and cloud based. These new applications are only going to drive the demand for bandwidth, and hence a need for faster connectivity, into the future as we move from ICT enhanced with ubiquitous high-speed broadband being a ‘value add’ to it becoming truly recognised across Australian society as a utility infrastructure.

Fig 3.2  
**Broadband Connections  
 by Channel in Australia**  
 % of total basis

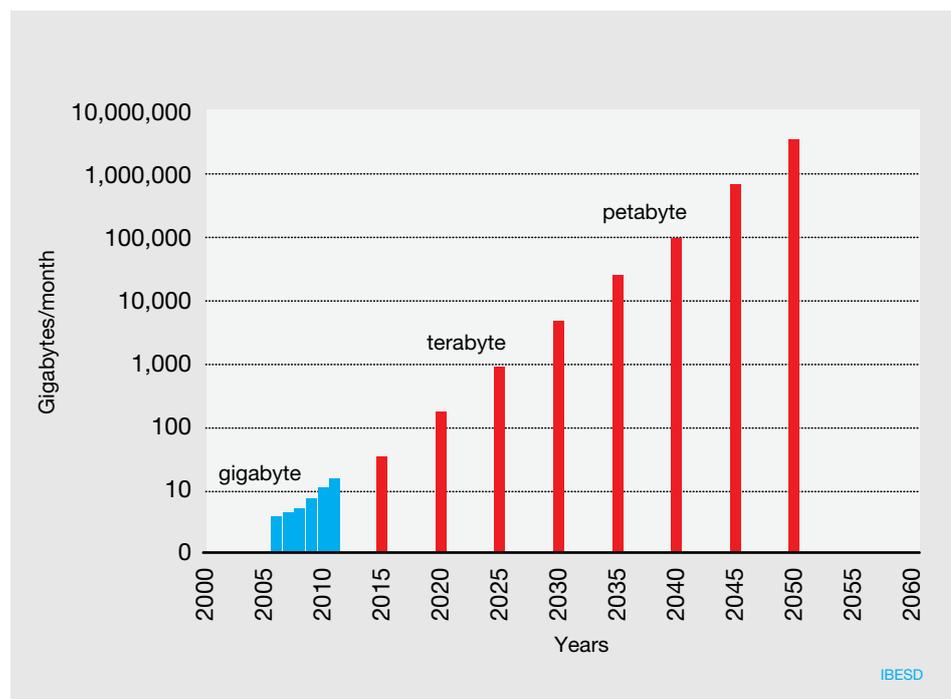


As high-speed broadband networks become ubiquitous, consumers will be exposed to new applications that increasingly make use of real-time video, for example, through video conferencing or Internet Protocol Television (IPTV), which relies on streaming or downloading video content on demand<sup>17</sup>. This increasingly insatiable appetite for video has led telecommunications vendor Cisco to predict that by year end 2012, internet video data will account for more than 50% of consumer internet traffic<sup>18</sup>. Cisco has also predicted that the Asia-Pacific region will experience an average yearly growth in internet-based video communications of 49% between 2010 and 2015, and a compound annual growth rate of 47% for internet video services such as IPTV during the same period.

If we assume a 40% growth in data annually over the next decade, this would see Australian consumers requiring a monthly data allowance approaching 200GB by 2020<sup>19</sup>.

Extrapolating these figures over the next 40 years (shown in **Fig 3.3**), it is not hard to imagine broadband networks needing to support individual consumer monthly download limits in excess of 5TB by 2030. Faster broadband networks are required to support these downloads, and by 2050 we may require broadband speeds in excess of 10 Gbps.

Fig 3.3  
**Broadband Usage Growth  
 in Australia**  
 GB/month



## 3.5 Energy Efficiency

The internet consumes about 1% of the world's electricity supply.

Energy consumption of broadband services could increase to 5%-10% of the world's electricity supply by 2020.

Extrapolations of the growth in monthly data downloads should be treated with caution as a never-ending supply of broadband services to the home is impossible. At a certain point the cost of energy to deliver broadband services may become more than the value of the service itself.

To put this in perspective, the internet consumes about 1% of the world's electricity supply. This is approximately the same as the total electricity generating capacity in Australia. The growth in the number of broadband applications and services, combined with fact that the number of internet users is rapidly growing as developing nations embrace the internet, leads to predictions that the energy consumption of broadband services could increase to 5%-10% of the world's electricity supply by 2020.

In the Australian context this could mean deploying more energy-efficient technologies and solutions to support broadband-related services.

The reality is that while demand for broadband will continue to grow, and speeds increase to meet this demand, greater attention will need to be paid to the energy consumption of broadband services and their impact on operational expenditure.

The move towards energy efficiency will signify a 'coming of age' for this new utility. Parallels can be drawn with 'applications' that make use of the electricity grid. Initial deployments of new devices meet user demands, but are often inefficient. Overtime, their design is finessed to meet external pressures.

## 3.6 Applications

### Proliferation of Information

The sheer amount of information available online is leading to information overload. This is driving a shift towards personalised information management. This personalisation is being driven in two ways.

First, aggregators of information are becoming increasingly important in the online environment. Facebook has successfully tapped into this by allowing its followers to communicate such information, including what they like or dislike, to their own social group while also collecting information on their users and on-selling this to other companies.

Second, intelligence is being built into web-enabled resources such as Google's search engine, enabling the returned information to be better targeted towards individuals' own needs and interests.

In future, machine-based decision making will increasingly assist consumers to navigate and better comprehend the vast amount of information they have at their fingertips. When IBM's Watson defeated two past champions on TV's Jeopardy! game show in February 2011, it demonstrated that computers are at last becoming learning systems – capable of consuming vast amounts of information about the world, learning from it and drawing conclusions that can help humans make better decisions.

In future, we can expect people to wear biosensors that measure their bodies' functions and vital signs, automatically updating their e-Health records and reporting any anomalies back to their local GP or hospital.

Over the coming years, the number of smart devices in the home will also expand. Intelligent refrigerators, washing machines, dishwashers, electricity and gas meters, water systems, heating and cooling systems, home security, lighting and entertainment systems will be commonplace in the home. Sensor networks will also increasingly be used in the home to monitor health and wellbeing. For example, fall detection monitors in the homes of the elderly will enable them to live at home longer, reducing the pressures on aged-care facilities.

In future, we can expect people to wear biosensors that measure the bodies' functions and vital signs, automatically updating their e-Health records and reporting any anomalies back to their local GP or hospital. The information produced from these sensors will be used to automatically control our personal environment and wellbeing, and provide alerts when non-ideal conditions occur.

### Virtual collaboration

The use of high-definition video conferencing is enabling people to connect online and have more personal interactions that mimic a face-to-face experience. The increased access to broadband will also enable an increase in haptic devices that have the capability to simulate the sense of touch, based on a virtual 3-D environment. Haptic devices have already been demonstrated to assist with skills training, for example assisting surgeons to finesse their motor skills prior to performing operations, and have also been developed to enable online physiotherapy sessions<sup>20</sup>.

Combinations of broadband tools, including social networking, video streaming, video conferencing, active gaming and haptic capabilities, help to create more immersive online virtual collaboration spaces for both business and leisure activities. This will have the potential to transform the economy as the geographical distance between workers and the workplace, and the distance between businesses, their supplies and customers, becomes less of an issue. Eventually, communications will become the surrogate transport, a concept explored further in Chapter 5.

### Devices

The increasing demand for simulated face-to-face anywhere, anytime access will blur the boundaries between real and virtual worlds. Three-dimensional images are already in use in cinemas, and 3D-enabled TVs are on the market. Over the next decade, we anticipate that this technology will mature and become a standard feature of TVs and monitors, thus enabling even more life-like virtual interactions between people. With the availability of high-speed broadband networks, the use of holographic images may also become more commonplace<sup>21</sup>.

In future, we will see the merging of the device interface and the human body, as all surfaces become potential interface points with computer/network technology. Surface technology – including the human skin – will be a platform for accessing information<sup>22</sup>. American and Finnish researchers have recently demonstrated contact lenses that can project an image in front of the eye<sup>23</sup>. Such lenses – which provide visual informatics overlays to wearers – have already been tested in rabbits and are considered highly viable as a 'real platform like the iPhone is today'<sup>24</sup>. Researchers are already developing devices that allow users to issue computer commands using their own skin as a touch-pad<sup>25</sup>.

American and Finnish researchers have recently demonstrated contact lenses that can project an image in front of the eye.

In addition, prototype 'epidermal electronic systems' (EESs) – microfilmic layers of electronics that can adhere to the human skin like stick-on tattoos – have already been successfully used to monitor human vital signs. EES technology could soon allow wearers to interface with sensors and devices via proximity or touch<sup>26</sup>.

Moreover, we are now seeing progress in direct neural control over devices and ICT systems. Brain-machine interfaces (BMIs) have allowed animals to control robotic devices using their brain alone. The same technology is now being tested in disabled patients but could extend its applications to broader human augmentation<sup>27</sup>.

At the same time, researchers from Dartmouth College have hacked consumer EEG headsets to control an iPhone by reading the user's brain waves and interpreting them as commands<sup>28</sup>.

Though this technology is in the early stages, once mature it would remove the requirement for people to use a dedicated device to view and interpret information. Looking further out, current science fiction themes such as cybernetics and augmented human intelligence, including the direct communication between the human brain and the world's data network, may become reality. These applications will require superfast networks to facilitate the seamless interaction between humans and their environment.

## In summary

As holographic and haptic technology become commonplace, the information we push down the broadband pipe will expand exponentially. By 2050 we may require broadband speeds in excess of 10 Gbps. To be viable, this will require energy-efficient technologies and solutions. Our interaction with the digital world will also become more seamless, with the potential for the human body to become the interface for digital devices.

# Industries and the Impact of the Digital Future

## 4.1 Key Findings to 2050

**GDP grows to \$5.3 trillion in 2012's economic terms** – with the services sector contributing over three quarters of this. The GDP for F2012, by contrast, is only \$1.5 trillion.

**Our new utility generates revenue of around \$1 trillion** – compared with expected revenue of \$131 billion in 2012.

**The new utility has enabled a raft of industries** including knowledge industries, health and environmental services.

**The following seven (out of 19) industry divisions benefit most from the new utility:**

1. Public Administration and Safety
2. Retail Trade
3. Mining
4. Health Care and Social Assistance
5. Professional, Scientific and Technical Services
6. Education and Training
7. Transport, Postal and Warehousing

**15 of Australia's 509 industry classes risk likely demise**, unless they reinvent themselves.

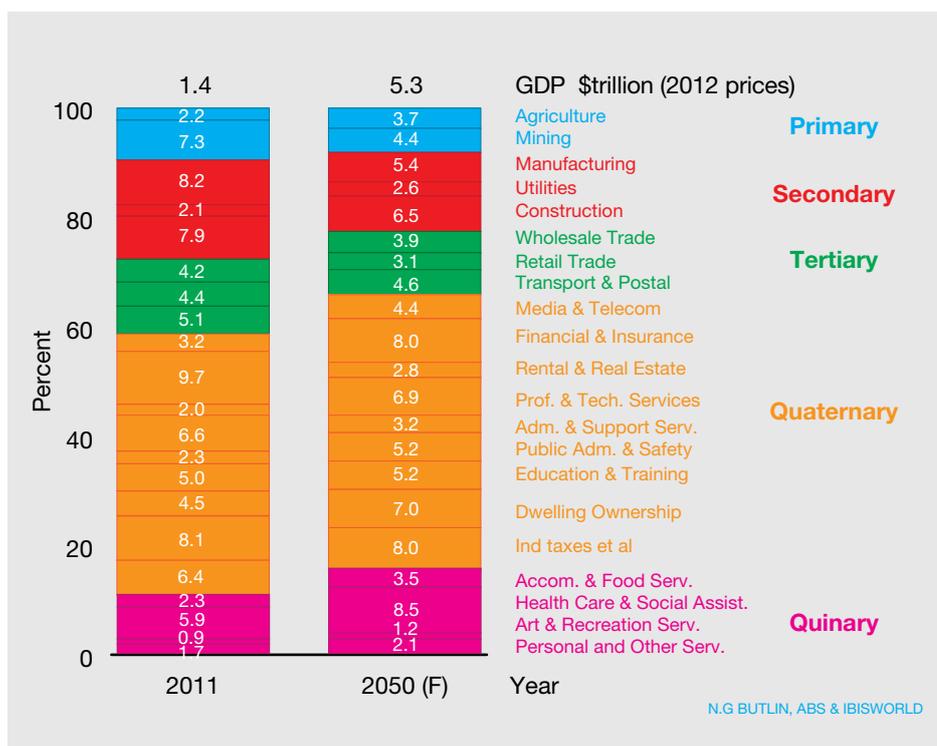
### What will Australia's industry mix look like in 2050?

By 2050, GDP will have grown from \$1.4 trillion in 2011 to \$5.3 trillion (constant 2012 prices).

In **Fig 4.1**, the composition of this GDP is shown for 2011 and 2050 (forecast). The service industries are increasing their dominance, as is happening in all developed economies.

The headline changes include the onward march of the quaternary services sector to more than half the nation's GDP (51% versus 48% in 2010) as part of the new age growth in information and/or finance-related industries. Further shrinkage of the primary, secondary and tertiary sectors could be expected, with a big increase in the quinary sector (10% to more than 14% of GDP) – due largely to the burgeoning health, hospitality and new household services industries.

Fig 4.1  
**Importance of Industries**  
 The changing mix:  
 2011 and 2050 (F)



With the proviso that long-range forecasts can only give us ballpark accuracy – at best – we anticipate that, by 2050:

**Agriculture, Forestry and Fishing** could be enjoying a renaissance, partly as a result of increasing food security concerns in Asia.

**Mining** will have eased back considerably from the current boom, but will then be growing again as part of a new cycle.

**Manufacturing** will have shrunk further as a result of local productivity plus imports.

**Construction and Transport, Postal and Warehousing** will continue to operate in the time-honoured narrow band of change with their usual cycles (the most stable of all industries).

**Wholesale Trade** and **Retail Trade** will ease somewhat as service product growth continues to outpace goods consumption growth.

**Education and Training** will experience pluses and minuses in the decades ahead, with a growing need for knowledge and skills retraining over a working life time, yet virtual education making big inroads into classroom education.

**Information Media and Telecommunications** will climb as a result of high-speed broadband, the emergence of more entertainment (given also increased leisure), and decision engines to supplement search engines and massive data flows.

**Financial and Insurance Services** will shrink in its GDP share with growing productivity and offshore competition (in our increasingly borderless world).

**Professional, Scientific and Technical Services** will grow on the back of more business service function outsourcing and the rise of online information.

**Health Care and Social Assistance** will grow in response to its growing priority in consumers' minds (and purses and taxes), and with an increasingly ageing society.

**Accommodation and Food Services** and **Arts and Recreation Services** will increase their GDP shares as a result of massive inbound tourism numbers.

Even **Personal and Other Services** should grow as a share of GDP as households continue to outsource non-core and discretionary activities.

## Fast-growth industries

In the Infotronics Age, outsourcing plus enabling utilities and technologies have led to a raft of new (or re-oriented) industries as suggested in **Fig 4.2**, which summarises the main growth areas through to the end of the current age.

Fig 4.2  
Fastest Growing  
Industry Themes  
New age 1965-2040s

**Knowledge industries** – database and multimedia services  
**Business services** – outsourcing non-core functions  
**Financial services** – outsourcing of transactions/investment  
**Property services** – property ownership/services  
**Mining** – energy mining (oil, gas, coal, uranium)  
**Construction** – cyclical but growing importance of civil work  
**Transport** – cyclical but growth in road, air, pipeline and freight forwarding  
**Health** – outsourcing home doctoring  
**Education** – outsourcing pre-school, plus universities  
**Personal and household services** – outsourcing chores  
**Hospitality and tourism** – outsourcing the kitchen and travel  
**Recreation and cultural services** – outsourcing leisure  
**ICT** – the new age all pervasive utility  
**Biotechnology and nanotechnology** – new age technologies  
**Environmental services** – testing, assessment, amelioration

IBISWORLD 15/11/11

## How will the new utility affect Australia's 19 industry divisions?

The following assessment of the prospects for the 509 classes of industry in the Australian economy over the next 40-50 years is the work of an Industry Impact Panel comprising: the author, Phil Ruthven; Dr Kate Cornick and Brad Gathercole, IBES; Larry Quick, Resilient Futures; and Dr Elaine Miles and Ian McGowan, IBISWorld. We believe this is the first report in the world that has rated every class of industry in the Australian economy according to the impact of the new utility.

### Methodology

The Industry Impact Panel set out to determine which of the 509 classes of industry would, as a consequence of the new utility, face a *likely demise*, gain a *generalised benefit*, experience a *significant benefit*, or experience a *transformational benefit*. The 19 industry divisions and their 509 industry classes were assessed separately by IBISWorld, IBES and Resilient Futures before the panel members triangulated their findings based on the following criteria: size of the industry, the industry's ability to take up technology; the industry's international competitiveness; and its potential for displacement.

In addition to the rating system, the data was cross-checked against IBISWorld's Industry Database, comprising quantitative analysis and forecasts of all industries in the Australian economy.

### Rating system

**A transformational benefit rating** – given in cases where the new utility would virtually underpin the industry in terms of product, features and delivery, or indeed enable the industry to exist at all.

**A significant benefit rating** – inferred such possibilities as product embellishment, potential productivity gain or other advantage that could be reflected in faster growth, lower costs and/or higher profitability.

**A generalised benefit rating** – one that virtually all industries would receive from the new utility, or a horizontal impact.

**A likely demise rating** – inferred the eventual extinction of the industry.

## Results overview

(% of the industry division's revenue that will benefit from the new utility)

### Transformational benefit

- Professional, Scientific and Technical Services (98%)
- Education and Training (98%)
- Health Care and Social Assistance (96%)
- Public Administration and Safety (89%)

### Significant benefit

- Administrative and Support Services (71%)
- Mining (66%)
- Electricity, Gas, Water and Waste Services (64%)
- Retail Trade (60%)
- Transport, Postal and Warehousing (59%)
- Information Media and Telecommunications (52%)

### Generalised benefit

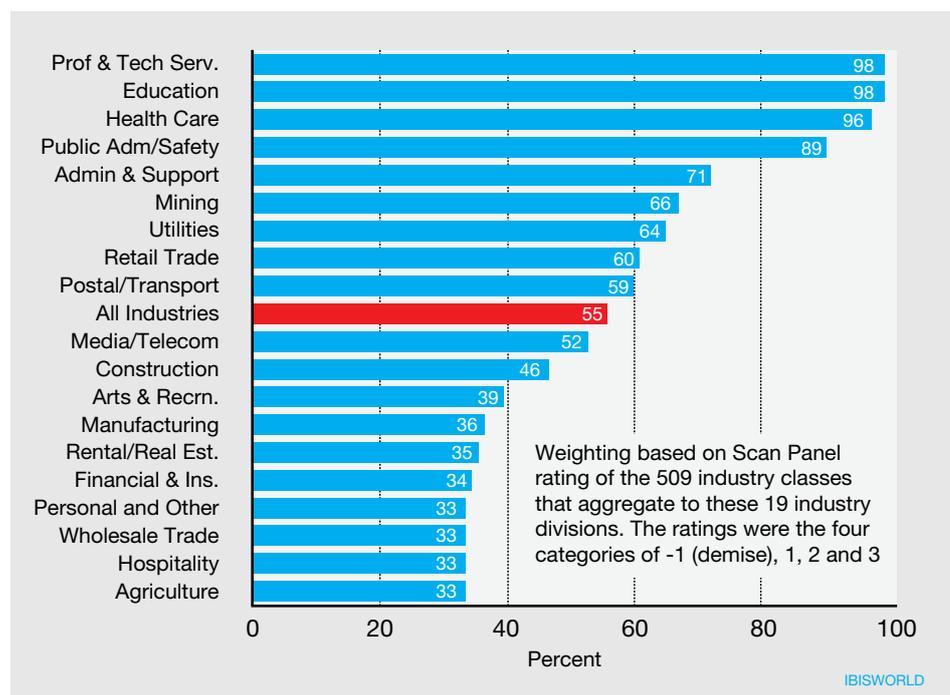
- Construction (46%)
- Arts and Recreation Services (39%)
- Manufacturing (36%)
- Rental, Hiring and Real Estate Services (35%)
- Financial and Insurance Services (34%)
- Personal and Other Services (34%)
- Wholesale Trade (33%)
- Accommodation and Food Services (33%)
- Agriculture, Forestry and Fishing (33%)

These results are graphically presented in **Fig. 4.3**.

### Likely Demise

Such a dire prediction was not allocated to any of the 19 industry divisions, but it was allocated to 15 of the 509 classes.

Fig 4.3  
Fast Broadband Benefit  
Ranking  
Weighted benefit  
% of revenue in each  
industry division



### Impact by revenue

The scores the Industry Impact Panel allocated to the 509 industry classes were then weighted on current (F2012) revenues for each class. The outcome is shown in **Fig 4.4**.

Seven out of the 19 industry divisions that house the 509 industry classes will benefit most from the next utility, accounting for three-quarters of the national opportunity by revenue, as summarised in

**Table 4.1**. Detailed results are explained in Appendix 7.2, showing the impact ratings and the revenue of the industry classes (for perspective purposes).

Fig 4.4  
**Opportune Industries**  
Weighted revenue of prospective industries, % of total 2012

Graph depicts transformational and significant rated industries.

Some revenues have been discounted from tabulated results: 1) *significant* is weighted at two-thirds revenue; and 2) Public Administration and Safety is weighted at half due to double counting of revenue (transfer payments) and social welfare.

The proportions do not purport to be convertible directly to ICT spending in the same proportions.

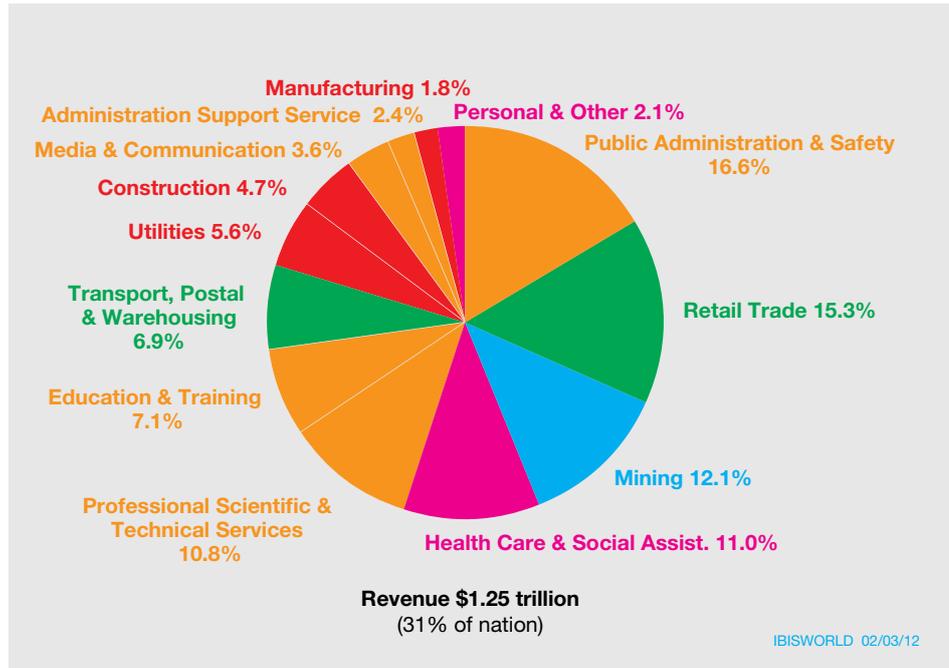


Table 4.1  
Key divisions to benefit  
from the new utility  
and the impact

## Key beneficiaries from the new utility by % of opportune industry revenue

(based on 31% of the nation's \$4 trillion total revenue in F2012)

### 1 Public Administration and Safety

Superfast broadband, analytics and advanced software programs will give us smarter, fast-response emergency services, which will use predictive analytics to forecast and mitigate the impact of natural disasters, among many other innovations.

### 2 Retail Trade

Retail will continue its online revolution, with eBay, Amazon and other diverse product group providers redefining the traditional concept of high street and shopping centre retailing.

### 3 Mining

Smart sensors and machine-to-machine communications will reap productivity benefits for mining by taking out labour costs and increasing efficiency. Superfast broadband will play a very important function in logistics, virtual operations (including robotics), ore grade use optimisation and exploration analyses. This will become much more important as mineral prices pause and fall after the current cycle peaks in the 2020s, if not earlier.

### 4 Health Care and Social Assistance

Poised to become Australia's biggest industry division and employer well before 2050, this division must harness all the power of analytics and the speed and connectivity of superfast broadband to prevent what will otherwise be a massive cost burden by the late 21st century. In this division, superfast broadband will be vital in driving healthcare costs down by faster diagnostics, preventive health systems, partial self-diagnostic services and more efficient systems and operations in hospitals.

### 5 Professional, Scientific and Technical Services

This industry division will grow on the back of more business service function outsourcing, the rise of online information, a massive increase in creative and enabling software, the growth of ICT in the form of cloud computing and many other activities.

### 6 Education and Training

Education must embrace the new paradigms powered by superfast broadband, and new delivery systems (including virtual delivery), if Australia is to become smarter in an increasingly borderless and competitive world. This is particularly important for higher education, which is facing growing competition from the increasingly information-oriented emerging large economies in the Asia-Pacific.

### 7 Transport, Postal and Warehousing

Along with water, energy and gas, Transport, Postal and Warehousing will reap major productivity benefits from the use of smart sensors and machine-to-machine communications that enable automated or more efficient operations.

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## 4.2 Primary Sector

The nation's primary sector, often referred to as the natural resource sector, has two industry divisions: *Agriculture, Forestry and Fishing* and *Mining* – both deriving their existence from the earth.

### 4.21 Agriculture, Forestry and Fishing

This division, one of our oldest, is under enormous pressures and adversity.

This division, one of our oldest, is under enormous pressures and adversity. It faces uncertain weather conditions across much of the traditional growing areas from year to year, with frequent droughts, floods, plagues and fluctuating prices. It can benefit from an undervalued Australian dollar, and suffer in times of an overvalued currency.

Subsidies in the European Union and the United States that prop up uneconomic rural producers have also proved an export barrier for decades. However, if such practices were discontinued the subsequent rationalisation of the rural communities in those nations may make them more competitive anyway.

Entering the second decade of the new century, the division has about a third of the enterprises it had half a century ago. Yet the average revenue per business in 2012 struggles to reach half a million dollars, a third of that of a modern convenience store, but with more than eight times the assets employed. Food agriculture and fishing now dominate the division's revenue (more than 85%), and are likely to further dominate as this century unfolds.

This division has had the lowest profitability of all private sector industries over the past few decades (1.8% return on equity after tax), and much lower than the 10-year bond rate. It is a division in need of a renaissance, especially given the rising food security fears in the Asian region.

Revenue of \$63 billion in 2012(F) ranks it 16th among our 19 industry divisions, yet 13th in terms of its value-added share of our GDP and its employment ranking.

The division's exports are a shadow of their once-dominating role and account for about a tenth of the nation's export earnings. It has few large corporations, the largest being less than half a billion dollars, although the number of large businesses is growing.

Some profound changes taking place in this division that could lead to a change in its fortunes in the decades ahead are:

**New markets** – A shift from Europe and North America to the Asia-Pacific.

**New products** – A shift from livestock products (especially wool and dairy) into beef, horticulture, cotton, oil seeds, grain legumes, aquaculture, crustaceans and molluscs, floriculture and outsourced services.

**New systems and technologies** – Water husbandry, dry land farming, hydroponics, fish farming, dominance of man-made forests (over native), laser levelling, varietal development, and biotechnology (genetic engineering, tissue culturing, hybridisation, etc.).

**New locations** – A shift northward where the majority of the nation's water and heat units are located, with Queensland, Western Australia and the Northern Territory emerging as the key growth areas.

**New ownership and corporate structure** – A shift from land ownership to leasing/rental (from property trusts), sub-contracting of agricultural services, contract supply of agricultural produce to local and overseas manufacturers, and the development of franchising.

The industry could conceivably recover into a new growth cycle that would take its economic share closer to 4% by the middle of the 21st century, or more.

### Industry Impact Panel Findings

In the impact scan of the 509 classes of industry to assess the influence of the new utility, Agriculture, Forestry and Fishing accounted for 49 of them. However, none qualified for a rating higher than a generalised benefit. It was one of two industry divisions (of 19 divisions) not to score any industry class in the substantive benefit or significant impact categories.

## 4.22 Mining

In the current sixth cycle, iron ore and natural gas are particularly important. They dominate the revenue of this division and will continue to do so.

Mining is currently our seventh largest division in revenue terms (almost four times greater than Agriculture, Forestry and Fishing), and our fourth biggest contributor to GDP. However the division is forecast to slip to ninth by the middle of the century. It is a small employer (16th largest industry division), but our largest exporter.

In stark contrast to its sister resource division, Mining is dominated by some giant corporations, one of which – BHP Billiton – is the world's biggest mining corporation, with Rio Tinto a very close second.

The division has a long cycle averaging 45 years, but varying in length from 35 to 55 years. It is climbing its sixth cycle since 1788, which should peak in the next decade and finish (at around 4%-5% of GDP) ready for another cycle by the middle of the century.

The past two life cycles in the Mining division, stretching back to the early 1960s, showed staggering growth in energy minerals such as oil, natural gas and uranium to add to the long-standing importance of coal. However, in the sixth cycle, iron ore and natural gas are particularly dominant. The changing mix of the Mining division over the past century is shown in **Fig 4.5**.

### Industry Impact Panel Findings

In the impact scan of this division, with its 16 classes of industry, all achieved a significant benefit rating as shown in **Table 4.2**.

This division is likely to reap productivity benefits from using smart sensors and machine-to-machine communications that enable automated or more efficient operations.

The new utility could play a very important function in logistics, virtual operations (including robotics), ore grade use optimisation, exploration analyses and other key functions in all the benefitting Mining industry classes. This need will become much more important as mineral prices pause and fall – as they will inevitably do, at least in real if not nominal terms – as the life cycle peaks in the 2020s if not earlier.

Clearly iron ore, coal, natural gas and uranium are the most important, as they dominate the revenue of this division and will continue to do so.

Fig 4.5  
**Australia's Changing Mining Industry Mix**  
 % share of total revenue basis

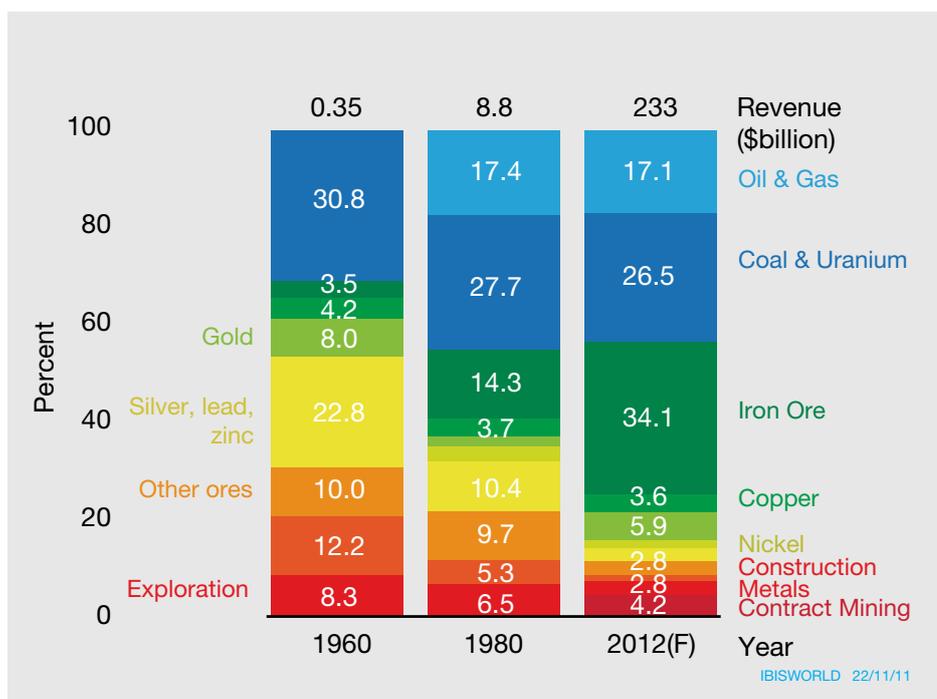


Table 4.2  
**Mining Impact Scan Results**  
 Revenue Guideline  
 \$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
0600 Coal Mining	60.2				
0700 Oil and Gas Extraction	39.8				
0801 Iron Ore Mining	73.2				
0802 Bauxite Mining	1.9				
0803 Copper Ore Mining	8.5				
0804 Gold Ore Mining	13.6				
0805 Mineral Sands Mining	1.2				
0806 Nickel Ore Mining	3.6				
0807 Silver-Lead-Zinc Ore Mining	6.6				
0809 Other Metal Ores Mining	3.0				
0911 Gravel and Sand Quarrying	1.1				
0919 Other Construction Materials	2.3				
0990 Other Non-Metallic Ores	1.4				
1011 Petroleum Exploration	3.7				
1012 Minerals Exploration	3.1				
1090 Mining Support Services	9.8				

## Vision of the Future

# Natural Resources

### **Common digital infrastructure**

By 2050, natural resource companies all over the world have developed a common digital infrastructure for managing all the phases of their value chain (exploration, projects and operations). This infrastructure provides almost unlimited and uninterrupted bandwidth, allowing vast amounts of data to be shared, analysed and used for key decision-making between the fields and remote operations centres or expert centres, independent of location and organisational belonging at all stages of the production process. Based on circulating (relevant) real-time data and open standards throughout the business, this infrastructure will span a combination of fibre-optics, satellite and other telecommunications technologies.

### **Ubiquitous sensors and analysis**

Natural resource operations now incorporate cheap and multifunction sensors throughout the entire value chain. In the case of a mining company, the pit-to-port process is now entirely monitored, with sensors gathering data for operations, maintenance and optimisation purposes at all times. All this data is filtered and streamed to key decision-makers on a real-time basis through the high-bandwidth infrastructure underpinning fields.

To avoid being overloaded with data, natural resources companies have installed filtering and automation procedures to synthesise raw operations data into meaningful decision-making information, based predominantly on business intelligence and advanced analytics solutions used widely across the industry. These solutions also prioritise emergent trends for operators' attention, allowing personnel to focus on the most critical issues at any given time.

### **Full remote control**

To deal with increasing cost pressures, more remote and hostile sites, and an ever shrinking pool of qualified personnel available to work in the field, remote operations centres now monitor, control and optimise all aspects of resource management. During normal operations, remote personnel are responsible for monitoring and controlling most aspects of field operations, with staff performing those few maintenance tasks that require an onsite presence. Remote centres operate on a 24/7 basis, drawing on exponential increases in real-time data to assess situations and perform tasks that could once only be handled on-site.

Remote operations centres are supported by continuous voice and video communication with onsite personnel, and can also visually monitor various areas of the field using live streams from multiple sources. Not only do most key personnel work away from the fields, but their primary role is now decision-making based on data fed through from onsite sensor networks. Video-enabled telepresence connects the few staff stationed onsite with their remote counterparts. 3-D real-time facility modelling, based on video and sensor data, not only allows the remote centres to assess situations more intuitively but can help physically model the potential effects of their decisions.

As well as the safety benefits of reducing onsite staffing levels, remote operations centres can instantaneously connect with one another to access global pools of expertise based on any operation's specific or emerging needs. These virtual command networks allow operators to oversee operations in a 'global office' made up of their entire organisation's expertise.

### **Predictive maintenance**

Sensors not only relay comprehensive data to operators, but also facilitates the prediction of potential maintenance requirements and optimise operations in real time. Data from these sensors is compared against previous trends and known warning signs to provide maintenance forecasts that accurately pinpoint potential failures in the system. Operators now identify degradation earlier, make faster decisions, and more effectively manage their start-up and shut-down processes based on these forecasts. Maintenance is no longer corrective but predictive, keeping operations running in peak or near-peak condition without costly downtime.

In normal circumstances, operators now rely on a combination of sensory data and analytics to automatically optimise processes across all operational areas. From prioritising cargo loads to reducing heavy machinery downtime, automated routines will make minute but continual adjustments that keep the entire operation running at peak efficiency without human intervention. Online systems instantly respond to developing problems, activating fallbacks and fail-safes that control the situation until scheduled maintenance or emergency decision-making can occur.

### **Digital collaboration**

The advent of the remote operations centre brings with it a new collaborative ethos in the industry. Producers, transporters and vendors increasingly share control over processes, linking their operations centres to manage different aspects in constant co-ordination. Telepresence allows these separate organisations to further synchronise their decisions, while also connecting on and offsite personnel more cohesively. Security standards have a new degree of openness to support this multi-organisation approach, but are stronger in how they safeguard the data flows that now sustain resource sites worldwide. Data is now shared across highly specialised teams so that any situation is handled with the appropriate expertise within and across organisations.

### **Trail blazers**

Fibre-optic networks are already being established in the North Sea and the Gulf of Thailand, connecting oil and gas and service companies with a common infrastructure.

Remote operations centres allow Rio Tinto to execute just-in-time delivery of its 'Pillbara Blend' by joining business and information silos in a single command body.

### **How the natural resources industry should prepare for the future**

- Use advanced analytics techniques to automate event detection; develop real-time operations rules, forecasts and predictions to control assets.
- Cultivate local expert and field adviser champions for integrated operations to overcome internal resistance to cultural shifts into office environments.
- Seek out IT providers with a nuanced understanding of field conditions; cultivate familiarity with telepresence and social media to boost effective adoption.
- Expand scope of collaboration to include suppliers, vendors and outside experts
- Support high levels of instrumentation and sensor installation with surveillance and intelligent alarming technologies.
- Dissolve silos of technical disciplines through centralisation in core operations centres.

## 4.3 Secondary Sector

The secondary sector has three industry divisions that owe their existence to the value adding of resources: *Manufacturing; Electricity, Gas, Water and Waste Services; and Construction.*

### 4.31 Manufacturing

Manufacturing's importance to the economy is expected to fall to around 5.5% of GDP by the middle of this century, perhaps lower.

This division is the epitome of the Industrial Age. In Australia, at its peak, it contributed more than 29% of GDP (in 1960). Now around a quarter of that share, its economic importance (value-added measure) is down to third place. However, while slipping too as an employer, it still has the fourth largest workforce in the nation at 954,000 employees at the end of 2011.

Its revenue at \$420 billion in 2012(F) also puts it in fourth place among the 19 industry divisions. However, its importance to the economy is expected to fall to around 5.5% of GDP by the middle of this century, perhaps lower.

One of the real-world disconnects in 2012 is the fact that it takes 145 defined classes of industry to delineate what manufacturing does in Australia. This points to a lack of focus in an age when international competitiveness is growing, and emerging economies – especially but not only China – have greater economies of scale, productivity and lower labour costs.

Iconic industries such as motor vehicle manufacture will fade away well before the end of the first quarter of this century, if not the decade we are now in. Our textiles, clothing and footwear (TCF) sector is already tiny and struggling, having once had tariff protection of more than 200% in the 1970s.

Food and beverages continue to be the largest component of the division's total revenue, yet not as immune to import competition as might once have been thought. Our imports from New Zealand, South America, Africa and elsewhere testify to the inroads into this segment.

The TCF sector, as previously mentioned, has long since been decimated with the dismantling of tariff barriers and quotas, with our motor vehicle industry under similar threat. Chemicals, polymers and petroleum products too are being displaced, as are paper products, transport equipment and machinery. Primary metals are likely to perform best as the nation takes better advantage of its plentiful mineral and energy resources and adopts world's best practice in smelting operations.

For all of the previous attrition, clever entrepreneurs with unique innovation can make a difference by establishing safe niches or ultra-niches on a national and even global level. It could be expected that up to 10% of the 143 classes in this division could yield such results. We have done so in the past, and continue to do so to this day, but nominating which classes will be that innovative is beyond the capacity of any forecaster.

Even then, the Manufacturing division overall will shrink as a share of the economy. However, being a tiny nation (0.3% of the world's population) means we will need to be increasingly clever in what we do in this division and others under similar international pressures.

## Industry Impact Panel Findings

No class was rated as likely to have a transformational benefit from the new utility, and only eight of the 143 classes in this division were rated as likely to experience significant benefit (see results in **Table 4.3**). The Industry Impact Panel also foresaw the demise of at least one class of manufacturing.

Table 4.3  
**Manufacturing Impact Scan Results**  
 Revenue Guideline  
 \$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
1411 Log Sawmilling	1.7				
1412 Wood Chipping	1.0				
1491 Prefab Wooden Buildings (+1492)	5.0				
1611 Printing	13.6				
1841 Human Pharmaceutical and Medicinal	9.2				
1842 Veterinary Pharmaceutical and Medicinal					
2010 Glass and Glass Products	2.5				
2412 Medical and Surgical Equipment	3.3				
1620 Reproduction of Recorded Media	0.2				

Some manufacturing subdivisions may be well placed to take advantage of the new utility in niche operations.

Some manufacturing subdivisions may be well placed to take advantage of the new utility in niche operations. These tend to be those that require the sharing of complex designs such as the Pharmaceutical and Medicinal Product Manufacturing and Professional and Scientific Equipment Manufacturing classes.

Manufacturers such as those supplying prefabricated wooden components for highly customised building designs will also see the benefits of high-speed communications between their customers, engineers and the factory floor.

The wood manufacturing industries were seen to require large files for computer-aided design (CAD) technology (sawmilling) and localised software (prefab buildings).

Printing and support services are users of large files, but the Industry Impact Panel also notes that this is a potential demise industry in the longer term.

Human Pharmaceutical and Medicinal manufacturing and Veterinary manufacturing may benefit from online direct sales, video-conferencing and associated advice.

Glass and Glass Products is a controversial addition. Electronic glass product components and devices are on the rise, but the question is whether they will be imported (most likely) or a niche industry established in Australia.

Medical and Surgical Equipment is similarly debatable due to imports, but large file transfer for design and remote/robotic applications are involved if locally manufactured.

It is expected that this next utility will see the death of recorded media.

## 4.32 Electricity, Gas, Water and Waste Services

This division was the utility for the Industrial Age in Australia from the mid-1860s to the mid-1960s.

This is a division that is expected to benefit substantially from the new utility.

This division was *the* utility for the Industrial Age in Australia from the mid-1860s to the mid-1960s, with steam power the predecessor to electricity for manufacturing until the early 20th century. It continues to be a vital utility in the Infotronics Age, with electricity accounting for 64% of the industry's revenue.

This division ranks last (19th) in employment among the 19 industry divisions, but 16th in its contribution to GDP and 12th in revenue ranking. It is a capital-intensive division, of course, populated with large corporations and dominated by government ownership. The latter characteristic will not survive this report's time frame (the middle of this century), with state governments already planning to privatise more of the utilities, especially electricity.

This is a division that is expected to benefit substantially from the new utility in terms of productivity (long overdue), facilitating the changing mix of technology in power generation, and safety. This would be heightened should Australia adopt nuclear energy at or before the middle of the century. Carbon emission tax and trading regimes add to this challenge.

The division's contribution to the economy peaked in the late 1980s and may ease a little further, while coming back to around 2.5%-3.0% of GDP in 2050.

### Industry Impact Panel Findings

Nine of the 13 classes are rated as *significant benefit* from the new utility, the remaining four as having a generalised benefit.

Table 4.4  
Electricity, Gas, Water  
and Waste Services  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
2611 Fossil Fuel Electricity Generation					
2612 Hydro-electricity Generation	20.9				
2619 Other Electricity Generation					
2620 Electricity Transmission	3.2				
2630 Electricity Distribution					
2640 On Selling and Market Operation	49.8				
2700 Gas Supply	8.9				
2811 Water Supply	9.8				
2812 Sewerage and Drainage Services	11.8				

This division is likely to reap productivity benefits from the use of smart sensors and machine-to-machine communications that enable automated or more efficient operations.

Every class in this industry division given a *significant benefit* rating was for similar reasons – the importance of smart utilities, involving: management strategies for cost effectiveness, export/import implications, data storage devices, optimising peak production times and machine-to-machine optimisation. Sensory network technology is a factor in areas such as water supply and control.

## Vision of the Future

### Energy

#### **A truly intelligent grid, with plugged in consumers**

By 2050, Australia's electricity grid is smart enough to serve individual household preferences for energy consumption. Rather than relying on households to reduce their energy consumption, the grid has taken control, with analytics and automation driving smarter energy use behind the scenes. For example, the grid now controls user-nominated devices, such as pool pumps and tumble dryers, which are not time-critical. This enables the grid to turn off non-essential devices during peak load times and to turn them on to take advantage of surplus energy in the grid. The result is a more reliable supply for Australia and lower energy bills for consumers.

This process requires its own infrastructure. Every household has an always-on internet service and a home area network that hooks up to the utility communications network.

By this time, 50% of Australia's electricity is generated from renewables and we are using fossil fuels much more economically. For example, energy from gas production is 80% efficient, rather than 30% efficient, thanks to the implementation of co-generation and tri-generation power systems. Many consumers produce their own energy, with any surplus being effortlessly extracted by the intelligent grid for local use.

#### **Electric vehicles**

By 2050, the astronomical price of oil, and a pressing need to establish national fuel security, have made fossil fuel-based land transport a thing of the past. Australians drive electric cars, which are recharged at home using single-car charging stations. Most recharging takes place between 2.00 am and 6.00 am, taking advantage of off-peak energy. However, consumers can request peak-hour top-ups when needed, with the grid only providing the energy required to make the planned journey. Electric cars will also provide needed energy at peak times, feeding back into the grid when there is high wholesale energy pricing.

#### **Commuting and workflow merge**

Commuting times and face-to-face meetings are managed by a congestion system linked to our electronic calendars, allowing us to schedule travel time during low congestion periods. Peak-hour traffic is kept under control by most Australians working from home during the rush hours, using video conferencing and collaborative tools. When we do drive in for a meeting, our calendar alerts us when we need to leave, based on current traffic conditions, and they negotiate a nearby car space with the city's parking system, sending the directions to our GPS. This approach not only saves time but optimises the energy consumed in surface transportation.

#### **Precinct-based cooling and heating systems**

Towns and cities have their own precinct-based, district cooling and heating systems – largely powered by renewables. Heating is by steam and cooling by chilled water. Service providers use analytics to model individual building requirements based on weather predictions and previous usage, enabling them to meet local heating and cooling needs in an extremely cost and energy-efficient manner. When doors and windows are left open on particularly hot or cold days – in air-conditioned space – the analytics will sense the waste and provide appropriate alarms to building managers/owners.

### **New retail model**

Energy purchasing has changed dramatically. We can buy packets of energy on eBay, with offers for consumption at a particular time. For example, packets will become available in line with bagasse production from sugar cane. Other special offers include monthly deals specifically for charging our electric cars at a particular time.

### **Trail blazers**

- In the United States, the Olympic Peninsula experiment has already allowed customers to nominate their energy preferences (from 'thrifty' to 'comfortable'), enabling the grid to turn off non-essential devices and reset air-conditioning by a couple of degrees during peak loads. The result has reduced peak load by 15% over a year and lowered energy bills.
- In New Zealand, providers are already packaging up blocks of energy.
- Germany has 29 GW of wind capacity, more than the equivalent of Australia's east coast consumption of 25 GW. In total, Germany generates 65 MW of energy from renewable resources (more than 20% of its overall needs).
- The Danish EDISON project is testing an intelligent power network to connect electric vehicles powered by wind energy.

### **How the energy industry should prepare for the future**

- Rollout smart metering and communication to support smart grids.
- Invest in distributed generation.
- Integrate local and central balancing of all generation.
- Aggregate distributed energy sources.
- Integrate large-scale heating and cooling precincts.
- Move to real customer participation in the power market.

### 4.33 Construction

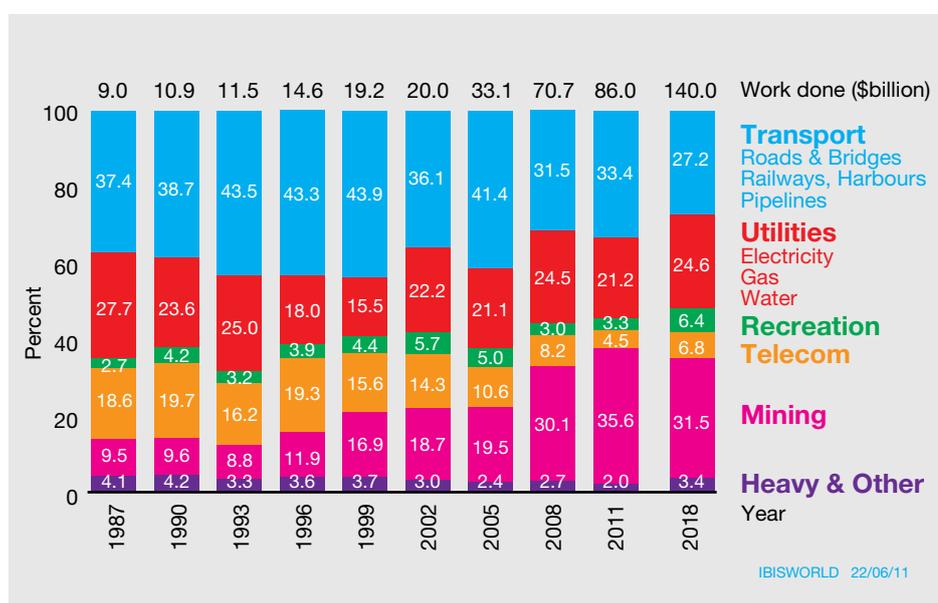
Construction is a big and important division, accounting for more than half of the nation's annual investment.

The final industry division in this secondary sector of the economy is Construction, poised to overtake Manufacturing's share of GDP during this decade. This is a big and important division, accounting for more than half of the nation's annual investment, including vital infrastructure for all our industries – not the least of which has been mining over the past decade.

Within the civil engineering segment (larger than building construction), mining has emerged as the single largest sector and is overtaking transport infrastructure (Fig 4.6). This predominance is expected to prevail for the rest of this decade, although not through to the middle of the century.

This division's revenue in 2012 marked the industry as the nation's sixth largest. Its contribution (value added) to the economy put in fourth place and its employment of more than one million in third place.

Fig 4.6  
Infrastructure Construction  
By sector, % of total base, 1987-2011



#### Industry Impact Panel Findings

The Industry Impact Panel results for the broadband impact on the 24 classes of industry in this division are shown in Table 4.5, again showing only those thought to have a significant benefit (4). None were classified as experiencing the top rating of a transformational benefit.

Table 4.5  
Construction Impact Scan Results  
Revenue Guideline \$billion, 2012 (E)

Industry Class	\$billion	T	S	G	D
3011 House Construction	41.3				
3019 Other Residential Building Construction	11.7				
3020 Non-Residential Building Construction	30.8				
3211 Land Development and Sub Division (+3212)	8.7				

**T** Transformational  
**S** Significant  
**G** Generalised  
**D** Likely Demise

Construction will increasingly make use of machine-to-machine communications and sensor technologies to improve productivity, although the impact of these technologies may not be profound when considered across the division. Remote inspection was one of the factors in the two building construction classes, and remote site visits for land development.

## 4.4 Tertiary Sector

The tertiary sector has been one of the anchor sectors of the Australian economy.

The tertiary sector has three industry divisions involved in the distribution and transport of goods (and people): *Wholesale Trade*; *Retail Trade*; and *Transport, Postal and Warehousing*.

The tertiary sector has been one of the anchor sectors of the Australian economy. Its share of the economy has fluctuated around 14% of GDP over that time, although it has been as low as 11% (1820s) and as high as 19% (1900).

In 1960, its contribution was 13.4% to GDP, and in 2011 it was 13.8%. We expect that share to ease to under 12% in 2050, in the face of the continuing faster growth of service products over goods.

### 4.4.1 Wholesale Trade

This division is big in revenue terms at \$422 billion in 2012(F), albeit with slim margins, and ranks third among the 19 industry divisions, but 11th in its value added contribution to the economy and the nation's employment. It is expected to drop just one position (to 12th) by 2050.

In terms of its make-up, basic materials (agricultural, forest, mineral and simply transformed products from both) have the largest share (35%), followed by machinery and equipment (25%) and motor vehicles (14%).

#### Industry Impact Panel Findings

The Industry Impact Panel could find just one industry class (of 40 classes in the division) that could have a *significant benefit* from the new utility; and one industry class that could face its demise.

Table 4.6  
Wholesale Trade  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

Industry Class	\$billion	T	S	G	D
3491 Professional and Scientific Goods	5.3				
3735 Book and Magazine	1.5				

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Professional and Scientific Goods wholesaling will receive a *significant benefit* due to potential IP and the need for consulting adjuncts.

Book and magazine wholesaling was viewed as in ultimate demise due to online/tablet displacement.

## 4.42 Retail Trade

The Retail Trade division epitomises the impact of the new utility in the form of the ongoing online revolution, which is as dramatic as the advent of chain stores in the 1880s and the self-service revolution of the late 1960s.

Washington H. Soul Pattinson (pharmacy chain) pioneered chain stores in New South Wales with six stores in operation by 1890, and Coles pioneered self-service supermarkets in 1960.

The advent of online shopping is the third revolution in this division. However, this time the dramatic reduction in prices of goods (offset to a small extent by delivery costs) as a result of lower labour costs and the reduction in with physical outlets, is likely to see a shrinkage in the division's value added share of the nation's GDP. It is important to note that online shopping is still retailing, not another displacing industry.

Like the Wholesale Trade division, Retail Trade is big on revenue (fifth of the 19 industry divisions), but in this case even bigger in employment (second largest), boosted by the high proportion of part-time and casual employees. However, its contribution to GDP ranks tenth, heading for 15th by 2050 for reasons given earlier. This is likely to result in shrinkage of the division's current share of GDP of 4.5% to 3.0% in the middle of the 21st century.

The retail market can be divided into three somewhat similar-sized segments: food outlets (37%), motor vehicles (33%), and household requisites (30%). In 2011, it is estimated that around 5% of sales were online, lower than in the United States but following that nation's lead.

### Industry Impact Panel Findings

The Industry Impact Panel has rated this division's 37 classes, finding that one will receive a *transformational benefit*, 11 a *significant benefit* and one likely to face its *demise*.

Table 4.7  
Retail Trade  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

**T** Transformational  
**S** Significant  
**G** Generalised  
**D** Likely Demise

Industry Class	\$billion	T	S	G	D
3911 Car Retailing (Online)	66.9				
4110 Supermarkets and Grocery Stores	83.7				
4121 Fresh Meat, Fish, Poultry Retailing	11.4				
4122 Fruit and Vegetable Retailing (Online)	12.9				
4123 Liquor Retailing (Online)	16.4				
4243 Toy And Game Retailing	1.7				
4251 Clothes Retailing (Online)	12.1				
4252 Footwear Retailing (Online)	2.6				
4253 Watch and Jewellery Retailing (Online)	3.8				
4259 Other Personal Accessory Retailing					
4260 Department Stores (Online)	19.3				
4271 Pharmaceutical and Toiletry Retailing	14.9				
4242 Entertainment Media Retailing	1.1				

The online revolution underpins most of the scores; and it is worth noting that eBay, Amazon and other diverse product group providers are, in fact, department stores.

Entertainment media stores are likely to be displaced by online offerings, and seen as part of the Information Media and Telecommunications industry division.

## Vision of the Future

### Retail and Consumer Products

#### **Smart consumers**

By 2050, the balance of power has completely shifted to the consumer, as ubiquitous broadband opens up a pipeline between the islands of intelligence that represent retailers and their customers. This enables consumers to make choices based on all the pricing information in the market, and retailers to completely personalise the retail experience consumers choose – whether real world or virtual.

Australians engage effortlessly with the digital world through a multitude of new devices. Our household appliances are voice-activated. Screen-based information is now old fashioned. We are used to immersive, real-world experiences created through holograms and haptic interfaces. We can share these physical experiences with friends or colleagues anywhere in the world – touching and trying out a new product together. Indeed, consumers have coalesced into communities of ‘we’ – people who want to share the same experiences.

#### **Death of the department store as we know it?**

The transactional side of retail has become completely automated. Every day, trillions of transactions are carried out machine-to-machine. We don't handover cash – or even a card. Transactions are handled by ‘intelligent agents’ – our automated personal assistants. These agents handle all the repetitive tasks in our lives. For example, they automatically provision our homes with groceries and basic goods, supported by the information from our smart appliances, such as fridges that sense when supplies get low.

The only time Australians actually visit a store is for the experience. Shops are enhanced with interactive interfaces, augmented reality and social media integration to create a unique experience for each individual consumer.

In 2012, shops can only carry a limited range of goods, targeted at the average consumer. By 2050, as we walk towards a display it stocks itself with virtual products selected for us based on the information gleaned every time we interact with a brand, online or in-store, and the personal information we are willing to share with our favourite brands. Haptic and holographic technology allows us to pick up and try these products – and for us to share the experience with our friends.

The department store as we know it no longer exists. Instead, retail outlets are curated environments, where consumers have personalised experiences. Retail has become a service through which we experience merchandising.

### **Manufacturing moves to the home**

By 2020, wholesale has disappeared, replaced by a new industry of local delivery networks, with consumers ordering directly from the manufacturer. At that time, manufacturing was polarising: consolidation at one end and globally franchised cottage industries at the other, with these small, local businesses leveraging intellectual property (IP) and economies of scale, while taking advantage of local resources and much shorter supply chains.

However, in 2050, the entire supply chain has largely been eliminated, with 3D-printing enabling individual manufacturing of personalised goods in our homes. These 3D-printers take a physical object, turn it into bits and bytes and reconstitute it in our homes. When we buy, we license the IP from the brand owner to manufacture their clothes, shoes or appliances ourselves. The broadband pipeline transports the extremely dense information required to specify these personalised goods.

### **Brand management is a core competency**

With manufacturing, storage and transport removed from the retail equation, branding is the only game in town. Brand owners are the new retailers and vice versa. The winners are those best able to understand how their product can improve our lives – and get that message to us. Generic advertising is dead, replaced with individual conversations that lead to personalised products, incentives and experiences.

Like many intermediary sectors, consumer research has become obsolete, as brand owners converse with individual customers all the time.

### **Trail blazers**

- Nespresso Coffee – being sold as an experience not a product.
- Apple Store – built around experiencing Apple products, minimal-effort transactions and home delivery.
- Tesco (UK) – using life cycle marketing to deliver personalised marketing, e.g. promoting baby food to customers who have just started buying nappies.

### **How retailers and consumer product companies should prepare for the future**

- Get to know your customers – through their purchases and the context of their communities (Facebook, Twitter, etc).
- Enable your customers to interact with you through any means (store, mobile, online).
- Start building experiences for individuals and their communities.
- Consider how different customer segments will want to use developing consumer touch points, such as holographic technology.
- Experiment with new types of consumer engagement.
- Invest in customer and social analytics.

## 4.43 Transport, Postal and Warehousing

Integrated transport systems have a large potential arising from the new utility and have the greatest impact in this industry division.

The Transport, Postal and Warehousing division in its earliest manifestations in the 18th and early 19th centuries constituted the main ‘utility’ of the Agrarian Age. This was an age when not only agriculture was important (and dominant) and requiring transport and storage, but also important to the economy were mining and commerce (wholesaling, retailing and banking).

It is the eighth largest division of the 19 with revenue of \$167 billion in 2012(F), the seventh largest contributor in value added to the economy and the nation’s ninth largest employer. It is expected that the division’s share of GDP could ease from the current 5.1% of GDP to 4% before recovering to just under 5% in 2050.

Road transport in all its forms, mainly freight, accounts for the largest share, at 30% of the total revenue in 2012(F). Warehousing and storage is a significant 20% followed by air transport. Support transport services (freight forwarding, etc.) are also a significant 17%. Postal services and courier services account for 6%.

### Industry Impact Panel Findings

The Industry Impact Panel results in assessing the 23 classes of industry in this division are shown in **Table 4.8**. Thirteen rated a *significant benefit* from the new utility.

Table 4.8  
Transport, Postal  
and Warehousing  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
4610 Road Freight Transport	48.8				
4621 Interurban and Rural Bus Transport	1.1				
4622 Urban Bus Transport (including Tramway)	5.7				
4623 Taxi and Other Road Transport	4.8				
4810 Water Freight Transport	5.8				
4820 Water Passenger Transport	5.8				
4710 Rail Freight Transport	9.8				
4900 Air and Space Transport	30.3				
5010 Scenic and Sightseeing Transport	0.2				
5101 Postal Services	12.3				
5102 Courier Pick-Up and Delivery Services	12.3				
5291 Customs Agency Services	3.4				
5292 Other Transport Support Services n.e.c.	12.1				

This division is likely to reap productivity benefits from the use of smart sensors and machine-to-machine communications that enable automated or more efficient operations.

Integrated transport systems have a large potential arising from the new utility and have the greatest impact in this industry division. In particular, high-speed broadband is expected to advance existing aids such as GPS, smart devices (e.g. monitoring temperature), telematics systems, timing, alert systems and logistics (including courier and freight tracking systems). However, a fair measure of personal transport is under threat from surrogate transport – see Chapter 5.

The advent of telepresence and faster broadband is likely to displace many physical transport trips, meetings and conferences.

## 4.5 Quarternary Sector

The quaternary sector is now the largest single sector of the five in Australia's economy, representing 47% of the nation's GDP.

The quaternary sector is now the largest single sector of the five in Australia's economy (and those of the OECD nations in general), representing 47% of the nation's GDP, heading for 51% by 2050. It has a smaller share of the nation's \$4 trillion revenue (42%) and a lower share again of employment (32%). But by all three measures it is our largest of the five sectors.

The industry divisions in this sector are: *Information Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Public Administration and Safety; and Education and Training.*

The theme running through this quaternary (fourth) sector are information and/or finance orientation.

### 4.51 Information Media and Telecommunications

The demise of newspaper and magazine publishing is associated with the slow but inevitable demise of the printed output, but is substituted by online versions.

This division is modest in size (12th in economic contribution, 14th in revenue size and 17th in the employment rank), but has been increasing its share of GDP for decades. Its main player, Telstra, is the nation's ninth largest corporation.

The make-up of the division's revenue in 2012(F) sees telecommunications (landline, mobile, satellite) dominating, with virtually half the revenue. Adding ISP revenue takes this to 57%.

Motion pictures (production, distribution, screening) are second with 15%, followed by the publishing-only component of newspapers and magazines (15% of the industry division's revenue). The printing component fits under the manufacturing industry division. TV and radio occupy a smaller 7% of the total.

#### Industry Impact Panel Findings

The Industry Impact Panel had some difficulty in rating some of the 25 classes of industry that make up this division. Its decisions are shown in **Table 4.9**.

The Information, Media and Telecommunications division will receive a *transformational benefit* from the rollout of high-speed broadband, with massive ongoing investment in infrastructure and the increasing proliferation of on-demand information services and applications such as internet protocol television (IPTV), smart devices, machine-to-machine communications, cloud computing and virtual collaborations. The rating of eight of the 25 classes in the *transformational benefit* category marks this division as one of the main beneficiaries of the new utility.

The ISPs and Web Search Portals industry class will continue to grow with the assistance of the new utility. It is of relevance to point out that internet advertising now is well over double that on radio (now more than 80 years old), about to overtake TV, then advance on print advertising.

Libraries may represent a double-edged sword: going online, or bypassed by search engines.

The demise of newspaper and magazine publishing is associated with the slow but inevitable demise of the printed output, but is substituted by online versions covered by the Internet Publishing and Broadcasting class. The same applies to books, directories and other publishing. Traditional TV, radio and cable are expected to be absorbed into internet distribution in due course.

Table 4.9

**Information Media and Telecommunications Impact Scan Results**  
Revenue Guideline  
\$billion, 2012 (E)

- T** Transformational  
**S** Significant  
**G** Generalised  
**D** Likely Demise

Industry Class	\$billion	T	S	G	D
5411 Newspaper Publishing	4.9				
5412 Magazine (and Other Periodical Publishing)	1.3				
5413 Book Publishing					
5414 Directory and Mailing List Publishing	2.7				
5419 Other Publishing (excluding Software, Music, Internet)					
5420 Software Publishing	0.9				
5512 Motion Picture and Video Distribution	2.7				
5513 Motion Picture Exhibition	1.9				
5514 Post-production Services (and other activities)	5.0				
5610 Radio Broadcasting	1.4				
5621 Free-to-Air Television Broadcasting					
5622 Cable (and Other Subscription Broadcasting)	4.3				
5700 Internet Publishing and Broadcasting	<1.0				
5801 Wired Telecoms Network Operation	10.2				
5802 Other Telecom Network Operation	20.0				
5809 Other Telecommunications Services	9.0				
5910 ISPs and Web Search Portals	6.4				
5921 Data Processing and Web Hosting Services	2.8				
5922 Electronic Information and Storage Services	2.0				
6010 Libraries and Archives	1.3				
6020 Other Information Services	0.4				

## 4.52 Financial and Insurance Services

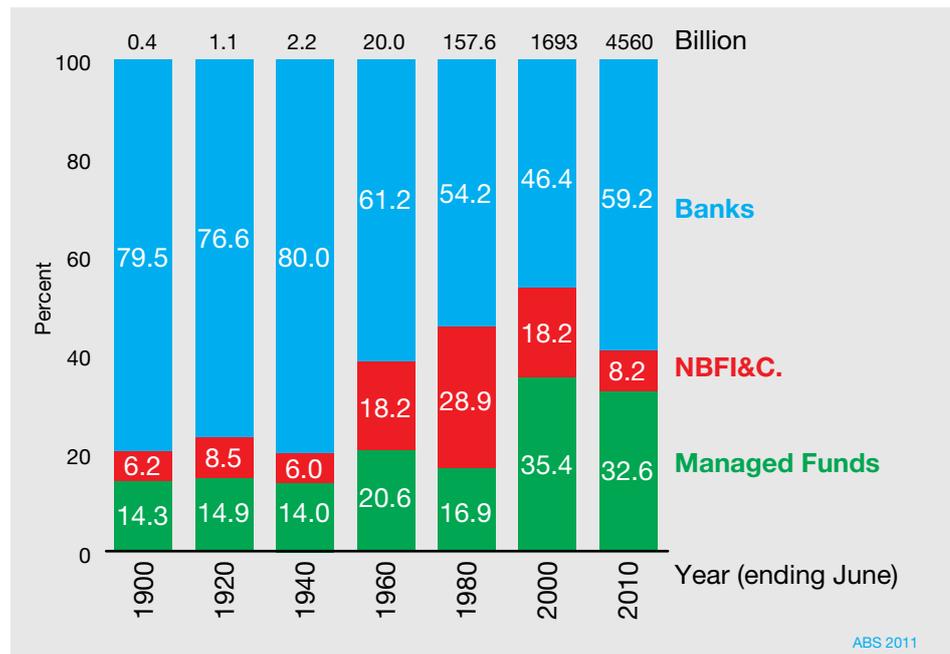
This industry division is the nation's largest in revenue terms and also the largest contributor to GDP with its value-added component, although expected to be overtaken by the Health Care and Social Assistance industry division. Its employment, at 427,000 at the end of 2011, placed it much further down at 12th. It is a very capital-intensive industry because of the financial assets involved in its services.

Its main players are among the nation's biggest corporations in revenue terms, with the Big Four banks occupying positions five to eight.

The industry's value added contributed just 2% of GDP in 1900, doubling that by the end of the Industrial Age in 1964, then rising to 10% by 2012. However, it is anticipated that its share will have retreated to around 8% of GDP by the middle of this century, largely the result of a topping-out in the significance of managed funds, new technology, the bypassing of some bank functions via the internet and borderless financial services in a freer trade environment across the globe.

The data in **Fig 4.7** shows the main drivers of the new age as measured by the relative importance of financial assets: managed funds and – for a while – non-bank financial institutions. The recently increased share of the banks can be expected to be displaced by managed funds as the global financial crisis fades.

**Fig 4.7**  
**The Finance Market**  
**by Major Sectors**  
Domestic assets basis,  
(% of total), 1900-2010



Some of the profound changes that have taken place in the Infotronics Age have been:

- the eschewing of hard assets by businesses and governments, which have chosen to lease buildings, equipment and transport vehicles and factor debts off their balance sheets thereby reducing their usage of banks;
- the advent of compulsory superannuation and increased voluntary savings (partly as a result of our ageing society), which has led to the growth of managed funds;
- the emerging trend to lease rather than own dwellings – occurring very slowly as that trend may be – which further erodes the role of banks as lenders;
- the rapid take-up of electronic banking by businesses and households alike.

All these serve to continue the changes in this division, assisted by the new utility.

### Industry Impact Panel Findings

Extraordinary as it may seem, the Industry Impact Panel found only one of the 14 industry classes in the division would experience more than a generalised benefit from the new utility: Health Insurance with a *significant benefit*.

Table 4.10  
Financial and Insurance  
Services Impact Scan  
Results  
Revenue Guideline  
\$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
6321 Health Insurance	17.4				

The new utility is more likely to threaten traditional financial services than enable it to grow as fast as it has in the past. PayPal is clearly taking fees that were once the sole domain of banks. There is already a commoditisation of transactions and video conferencing should reduce revenues generated via physical meetings. In addition, high-speed broadband is removing lags in the payments system (which currently benefit banks) and fees for service are overtaking commissions among brokers and advisers.

We could only nominate Health Insurance as a significant beneficiary of the new utility given its capacity to increase efficiency, services and knowledge in one of the nation's fastest-growing industries of the next four decades.

Undoubtedly the Financial and Insurance Services industry division will continue to be a huge consumer of ICT services for a long time, but the paradox is the likely eventual shrinking of its share of the nation's GDP through efficiencies and competition from abroad (direct competition and outsourcing of non-core functions) and the bypassing of many of its traditional functions.

### 4.53 Rental, Hiring and Real Estate Services

This industry division covers: vehicle, plant and equipment hiring; property operators; and real estate agents. Property operators account for the lion's share (83%) of the division's total revenue.

There are just nine classes of industry in this division, which ranks 11th in revenue among the 19 industry divisions, 15th in employment ranking and 17th in contribution to GDP.

### Industry Impact Panel Findings

The Industry Impact Panel identified just two classes in the review that were other than likely to experience more (or less than) a *generalised benefit*. Video hire was expected to die, and Real Estate Services were expected to enjoy *significant benefit* from the new utility.

Table 4.11  
Rental, Hiring and  
Real Estate Services  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
6632 Video and Other Electronic Media Rental/Hiring	1.0				
6720 Real Estate Services	9.0				

The Industry Impact Panel could only identify Real Estate Services as a major beneficiary in this industry division, in terms of what the new utility can bring through telepresence, video conferencing, auctioning and other services.

## 4.54 Professional, Scientific and Technical Services

This industry division is the home of ICT services, and the beneficiary of the trend to business outsourcing of non-core functions.

This industry division, with 16 industry classes, has been one of the outstanding performers in the new age since the mid-1960s. It is the home of ICT services, and the beneficiary of the trend to business outsourcing of non-core functions ranging across accounting and legal matters, consumer research, information and a host of technical services. Its rise in importance will be seen shortly.

The division ranks fifth in employment and fifth in its contribution to the economy (but is expected to rise to third by 2050). Its revenue puts it in tenth place, reminding us of the higher value-added to revenue ratio than the goods and goods-related divisions.

It has several big players on a revenue basis, with the all top 10 in this industry division with revenue in excess of \$1 billion. We expect its share of GDP will be around the current level in 2050, having increased its share in the meantime towards 8% of GDP before easing towards the end of this period. The Technical Services segment is the largest subdivision (33%), followed by the Legal and Accounting Services (30%) and ICT Services (23%).

### Industry Impact Panel Findings

The Industry Impact Panel was particularly bullish about prospects for the 16 industry classes in this division, scoring them with *transformational benefit* (14) or *significant benefit* (2). No other industry division in the 19 scored so high.

Table 4.12  
Professional, Scientific and Technical Services  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
6910 Scientific Research Services	2.2				
6921 Architectural Services	3.0				
6922 Surveying and Mapping Services	3.0				
6923 Engineering Design and Consulting	29.0				
6924 Other Specialised Design Services	4.2				
6925 Scientific Testing and Analysis Services	5.8				
6931 Legal Services	19.9				
6932 Accounting Services	15.8				
6940 Advertising Services	2.1				
6950 Market Research and Statistical Services	1.0				
6961 Corporate H/O Management Services	3.5				
6962 Management Advice and Consulting	8.2				
6970 Veterinary Services	2.5				
6991 Professional Photographic Services	0.8				
6999 Other Professional Scientific and Technical Services	5.8				
7000 Computer System Design and Related	31.1				

Time zones in business may well help Australia in 24/7 global activity. The creation and selling of IP globally can be expected to increase. Architecture, as distinct from drafting services, can and is now playing in the global marketplace. Quick rendering and compression technologies are a boon.

Nevertheless, Australia will stand to lose some revenue with the same advantages accruing to overseas businesses.

The expected growth of this division to more than 3% GDP in 2050 is predicated on a continuation of outsourcing.

## 4.55 Administrative and Support Services

This industry division is one of the smallest in the economy, with the second lowest revenue (\$50 billion), although ranking 14th in its contribution to GDP and 13th in employment. It has at least three players with revenues in excess of \$1 billion.

This division owes the growth in its share of GDP, now 2.4% compared with half that in the mid-1960s, to outsourcing by corporations. Such outsourcing includes: employment placement and staffing; travel agency services; credit reporting; and building maintenance services such as cleaning and gardening.

The expected growth of this division to more than 3% of GDP in 2050 is predicated on a continuation of such outsourcing, with more services and with a deeper penetration of the potential market for outsourcing.

### Industry Impact Panel Findings

The Industry Impact Panel selected four of the 12 industry classes in this division as benefitting from the new utility.

Table 4.13  
Administrative and Support Services Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
7211 Employment Placement and Recruitment	>3.0				
7212 Labour Supply Services	15.0				
7220 Travel Agency and Tour Arrangement	2.0				
7291 Office Administrative Services	10.0				

This industry division is likely to be a big beneficiary of the new utility. Recruitment, working from home (partially and some wholly), DIY bookings and outsourced office work are all going to benefit.

## 4.56 Public Administration and Safety

This government-controlled industry division excludes other commercial government activities, such as power generation enterprises, hospitals, water boards and transport enterprises. Some of these are included in other industry divisions such as education, health, arts and others.

However, the 'safety' segment includes defence, policing, correctional centres and other safety and regulatory activities.

The second biggest industry division on a revenue basis (after Financial and Insurance Services), it is a more modest 8th in economic contribution and employment ranking. Rising taxes, towards the OECD average of around 36% (from our current 31%), may be on the cards with an ageing society (pensions, health, etc.), but not necessarily pre-ordained. We expect only a modest rise in this division's share of GDP from 4.9% in 2011(F) to just 5.2% in 2050.

We expect superannuation benefits will mitigate a potential sharp rise in pensions, and long-overdue productivity improvements (with the aid of high-speed broadband and analytics) should mitigate runaway health costs.

### Industry Impact Panel Findings

The Industry Impact Panel selected 12 of the 13 industry classes in this division as gaining a *transformational benefit* (5) or *significant benefit* (7).

Table 4.14  
Public Administration  
and Safety/Defence  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
7510 Central Government Administration	209.0				
7520 State Government Administration	160.0				
7530 Local Government Administration	19.0				
7540 Justice	17.0				
7551 Domestic Government Representation	<1.0				
7552 Foreign Government Representation	<1.0				
7711 Police Services	13.0				
7712 Investigation and Security Services	13.0				
7713 Fire Protection, Emergency Services	1.1				
7714 Correctional and Detention Services	3.8				
7719 Other Public Order and Safety Services	1.5				
7720 Regulatory Services	0.6				

The forecast impact will be driven by:

- Voting and referendums becoming online and lower cost.
- More participatory government: me to we.
- Amelioration of the tyranny of distance.
- The sheer clout of the money passing through government hands.
- Implications for local governments, cities and shires.
- Changes to systemic behaviours (bureaucracy).
- Better feedback through levels of government or emergency services.

## Vision of the Future

# Government

By 2050, government does more than simply regulate the outputs of our economic and societal systems. It is a smoothly functioning system itself, interconnecting dynamically with citizens, communities and businesses in real time to spark growth, innovation and progress. From a citizen's perspective, the different levels and jurisdictions of government work seamlessly together to present a single service.

Key to this is our networked world, enabled by superfast broadband, mobile technology and cheap computer chips. The networked consumer devices we started to see in 2012 were followed by networked businesses – and finally networked everything. Every element of society and our communities – from the shoes on our feet, to the roads they walk down – is actuated and full of sensors. Every object can throw off information about its status, location and interactions. As we pass any artefact – building, road, street sign, shop – it can tell us about itself.

It took a decade of public debate and public/private collaboration to create the universally supported privacy protocols that enable this networked world to be used for the common good.

### **Holistic policy making**

In 2050, by harnessing the information thrown off by the networked world, governments can understand the interconnected nature of policy making. Predictive analytics enables proposed policy changes in one system to be mapped against their flow-on impact to all systems.

As a result, at the national level, we now have deep insights into the trade-off between water, energy, air and climate. This led Australia to fundamentally rethink its water and energy policies. Our country is now forging towards a sustainable future by taking control of our water and energy resources.

At a local level, our councils understand how a proposed policy change will affect the whole system-of-systems that make up our towns and cities. Our fire departments use advanced analytics to evaluate risk of fire in different places and manage their inspections accordingly. Our police services use advanced models to predict where certain types of crime are likely to happen under certain conditions. Our public works agencies get earlier notice of impending events and can preposition resources to respond.

### **Personalised transport**

Federal and state governments have collaborated in building intelligent transport infrastructure that offers citizens seamless door-to-door solutions. This personalised, customised, connected portfolio of transportation services is akin to the personalised telecommunications portfolios that used to connect our iPods, laptops and mobile phones in 2012. The travel network responds to us as we make our way through our communities. For example, road signs will automatically appear in a viewer's native language and the system will prompt us to adapt our route and method of transport to avoid congestion. As we change our travel plans, the system updates any charges for travel, based on the time and mode of transport we select.

### **Enhanced public safety**

The location information built into every person and every object has radically changed emergency response. Just as every parent knows where their child is, emergency services know how many people are in a burning building – and where they are. Fire officers can take control of building management systems, using lighting, lifts and security doors to support evacuations.

The police force is hugely effective now video analytics can alert the nearest officers of potential issues as they begin to happen. Alerts can be triggered by: known criminals appearing in certain locations; crowds of people moving with an apparent purpose; or someone standing too close to the edge in a railway system. When officers enter unfamiliar premises, they are streamed information about the building's schematic and whether firearms are registered to the occupants.

### **Trail blazers**

- Malta is tackling its pending water crisis with a smart integrated water and energy system.
- An application that directs drivers to the nearest available parking meter is operational in some US cities.
- Research has begun into vehicles that do not require drivers and the means for those vehicles to interact with the road system.

### **How the public sector should prepare for the future**

- Invest in intelligent infrastructure.
- Use regulation to support the development of the networked world.
- Create a more flexible governance model that will enable resources to be moved around more easily.
- Address the culture change issues this future may create.
- Develop more agile structures for government to include private sector and community resources.
- Prepare for the privacy debate and continue to improve cyber security.
- Re-evaluate the inhibitors to all levels of government operating in a seamless way.

## 4.57 Education and Training

Education and Training needs to embrace the new utility if the nation is to become smarter in an increasingly borderless and competitive world.

Given its low productivity and critical input to Australia's prosperity, Education and Training needs to embrace the new utility paradigms of education, new delivery systems (including virtual delivery) and more, if the nation is to become smarter in an increasingly borderless and competitive world.

This industry division is likely to be a little more important in 2050 as a share of GDP – 5.2% versus 4.5% in 2011(F). In terms of industry make-up, the revenue shares of the tertiary and secondary school sectors are similar, but the secondary school students are three times the 1.2 million students at universities.

### Industry Impact Panel Findings

The Industry Impact Panel was unanimous regarding the impact of the new utility on Education and Training. All 11 industry classes were deemed beneficiaries: nine at the *transformational benefit* level and two at the *significant benefit* level.

Table 4.15  
Education and Training  
Impact Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
8010 Preschool Education	0.8				
8021 Primary Education					
8022 Secondary Education					
8023 Combined Primary and Secondary Education	44.3				
8024 Special School Education					
8101 Technical and Vocational Education					
8102 Higher Education	39.0				
8211 Sports and Physical Instruction	6.4				
8212 Arts Education					
8219 Adult, Community and Other Education n.e.c.	1.1				
8220 Educational Support Services	0.2				

As in the Retail Trade division, the Industry Impact Panel considered that the online revolution (enabled further by the new utility) underpinned the high ratings given to all the 11 industry classes.

## 4.6 Quinary Sector

This sector has four industry divisions: *Accommodation and Food Services*; *Health Care and Social Assistance*; *Arts and Recreation Services*; and *Personal and Other Services*.

In 1960, it accounted for 8% of the nation's GDP. It now stands at 10.4%, on its way to a forecast of nearly 17% in 2050. This emergence is due to the increase in outsourcing by households and individuals in the Infotronics Age, now over 45 years old. We are outsourcing more health, hospitality (eating out and accommodation), entertainment and recreation, and household chores.

### 4.61 Accommodation and Food Services

This industry division serves both a domestic clientele and (increasingly) inbound visitors. Our domestic population is around 23 million, our visitors around six million each year but with prospects of 25 million a year by 2030 – increasingly from China and, in later decades, India and other fast developing Asian economies.

The division's revenue places it at 15th position among the 19 industry divisions, with its contribution to the economy rank the same, but in seventh position for employment.

There are three sizeable players, all in the food services component, being: McDonald's (\$2.9 billion revenue), Yum! Restaurants (\$ 2.4 billion with KFC and Pizza Hut), and Competitive Foods with its range of fast food outlets (\$1.2 billion).

It is thought this division will growth from its current 2.3% of GDP to 3.5% in 2050.

#### Industry Impact Panel Findings

The Industry Impact Panel could not rate any of the six industry classes in this industry division higher than a generalised benefit.

### 4.62 Health Care and Social Assistance

This division is poised to become the major industry division in the Australian economy. It already occupies first position on the employment ladder and has had no down cycle in its centuries-long history.

This division is our highest employer with 1.35 million workers in 2012. While the sixth largest contributor to our GDP in 2011(F), it is expected to become the largest in 2050. Historically, back to the early 19th century, government has footed two-thirds of the health bill of the nation and the beneficiaries the other one-third. These outlays include other goods and services outside this division such as pharmaceuticals, health insurance and other products.

The costs of this industry continue to grow, concerning everybody in the community and government.

This is why this division, and the wider health market, needs to harness all the power of analytics, high-speed broadband and other innovations to prevent what could be a cost burden too heavy to carry into the late 21st century.

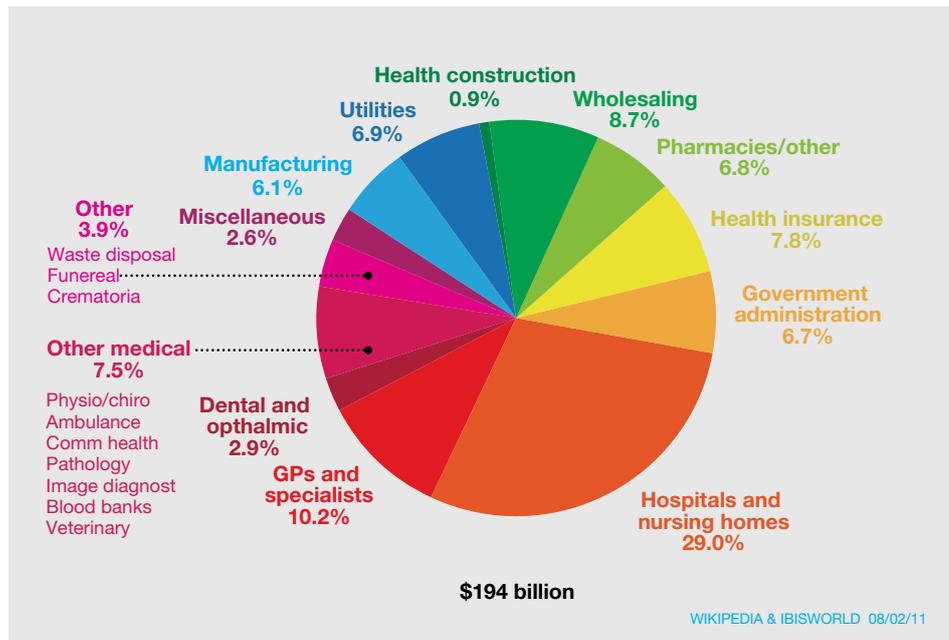
Health Care and Social Assistance is our highest employer with 1.35 million workers in 2012.

In terms of segmentation, 42% of the division's \$147 billion revenue in 2012 is taken in by medical and other health care services, with 35% by hospitals, 13% with social assistance services and 10% by residential care services.

Health outlays that lie outside this industry division that are centred on hospitals, medical care, residential care and social assistance mean that the entire market for health is much larger in revenue.

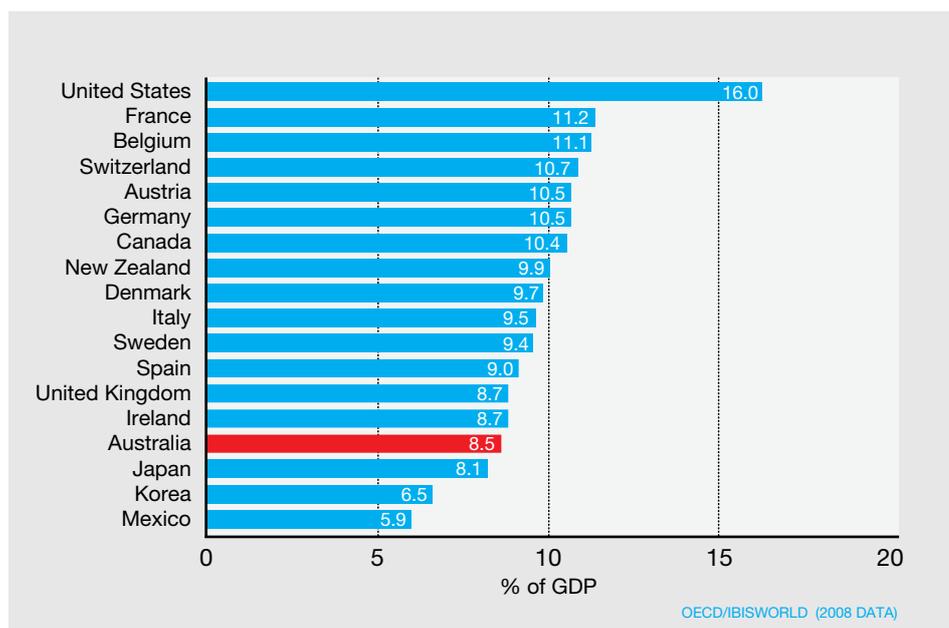
The full extent of the health market in 2010 is shown in **Fig 4.8**. In 2012, the outlays are nudging \$215 billion, or more than \$65 billion higher than the industry division we are now analysing.

Fig 4.8  
Australian Health Market  
2010(F)



Australia is not alone in facing this issue. In fact, our outlays as a share of GDP sit well down the ladder of the 2008 comparison of developed economies (**Fig 4.9**).

Fig 4.9  
Health Expenditure  
% of GDP



## Industry Impact Panel Findings

The Industry Impact Panel accorded 15 of the 16 industry classes in this division with high ratings in terms of their benefit from the new utility: 13 *transformational benefit* ratings and two *significant benefit* ratings.

Table 4.16  
**Health Care and Social Assistance Impact Scan Results**  
 Revenue Guideline  
 \$billion, 2012 (E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Industry Class	\$billion	T	S	G	D
8401 Hospitals (except Psychiatric Hospitals)	50.7				
8402 Psychiatric Hospitals	0.8				
8511 General Practice Medical Services	9.9				
8512 Specialist Medical Services	10.9				
8520 Pathology and Diagnostic Imaging	5.3				
8531 Dental Services	5.5				
8532 Optometry and Optical Dispensing	1.6				
8533 Physiotherapy Services	1.4				
8534 Chiropractic and Osteopathic Services	0.9				
8539 Other Allied Health Services	<1.0				
8591 Ambulance Services	2.4				
8599 Other Health Care Services n.e.c	23.9				
8601 Aged Care Residential Services	14.2				
8609 Other Residential Care Services	14.2				
8790 Other Social Assistance Services	11.9				

The growth in demand and the appallingly low productivity in this industry division point to the desperate need for analytics, systemic behavioural changes and the full armoury of tools (including high-speed broadband) across the board of this massive division.

## Vision of the Future

### Healthcare

#### **A health system we can afford**

By 2050, Australia has halted the spiralling cost of health care, with a new model founded on:

- Home-based care, enabled by remote health monitoring and telemedicine
- Early intervention and prevention, enabled by home health monitoring and easy access to reliable health information
- Tremendous strides in personalised medicine enabled by doctors' ability to access and analyse vast amounts of health data and the dramatically reduced cost of DNA testing.

After four decades of research enhanced by super-computers and powerful analytics, many cancers can now be cured. Hospitals concentrate purely on acute cases, with patients returning to the community much earlier thanks to a network of home nursing and patient care services. This network also allows the elderly to remain in their own homes. Chronic diseases are managed in the community and often prevented through early intervention. Australia's fastest growing service sector is the new wellness industry, which supports a community of Australians that believes staying healthy is a personal responsibility.

#### **Homes are the primary care centres**

The digital infrastructure in our smart homes can connect elderly residents, recovering surgical patients or people with chronic illnesses to remote health monitoring services. Wireless sensors will automatically alert local nursing services if vital signs, or indicators such as blood sugar, reach concerning levels. Home devices with motion recognition sensors can also detect if a person falls and does not get up, or if they are doing their rehabilitation exercises correctly. An automated medication dispenser will record the time and dosage of any medication.

#### **Consultations at the patient's convenience**

Teleconferencing and remote data capture allow Australians to access health services – including GP and specialist consultations – from anywhere: in our homes, or on our smartphones. The hours spent in the doctor's waiting rooms are a thing of the past. By 2050, the specialist and the technology come to you. Now geography is no longer a constraint, patients have a greater choice of specialist and the wait between diagnosis and clinical appointment is almost non-existent.

#### **Hospitals are for acute care only**

With the exception of serious accidents and acute disease exacerbation, hospitals are no longer the first port of call for health emergencies. Up to 50% of patients who would have ended up in hospital in 2012 are now funnelled by a triage portal into community centres or treated at home. There is no such thing as an 'outpatient'. Excellent home nursing and primary care services allow surgical patients to go home early, and maternity units to routinely send new mothers home after 24 hours. Treatments such as chemotherapy and renal dialysis are performed at local clinics or in the home.

#### **Clinical change accelerates**

High-speed ubiquitous broadband has breached the medical data dam, making information on patient populations and clinical trials available to researchers around the world. Whereas it used to take up to 18 years for new treatments to become common clinical practice, accepted best practice changes annually. The wealth of data and availability of predictive analytics reduces reliance on clinical trials, enabling new treatments to be developed more quickly. Advances in DNA testing have led to personalised medicine, bringing with it a cure to many diseases, including most forms of cancer.

### **Team-based health care**

We no longer take a fragmented view of health; instead, medical teams (including nurses, nutritionists, pharmacists and radiographers – some local, some remote) form around a patient's needs and are connected in a virtual team room. As a result, specialists are no longer a bottleneck to service delivery. The right person does the right job. Patient information is updated in real time, accessed by everyone in the team. This holistic, patient-centric model dramatically improves health outcomes.

### **Health professionals practice to their qualification**

Skills shortages have forced the sector to rethink professional remits, with lower-level tasks handed down to appropriately skilled, yet less qualified candidates. GPs now purely specialise in complex diagnoses. Pharmacists prescribe and administer, as well as distribute treatments. Nurses make simple diagnoses and oversee treatment; they no longer get involved in housekeeping tasks, such as making beds.

Health professional training is split between chronic and acute care; many people are specialising in the new disciplines of prevention and wellness.

### **Rise of the wellness industry**

Keeping our population healthy is a national priority, supported by the burgeoning wellness industry. Fitness centres have evolved from advising on diet and exercise to providing health checks and wellness services, such as (the now easily affordable) DNA testing and genomics for tailoring of health and wellness management.

Citizens take pride in being responsible for their health. Most Australians know their at-risk diseases and are well informed about preventive care. 'Dr Google' is recognised as dangerously inaccurate. Instead, people rely on the health industry-created online resource 'Ask the doctor', based on new question and answer technology. We routinely perform simple online diagnostic tests at home – such as a blood test for infection – before bothering a doctor.

### **Trail blazers**

- Rather than adding more beds, aged-care homes in Australia are looking to develop home management services, combining nursing and home help assistance.
- The Danish health system uses digital care for primary care management with automated MedReady Plus Dispenser for medications management, which records medications being dispensed by the individuals.
- In Newcastle, NSW Health is trialling remote monitoring of people with chronic diseases via the NBN.
- IBM Israel Research – universAAL (Ambient Assisted Living) Project – is using information and communications technology to help elderly people to remain in their homes.

### **How the health industry should prepare for the future**

- Invest in remote monitoring technology.
- Introduce patient-centric care, with teams of healthcare professionals.
- Begin extending healthcare practice to professional qualifications (e.g. expand the pharmacy remit).
- Begin building out the fitness centre concept into preventative health care.
- Include prevention and wellness in nurse training.
- Build Patient-Centred Primary Care Health Service Centres as the delivery unit for ambulatory care and acute situations.

## 4.63 Arts and Recreation Services

This industry division is one of the smallest ranking 19th in contribution to GDP and 18th in revenue and employment.

As with the Accommodation and Food Services division, a surge in inbound tourists later this decade and beyond, coupled with growing leisure time, should ensure a share of GDP around 1.2% in 2011 compared with 1.8% in 2050.

### Industry Impact Panel Findings

The Industry Impact Panel identified five of the 17 industry classes in this division as being beneficiaries of the new utility: two with a *transformational benefit* and three with *significant benefits*.

Table 4.17  
Arts and Recreation  
Services Impact  
Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
8910 Museum Operation	2.1				
8921 Zoological and Botanical Gardens	0.9				
8922 Nature Reserves and Conservation Parks	2.9				
9001 Performing Arts Operation	0.6				
9002 Creative Artists, Musicians, Writers et al	0.2				

The new utility will be important to this division. Arts and Recreational Services will be able to access wider audiences via new media. For example, museums and art galleries will be able to attract a greater number of visitors through the use of online virtual spaces and augmented reality.

## 4.64 Personal and Other Services

The final industry division in this quinary sector is also a small division at this juncture, but likely to increase its stature by 2050. This is predicated on more outsourcing of services by more individuals and households for of repairs and maintenance, personal and household services and an increase in the proportion of households employing staff.

With revenue of just \$37 billion, it is the smallest by that measure, 18th in contribution to the economy, yet the tenth highest by employment with 450,000 people.

### Industry Impact Panel Findings

The Industry Impact Panel identified two beneficiary classes of the 23 in this division, both likely to experience *significant benefits*. One class was expected to die out (Photographic Film Processing).

Table 4.18  
Personal and Other  
Services Impact  
Scan Results  
Revenue Guideline  
\$billion, 2012 (E)

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Industry Class	\$billion	T	S	G	D
9512 Diet and Weight Reduction Centres	0.8				
9520 Funeral, Crematorium, Cemetery Services	1.0				
9532 Photographic Film Processing	0.5				

## 4.7 Impact Summary

A summary of the preceding analyses is shown in **Table 4.19**. The Industry Impact Panel found that the impact of the new utility could lead to:

- the **demise**, eventually, of 15 industry classes (3%)
- a **transformational benefit** for 52 classes (10%)
- a **significant benefit** for 84 classes (17%)
- a **generalised benefit** for the rest (70%).

These results cover the 509 defined classes of activity in the economy.

Table 4.19  
Impact by Number  
of Industries  
by Industry Classes

<b>T</b>	Transformational
<b>S</b>	Significant
<b>G</b>	Generalised
<b>D</b>	Likely Demise

Division Titles	Industry Classes	T	S	G	D
Agriculture	49	-	-	49	-
Mining	16	-	13	3	-
Manufacturing	145	-	8	136	1
Utilities	13	-	9	4	-
Construction	24	-	4	20	-
Wholesale Trade	40	-	1	38	1
Retail Trade	37	-	11	24	1
Accommodation and Food	6	-	-	6	-
Transport/Postal	23	-	13	10	-
Media and Telecom	25	8	3	4	10
Financial and Insurance	14	-	1	13	-
Rental and Real Estate	9	-	1	7	1
Professional and Technical Services	16	14	2	-	-
Administration and Support Services	12	2	2	8	-
Public Administration and Safety	13	5	7	-	-
Education	11	9	2	-	-
Health and Social Assistance	16	13	2	1	-
Arts and Recreation	17	2	3	12	-
Other Services	23	-	2	20	1
<b>Total</b>	<b>509</b>	<b>52</b>	<b>84</b>	<b>358</b>	<b>15</b>
<b>Share of Total</b>	<b>100%</b>	<b>10%</b>	<b>17%</b>	<b>70%</b>	<b>3%</b>

Impressive as the findings in **Table 4.19** are, the categorisation by revenue in the same fields is more so. The dollar revenue of the 509 industry classes in the three key categories is shown in **Table 4.20**, along with the proportions of the total \$4 trillion revenue of the nation in 2012.

This way of measuring the impact of the new utility is more relevant since it examines the share of the nation's \$4 trillion of revenue (and by inference, \$1.5 trillion of GDP) being affected far better or worse by the advent of this powerful new utility. This way, the true impact is more obvious.

Table 4.20  
**Impact by Revenue  
of Opportune Industries**  
Industry Classes total  
revenue (E) (\$billions)

**T** Transformational  
**S** Significant  
**G** Generalised  
**D** Likely Demise

Division Titles	\$billion	T	S	G	D
Public Administration and Safety	450	391	36	23	-
Retail Trade	406	84	162	159	1
Mining	233	-	228	5	-
Health and Social Assistance	147	137	2	8	-
Professional and Technical Services	138	131	7	-	-
Transport/Postal	167	-	129	38	-
Utilities	116	-	105	11	-
Education	92	85	7	-	-
Construction	236	-	88	148	-
Media and Telecom	79	20	39	3	17
Manufacturing	420	-	33	387	<1
Administration and Support Services	51	27	4	20	-
Financial and Insurance	534	-	17	517	-
Rental and Real Estate	129	-	9	119	1
Arts and Recreation	49	2	4	43	-
Wholesale Trade	422	-	5	415	2
Other Services	37	1	2	34	-
Accommodation and Food	77	-	-	77	-
Agriculture	62	-	-	62	-
<b>Total Revenue (\$billion)</b>	<b>3845</b>	<b>878</b>	<b>877</b>	<b>2069</b>	<b>21</b>
<b>Share of Total</b>	<b>100%</b>	<b>22.8%</b>	<b>22.8%</b>	<b>53.8%</b>	<b>0.6%</b>

This time, in revenue terms, the Industry Impact Panel predicted:

- the **demise**, eventually, of <1% of the current total revenue
- a **transformational benefit** for 23% of the total revenue
- a **significant benefit** on 23% of the revenue
- a **generalised benefit** on the rest (54%).

## In summary

The new utility will confer substantial benefits on the vast majority of Australia's industry classes, with the potential to generate revenue of around \$1 trillion – compared with expected revenue of \$131 billion in 2012. The biggest beneficiaries – those receiving transformational benefits – will be some of our least productive including: mining, health and education. In particular, the transformation will shift supply chain responsibilities, with manufacturing and health care moving to the home and the reinvention of the department store as we know it. The result will be new levels of convenience for consumers and radically different cost structures for private and public organisations.

# Australian Business and Society of the Future

## Key Findings

Standalone small business will eventually become a thing of the past.

**Fast growth in medium-sized enterprises** – Companies with revenues of \$1 million-\$100 million will have the fastest growth, due to: the trend to outsourcing by households and businesses, creating new entrepreneurial opportunities; the lower demand for capital (being service industries that are growing); and more flexible lenders. However, the standalone small business will eventually become a thing of the past. Franchises will be required to provide the economies of scale and IP required to operate in the Infotronics Age.

**Rise of the virtual corporation** – As they increasingly outsource assets and non-core functions and activities, many corporations will move to a virtual structure.

**Teleworking** – Perhaps one in four people in the workforce could be working at least partially from home if not full-time in the middle of this century. If so, then we would have five million working from home at least part of the time – taking millions of commuters off the roads. Almost half would directly benefit from – if not actually be enabled by – high-speed ubiquitous broadband.

**Communications becomes the ‘surrogate transport’** – By 2050, Australian households could be allocating up to 40% of mobility spending on telecommunications. This will be partly driven by the use of telecommunications/broadband services to work from home more frequently than we do now, with communications becoming the ‘surrogate transport’ of the era.

**Smarter cities** – our cities will be able to utilise integrated digital infrastructure enabling us to improve their liveability, social and cultural relevance, sustainable urban development and economic success.

## 5.1 Enterprise of the Future

Adapting to the Infotronics Age has thrown up a series of challenges for Australian enterprises:

- Businesses have had to change from a production mindset to market orientation.
- Protectionism has faded, and international trade has grown dramatically.
- Goods industries have lost importance as shares of GDP.
- More than 100 new service industries have emerged.
- IP became far more useful than hard assets.
- The ownership of hard assets had to be jettisoned in favour of leasing.
- Outsourcing of non-core functions and activities became necessary.

- Old-style employment is slowly giving way to contractualism.
- Small and medium enterprises (SMEs) are increasing their share of the economy (new industries, outsourcing).
- Franchising is now an option, and strategic alliances are becoming vital.
- Adopting an information mindset has become a condition of survival.

## Company Size and Structure

By 2050, we expect to see more private companies and SMEs gaining increased importance in the economy.

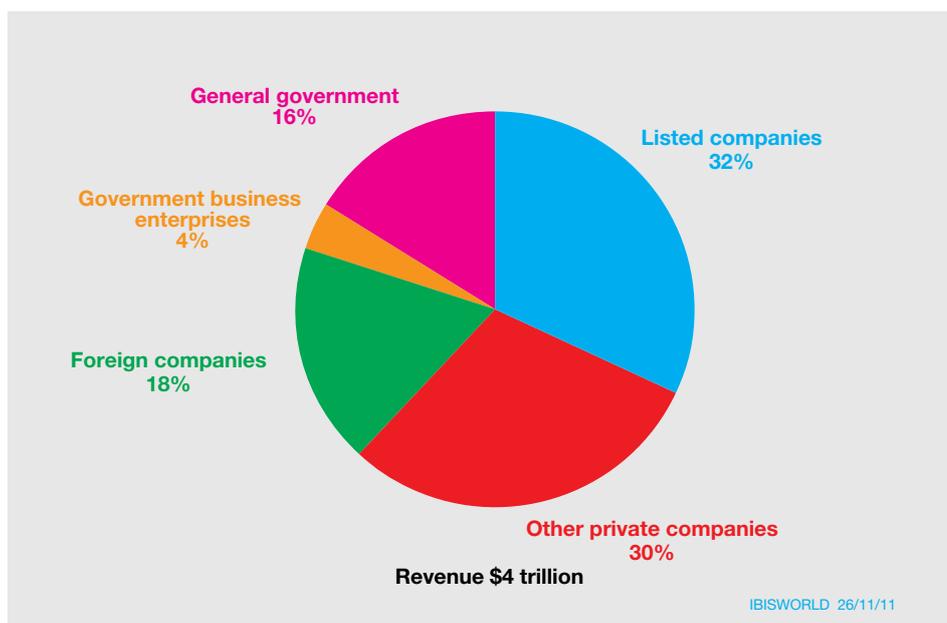
The current mix of enterprises in Australia by ownership is shown in Fig 5.1.

Government has a smaller share, particularly via its government business enterprises (GBEs), than it did two decades ago due to the significant level of privatisation at both federal and state level.

Notable privatisations by governments over recent decades include: banks (CBA, SBV, SA Bank), transport (Qantas, state railways/tramways), manufacturing (defence), utilities (electricity, water) and telecommunications (Telstra). Governments have retained most of the general government activities, notably education and health. In the decades ahead, privatisation is expected to continue.

Government has a smaller share, particularly via its government business enterprises, than it did two decades ago due to the significant level of privatisation at both federal and state level.

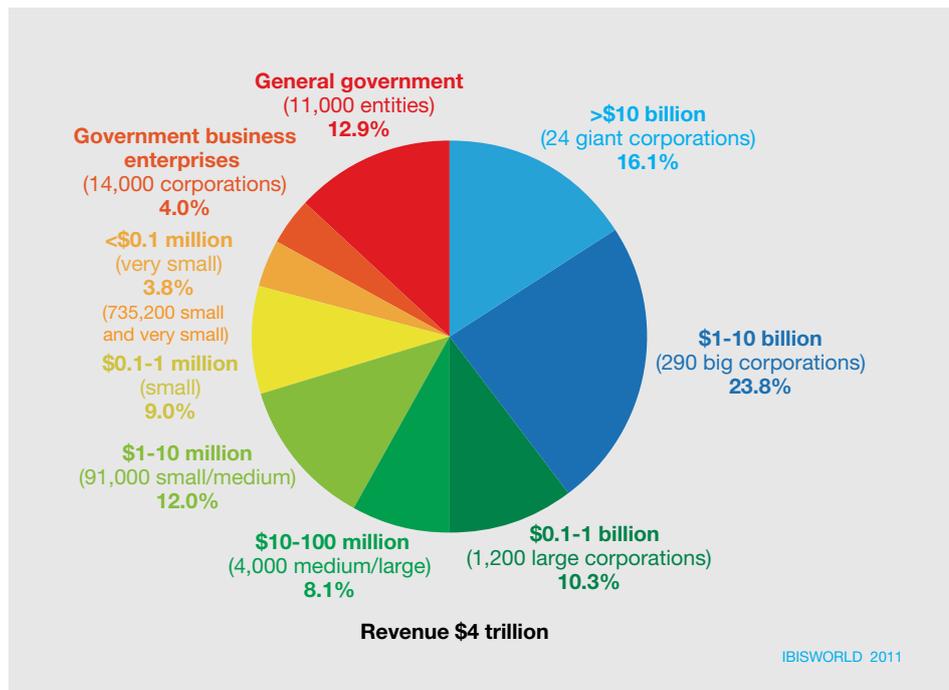
Fig 5.1  
**Type of Enterprises in the Australian Economy**  
 Operating businesses, revenue based, 2011 (E)



Turning to the size of enterprises in the economy, Fig 5.2 reveals the picture of the forecast for 2012(F).

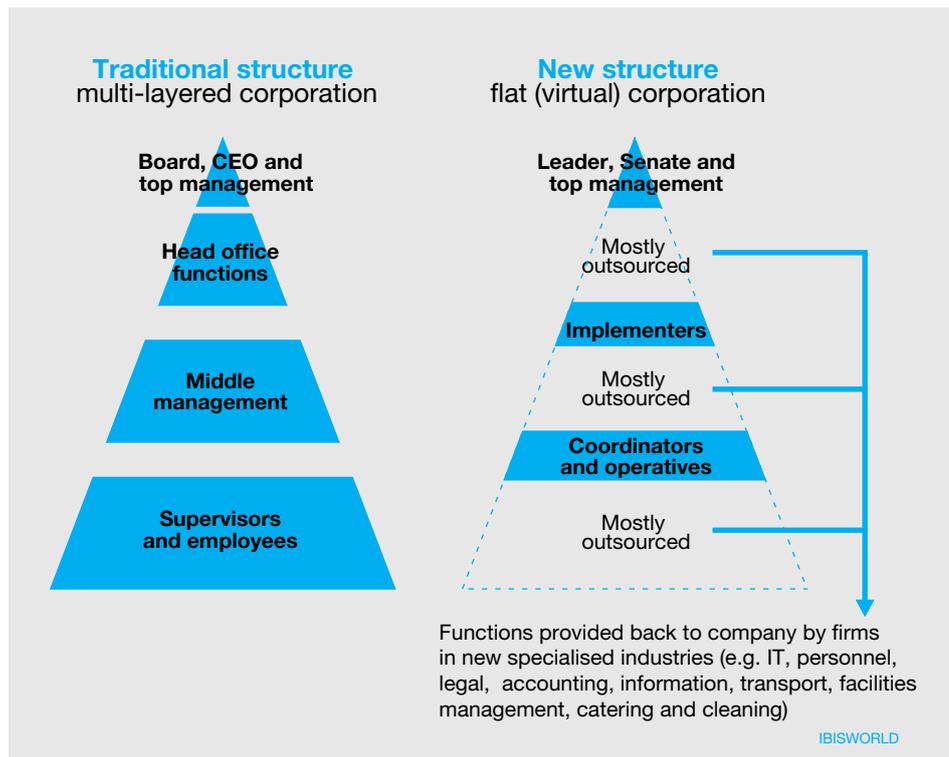
Corporations with revenue in excess of \$100 million account for just over 50% of the nation's total revenue (although a significantly lower share of employment). However, we are seeing faster growth in the medium-sized enterprises (\$1 million-\$100 million) due to several factors, including: the trend to outsourcing by households and businesses, creating new entrepreneurial opportunities; the lower demand for capital (being service industries that are growing); and more cooperative lenders prepared to look at cash flow lending rather than purely collateral lending of the past.

Fig 5.2  
**Size of Enterprises in the Australian Economy**  
 Operating businesses 2012 (E)



Increasingly, enterprises will operate as virtual corporations, as depicted in Fig 5.3.

Fig 5.3  
**The New Age Virtual Corporation**  
 ANZSIC (Australian and New Zealand Industrial Classification)



## 5.2 Workplace of the Future

### Increase in Telecommuting

Perhaps one in four people in the workforce could be working at least partially from home if not full-time in the middle of this century.

Working from home will benefit most from the evolution of the new utility by the end of this decade, onwards to the middle of the century and beyond. We are also seeing the fading of the geographic working imperative via partial or total working from home, or other places remote from an employer's location. This pattern is accelerating in the second half of the Infotronics Age.

High-speed broadband will overcome the tyranny of distance experienced in Australia and will reinvigorate regional communities as teleworking enables jobs centred in capital cities to be relocated to regional and rural communities. Skilled workers will be able to undertake work that is typically metro-based today, no matter where they live. Teleworking will make use of applications such as video conferencing, cloud computing, large file sharing, as well as real-time collaboration across geographically diverse locations.

Official statistics are about a decade old, although anecdotal evidence can be used to make some useful comments and forecasts. Entering this second decade of the century, it appears that:

- An estimated 1.4 million people work from home (about one in eight).
- The geographic imperative is fading (via partial or total working from home or other places remote from an employer's location).
- A trend for partial working from home will grow faster than total working from home.

This pattern is accelerating in the Hyper Digital Era (post-2007) at the same time as the new utility evolves. We can see the following trends:

- Those most likely to work from home are aged between 35 and 54 years (60% of the total) followed by those aged 25 to 34 years (20%). The younger and older age groups have a much lower propensity.
- There is little overall gender difference in those working from home.
- The occupations most commonly working from home are:
  - managers and administrators (c. 40%)
  - advanced clerical and service workers (c. 30%)
  - professionals (>15%)
  - associate professionals (>11%).
- Apart from farmers, the industries with the highest participation of those working from home as a share of their own industry's employment are:
  - personal and other services
  - property-related and professional and technical services
  - education
  - arts, cultural and recreational services
  - finance and insurance services.

Perhaps one in four people in the workforce could be working at least partially from home if not full-time in the middle of this century. If so, then we would have five million working from home, of which almost half would directly benefit from – if not actually be enabled by – high-speed ubiquitous broadband.

## Changing Nature of Work

The top 1,000 firms employ around one third of the 11.5 million workers.

In the world of work we accept the term 'employee' as the norm for employment. Indeed it is, accounting for 80%-90% of all employment, depending on definitions.

Yet, we predict the term 'employee' will probably go out of use in the second half of the 21st century as workers effectively become their own business, negotiating with other businesses on a contractual basis, as shown in **Fig 5.4**.

The new order, already underway, includes payment for outputs not inputs (hours of work and their starting and finishing times). Many individuals will need advice on becoming safely and fairly independent, just as they get advice these days on their finances from accountants or financial planners.

The ICT and internet-savvy Net Generation are pioneering this dramatic shift in the workforce. They and the Gen Xers already outnumber the older generations in the workforce (including Baby Boomers), but do not yet outrank them in seniority or management. This will happen over the next decade and, as the freedom grows, it will lead to workers-cum-businesses earning both wages and profits.

The shrinkage of the proportion of employers in **Fig 5.4** is at first surprising. Despite there being more than 1.6 million 'operational' enterprises, less than a million employ any staff and a high proportion of the others are big employers. The top 1,000 firms employ a third of the 11.5 million workers.

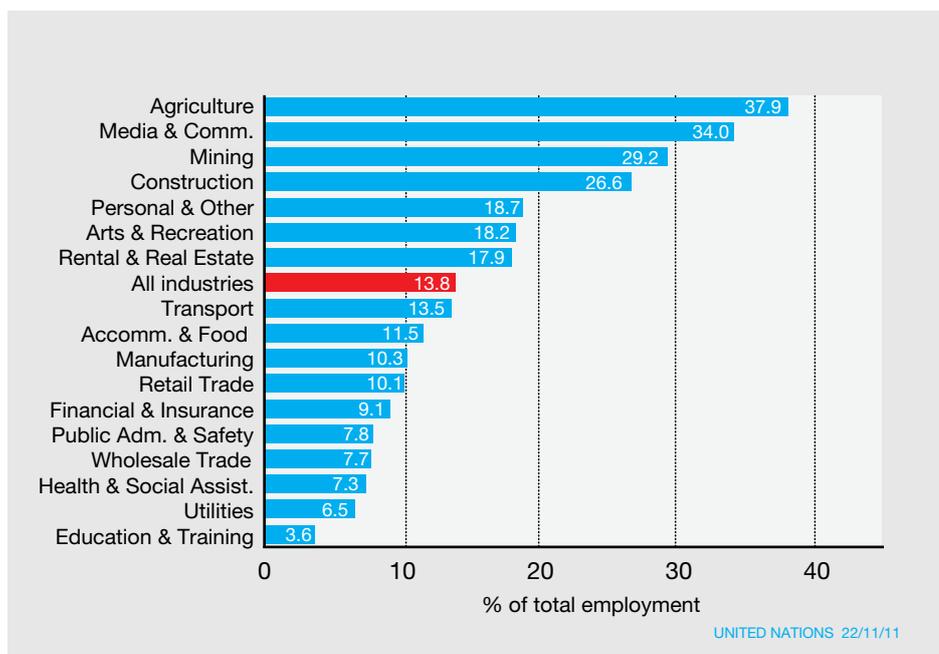
Fig 5.4  
Disposition of Workforce  
in Australia  
% of total basis



Ironically, it is the older industries that have the highest participation rate for self-employed or contractual relationships as **Fig 5.5** shows.

However, the growth of work is in the service industries and with the Gen Xers and Net Generation, not the goods industries and the Baby Boomers or older generation.

Fig 5.5  
**Self-employed and Contractors in Australia**  
 Share of total employment by industry (%) in the mid-2000s



Increasingly during this century, our ‘workers’ will morph into businesses in their own right. This will be helped by professional advice about their direction, skill sets and the bargaining/pricing of the outputs they supply to another business once called an employer. Eventually, the term ‘employee’ may pass into the history books.

The great challenge for businesses is how to have an organisational culture, mateship and collegiality with an increasingly virtual workforce in the Infotonics Age.

Companies have begun to use social media in many aspects of their operations as the population becomes an interconnected web of producers, marketers, investors and consumers, sharing information and learning. Innovation is being driven by this interconnectedness and cross-fertilisation. Smart companies are harnessing this new age bonanza.

## 5.3 Household of the Future

Australian households are well-off by OECD standards, with high incomes and the safety of near-full employment. The recent sources of that income are shown in **Fig 5.6**, followed by the growth pattern of incomes in **Fig 5.7**.

Fig 5.6  
**Australia's Household Income**  
By source (% of total basis) F2011

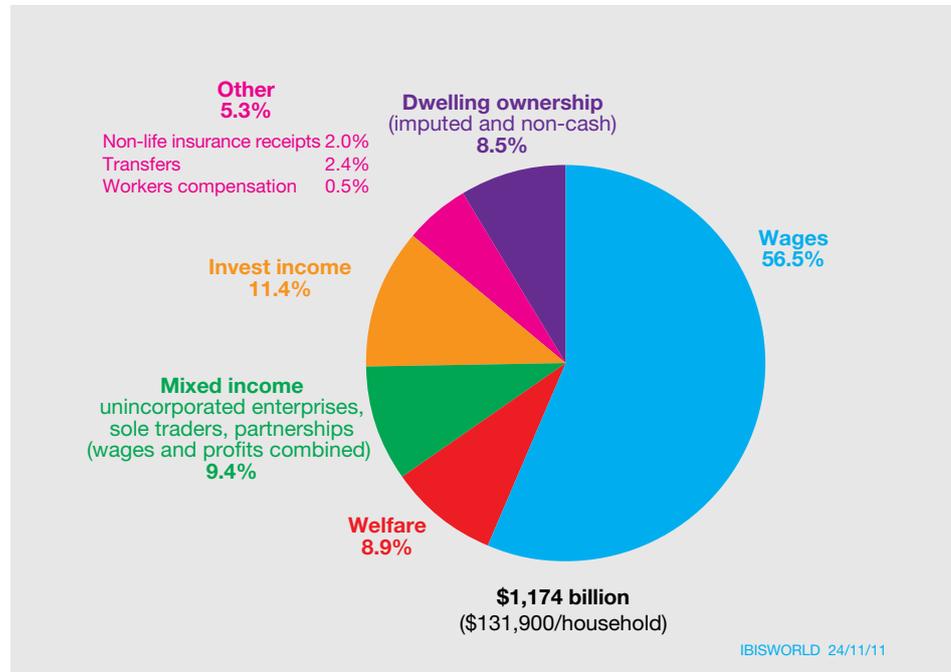
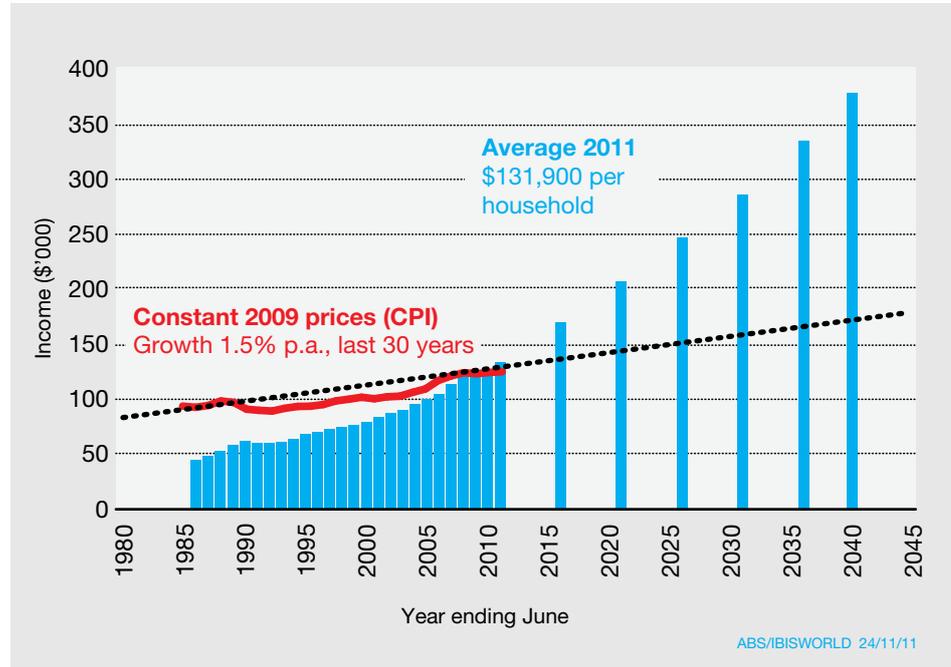


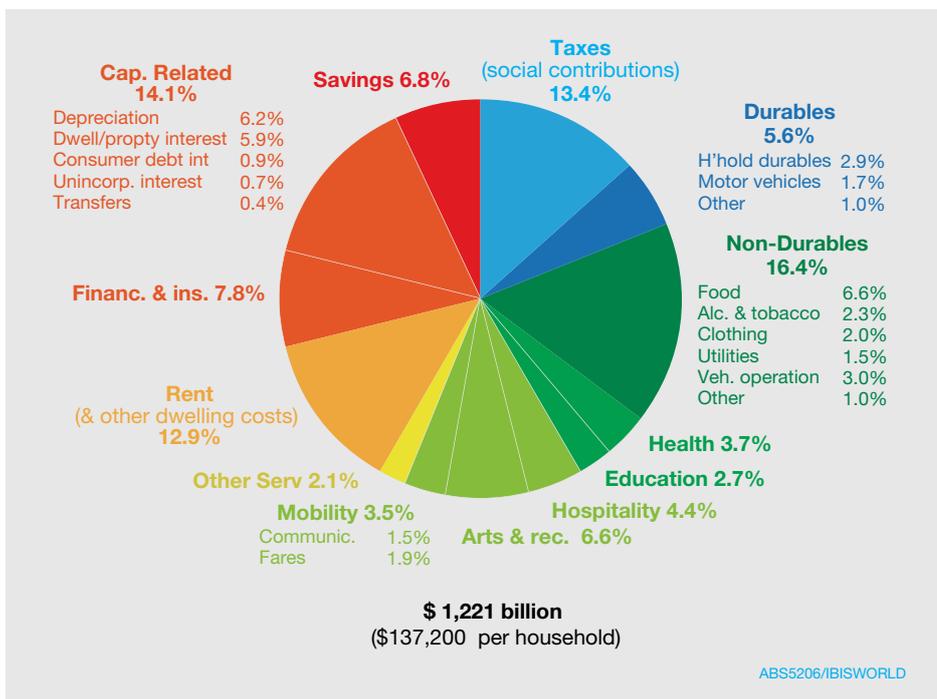
Fig 5.7  
**Household Income in Australia**  
Average/household (actual prices)  
1986-2011



The wages component of household incomes has been stable at around 50%-55% for decades. There has been some shuffling among the other sources, although investment income is growing on the back of superannuation and retirees' investments.

Today, average income is \$132,000 per household in F2011. By 2040, this is likely to be around \$375,000, (around \$188,000 in today's money) – 50% higher than in 2011. The data in **Fig 5.8** reveals where our expenditure took place last year.

**Fig 5.8**  
**Australian Household Expenditure**  
 Year to December 2011



Faster broadband and the clever use of advanced software and video spells the inexorable diminution of traditional retailing in the decades ahead.

There are almost nine million households in Australia in 2012, with the average household now allocating barely more than a fifth (22%) of expenditure to goods at retail outlets or (increasingly) online, where we are heading to 10%+ this decade. Indeed, faster broadband and the clever use of advanced software and video spells the inexorable diminution of traditional retailing in the decades ahead. This steady fall in spending on goods over the past century or more is shown in **Fig 5.9**.

The data in **Fig 5.10** shows where we are spending, with more going to outsourced chores and activities, which now exceeds all retail spending (excluding motor vehicles and related costs).

**Fig 5.9**  
**Changing Household Expenditure in Australia**  
 % of total basis

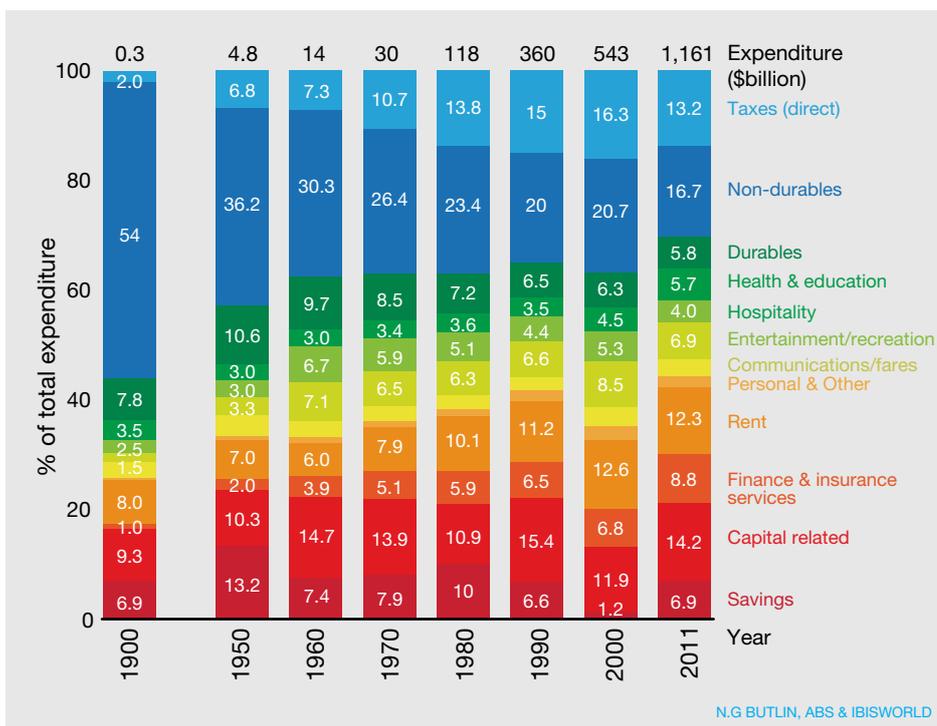
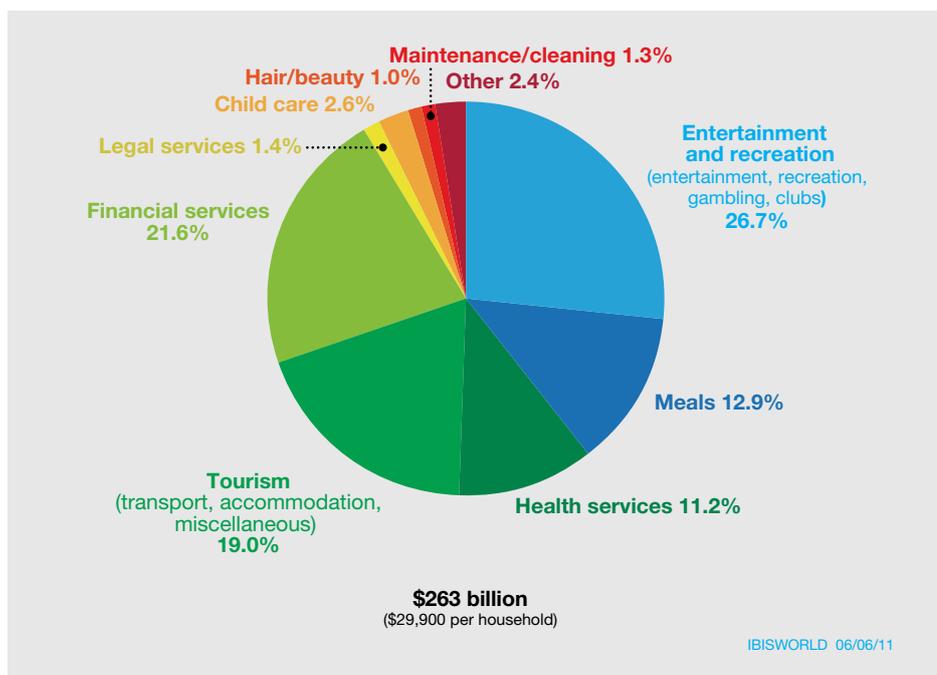


Fig 5.10  
Australia's Household  
Outsourcing in the  
New Age  
2011



These changing patterns of spending tell us a lot about our lifestyle preferences. These preferences are in turn affected by rising incomes, the falling cost of goods (in real terms) and the emergence of new entrepreneurs and industries to supply us with new services.

As shown in **Table 5.1**, the new utility is likely to have a transformational or significant benefit in many areas of Australia's future lifestyle. In particular, anywhere, anytime access will enable people living in regional and rural communities to have access to specialist services available in larger cities, including health services and education opportunities.

Table 5.1  
Benefits to Households

- T** Transformational
- S** Significant
- G** Generalised

Factor influencing households	T	S	G
Tertiary education			
Non-vocational education			
Work from home			
Mental health			
Physical/surgical health			
Aged health			
Data/information			
Gambling			
Big screen entertainment			
Other online			
Live arts			
Age group: seniors			
Age group: adults			
Age group: children			
Secondary education			
Primary education			
Online spending			
Dental health			
Social media			
Other telecommunications			
Time management			
Sports entertainment			
Locality: city vs. regional			

Undoubtedly one of the most recent and astonishing changes in lifestyles has emerged in the Hyper Digital Era the advent of (even slow) broadband, in the form of social media. The unique Australian visitors (UVAs) figures for our most popular social media are shown in **Table 5.2**.

Table 5.2  
Social Media Unique  
Australian Visitors  
per month, 2011

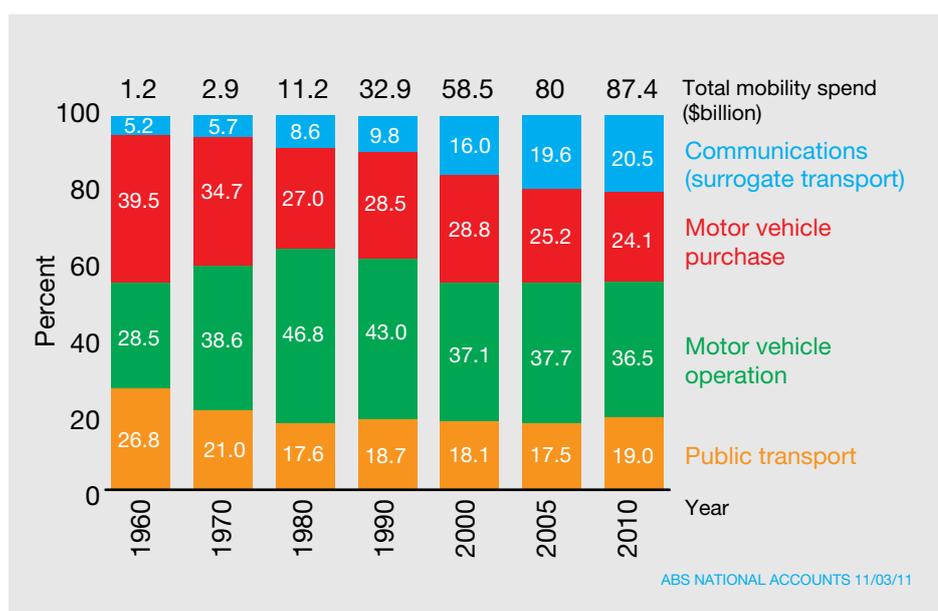
2011	UVAs per month
Facebook	9.8 million
YouTube	6.7 million
Blogspot	2.2 million
Twitter	1.0 million
WordPress	920,000
LinkedIn	760,000
MySpace	630,000
Flickr	630,000
Tumblr	350,000
Digg	110,000
StumbleUpon	94,000
Reddit	57,000
Delicious	52,000

Communications  
will have become  
the 'surrogate  
transport'.

The use of social media and telepresence video is changing our mobility spending patterns as **Fig 5.11** shows so clearly. By mid-century, households could be allocating up to 40% of mobility spending on telecommunications as we increasingly work from home.

At this point, communications will have become the 'surrogate transport'. This will mark a dramatic societal change, with the potential to solve multiple problems including: congestion, population decline in rural Australia and the struggle to achieve work/life balance.

Fig 5.11  
Australia's Personal  
Mobility Spending  
% of total basis,  
including surrogate  
transport  
(telecommunications)

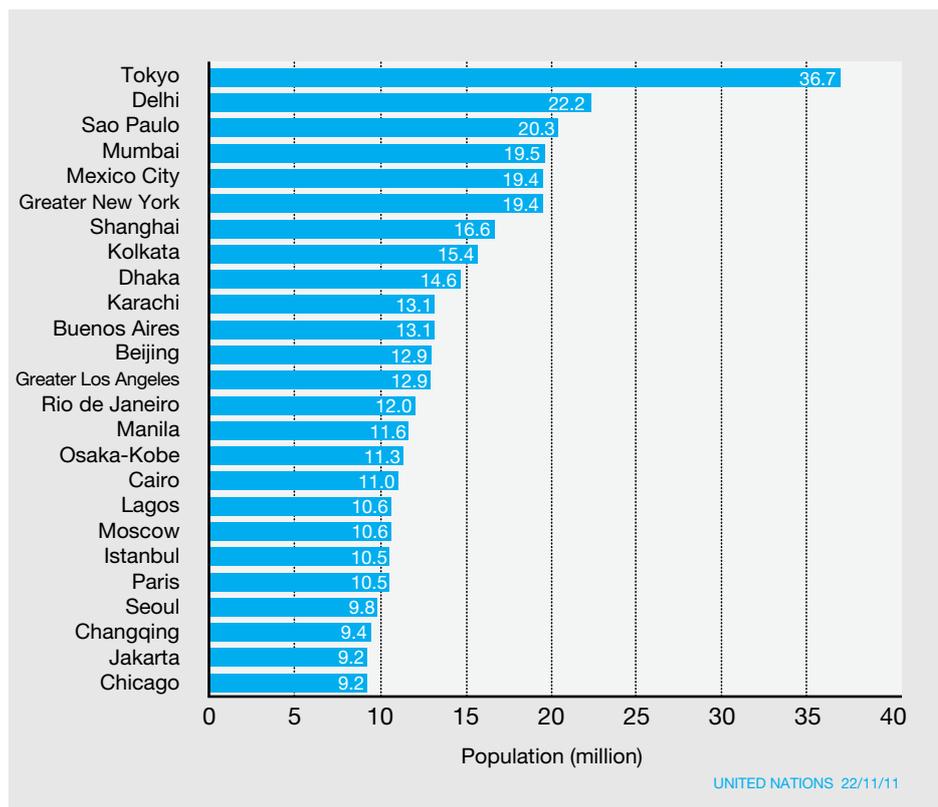


## 5.4 Cities of the Future

The world is urbanising rapidly as developing economies industrialise, and as OECD nations agglomerate already-large cities with satellite cities to become megalopolises. Tokyo is a large city of around nine million people, but on an agglomerated basis is closer to a mind-boggling 37 million people. It has been suggested that we may well see a megalopolis of 100 million people in the 22nd century. If so, it would probably be in China or, just maybe, India.

In **Fig 5.12** and **Fig 5.13** we show the world's most populated agglomerates and the world's most liveable cities.

Fig 5.12  
Largest City  
Agglomerations  
2010

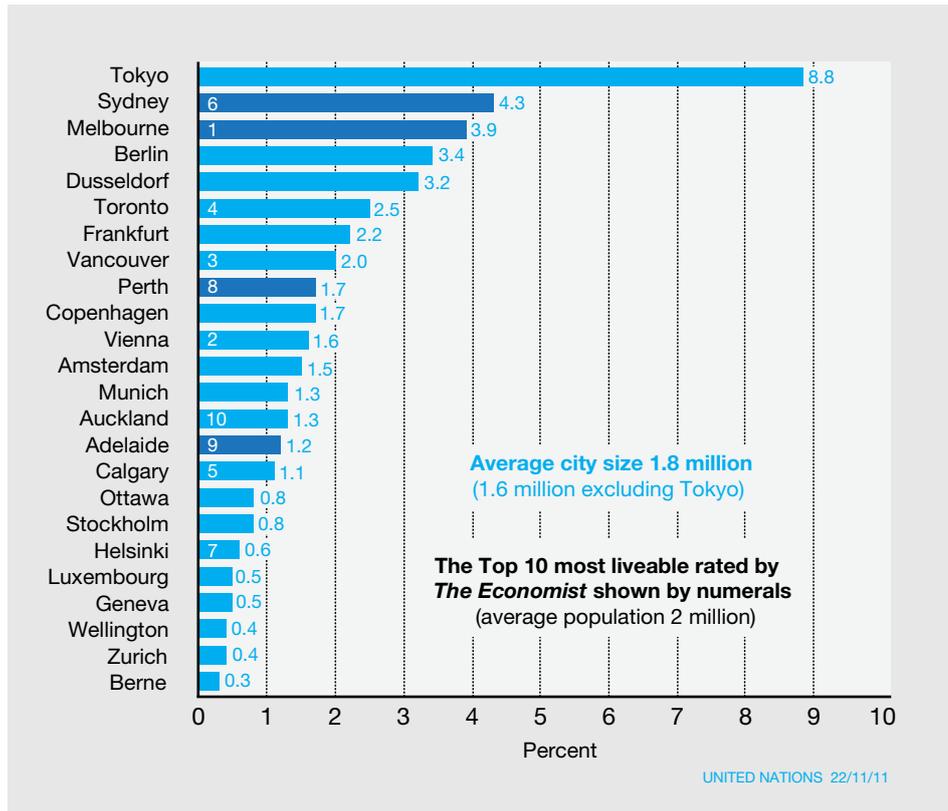


The message is clear: none of the megalopolises make it to the most liveable category. Further, the average city size of the most liveable is 1.8 million. Among the top 10, the average is little different (two million).

Australia, interestingly, has four of its capitals in **Fig 5.13**, with two of them (Sydney and Melbourne) near the upper limit of populations that can hold a position on this enviable list.

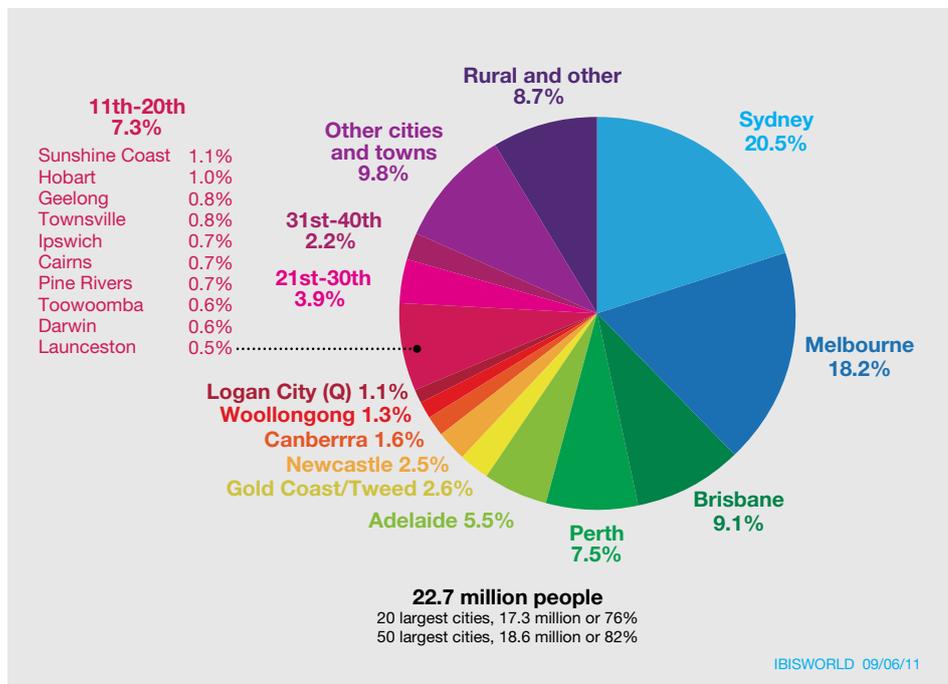
The aspects involved in liveability are headlined by 10 factors: safety, stability, tolerance, hygiene, health care, education, infrastructure (including public transportation), environment, culture and recreation. Those doing the ranking of liveability such as Mercer, The Economist, Monocle and others add many more factors (up to a hundred).

Fig 5.13  
**World's Most Liveable Cities**  
 (in population order, not ranking) 2011



Australia's most populated cities in 2011 are shown in Fig 5.14. All of them are in the range of the most liveable cities.

Fig 5.14  
**Australia's Twenty Largest Cities**  
 2011



We have 20 cities with a population over 100,000 including five cities more than one million.

We have 20 cities with a population over 100,000 (considered by many to be the minimal critical-mass level for self-sustainable development), including five cities more than one million, which represent just over three-quarters of the population. It is likely we will add another one or two cities of one million plus within 50 years as the population almost doubles to 44 million. This suggests that Australia has an excellent opportunity to continue to have liveable cities, if we invest in the digital infrastructure required to manage them appropriately.

The challenges for our large cities differ according to size. Our largest cities – Sydney and Melbourne – need de-choking (traffic and other congestion), greater safety (lower crime rate), greater resilience, more efficient utilities and delivery of health and other services. Such cities can benefit from very high-speed broadband (>100 Mbps) to deploy “smarter city infrastructure and networks” through the use of software, sensors and analytics to enable cities to be more efficiently, safe and sustainable.

The nations with the fastest broadband are: South Korea, Hong Kong, Japan, the Netherlands, Romania, Latvia, Switzerland, Belgium and Ireland. Of particular interest is the fact that Asia (Asia-Pacific and Indian Subcontinent) has two-thirds of the fastest broadband cities in the world, and that’s where 80% of our exports occur.

The three fastest in 2011 were in Japan, which also had 61 of the 100 fastest cities. Eighteen were in the United States (many in California, on the Pacific Rim), three in Canada and the rest mainly in the European Union, where the Scandinavian nations are prominent. Finland has even legislated that it is a citizen’s right to have access to broadband on mobiles of at least 3G.

A smarter city needs to incorporate digital infrastructure (mobile and fixed phones, satellite TVs, computer networks, e-commerce, internet services, sensors) and ubiquitous connectivity to enable entrepreneurial activity, productivity improvement and economic growth.

So the challenge is there for Australia to catch up. According to Catherine Caruana-McManus (IBM Smarter Cities) the significant challenges for cities include: applying innovation to improve the efficiency of age-old infrastructures, potentially offsetting new investment; developing new economic and business models to fund new infrastructure; the complexity of servicing citizens who are highly mobile and diverse; and the need to solve city problems and issues in a much more collaborative way (e.g. among citizens, stakeholders and across different levels of government). The impact of national reform agendas in health, water and energy are also critical.

Superfast ubiquitous broadband, analytics and advanced software will be of substantive help in many of these challenges.

## Planning for a Smart City

An example of the forward-thinking and planning for a smarter city (or in this case, a region) is the statement of key initiatives of the North Melbourne Region of Victoria, as repeated below (with permission).

### **Broadband for Seniors**

Further developing ICT literacy of the older members of the community, facilitating the pathway to assistive living and linking them to community care, medical support and family by leveraging the resources available through a broadband enabled ecosystem. Leveraging the very successful Broadband for the Seniors' business model to expand services via public kiosk infrastructure. For example, kiosks can be used to provide public access to counselling services, care services, training services and so on. Taking these services into residences is a natural extension of this work to reduce social isolation and improve remote care (note there are approximately 60 Broadband for Seniors kiosks deployed across the region).

### **Connection Kiosks**

Using broadband enabled kiosks as a means of connecting disadvantaged people, and people suffering from various form of mental illness, to relevant care groups in a way that is private and secure. The aim is to provide proactive support in the community rather than place stress on the police and other agencies to provide first line identification of these problems.

Delivering an education portal and high-speed broadband to provide a secure link between members of the community so that they can communicate and collaborate. The purpose is to deliver improvements that can be achieved across a number of measurable factors such as improved education monitoring, and better community involvement. The e-education services can be delivered at the place of learning, at home or via public kiosk infrastructure. For example, kiosks can be used to provide public access vocational and language training services.

### **Public Safety**

Enhancing public safety and emergency communications by providing improved access to information before, during and after emergency events.

### **Teleworking**

There is an extensive workforce in the geographic area which commutes from within and outside of the geographic area. Faster broadband services will create more opportunities to work from home or from a location away from the traditional workplace.

- At this stage, only 6% of Australians telework, compared with 11% in the United States and 10% in Europe (Access Economics, 2010).
- Increasing the rate of teleworking can have benefits for the nation.

Employers and individuals:

- The estimated value of just a 10% increase in employees that telework, for 50% of the time, is between \$1.4 billion and \$1.9 billion a year (savings in carbon emissions, transport, infrastructure).
- Employers can benefit from savings in office space and equipment, and employ highly skilled people regardless of their location or mobility.
- For people who telework, the benefits in time and cost savings and increased flexibility are ongoing (Access Economics, 2010).

The generic concept of a Smart (or Digital) City is well canvassed across the world. But the practical implementation of these concepts is an evolutionary process. The availability of ubiquitous broadband and wireless networks in combination enable the introduction of smart city concepts. The key elements of the smart city are embedded in the strategy of the seven councils of the North Melbourne Region of Victoria.

## In summary

By 2050, we will work in virtual corporations, with at least a quarter of the workforce doing so from home – spending more on communications than transport. Many of us will be businesses in our own right, rather than direct employees. Average household income will grow by 50%. The way we access entertainment, health, education and government services will be completely transformed. Our cities will be smarter: safer, greener and more productive.



# Recommendations

Interfacing with customers at every point of value creation is what differentiates a customer-centred business from one that simply knows how to target its customers well.

## 6.1 For Organisations

### Future shapers of change – organisations

#### **Deliver business model innovation**

Companies must constantly explore how they can most effectively capture revenue, structure enterprise activities and stake a position in new or existing industries. Subscription or per-usage fees? Acquire new skills or outsource certain functions? Collaborate with competitors or break into an entirely new industry? Answers to these questions will help determine flexible new business models that are suited to the era of accelerated digital transformation.

#### **Drive customer and community collaboration**

Customers and communities will be engaged across every phase of business activities – not just sales, marketing and service, but also product design, supply chain management, human resources, IT and finance. Customer interaction in these areas often leads to open collaboration that accelerates innovation, using online communities created either organically or with the support of the business. Interfacing with customers at every point of value creation is what differentiates a customer-centred business from one that simply knows how to target its customers well.

#### **Integrate cross-channel**

The ability to integrate across all customer touch-points is essential for managing digital operations. Customers switch back and forth between email and social networks, spanning an array of physical and online platforms during any given transaction. During all of these interactions, customers expect consistency and clarity in how companies take into account their individual histories and preferences. Online, physical and mobile platforms will have to provide quick, efficient service that transcends the customer's choice of channel.

#### **Obtain insights from analytics**

Creating and maintaining a customer-centric enterprise changes the basis for decisions within an organisation and among its partners. Insight from analytics brings predictive capabilities to all functions so that all channels can be aligned around customer needs and preferences. The computing power needed for analytics can be local and centralised, or accessible through shared services 'in the cloud'. Businesses of every size have the ability to develop highly segmented and individualised information that meets individual customer expectations. Top-performing companies are formulating decisions based on facts rather than gut feeling or personal experience, embedding analytics into all their operations to transform insights into action.

### **Optimise the digitally-enabled supply chain**

Physical components of the supply chain, such as trucks, pallets, warehouses, even individual packages, are being equipped and interconnected with sensors and actuators that enable data and analysis for on-the-spot action. Companies that capture and integrate that information gain the full benefits of a digitally enabled supply chain – the ability to dynamically manage costs for serving even the smallest segments of their markets and the flexibility to determine the best inventory allotments based on supply and demand predictions. Using real-time data, these companies can also find the best transport methods by weighing predicted customer service outcomes against impact.

## **Future capabilities needed – organisations**

### **Technology-enabled capability**

Future organisations will invest in technology enablement solely on the basis of its real value to efficiency and function. Smart analytics and data will gain primacy as one of the main channels through which this value is derived. Decisions around the strategic value of technology will result in an expanding IT and social media footprint for most organisations, combined with increasingly creative strategies that incorporate a growing number of stakeholders – including those the business seeks to serve.

### **People-enabled capability**

Technological enablement will drive two major shifts in people management: community connection and decision capability. Decisions become outcome-based rather than embedded within hierarchical organisation structures, drawing on data to make new types of decisions across all areas of business. Human analysis and insight is applied to growing volumes of real-time data to address requirements of customers and employees as soon as they emerge. As accountability and individual ownership increases, so too does employee engagement with the business as something into which they have tangible and meaningful input.

### **Culture-enabled capability**

The vertical hierarchy is flattening and will continue doing so. Horizontal organisations will aim to be flexible and responsive, turning their focus to ‘what’ and ‘why’ work is done instead of ‘where’. This priority shift towards outcomes-based performance and collaboration will result in greater mobility and openness towards new ways of working. It will also result in greater underlying shifts in organisational culture; overcoming the traditional ‘four walls’ and management chain of the workplace will take significant internal momentum.

### **Capability to deliver in a horizontal world**

Boundaries between business and consumer will blur alongside trends towards more horizontal organisations. With increasing demand from customers for input into all aspects of business process, this ‘horizontal world’ will see extensive collaboration from members both within and outside organisations on product and service design, development and delivery. Executive direction and grassroots feedback will play equal roles in business development. Horizontal businesses will thrive in this flat-form world, while rigid hierarchies will struggle to compete.

## 6.2 For Citizens

### Future shapers of change – citizens

Tribalism is now moving to a combination of virtual and geographic spaces.

#### **The nature of work is changing**

The industries, occupations, locations (including remote) and nature of work will be in constant change. Citizens, for their part, will need flexibility, access to information about work opportunities and associated new skills (and where and how to acquire them) to gradually adopt the concept of being one's own business as distinct from the employee of the previous eras and ages.

#### **New tribalism**

The tribalism of the Industrial Age and the first half of the Infotronics Age was largely geographic and often localised to streets and suburbs. Tribalism is now moving to a combination of virtual and geographic spaces, enabled by social media and fast broadband. Geographic tribalism will continue, especially in the family-raising age bracket for obvious reasons, but the bonding in this phase will be maintained via the above utilities as well as telepresence. Tribes will be plural for most individuals, based on a wide spectrum including: family, work, sport, culture, recreation, and other interests.

#### **Longer and healthier lives**

Over little more than two centuries, life expectancy has grown from below 40 years in 1800 to above 84 for females in 2012. One in every four born in the first decade of this 21st century will live to 100 years of age, according to actuarial estimates. The new utility will see the convergence of technological, pharmaceutical, biological (including DNA and molecular diagnostics and manipulation) and other advances with learning systems, cognitive computing and analytics. The achievements are likely to be spectacular, leading to the need by individuals to rethink their life goals and activities – not least of which will include multiple careers, lifelong learning and frequent reskilling, and later retirement.

#### **New internationalism**

Australia has had past centuries with changing main allies (for investment and trade) including the United Kingdom and Europe at large, the United States and – more recently – the Asia-Pacific. Australia is now integrating its economy and society more closely into this latter region, a region already beginning to morph into the mega Asian region (including the Indian Subcontinent). The advent of instant translation devices aided by faster broadband will prove a boon to tourism, inbound and outbound, investment and trade.

These and many other emerging applications and benefits across the life-skill spectrum will demand an open and receptive mind – not a universal attribute in any community. The role of coaching and mentoring will take on new forms and dimensions to assist the population at large to avoid the natural tendency to be sceptical, resist change, and in the process deny themselves the full opportunities and benefits that this new era offers, if not promises.

## Future capabilities needed – citizens

Developing a flexible, mobile population will entail significant changes to learning and training processes.

### **Capability to embrace a smarter agenda**

Guesswork, hunches and ballpark estimates will be things of the past. The explosion in comprehensive and real-time information has radically changed the nature of decision-making in everything from domestic duties to high-level corporate strategy. Citizens will adopt a new literacy: the ability to interpret this information and incorporate it into their everyday decisions. This requires an array of creative and analytic skills, forcing a radical redefinition of intrinsically ‘human’ capacities for intuition, inspiration and logic.

### **Capability to work differently – the importance of ‘what’ over ‘where’**

Mobile connectivity, telepresence, and ubiquitous computing will shift not only the location but the nature of work. Citizens will continue to integrate these technologies into their working lives, forcing many to negotiate the once-solid boundaries between work and leisure. The individual will have greatly increased power in choosing how they complete any given task at hand; achieving objectives will be the key definer of advancement, rather than hours spent at an office or other fixed location. Citizens will navigate the demands of professional and personal spheres with greater ease, simultaneously resulting in higher productivity and a more sustainable quality of life.

### **Capability to take advantage of flexible education**

Developing a flexible, mobile population will entail significant changes to learning and training processes. Skills in problem-solving, responsiveness and rapid innovation will take precedence over static knowledge and memorisation, in large part due to growing access to the internet’s global knowledge resources. Education itself will become more flexible, extending across geographical borders to connect citizens with learning resources that meet their specific needs and situations.

### **Capability to utilise different skills in communities both real and virtual**

Citizenship will no longer be defined by country, but increasingly by allegiance to multiple and simultaneous communities both virtual and geospatial. Citizens of these communities will adopt widely differing customs, practices and identities depending on which environment they interact in. Fluency in a variety of digital and cultural languages will become increasingly important for personal and professional communications alike, as will an understanding of the etiquettes and norms which govern the real, virtual, and borderline regions of human community.

# Addenda

## 7.1 Outsourcing Figures

Fig 7.1  
Household Outsourcing  
in the New Age

### Entertainment

Hospitality clubs  
Taverns, pubs and bars  
Casinos, other gambling

### Tourism

Hotels, motels, guesthouses, etc.  
Entertainment centres, theme parks  
Air travel, boat travel, car rental

### Meals

Fast food outlets  
Theme restaurants  
Home delivery (or fast food)

### Finance, investment and legal

Investment advice and management  
Tax planning and returns  
Legal services

### Health

Wellness  
Home nursing, aged care at home  
Home masseur treatment

### Childminding

Nanny services, childminding

### Maintenance

Room/house painting  
Home repairs  
Electrical  
Plumbing

### Gardening/exterior

Landscaping, clean-ups  
Lawn mowing  
Pool maintenance

### Hair and beauty

Hairdresser/beauty salons  
Hair restoration

### Cleaning

Laundry, dry cleaning services  
Internal cleaning  
External cleaning

### Car maintenance

Detailing, oil changes, brakes, etc.

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Fig 7.2  
Business Outsourcing  
in the New Age

### Trucking

Road transport industry

### Cleaning

Office, factory, hotel, etc.  
Laundry, work clothes

### Canteens and dining rooms

Caterers

### Maintenance

Painting  
Engineering  
Carpentry

### Security

Security systems  
Surveillance services

### Personnel

Recruitment  
Outplacement  
Training

### Reception

Serviced offices

### Accounting

Payroll, invoicing, share registers  
Full contract accounting  
Superannuation administration

### Computing

Software development and writing  
Computer services (IT outsourcing)

### Property

Property trusts  
Property management

### Marketing

Advertising, media buying  
Call centres

### Distribution

Warehousing and delivery

### Information and planning

Database services  
Strategic and other consulting

### Franchising

Operations

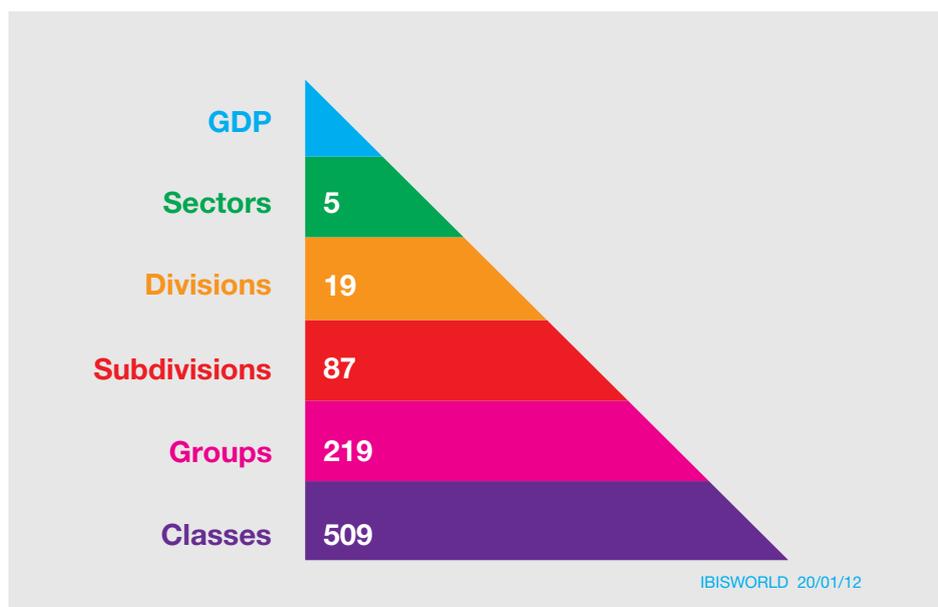
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Fig 7.3  
Overseas Outsourcing  
in the New Age



## 7.2 Industry Impact Panel Findings

Fig 7.4  
**Australia's Industry Structure**  
ANZSIC (Australia  
New Zealand Standard  
Industrial Classification)



### Generalised Benefits and Impacts by Industry Divisions

Workshop: IBISWorld/IBES December 2011

This scan is designed to prioritise Australia's 509 classes of industry. There are just four scoring levels as follows:

#### **Transformational Benefit**

That could include the underpinning enabling of the industry/products.

#### **Significant Benefit**

Benefit that could show in productivity, new features, etc.

#### **Generalised Benefit**

Of the new utility (the horizontal impact of the utility).

#### **Warning of Likely Demise**

Industries in danger of being destroyed.

## Division A: Agriculture, Forestry and Fishing

Fig 7.5  
Agriculture, Forestry  
and Fishing  
ANZSIC Division A

<b>Sector</b> .....	<b>Primary</b>
<b>Revenue in F2012 (\$billion)</b> .....	63
<b>Rank (among 19 Divisions)</b> .....	16th
<b>Value Added (\$billion) and Share of GDP</b> .....	36 (2.6%)
<b>Rank in 2012</b> .....	13th
<b>Rank in 2050</b> .....	12th
<b>Employment ('000) and Rank</b> .....	334 (13th)
<b>Exports (\$billion)</b> .....	30

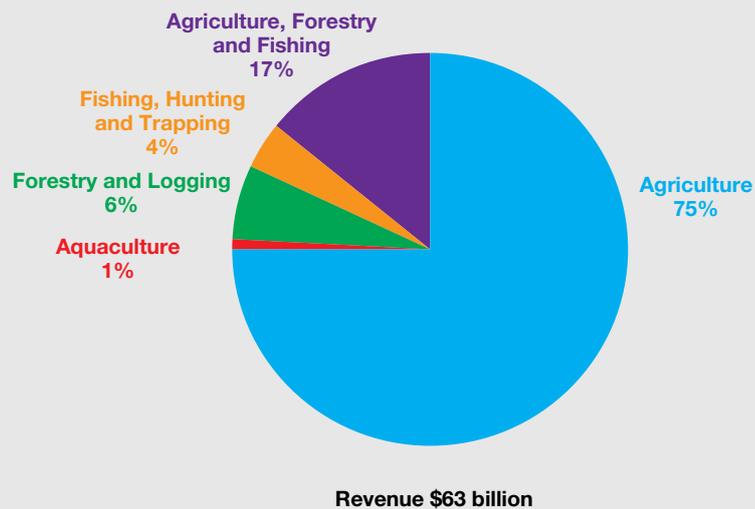
### Top 10 Players

(revenue, \$billion, c.2011)

Sanford	0.44	Aust Agr Co	0.27
Forests NSW	0.42	Select Harvests	0.25
Namoi Cotton	0.41	Tassal	0.23
Kahlbetzer	0.37	Lake Woods	0.19
Costa Exchange	0.36	Forestry Tas.	0.15

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Fig 7.6  
Agriculture, Forestry  
and Fishing  
Shares of industry  
revenue F2012(E)



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Table 7.1  
**Division A: Agriculture,  
 Forestry and Fishing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division A</b>	\$billion	<b>T</b>	<b>S</b>	<b>G</b>	<b>D</b>
<b>Sub Division 01 Agriculture</b>					
<b>Group 011 Nursery and Floriculture Production</b>					
Class 0111 Nursery Production (Under Cover)					
Class 0112 Nursery Production (Outdoors)					
Class 0113 Turf Growing	1.5				
Class 0114 Floriculture Production (Under Cover)					
Class 0115 Floriculture Production (Outdoors)	0.3				
<b>Group 012 Mushroom and Vegetable Growing</b>					
Class 0121 Mushroom Growing					
Class 0122 Vegetable Growing (Under Cover)					
Class 0123 Vegetable Growing (Outdoors)	2.9				
<b>Group 013 Fruit and Tree Nut Growing</b>					
Class 0132 Kiwifruit Growing					
Class 0133 Berry Fruit Growing					
Class 0136 Citrus Fruit Growing					
Class 0137 Olive Growing	1.7				
Class 0139 Other Fruit and Tree Nut Growing					
Class 0134 Apple and Pear Growing	0.5				
Class 0135 Stone Fruit Growing	0.4				
Class 0131 Grape Growing	1.0				
<b>Group 014 Sheep, Beef Cattle and Grain Farming</b>					
Class 0141 Sheep Farming (Specialised)					
Class 0142 Beef Cattle Farming (Specialised)					
Class 0143 Beef Cattle Feedlots (Specialised)					
Class 0144 Sheep-Beef Cattle Farming					
Class 0145 Grain-Sheep or Grain-Beef Cattle Farming	12.8				
Class 0146 Rice Growing					
Class 0149 Other Grain Growing	11.8				
<b>Group 015 Other Crop Growing</b>					
Class 0151 Sugar Cane Growing	1.3				
Class 0152 Cotton Growing	2.8				
Class 0159 Other Crop Growing n.e.c.	3.0				
<b>Group 016 Dairy Cattle Farming</b>					
Class 0160 Dairy Cattle Farming	3.8				
<b>Group 017 Poultry Farming</b>					
Class 0171 Poultry Farming (Meat)	0.9				
Class 0172 Poultry Farming (Eggs)	0.4				
<b>Group 018 Deer Farming</b>					
Class 0180 Deer Farming	<1.0				

Table 7.1 *continued*  
**Division A: Agriculture, Forestry and Fishing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Group 019 Other Livestock Farming</b>		
Class 0191 Horse Farming	0.9	
Class 0192 Pig Farming	0.9	
Class 0193 Beekeeping	<1.0	
Class 0199 Other Livestock Farming n.e.c.	<1.0	
<b>Subdivision 02 Aquaculture</b>		
<b>Group 020 Aquaculture</b>		
Class 0201 Offshore Longline and Rack Aquaculture		
Class 0202 Offshore Caged Aquaculture	0.8	
Class 0203 Onshore Aquaculture		
<b>Subdivision 03 Forestry and Logging</b>		
<b>Group 030 Forestry and Logging</b>		
Class 0301 Forestry	1.9	
Class 0302 Logging	2.0	
<b>Subdivision 04 Fishing, Hunting and Trapping</b>		
<b>Group 041 Fishing</b>		
Class 0411 Rock Lobster and Crab Potting		
Class 0412 Prawn Fishing		
Class 0413 Line Fishing		
Class 0414 Fish Trawling, Seining and Netting	1.5	
Class 0419 Other Fishing		
<b>Group 042 Hunting and Trapping</b>		
Class 0420 Hunting and Trapping	0.8	
<b>Subdivision 05 Agriculture, Forestry and Fishing Support Services</b>		
<b>Group 051 Forestry Support Services</b>		
Class 0510 Forestry Support Services	0.5	
<b>Group 052 Agriculture and Fishing Support Services</b>		
Class 0521 Cotton Ginning	2.8	
Class 0522 Shearing Services	5.4	
Class 0529 Other Agriculture and Fishing Support		
<b>Agriculture, Forestry and Fishing Division</b>	<b>63.0</b>	

## Division B: Mining

Fig 7.7  
Mining  
ANZSIC Division B

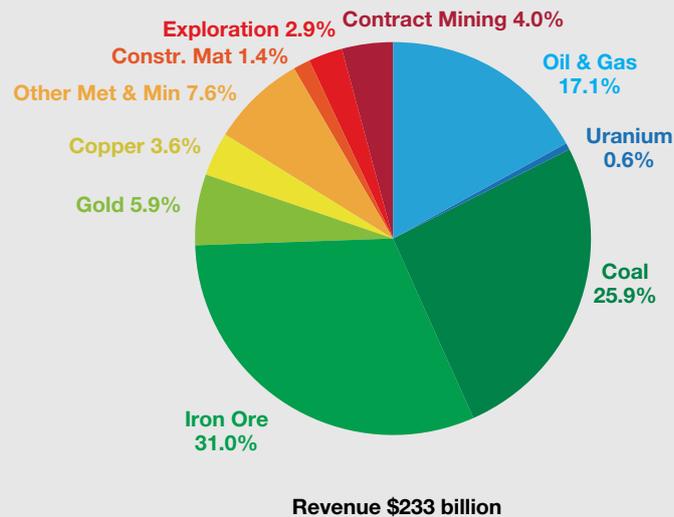
<b>Sector</b> .....	<b>Primary</b>
<b>Revenue in F2012 (\$billion)</b> .....	233
<b>Rank (among 19 Divisions)</b> .....	7th/19
<b>Value Added (\$billion) and Share of GDP</b> .....	118 (7.2%)
<b>Rank in 2012</b> .....	4th
<b>Rank in 2050</b> .....	9th
<b>Employment ('000) and Rank</b> .....	226 (16th/19)
<b>Exports (\$billion) and Rank</b> .....	160 (1st/19)

**Top 10 Players  
(Revenue, \$billion, c.2011)**

BHP Billiton	68.4	Shell Energy	4.4
Rio Tinto	57.9	Newcrest	4.1
Xstrata	23.2	Anglo Amer.	3.9
Fortescue	5.2	Santos	2.8
Woodside	4.5	Peabody	2.8

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Fig 7.8  
Mining  
Shares of industry  
revenue F2012(E)



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Table 7.2  
**Division B: Mining**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division B</b>	\$billion	<b>T</b>	<b>S</b>	<b>G</b>	<b>D</b>
<b>Subdivision 06 Coal Mining</b>					
<b>Group 060 Coal Mining</b>					
Class 0600 Coal Mining	60.2				
<b>Subdivision 07 Oil and Gas Extraction</b>					
<b>Group 070 Oil and Gas Extraction</b>					
Class 0700 Oil and Gas Extraction	39.8				
<b>Subdivision 08 Metal Ore Mining</b>					
<b>Group 080 Metal Ore Mining</b>					
Class 0801 Iron Ore Mining	73.2				
Class 0802 Bauxite Mining	1.9				
Class 0803 Copper Ore Mining	8.5				
Class 0804 Gold Ore Mining	13.6				
Class 0805 Mineral Sand Mining	1.2				
Class 0806 Nickel Ore Mining	3.6				
Class 0807 Silver-Lead-Zinc Ore Mining	6.6				
Class 0809 Other Metal Ore Mining	3.0				
<b>Subdivision 09 Non-Metallic Mineral Mining and Quarrying</b>					
<b>Group 091 Construction Material Mining</b>					
Class 0911 Gravel and Sand Quarrying	1.1				
Class 0919 Other Construction Material Mining	2.3				
<b>Group 099 Other Non-Metallic Mineral Mining and Quarrying</b>					
Class 0990 Other Non-Metallic Mineral Mining and Quarrying	1.4				
<b>Subdivision 10 Exploration and Other Mining Support Services</b>					
<b>Group 101 Exploration</b>					
Class 1011 Petroleum Exploration	3.7				
Class 1012 Mineral Exploration	3.1				
<b>Group 109 Other Mining Support Services</b>					
Class 1090 Other Mining Support Services	9.8				
<b>Mining Division</b>	<b>233.0</b>				

## Division C: Manufacturing

Fig 7.9

**Manufacturing**  
ANZSIC Division C

<b>Sector</b> .....	<b>Secondary</b>
<b>Revenue in F2012 (\$billion)</b> .....	420
<b>Rank (among 19 Divisions)</b> .....	4th
<b>Value Added (\$billion) and Share of GDP</b> .....	112 (8.2%)
<b>Rank in 2012</b> .....	3rd
<b>Rank in 2050</b> .....	5th
<b>Employment ('000) and Rank</b> .....	976 (4th)
<b>Exports (\$billion)</b> .....	84

### Top Players

(revenue, \$billion, c.2011)

Fonterra	20.1	Sims Metal	8.9
Caltex	19.9	Toyota	8.5
Shell	18.5	One Steel	7.4
AMCOR	12.7		
Bluescope	9.2		

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Fig 7.10

**Manufacturing**  
Shares of industry  
revenue F2012(E)

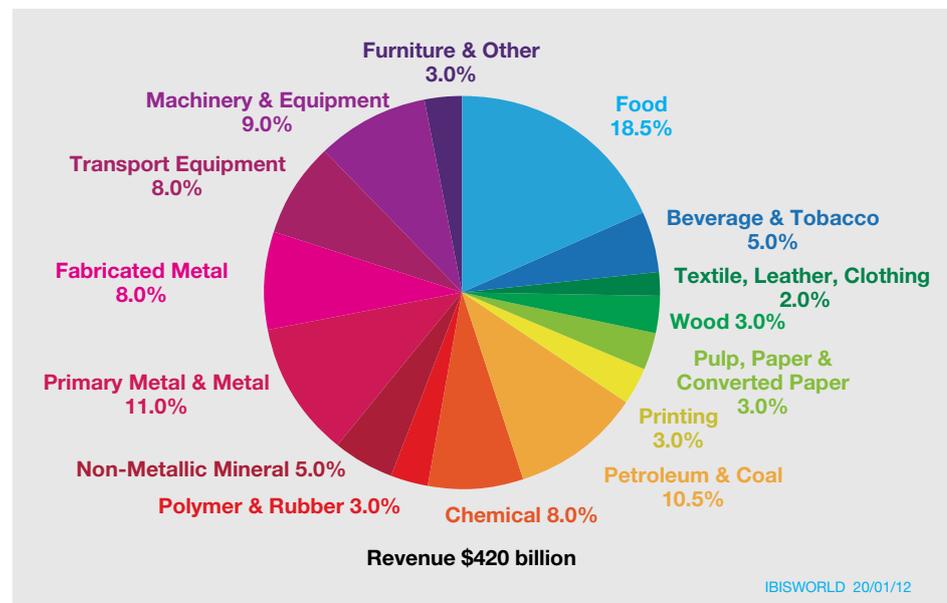


Table 7.3  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division C</b>	\$billion	T	S	G	D
<b>Subdivision 11 Food Product Manufacturing</b>					
<b>Group 111 Meat and Meat Product Manufacturing</b>					
Class 1111 Meat Processing	13.0				
Class 1112 Poultry Processing	6.7				
Class 1113 Cured Meat and Smallgoods Manufacturing	3.4				
<b>Group 112 Seafood Processing</b>					
Class 1120 Seafood Processing	1.4				
<b>Group 113 Dairy Product Manufacturing</b>					
Class 1131 Milk and Cream Processing	7.4				
Class 1132 Ice Cream Manufacturing	0.5				
Class 1133 Cheese and Other Dairy Product Manufacturing	10.0				
<b>Group 114 Fruit and Vegetable Processing</b>					
Class 1140 Fruit and Vegetable Processing	3.8				
<b>Group 115 Oil and Fat Manufacturing</b>					
Class 1150 Oil and Fat Manufacturing	2.3				
<b>Group 116 Grain Mill and Cereal Product Manufacturing</b>					
Class 1161 Grain Mill Product Manufacturing	2.6				
Class 1162 Cereal, Pasta and Baking Mix Manufacturing	2.9				
<b>Group 117 Bakery Product Manufacturing</b>					
Class 1171 Bread Manufacturing (Factory based)	2.8				
Class 1172 Cake and Pastry Manufacturing (Factory based)	1.5				
Class 1173 Biscuit Manufacturing (Factory based)					
Class 1174 Bakery Product Manufacturing (Non-factory based)	1.3				
<b>Group 118 Sugar and Confectionery Manufacturing</b>					
Class 1181 Sugar Manufacturing	2.1				
Class 1182 Confectionery Manufacturing	3.1				
<b>Group 119 Other Food Product Manufacturing</b>					
Class 1191 Potato, Corn and Other Crisp Manufacturing	2.9				
Class 1192 Prepared Animal and Bird Feed Manufacturing	3.8				
Class 1199 Other Food Product Manufacturing n.e.c.	8.4				

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Subdivision 12 Beverage and Tobacco</b>		
<b>Product Manufacturing</b>		
<b>Group 121 Beverage Manufacturing</b>		
Class 1211 Soft Drink, Cordial and Syrup Manufacturing	5.8	
Class 1212 Beer Manufacturing	5.2	
Class 1213 Spirit Manufacturing	0.5	
Class 1214 Wine and Other Alcoholic Beverage Manufacturing	7.0	
<b>Group 122 Cigarette and Tobacco Product Manufacturing</b>		
Class 1220 Cigarette and Tobacco Product Manufacturing	1.3	
<b>Subdivision 13 Textile, Leather, Clothing and Footwear Manufacturing</b>		
<b>Group 131 Textile Manufacturing</b>		
Class 1311 Wool Scouring		
Class 1312 Natural Textile Manufacturing		
Class 1313 Synthetic Textile Manufacturing		
Class 1334 Textile Finishing and Other Textile Product Manufacturing	1.0	
<b>Group 132 Leather Tanning, Fur Dressing and Leather Product Manufacturing</b>		
Class 1320 Leather Tanning, Fur Dressing and Leather Manufacturing	0.9	
<b>Group 133 Textile Product Manufacturing</b>		
Class 1331 Textile Floor Covering Manufacturing	1.1	
Class 1332 Rope, Cordage and Twine Manufacturing	1.4	
Class 1333 Cut and Sewn Textile Product Manufacturing		
<b>Group 134 Knitted Product Manufacturing</b>		
Class 1340 Knitted Product Manufacturing	0.3	
<b>Group 135 Clothing and Footwear Manufacturing</b>		
Class 1351 Clothing Manufacturing	3.6	
Class 1352 Footwear Manufacturing	0.4	
<b>Subdivision 14 Wood Product Manufacturing</b>		
<b>Group 141 Log Sawmilling and Timber Dressing</b>		
Class 1411 Log Sawmilling	1.7	
Class 1412 Wood Chipping	1.0	
Class 1413 Timber Resawing and Dressing	2.5	

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Group 149 Other Wood Product Manufacturing</b>		
Class 1491 Prefabricated Wooden Building Manufacturing	5.0	
Class 1492 Wooden Structural Fitting and Component Manufacturing		
Class 1493 Veneer and Plywood Manufacturing	1.6	
Class 1494 Reconstituted Wood Product Manufacturing	0.8	
Class 1499 Other Wood Product Manufacturing n.e.c.		
<b>Subdivision 15 Pulp, Paper and Converted Paper Product Manufacturing</b>		
<b>Group 151 Pulp, Paper and Paperboard Manufacturing</b>		
Class 1510 Pulp, Paper and Paperboard Manufacturing	3.2	
<b>Group 152 Converted Paper Product Manufacturing</b>		
Class 1521 Corrugated Paperboard and Paper Container Manufacturing	3.6	
Class 1522 Paper Bag Manufacturing	0.5	
Class 1523 Paper Stationery Manufacturing	1.3	
Class 1524 Sanitary Paper Product Manufacturing		
Class 1529 Other Converted Paper Product Manufacturing	3.0	
<b>Subdivision 16 Printing (including the Reproduction of Recorded Media)</b>		
<b>Group 161 Printing and Printing Support Services</b>		
Class 1611 Printing	13.6	
Class 1612 Printing Support Services	0.7	
<b>Group 162 Reproduction of Recorded Media</b>		
Class 1620 Reproduction of Recorded Media	0.2	
<b>Subdivision 17 Petroleum and Coal Product Manufacturing</b>		
<b>Group 170 Petroleum and Coal Product Manufacturing</b>		
Class 1701 Petroleum Refining and Petroleum Fuel Manufacturing	45.3	
Class 1709 Other Petroleum and Coal Product Manufacturing	1.4	
<b>Subdivision 18 Basic Chemical and Chemical Product Manufacturing</b>		
<b>Group 181 Basic Chemical Manufacturing</b>		
Class 1811 Industrial Gas Manufacturing	3.3	

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Class 1812 Basic Organic Chemical Manufacturing	1.2	
Class 1813 Basic Inorganic Chemical Manufacturing	3.7	
<b>Group 182 Basic Polymer Manufacturing</b>		
Class 1821 Synthetic Resin and Synthetic Rubber Manufacturing		
Class 1829 Other Basic Polymer Manufacturing	3.0	
<b>Group 183 Fertiliser and Pesticide Manufacturing</b>		
Class 1831 Fertiliser Manufacturing	3.5	
Class 1832 Pesticide Manufacturing	0.9	
<b>Group 184 Pharmaceutical and Medicinal Product Manufacturing</b>		
Class 1841 Human Pharmaceutical and Medicinal Product Manufacturing		
Class 1842 Veterinary Pharmaceutical and Medicinal Product Manufacturing	9.2	
<b>Group 185 Cleaning Compound and Toiletry Preparation Manufacturing</b>		
Class 1851 Cleaning Compound Manufacturing	2.6	
Class 1852 Cosmetic and Toiletry Preparation Manufacturing	1.0	
<b>Group 189 Other Basic Chemical Product Manufacturing</b>		
Class 1891 Photographic Chemical Product Manufacturing		
Class 1892 Explosive Manufacturing	1.9	
Class 1899 Other Basic Chemical Product Manufacturing n.e.c.	2.0	
<b>Subdivision 19 Polymer Product and Rubber Product Manufacturing</b>		
<b>Group 191 Polymer Product Manufacturing</b>		
Class 1916 Paint and Coatings Manufacturing	0.4	
Class 1911 Polymer Film and Sheet Packaging Material Manufacturing		
Class 1912 Rigid and Semi-Rigid Polymer Product Manufacturing		
Class 1913 Polymer Foam Product Manufacturing		
Class 1914 Tyre Manufacturing		
Class 1915 Adhesive Manufacturing		
Class 1919 Other Polymer Product Manufacturing	10.7	
<b>Group 192 Natural Rubber Product Manufacturing</b>		
Class 1920 Natural Rubber Product Manufacturing		

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Subdivision 20 Non-Metallic Mineral Product Manufacturing</b>		
<b>Group 201 Glass and Glass Product Manufacturing</b>		
Class 2010 Glass and Glass Product Manufacturing	2.5	
<b>Group 202 Ceramic Product Manufacturing</b>		
Class 2021 Clay Brick Manufacturing	1.1	
Class 2029 Other Ceramic Product Manufacturing	0.8	
<b>Group 203 Cement, Lime, Plaster and Concrete Product Manufacturing</b>		
Class 2031 Cement and Lime Manufacturing	2.5	
Class 2032 Plaster Product Manufacturing	1.4	
Class 2033 Ready-Mixed Concrete Manufacturing	6.0	
Class 2034 Concrete Product Manufacturing	3.8	
<b>Group 209 Other Non-Metallic Mineral Product Manufacturing</b>		
Class 2090 Other Non-Metallic Mineral Product Manufacturing	2.5	
<b>Subdivision 21 Primary Metal and Metal Product Manufacturing</b>		
<b>Group 211 Basic Ferrous Metal Manufacturing</b>		
Class 2110 Iron Smelting and Steel Manufacturing	8.4	
<b>Group 212 Basic Ferrous Metal Product Manufacturing</b>		
Class 2121 Iron and Steel Casting	1.8	
Class 2122 Steel Pipe and Tube Manufacturing	1.8	
<b>Group 213 Basic Non-Ferrous Metal Manufacturing</b>		
Class 2131 Alumina Production	7.7	
Class 2132 Aluminium Smelting	6.6	
Class 2133 Copper, Silver, Lead and Zinc Smelting and Refining	9.0	
Class 2139 Other Basic Non-Ferrous Metal Manufacturing	5.1	
<b>Group 214 Basic Non-Ferrous Metal Product Manufacturing</b>		
Class 2141 Non-Ferrous Metal Casting	0.2	
Class 2142 Aluminium Rolling, Drawing, Extruding	1.8	
Class 2149 Other Basic Non-Ferrous Metal Product Manufacturing	3.7	
<b>Subdivision 22 Fabricated Metal Product Manufacturing</b>		
<b>Group 221 Iron and Steel Forging</b>		
Class 2210 Iron and Steel Forging	1.0	

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Group 222 Structural Metal Product Manufacturing</b>		
Class 2221 Structural Steel Fabricating	7.8	
Class 2222 Prefabricated Metal Building Manufacturing	3.3	
Class 2223 Architectural Aluminium Product Manufacturing	4.4	
Class 2224 Metal Roof and Guttering Manufacturing (except Aluminium)		
Class 2229 Other Structural Metal Product Manufacturing	2.3	
<b>Group 223 Metal Container Manufacturing</b>		
Class 2231 Boiler, Tank and Other Heavy Gauge Metal Container Manufacturing	1.6	
Class 2239 Other Metal Container Manufacturing		
<b>Group 224 Sheet Metal Product Manufacturing (except Metal Structural and Container Products)</b>		
Class 2240 Sheet Metal Product Manufacturing (except Metal Structural and Container Products)	4.6	
<b>Group 229 Other Fabricated Metal Product Manufacturing</b>		
Class 2291 Spring and Wire Product Manufacturing	1.3	
Class 2292 Nut, Bolt, Screw and Rivet Manufacturing	0.5	
Class 2293 Metal Coating and Finishing	1.6	
Class 2299 Other Fabricated Metal Product Manufacturing n.e.c.	5.8	
<b>Subdivision 23 Transport Equipment Manufacturing</b>		
<b>Group 231 Motor Vehicle and Motor Vehicle Part Manufacturing</b>		
Class 2311 Motor Vehicle Manufacturing	11.1	
Class 2312 Motor Vehicle Body and Trailer Manufacturing	3.7	
Class 2313 Automotive Electrical Component Manufacturing	1.5	
Class 2319 Other Motor Vehicle Parts Manufacturing	5.4	
<b>Group 239 Other Transport Equipment Manufacturing</b>		
Class 2391 Shipbuilding and Repair Services	2.6	
Class 2392 Boatbuilding and Repair Services	1.3	

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Class 2393 Railway Rolling Stock Manufacturing and Repair Services	3.3	
Class 2394 Aircraft Manufacturing and Repair Services	3.7	
Class 2399 Other Transport Equipment Manufacturing n.e.c.	<1.0	
<b>Subdivision 24 Machinery and Equipment Manufacturing</b>		
<b>Group 241 Professional and Scientific Equipment Manufacturing</b>		
Class 2411 Photographic, Optical and Ophthalmic Equipment Manufacturing	0.8	
Class 2412 Medical and Surgical Equipment Manufacturing	3.3	
Class 2419 Other Professional and Scientific Equipment Manufacturing	1.7	
<b>Group 242 Computer and Electronic Equipment Manufacturing</b>		
Class 2421 Computer and Electronic Office Equipment Manufacturing	0.6	
Class 2422 Communication Equipment Manufacturing	1.6	
Class 2429 Other Electronic Equipment Manufacturing	1.8	
<b>Group 243 Electrical Equipment Manufacturing</b>		
Class 2431 Electric Cable and Wire Manufacturing	2.0	
Class 2432 Electric Lighting Equipment Manufacturing	0.9	
Class 2439 Other Electrical Equipment Manufacturing	4.8	
<b>Group 244 Domestic Appliance Manufacturing</b>		
Class 2441 Whiteware Appliance Manufacturing		
Class 2449 Other Domestic Appliance Manufacturing	2.5	
<b>Group 245 Pump, Compressor, Heating and Ventilation Equipment Manufacturing</b>		
Class 2451 Pump and Compressor Manufacturing	1.5	
Class 2452 Fixed Space Heating, Cooling and Ventilation Equipment Manufacturing	0.8	
<b>Group 246 Specialised Machinery and Equipment Manufacturing</b>		
Class 2461 Agricultural Machinery and Equipment Manufacturing	1.3	
Class 2462 Mining and Construction Machinery Manufacturing	5.0	

Table 7.3 *continued*  
**Division C: Manufacturing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Class 2463 Machine Tool and Parts Manufacturing	1.1	
Class 2469 Other Specialised Machinery and Equipment Manufacturing	0.5	
<b>Group 249 Other Machinery and Equipment Manufacturing</b>		
Class 2491 Lifting and Material Handling Equipment Manufacturing	0.9	
Class 2499 Other Machinery and Equipment Manufacturing n.e.c.	5.4	
<b>Subdivision 25 Furniture and Other Manufacturing</b>		
<b>Group 251 Furniture Manufacturing</b>		
Class 2511 Wooden Furniture and Upholstered Seat Manufacturing	5.6	
Class 2512 Metal Furniture Manufacturing	0.9	
Class 2513 Mattress Manufacturing	0.6	
Class 2519 Other Furniture Manufacturing	2.4	
<b>Group 259 Other Manufacturing</b>		
Class 2591 Jewellery and Silverware Manufacturing	0.9	
Class 2592 Toy, Sporting and Recreational Product Manufacturing	0.5	
Class 2599 Other Manufacturing n.e.c.	0.5	
<b>Manufacturing Division</b>	<b>420.0</b>	

## Division D: Electricity, Gas, Water and Waste Services

Fig 7.11  
Electricity, Gas, Water  
and Waste Services  
ANZSIC Division D

<b>Sector</b> .....	<b>Secondary</b>
<b>Revenue in F2012 (\$billion)</b> .....	116
<b>Rank (among 19 Divisions)</b> .....	12th
<b>Value Added (\$billion) and Share of GDP</b> .....	30.8 (2.2%)
<b>Rank in 2012</b> .....	16th
<b>Rank in 2050</b> .....	17th
<b>Employment ('000) and Rank</b> .....	159 (19th)
<b>Exports (\$billion)</b> .....	N/A

### Top Players

(revenue, \$billion, c.2011)

Origin Energy	10.4	Synergy	2.7
AGL	7.1	Essential Energy	2.6
Ausgrid	4.0	Meridian Energy	2.2
Tru Energy	3.5		
Endeavour	2.9		

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Fig 7.12  
Electricity, Gas, Water  
and Waste Services  
Shares of industry  
revenue F2012(E)

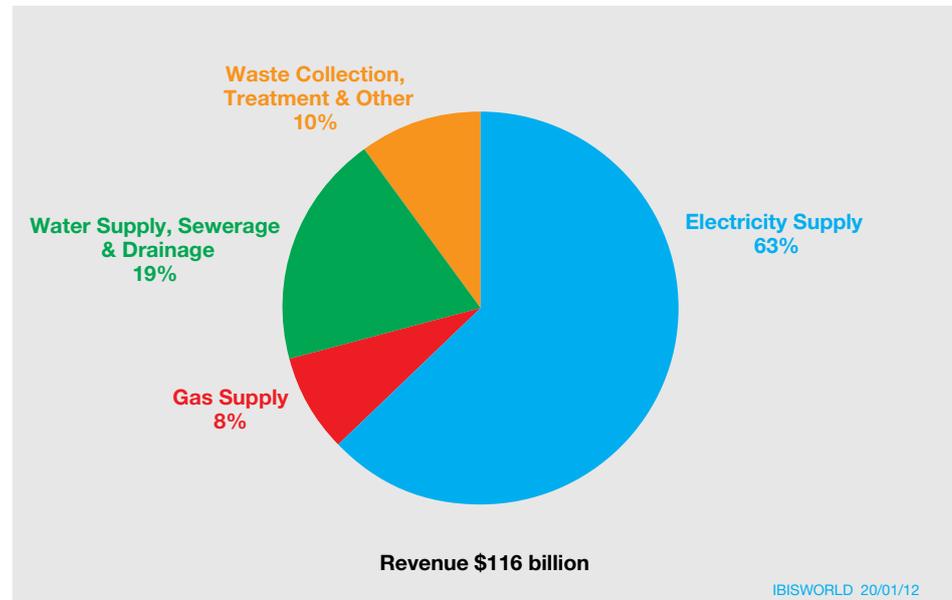


Table 7.4  
**Division D: Electricity, Gas,  
 Water and Waste Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division D</b>	\$billion	T	S	G	D
<b>Subdivision 26 Electricity Supply</b>					
<b>Group 261 Electricity Generation</b>					
Class 2611 Fossil Fuel Electricity Generation					
Class 2612 Hydro-Electricity Generation	20.9				
Class 2619 Other Electricity Generation					
<b>Group 262 Electricity Transmission</b>					
Class 2620 Electricity Transmission	3.2				
<b>Group 263 Electricity Distribution</b>					
Class 2630 Electricity Distribution					
<b>Group 264 On Selling Electricity and Electricity Market Operation</b>					
Class 2640 On Selling Electricity and Electricity Market Operation	49.8				
<b>Subdivision 27 Gas Supply</b>					
<b>Group 270 Gas Supply</b>					
Class 2700 Gas Supply	8.9				
<b>Subdivision 28 Water Supply, Sewerage and Drainage Services</b>					
<b>Group 281 Water Supply, Sewerage and Drainage Services</b>					
Class 2811 Water Supply	9.8				
Class 2812 Sewerage and Drainage Services	11.8				
<b>Subdivision 29 Waste Collection, Treatment and Disposal Services</b>					
<b>Group 291 Waste Collection Services</b>					
Class 2911 Solid Waste Collection Services	11.2				
Class 2919 Other Waste Collection Services					
<b>Group 292 Waste Treatment, Disposal and Remediation Services</b>					
Class 2921 Waste Treatment and Disposal Services	<1.0				
Class 2922 Waste Remediation and Materials Recovery Services	<1.0				
<b>Utilities Division</b>	<b>116.0</b>				

## Division E: Construction

Fig 7.13  
**Construction**  
 ANZSIC Division E

<b>Sector</b> .....	<b>Secondary</b>
<b>Revenue in F2012 (\$billion)</b> .....	236
<b>Rank (among 19 Divisions)</b> .....	6th
<b>Value Added (\$billion) and Share of GDP</b> .....	100 (7.7%)
<b>Rank in 2012</b> .....	4th
<b>Rank in 2050</b> .....	4th
<b>Employment ('000) and Rank</b> .....	1038 (3rd)
<b>Exports (\$billion)</b> .....	N/A

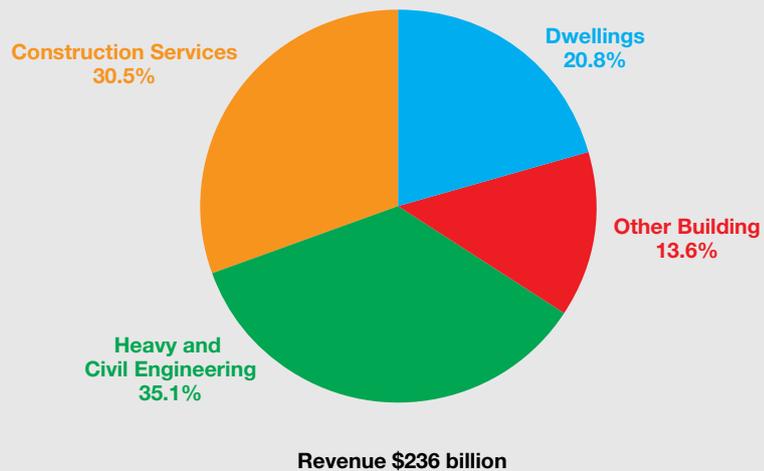
### Top Players

(revenue, \$billion, c.2011)

Leighton	15.9	RTA (NSW)	2.5
Downer EDI	6.3	BGC	2.3
Valemus	3.7	Hastie Group	1.9
Brookfield	2.6		

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Fig 7.14  
**Construction**  
 Shares of industry  
 revenue F2012(E)



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Table 7.5  
**Division E: Construction**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division E</b>	\$billion	T	S	G	D
<b>Subdivision 30 Building Construction</b>					
<b>Group 301 Residential Building Construction</b>					
Class 3011 House Construction	41.3				
Class 3019 Other Residential Building Construction	11.7				
<b>Group 302 Non-Residential Building Construction</b>					
Class 3020 Non-Residential Building Construction	30.8				
<b>Subdivision 31 Heavy and Civil Engineering Construction</b>					
<b>Group 310 Heavy and Civil Engineering Construction</b>					
Class 3101 Road and Bridge Construction	17.5				
Class 3109 Other Heavy and Civil Engineering Construction	65.5				
<b>Subdivision 32 Construction Services</b>					
<b>Group 321 Land Development and Site Preparation Services</b>					
Class 3211 Land Development and Subdivision					
Class 3212 Site Preparation Services	8.7				
<b>Group 322 Building Structure Services</b>					
Class 3221 Concreting Services	7.4				
Class 3222 Bricklaying Services	1.8				
Class 3223 Roofing Services	1.4				
Class 3224 Structural Steel Erection Services	2.3				
<b>Group 323 Building Installation Services</b>					
Class 3231 Plumbing Services	8.2				
Class 3232 Electrical Services	11.1				
Class 3233 Air Conditioning and Heating Services	5.0				
Class 3234 Fire and Security Alarm Installation Services	3.1				
Class 3239 Other Building Installation Services					
<b>Group 324 Building Completion Services</b>					
Class 3241 Plastering and Ceiling Services	4.1				
Class 3242 Carpentry Services	6.2				
Class 3243 Tiling and Carpeting Services	1.3				
Class 3244 Painting and Decorating Services	3.3				
Class 3245 Glazing Services	1.2				
<b>Group 329 Other Construction Services</b>					
Class 3291 Landscape Construction Services	2.9				
Class 3292 Hire Construction Machinery and Operator					
Class 3299 Other Construction Services n.e.c.	1.7				
<b>Construction Division</b>	<b>236.0</b>				

## Division F: Wholesale Trade

Fig 7.15

**Wholesale Trade**  
ANZSIC Division F

<b>Sector</b> .....	<b>Tertiary</b>
<b>Revenue in F2012 (\$billion)</b> .....	422
<b>Rank (among 19 Divisions)</b> .....	3rd
<b>Value Added (\$billion) and Share of GDP</b> .....	57 (4.2%)
<b>Rank in 2012</b> .....	.11th
<b>Rank in 2050</b> .....	.12th
<b>Employment ('000) and Rank</b> .....	411 (11th)
<b>Exports (\$billion)</b> .....	N/A

### Top Players

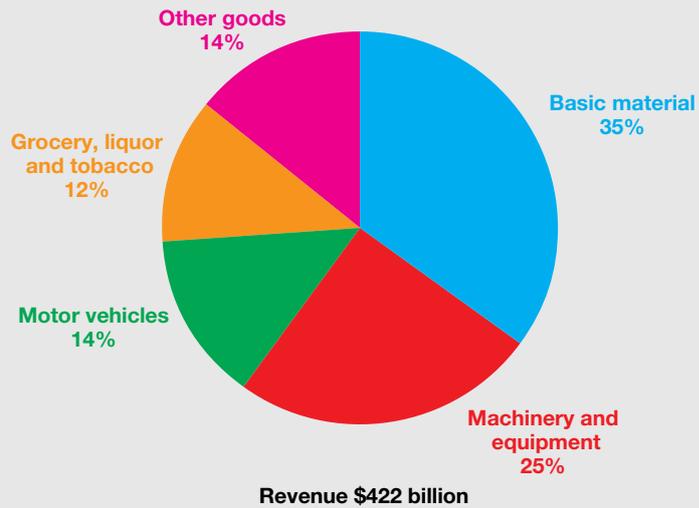
(revenue, \$billion, c.2011)

Metcash	12.5	API	3.4
Agrium	5.6	Hewlett Packard	3.3
Zuellig	3.7	Daimler	2.7
Citic	3.7		
Apple	3.6		

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Fig 7.16

**Wholesale Trade**  
Shares of industry  
revenue F2012(E)



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Table 7.6  
**Division F: Wholesale Trade**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division F</b>	\$billion	T	S	G	D
<b>Subdivision 33 Basic Material Wholesaling</b>					
<b>Group 331 Agricultural Product Wholesaling</b>					
Class 3311 Wool Wholesaling	2.7				
Class 3312 Cereal Grain Wholesaling	12.6				
Class 3319 Other Agricultural Product Wholesaling	26.0				
<b>Group 332 Mineral, Metal and Chemical Wholesaling</b>					
Class 3321 Petroleum Product Wholesaling	48.1				
Class 3322 Metal and Mineral Wholesaling	27.0				
Class 3323 Industrial and Agricultural Chemical Product Wholesaling	6.6				
<b>Group 333 Timber and Hardware Goods Wholesaling</b>					
Class 3331 Timber Wholesaling	3.8				
Class 3332 Plumbing Goods Wholesaling	20.8				
Class 3339 Other Hardware Goods Wholesaling					
<b>Subdivision 34 Machinery and Equipment Wholesaling</b>					
<b>Group 341 Specialised Industrial Machinery and Equipment Wholesaling</b>					
Class 3411 Agricultural and Construction Machinery Wholesaling	17.1				
Class 3419 Other Specialised Industrial Machinery and Equipment Wholesaling	7.3				
<b>Group 349 Other Machinery and Equipment Wholesaling</b>					
Class 3491 Professional and Scientific Goods Wholesaling	5.3				
Class 3492 Computer and Computer Peripheral Wholesaling	19.6				
Class 3493 Telecommunication Goods Wholesaling	26.0				
Class 3494 Other Electrical and Electronic Goods Wholesaling					
Class 3499 Other Machinery and Equipment Wholesaling n.e.c.	30.2				
<b>Subdivision 35 Motor Vehicle and Motor Vehicle Parts Wholesaling</b>					
<b>Group 350 Motor Vehicle and Motor Vehicle Parts Wholesaling</b>					
Class 3501 Car Wholesaling	40.9				
Class 3502 Commercial Vehicle Wholesaling					
Class 3503 Trailer and Other Motor Vehicle Wholesaling	5.0				

Table 7.6 *continued*  
**Division F: Wholesale Trade**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Class 3504 Motor Vehicle New Parts Wholesaling	11.6	
Class 3505 Motor Vehicle Dismantling and Used Parts Wholesaling	1.1	
<b>Subdivision 36 Grocery, Liquor and Tobacco Product Wholesaling</b>		
<b>Group 360 Grocery, Liquor and Tobacco Product Wholesaling</b>		
Class 3601 General Line Grocery Wholesaling	16.2	
Class 3609 Other Grocery Wholesaling		
Class 3602 Meat, Poultry and Smallgoods Wholesaling	2.5	
Class 3603 Dairy Produce Wholesaling	6.0	
Class 3604 Fish and Seafood Wholesaling	4.1	
Class 3605 Fruit and Vegetable Wholesaling	7.3	
Class 3606 Liquor and Tobacco Product Wholesaling	7.9	
<b>Subdivision 37 Other Goods Wholesaling</b>		
<b>Group 371 Textile, Clothing and Footwear Wholesaling</b>		
Class 3711 Textile Product Wholesaling	4.4	
Class 3712 Clothing and Footwear Wholesaling	10.9	
<b>Group 372 Pharmaceutical and Toiletry Goods Wholesaling</b>		
Class 3720 Pharmaceutical and Toiletry Goods Wholesaling	12.2	
<b>Group 373 Furniture, Floor Covering and Other Goods Wholesaling</b>		
Class 3731 Furniture and Floor Covering Wholesaling	3.4	
Class 3732 Jewellery and Watch Wholesaling	2.2	
Class 3733 Kitchen and Diningware Wholesaling		
Class 3734 Toy and Sporting Goods Wholesaling	3.8	
Class 3735 Book and Magazine Wholesaling	1.5	
Class 3736 Paper Product Wholesaling	7.6	
Class 3739 Other Goods Wholesaling n.e.c.	12.1	
<b>Subdivision 38 Commission-Based Wholesaling</b>		
<b>Group 380 Commission-Based Wholesaling</b>		
Class 3800 Commission-Based Wholesaling	<1.0	
<b>Wholesaling Division</b>	<b>422.0</b>	

## Division G: Retail Trade

Fig 7.17

**Retail Trade**  
ANZSIC Division G

<b>Sector</b> .....	<b>Tertiary</b>
<b>Revenue in F2012 (\$billion)</b> .....	406
<b>Rank (among 19 Divisions)</b> .....	5th
<b>Value Added (\$billion) and Share of GDP</b> .....	61 (4.5%)
<b>Rank in 2012</b> .....	10th
<b>Rank in 2050</b> .....	15th
<b>Employment ('000) and Rank</b> .....	1212 (2nd)
<b>Exports (\$billion)</b> .....	N/A

### Top Players

(revenue, \$billion, c.2011)

Westfarmers	55.5	Aldi	2.8
Woolworths	54.5	Harvey Norman	2.7
Auto. Holdings	3.3	7-Eleven	2.1
JB HiFi	3.0	Muir (Good Guys)	2.1
Myer	2.9	David Jones	2.0

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Fig 7.18

**Retail Trade**  
Shares of industry  
revenue F2012(E)

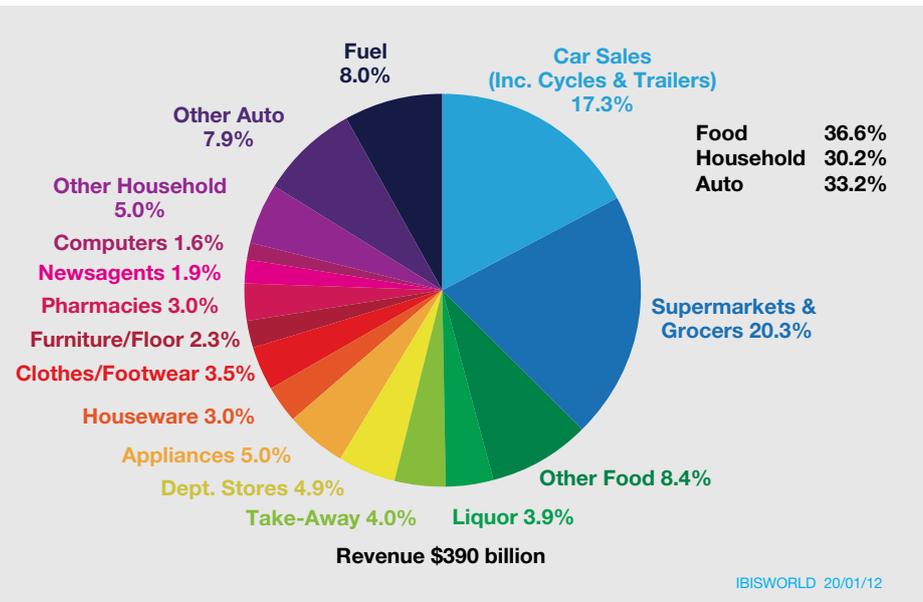


Table 7.7  
**Division G: Retail Trade**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division G</b>	\$billion	T	S	G	D
<b>Subdivision 39 Motor Vehicle and Motor Vehicle Parts Retailing</b>					
<b>Group 391 Motor Vehicle Retailing</b>					
Class 3911 Car Retailing	66.9				
Class 3912 Motor Cycle Retailing	3.3				
Class 3913 Trailer and Other Motor Vehicle Retailing	2.2				
<b>Group 392 Motor Vehicle Parts and Tyre Retailing</b>					
Class 3921 Motor Vehicle Parts Retailing	1.7				
Class 3922 Tyre Retailing	4.9				
<b>Subdivision 40 Fuel Retailing</b>					
<b>Group 400 Fuel Retailing</b>					
Class 4000 Fuel Retailing	36.9				
<b>Subdivision 41 Food Retailing</b>					
<b>Group 411 Supermarket and Grocery Stores</b>					
Class 4110 Supermarket and Grocery Stores	83.7				
<b>Group 412 Specialised Food Retailing</b>					
Class 4121 Fresh Meat, Fish and Poultry Retailing	11.4				
Class 4122 Fruit and Vegetable Retailing	12.9				
Class 4123 Liquor Retailing	16.4				
Class 4129 Other Specialised Food Retailing	10.8				
<b>Subdivision 42 Other Store-Based Retailing</b>					
<b>Group 421 Furniture, Floor Coverings, Houseware and Textile Goods Retailing</b>					
Class 4211 Furniture Retailing	7.3				
Class 4212 Floor Coverings Retailing	2.8				
Class 4213 Houseware Retailing	1.4				
Class 4214 Manchester and Other Textile Goods Retailing	2.7				
<b>Group 422 Electrical and Electronic Goods Retailing</b>					
Class 4221 Electrical, Electronic and Gas Appliance Retailing	4.2				
Class 4222 Computer and Computer Peripheral Retailing	6.8				
Class 4229 Other Electrical and Electronic Goods Retailing					
<b>Group 423 Hardware, Building and Garden Supplies Retailing</b>					
Class 4231 Hardware and Building Supplies Retailing	11.6				
Class 4232 Garden Supplies Retailing	2.3				

Table 7.7 *continued*  
**Division G: Retail Trade**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Group 424 Recreational Goods Retailing</b>			
Class 4241 Sport and Camping Equipment Retailing	4.1		
Class 4242 Entertainment Media Retailing	1.1		
Class 4243 Toy and Game Retailing	1.7		
Class 4244 Newspaper and Book Retailing	5.8		
Class 4245 Marine Equipment Retailing	2.8		
<b>Group 425 Clothing, Footwear and Personal Accessory Retailing</b>			
Class 4251 Clothing Retailing	12.1		
Class 4252 Footwear Retailing	2.6		
Class 4253 Watch and Jewellery Retailing	3.8		
Class 4259 Other Personal Accessory Retailing			
<b>Group 426 Department Stores</b>			
Class 4260 Department Stores	19.3		
<b>Group 427 Pharmaceutical and Other Store-Based Retailing</b>			
Class 4271 Pharmaceutical, Cosmetic and Toiletry Goods Retailing	14.9		
Class 4272 Stationery Goods Retailing	2.0		
Class 4273 Antique and Used Goods Retailing	2.7		
Class 4274 Flower Retailing	0.9		
Class 4279 Other Store-Based Retailing n.e.c.	7.7		
<b>Subdivision 43 Non-Store Retailing and Retail Commission-Based Buying and/or Selling</b>			
<b>Group 431 Non-Store Retailing</b>			
Class 4310 Non-Store Retailing	15.0		
<b>Group 432 Retail Commission-Based Buying and/or Selling</b>			
Class 4320 Retail Commission-Based Buying and/or Selling	20.0		
<b>Retail Division</b>	<b>406.0</b>		

## Division H: Accommodation and Food Services

Fig 7.19  
Accommodation  
and Food Services  
ANZSIC Division H

<b>Sector</b> .....	<b>Quinary</b>
<b>Revenue in F2012 (\$billion)</b> .....	77
<b>Rank (among 19 Divisions)</b> .....	15th
<b>Value Added (\$billion) and Share of GDP</b> .....	31.4 (2.3%)
<b>Rank in 2012</b> .....	15th
<b>Rank in 2050</b> .....	13th
<b>Employment ('000) and Rank</b> .....	771 (7th)
<b>Exports (\$billion)</b> .....	N/A

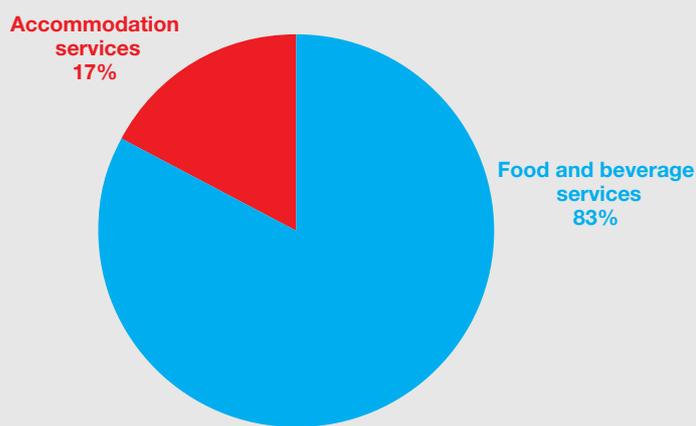
### Top Players

(revenue, \$billion, c.2011)

McDonalds	2.87	Mantra Group	0.40
Yum!	2.43	IHG Hotels	0.26
Comp. Foods	1.16	Hilton Hotel	0.16
Dominos	0.73		
AAPT	0.68		

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Fig 7.20  
Accommodation  
and Food Services  
Shares of industry  
revenue F2012(E)



Revenue \$77.46 billion

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Table 7.8  
**Division H: Accommodation  
 and Food Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division H</b>	\$billion	T	S	G	D
<b>Subdivision 44 Accommodation</b>					
<b>Group 440 Accommodation</b>					
Class 4400 Accommodation	13.4				
<b>Subdivision 45 Food and Beverage Services</b>					
<b>Group 451 Cafes, Restaurants and Takeaway Food Services</b>					
Class 4511 Cafes and Restaurants	34.5				
Class 4512 Takeaway Food Services	4.7				
Class 4513 Catering Services	4.7				
<b>Group 452 Pubs, Taverns and Bars</b>					
Class 4520 Pubs, Taverns and Bars	15.0				
<b>Group 453 Clubs (Hospitality)</b>					
Class 4530 Clubs (Hospitality)	9.9				
<b>Accommodation and Food Services</b>	<b>77.0</b>				

## Division I: Transport, Postal and Warehousing

Fig 7.21  
Transport, Postal  
and Warehousing  
ANZSIC Division I

<b>Sector</b> .....	<b>Tertiary</b>
<b>Revenue in F2012 (\$billion)</b> .....	167
<b>Rank (among 19 Divisions)</b> .....	8th
<b>Value Added (\$billion) and Share of GDP</b> .....	74 (5.1%)
<b>Rank in 2012</b> .....	7th
<b>Rank in 2050</b> .....	8th
<b>Employment ('000) and Rank</b> .....	581 (9th)
<b>Exports (\$billion)</b> .....	N/A

### Top Players

(revenue, \$billion, c.2011)

Qantas	15.1	Asciano	3.1
Toll	8.3	Linfox	2.6
Aust. Post	5.0	Railcorp NSW	2.6
Virgin	3.3	Co-op Bulk	2.1
QR National	3.1		

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Fig 7.22  
Transport, Postal  
and Warehousing  
Shares of industry  
revenue F2012(E)

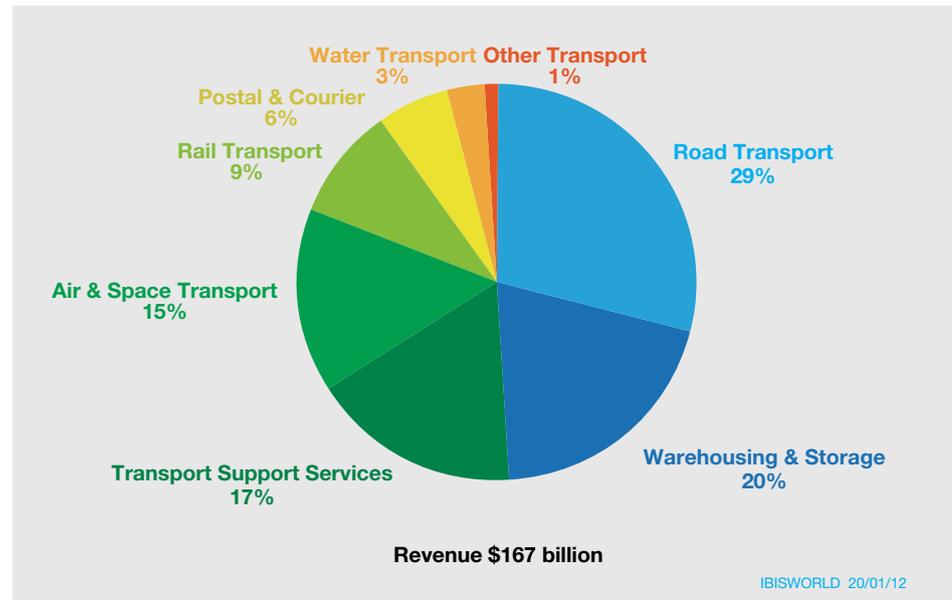


Table 7.9  
**Division I: Transport, Postal and Warehousing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division I</b>	\$billion	T	S	G	D
<b>Subdivision 46 Road Transport</b>					
<b>Group 461 Road Freight Transport</b>					
Class 4610 Road Freight Transport	48.8				
<b>Group 462 Road Passenger Transport</b>					
Class 4621 Interurban and Rural Bus Transport	1.1				
Class 4622 Urban Bus Transport (Including Tramway)	5.7				
Class 4623 Taxi and Other Road Transport	4.8				
<b>Subdivision 47 Rail Transport</b>					
<b>Group 471 Rail Freight Transport</b>					
Class 4710 Rail Freight Transport	9.8				
<b>Group 472 Rail Passenger Transport</b>					
Class 4720 Rail Passenger Transport	7.5				
<b>Subdivision 48 Water Transport</b>					
<b>Group 481 Water Freight Transport</b>					
Class 4810 Water Freight Transport	5.8				
<b>Group 482 Water Passenger Transport</b>					
Class 4820 Water Passenger Transport					
<b>Subdivision 49 Air and Space Transport</b>					
<b>Group 490 Air and Space Transport</b>					
Class 4900 Air and Space Transport	30.3				
<b>Subdivision 50 Other Transport</b>					
<b>Group 501 Scenic and Sightseeing Transport</b>					
Class 5010 Scenic and Sightseeing Transport	0.2				
<b>Group 502 Pipeline and Other Transport</b>					
Class 5021 Pipeline Transport	1.6				
Class 5029 Other Transport n.e.c.					
<b>Subdivision 51 Postal and Courier Pick-Up and Delivery Services</b>					
<b>Group 510 Postal and Courier Pick-Up and Delivery Services</b>					
Class 5101 Postal Services	12.3				
Class 5102 Courier Pick-up and Delivery Services					
<b>Subdivision 52 Transport Support Services</b>					
<b>Group 521 Water Transport Support Services</b>					
Class 5211 Stevedoring Services					
Class 5212 Port and Water Transport Terminal Operations					
Class 5219 Other Water Transport Support Services	16.4				
<b>Group 522 Airport Operations and Other Air Transport Support Services</b>					
Class 5220 Airport Operations and Other Air Transport Support Services					

Table 7.9 *continued*  
**Division I: Transport, Postal and Warehousing**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Group 529 Other Transport Support Services</b>			
Class 5291 Customs Agency Services	3.4		
Class 5292 Freight Forwarding Services	12.1		
Class 5299 Other Transport Support Services n.e.c.	1.2		
<b>Subdivision 53 Warehousing and Storage Services</b>			
<b>Group 530 Warehousing and Storage Services</b>			
Class 5301 Grain Storage Services	1.6		
Class 5309 Other Warehousing and Storage Services	4.9		
<b>Transport Division</b>	<b>167.0</b>		

## Division J: Information Media and Telecommunications

Fig 7.23  
Information Media and  
Telecommunications  
ANZSIC Division J

<b>Sector</b> .....	<b>Quaternary</b>
<b>Revenue in F2012 (\$billion)</b> .....	80
<b>Rank (among 19 Divisions)</b> .....	14th
<b>Value Added (\$billion) and Share of GDP</b> .....	40.6 (4.4%)
<b>Rank in 2012</b> .....	12th
<b>Rank in 2050</b> .....	10th
<b>Employment ('000) and Rank</b> .....	201 (17th)
<b>Exports (\$billion)</b> .....	0.33

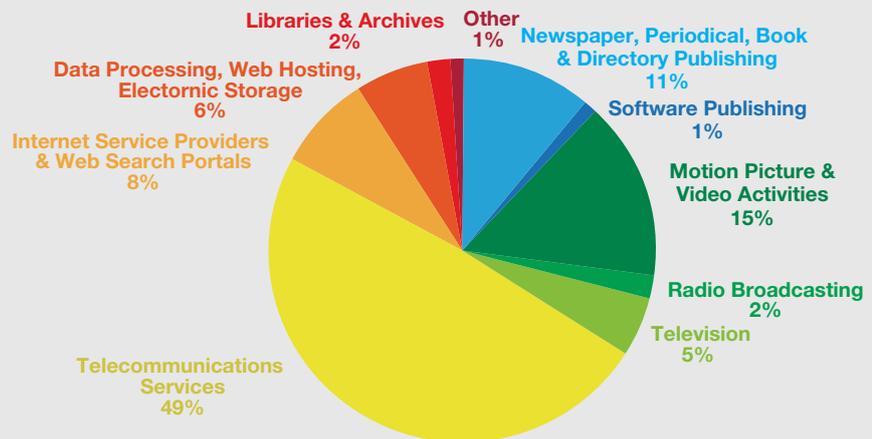
### Top Players

(revenue, \$billion, c.2011)

Telstra	25.4	Seven Group	3.3
Singtel Optus	9.4	Foxtel	2.1
Vodaphone	5.0	Nine Group	2.0

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Fig 7.24  
Information Media and  
Telecommunications  
Shares of industry  
revenue F2012(E)



Revenue \$80 billion

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Table 7.10  
**Division J: Information  
 Media and  
 Telecommunications**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division J</b>	\$billion	T	S	G	D
<b>Subdivision 54 Publishing (except Internet and Music Publishing)</b>					
<b>Group 541 Newspaper, Periodical, Book and Directory Publishing</b>					
Class 5411 Newspaper Publishing	4.9				
Class 5412 Magazine and Other Periodical Publishing	1.3				
Class 5413 Book Publishing					
Class 5414 Directory and Mailing List Publishing					
Class 5419 Other Publishing (except Software, Music and Internet)	2.7				
<b>Group 542 Software Publishing</b>					
Class 5420 Software Publishing	0.9				
<b>Subdivision 55 Motion Picture and Sound Recording Activities</b>					
<b>Group 551 Motion Picture and Video Activities</b>					
Class 5511 Motion Picture and Video Production	2.3				
Class 5512 Motion Picture and Video Distribution	2.7				
Class 5513 Motion Picture Exhibition	1.9				
Class 5514 Post-production Services and Other Motion Picture and Video Activities	5.0				
<b>Group 552 Sound Recording and Music Publishing</b>					
Class 5521 Music Publishing					
Class 5522 Music and Other Sound Recording Activities	0.1				
<b>Subdivision 56 Broadcasting (except Internet)</b>					
<b>Group 561 Radio Broadcasting</b>					
Class 5610 Radio Broadcasting	1.4				
<b>Group 562 Television Broadcasting</b>					
Class 5621 Free-to-Air Television Broadcasting					
Class 5622 Cable and Other Subscription Broadcasting	4.3				
<b>Subdivision 57 Internet Publishing and Broadcasting</b>					
<b>Group 570 Internet Publishing and Broadcasting</b>					
Class 5700 Internet Publishing and Broadcasting	<1.0				
<b>Subdivision 58 Telecommunications Services</b>					
<b>Group 580 Telecommunications Services</b>					
Class 5801 Wired Telecommunications Network Operation	10.2				

Table 7.10 *continued*  
**Division J: Information  
 Media and  
 Telecommunications**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

Class 5802 Other Telecommunications Network Operation	20.0	
Class 5809 Other Telecommunications Services	9.0	
<b>Subdivision 59 Internet Service Providers, Web Search Portals and Data Processing Services</b>		
<b>Group 591 Internet Service Providers and Web Search Portals</b>		
Class 5910 Internet Service Providers and Web Search Portals	6.4	
<b>Group 592 Data Processing, Web Hosting and Electronic Information Storage Services</b>		
Class 5921 Data Processing and Web Hosting Services	2.8	
Class 5922 Electronic Information Storage Services	2.0	
<b>Subdivision 60 Library and Other Information Services</b>		
<b>Group 601 Libraries and Archives</b>		
Class 6010 Libraries and Archives	1.3	
<b>Group 602 Other Information Services</b>		
Class 6020 Other Information Services	0.4	
<b>Information Media and Telecommunications Division</b>	<b>80.0</b>	

## Division K: Financial and Insurance Services

Fig 7.25  
Financial and  
Insurance Services  
ANZSIC Division K

Sector	Quaternary
Revenue in F2012 (\$billion)	534
Rank (among 19 Divisions)	1st
Value Added (\$billion) and Share of GDP	137.2 (9.7%)
Rank in 2012	1st
Rank in 2050	2nd
Employment ('000) and Rank	427 (12th)
Exports (\$billion)	1.42

### Top Players

(revenue, \$billion, c.2011)

CBA	46.2	QBE	15.0
Westpac	43.0	Aust. Super	14.2
NAB	40.0	First State	14.2
ANZ	35.4	IAG	12.3
Suncorp	19.0	Macquarie	11.5

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Fig 7.26  
Financial and  
Insurance Services  
Shares of industry  
revenue F2012(E)

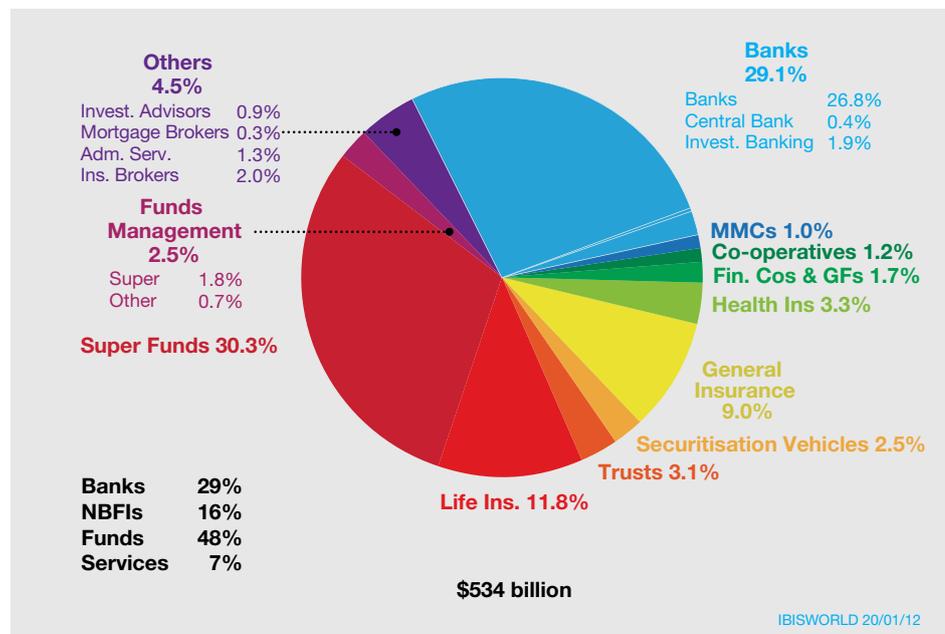


Table 7.11  
**Division K: Financial and Insurance Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division K</b>	\$billion	T	S	G	D
<b>Subdivision 62 Finance</b>					
<b>Group 621 Central Banking</b>					
Class 6210 Central Banking	2.0				
<b>Group 622 Depository Financial Intermediation</b>					
Class 6221 Banking					
Class 6222 Building Society Operation					
Class 6223 Credit Union Operation	167.0				
Class 6229 Other Depository Financial Intermediation					
<b>Group 623 Non-Depository Financing</b>					
Class 6230 Non-Depository Financing	13.8				
<b>Group 624 Financial Asset Investing</b>					
Class 6240 Financial Asset Investing	16.7				
<b>Subdivision 63 Insurance and Superannuation Funds</b>					
<b>Group 631 Life Insurance</b>					
Class 6310 Life Insurance	63.0				
<b>Group 632 Health and General Insurance</b>					
Class 6321 Health Insurance	17.4				
Class 6322 General Insurance	48.2				
<b>Group 633 Superannuation Funds</b>					
Class 6330 Superannuation Funds	162.0				
<b>Subdivision 64 Auxiliary Finance and Insurance Services</b>					
<b>Group 641 Auxiliary Finance and Investment Services</b>					
Class 6411 Financial Asset Broking Services					
Class 6419 Other Auxiliary Finance and Investment Services	43.6				
<b>Group 642 Auxiliary Insurance Services</b>					
Class 6420 Auxiliary Insurance Services	<1.0				
<b>Financial and Insurance Services Division</b>	<b>534.0</b>				

## Division L: Rental, Hiring and Real Estate Services

Fig 7.27

Rental, Hiring and  
Real Estate Services  
ANZSIC Division L

Sector	Quaternary
Revenue in F2012 (\$billion)	129
Rank (among 19 Divisions)	11th
Value Added (\$billion) and Share of GDP	29.7 (2.0%)
Rank in 2012	17th
Rank in 2050	16th
Employment ('000) and Rank	193 (15th)
Exports (\$billion)	0.2

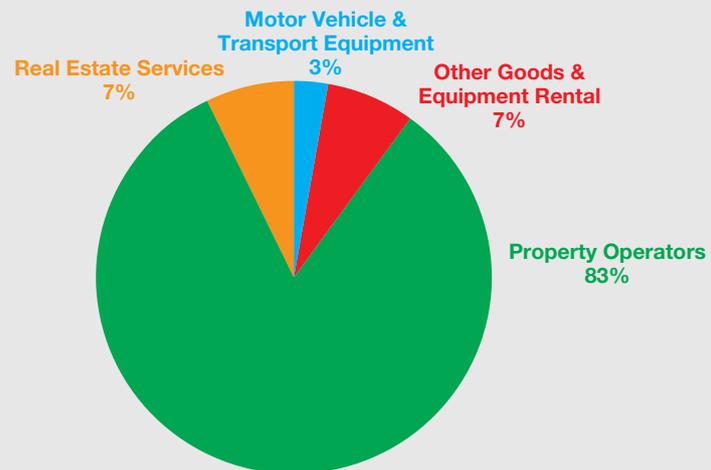
### Top Players (revenue, \$billion, c.2011)

Lend Lease	9.2
Brambles	4.6
Centro Properties	4.2
Wesfield Group	3.6
Mirvac	2.0

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Fig 7.28

Rental, Hiring and  
Real Estate Services  
Shares of industry  
revenue F2012(E)



Revenue \$129 billion

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Table 7.12  
**Division L: Rental, Hiring  
and Real Estate Services**  
by revenue,  
\$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division L</b>	\$billion	T	S	G	D
<b>Subdivision 66 Rental and Hiring Services (except Real Estate)</b>					
<b>Group 661 Motor Vehicle and Transport Equipment Rental and Hiring</b>					
Class 6611 Passenger Car Rental and Hiring	3.1				
Class 6619 Other Motor Vehicle and Transport Equipment Rental and Hiring	1.1				
<b>Group 662 Farm Animal and Bloodstock Leasing</b>					
Class 6620 Farm Animal and Bloodstock Leasing	<1.0				
<b>Group 663 Other Goods and Equipment Rental and Hiring</b>					
Class 6631 Heavy Machinery and Scaffolding Rental and Hiring	5.4				
Class 6632 Video and Other Electronic Media Rental and Hiring	1.0				
Class 6639 Other Goods and Equipment Rental and Hiring n.e.c.	1.7				
<b>Group 664 Non-Financial Intangible Assets (Except Copyrights) Leasing</b>					
Class 6640 Non-Financial Intangible Assets (Except Copyrights) Leasing	<1.0				
<b>Subdivision 67 Property Operators and Real Estate Services</b>					
<b>Group 671 Property Operators</b>					
Class 6711 Residential Property Operators	29.1				
Class 6712 Non-Residential Property Operators	78.4				
<b>Group 672 Real Estate Services</b>					
Class 6720 Real Estate Services	9.0				
<b>Rental and Hiring Division</b>	<b>129.0</b>				

## Division M: Professional, Scientific and Technical Services

Fig 7.29

Professional, Scientific and Technical Services  
ANZSIC Division M

<b>Sector</b> .....	<b>Quaternary</b>
<b>Revenue in F2012 (\$billion)</b> .....	138
<b>Rank (among 19 Divisions)</b> .....	10th
<b>Value Added (\$billion) and Share of GDP</b> .....	86.3 (6.6%)
<b>Rank in 2012</b> .....	5th
<b>Rank in 2050</b> .....	3rd
<b>Employment ('000) and Rank</b> .....	864 (5th)
<b>Exports (\$billion)</b> .....	8.3

**Top Players**  
(revenue, \$billion, c.2011)

Worley Parsons	5.7	PWC	1.4
IBM	4.6	CSIRO	1.2
Transfield	2.8	Dimensions Data	1.2
McDonald D	2.0	Chandler McL	1.2
Skilled Group	1.9	Sinclair Knight	1.1

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Fig 7.30

Professional, Scientific and Technical Services  
Shares of industry revenue F2012(E)

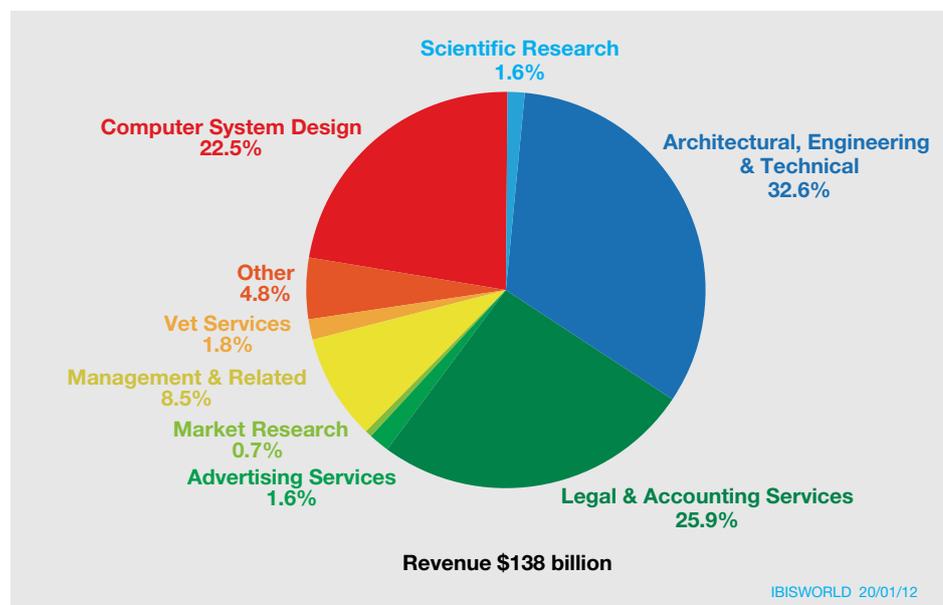


Table 7.13  
**Division M: Professional, Scientific and Technical Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division M</b>	\$billion	T	S	G	D
<b>Subdivision 69 Professional, Scientific and Technical Services (Except Computer System Design and Related Services)</b>					
<b>Group 691 Scientific Research Services</b>					
Class 6910 Scientific Research Services	2.2				
<b>Group 692 Architectural, Engineering and Technical Services</b>					
Class 6921 Architectural Services	3.0				
Class 6922 Surveying and Mapping Services	3.0				
Class 6923 Engineering Design and Engineering Consulting Services	29.0				
Class 6924 Other Specialised Design Services	4.2				
Class 6925 Scientific Testing and Analysis Services	5.8				
<b>Group 693 Legal and Accounting Services</b>					
Class 6931 Legal Services	19.9				
Class 6932 Accounting Services	15.8				
<b>Group 694 Advertising Services</b>					
Class 6940 Advertising Services	2.1				
<b>Group 695 Market Research and Statistical Services</b>					
Class 6950 Market Research and Statistical Services	1.0				
<b>Group 696 Management and Related Consulting Services</b>					
Class 6961 Corporate Head Office Management Services	3.5				
Class 6962 Management Advice and Related Consulting Services	8.2				
<b>Group 697 Veterinary Services</b>					
Class 6970 Veterinary Services	2.5				
<b>Group 699 Other Professional, Scientific and Technical Services</b>					
Class 6991 Professional Photographic Services	0.8				
Class 6999 Other Professional, Scientific and Technical Services n.e.c.	5.8				
<b>Subdivision 70 Computer System Design and Related Services</b>					
<b>Group 700 Computer System Design and Related Services</b>					
Class 7000 Computer System Design and Related Services	31.1				
<b>Professional, Scientific and Technical Services Division</b>	<b>138.0</b>				

## Division N: Administrative and Support Services

Fig 7.31

**Administrative and Support Services**  
ANZSIC Division N

<b>Sector</b> .....	<b>Quaternary</b>
<b>Revenue in F2012 (\$billion)</b> .....	50
<b>Rank (among 19 Divisions)</b> .....	17th
<b>Value Added (\$billion) and Share of GDP</b> .....	32.3 (2.4%)
<b>Rank in 2012</b> .....	14th
<b>Rank in 2050</b> .....	14th
<b>Employment ('000) and Rank</b> .....	357 (13th)
<b>Exports (\$billion)</b> .....	N/A

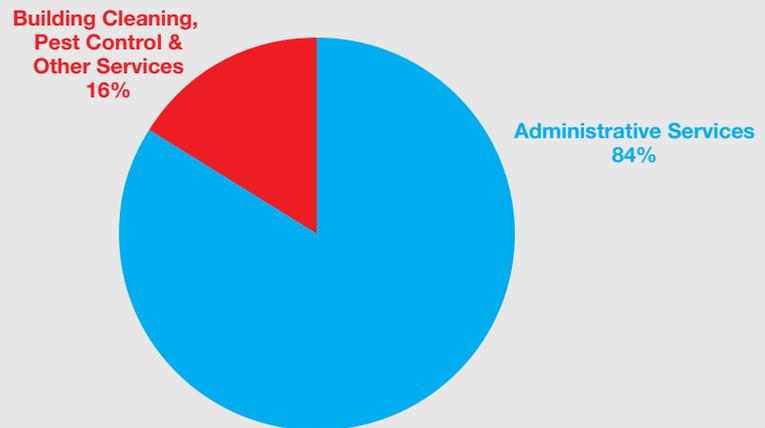
**Top Players**  
(revenue, \$billion, c.2011)

Spotless	2.8
Flight Centre	1.9
Chandler McL	1.1

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Fig 7.32

**Administrative and Support Services**  
Shares of industry revenue F2012(E)



Revenue \$50 billion

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Table 7.14  
**Division N: Administrative and Support Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division N</b>	\$billion	T	S	G	D
<b>Subdivision 72 Administrative Services</b>					
<b>Group 721 Employment Services</b>					
Class 7211 Employment Placement and Recruitment Services					
Class 7212 Labour Supply Services					
<b>Group 722 Travel Agency and Tour Arrangement Services</b>					
Class 7220 Travel Agency and Tour Arrangement Services	43.0				
<b>Group 729 Other Administrative Services</b>					
Class 7291 Office Administrative Services					
Class 7292 Document Preparation Services					
Class 7293 Credit Reporting and Debt Collection Services					
Class 7294 Call Centre Operation					
Class 7299 Other Administrative Services n.e.c.					
<b>Subdivision 73 Building Cleaning, Pest Control and Other Support Services</b>					
<b>Group 731 Building Cleaning, Pest Control and Gardening Services</b>					
Class 7311 Building and Other Industrial Cleaning Services	8.0				
Class 7312 Building Pest Control Services					
Class 7313 Gardening Services					
<b>Group 732 Packaging Services</b>					
Class 7320 Packaging Services					
<b>Administration and Support Services Division</b>	<b>51.0</b>				

## Division O: Public Administration and Safety

Fig 7.33  
Public Administration  
and Safety  
ANZSIC Division O

<b>Sector</b> .....	<b>Quaternary</b>
<b>Revenue in F2012 (\$billion)</b> .....	449
<b>Rank (among 19 Divisions)</b> .....	2nd
<b>Value Added (\$billion) and Share of GDP</b> .....	68 (4.9%)
<b>Rank in 2012</b> .....	8th
<b>Rank in 2050</b> .....	6th
<b>Employment ('000) and Rank</b> .....	737 (8th)
<b>Exports (\$billion)</b> .....	0.9

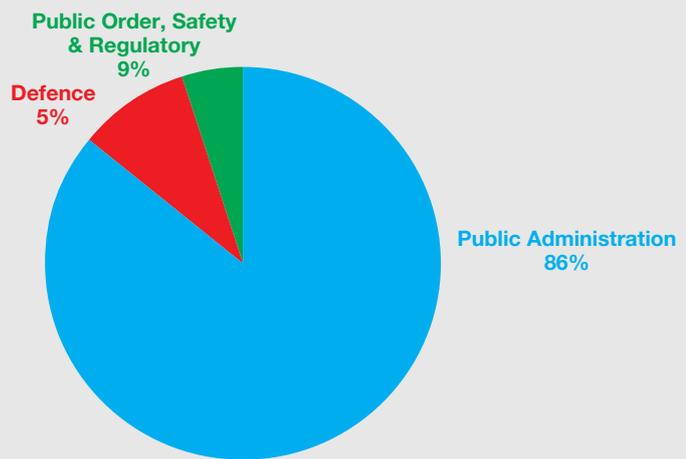
### Top Players

(revenue, \$billion, c.2011)

Fed. Govt	313	Dept. Defence	29
NSW Govt.	59	WA Govt.	24
Vic Govt.	46	SA Govt	15
Qld Govt.	41	Tas Govt	3

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Fig 7.34  
Public Administration  
and Safety  
Shares of industry  
revenue F2012(E)



Revenue \$449 billion

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Table 7.15  
**Division O: Public Administration and Safety**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division O</b>	\$billion	<b>T</b>	<b>S</b>	<b>G</b>	<b>D</b>
<b>Subdivision 75 Public Administration</b>					
<b>Group 751 Central Government Administration</b>					
Class 7510 Central Government Administration	209.0	■			
<b>Group 752 State Government Administration</b>					
Class 7520 State Government Administration	160.0	■			
<b>Group 753 Local Government Administration</b>					
Class 7530 Local Government Administration	19.0	■			
<b>Group 754 Justice</b>					
Class 7540 Justice	17.0		■		
<b>Group 755 Government Representation</b>					
Class 7551 Domestic Government Representation	<1.0		■		
Class 7552 Foreign Government Representation	<1.0		■		
<b>Subdivision 76 Defence</b>					
<b>Group 760 Defence</b>					
Class 7600 Defence	23.3			■	
<b>Subdivision 77 Public Order, Safety and Regulatory Services</b>					
<b>Group 771 Public Order and Safety Services</b>					
Class 7711 Police Services	13.0		■		
Class 7712 Investigation and Security Services					
Class 7713 Fire Protection and Other Emergency Services	1.1	■			
Class 7714 Correctional and Detention Services	3.8		■		
Class 7719 Other Public Order and Safety Services	1.5	■			
<b>Group 772 Regulatory Services</b>					
Class 7720 Regulatory Services	0.6		■		
<b>Public Administration and Safety Division</b>	<b>450.0</b>	■			

## Division P: Education and Training

Fig 7.35

**Education and Training**  
ANZSIC Division P

Sector	Quaternary
Revenue in F2012 (\$billion)	92
Rank (among 19 Divisions)	13th
Value Added (\$billion) and Share of GDP	61.1 (4.5%)
Rank in 2012	9th
Rank in 2050	7th
Employment ('000) and Rank	858 (6th)
Exports (\$billion)	0.6

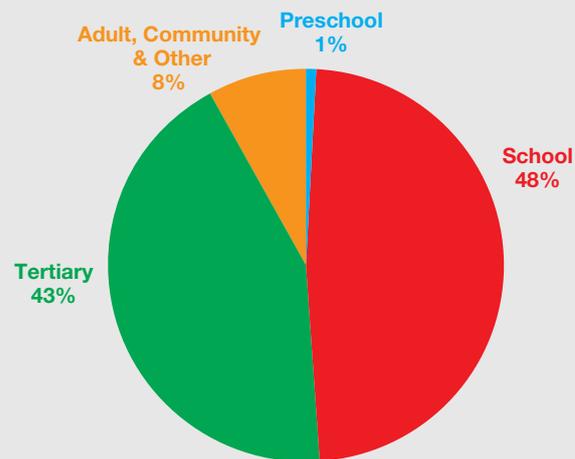
**Top 10 Players**  
(revenue, \$billion, c.2011)

Uni of Melb	1.7	ANU	1.0
Monash Uni	1.5	RMIT	0.9
Uni of Sydney	1.5	Uni of WA	0.8
Uni of Qld	1.5	Uni of Adel	0.7
Uni of NSW	1.4	QUT	0.7

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Fig 7.36

**Education and Training**  
Shares of industry  
revenue F2012(E)



Revenue \$92 billion

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Table 7.16  
**Division P: Education and Training**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division P</b>	\$billion	T	S	G	D
<b>Subdivision 80 Preschool and School Education</b>					
<b>Group 801 Preschool Education</b>					
Class 8010 Preschool Education	0.8				
<b>Group 802 School Education</b>					
Class 8021 Primary Education					
Class 8022 Secondary Education					
Class 8023 Combined Primary and Secondary Education	44.3				
Class 8024 Special School Education					
<b>Subdivision 81 Tertiary Education</b>					
<b>Group 810 Tertiary Education</b>					
Class 8101 Technical and Vocational Education and Training					
Class 8102 Higher Education	39.0				
<b>Subdivision 82 Adult, Community and Other Education</b>					
<b>Group 821 Adult, Community and Other Education</b>					
Class 8211 Sports and Physical Recreation Instruction	6.4				
Class 8212 Arts Education					
Class 8219 Adult, Community and Other Education n.e.c.	1.1				
<b>Group 822 Educational Support Services</b>					
Class 8220 Educational Support Services	0.2				
<b>Education and Training Division</b>	<b>92.0</b>				

## Division Q: Health Care and Social Assistance

Fig 7.37  
**Health Care and Social Assistance**  
 ANZSIC Division Q

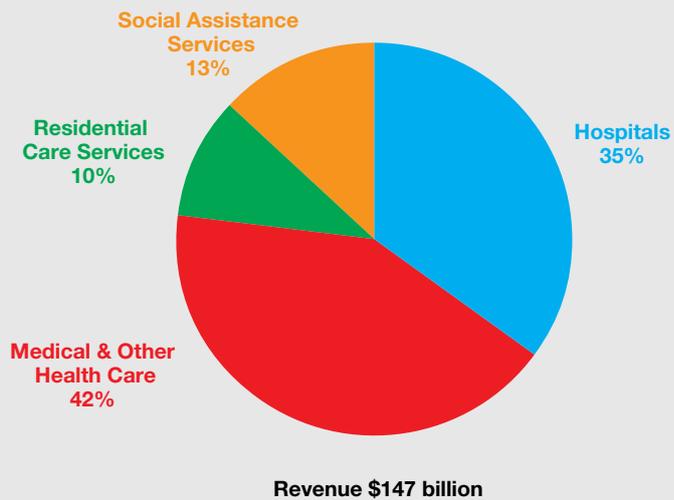
Sector	Quinary
Revenue in F2012 (\$billion)	147
Rank (among 19 Divisions)	9th
Value Added (\$billion) and Share of GDP	80 (5.6%)
Rank in 2012	6th
Rank in 2050	1st
Employment ('000) and Rank	1352 (6th)
Exports (\$billion)	0.7

**Top Players**  
 (revenue, \$billion, c.2011)

Qld Health	1.7
Ramsay Health	1.5
SA Health	1.5
Sonic	1.5

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Fig 7.38  
**Health Care and Social Assistance**  
 Shares of industry revenue F2012(E)



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Table 7.17  
**Division Q: Health Care and Social Assistance**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division Q</b>	\$billion	<b>T</b>	<b>S</b>	<b>G</b>	<b>D</b>
<b>Subdivision 84 Hospitals</b>					
<b>Group 840 Hospitals</b>					
Class 8401 Hospitals (Except Psychiatric Hospitals)	50.7				
Class 8402 Psychiatric Hospitals	0.8				
<b>Subdivision 85 Medical and Other Health Care Services</b>					
<b>Group 851 Medical Services</b>					
Class 8511 General Practice Medical Services	9.9				
Class 8512 Specialist Medical Services	10.9				
<b>Group 852 Pathology and Diagnostic Imaging Services</b>					
Class 8520 Pathology and Diagnostic Imaging Services	5.3				
<b>Group 853 Allied Health Services</b>					
Class 8531 Dental Services	5.5				
Class 8532 Optometry and Optical Dispensing	1.6				
Class 8533 Physiotherapy Services	1.4				
Class 8534 Chiropractic and Osteopathic Services	0.9				
Class 8539 Other Allied Health Services	<1.0				
<b>Group 859 Other Health Care Services</b>					
Class 8591 Ambulance Services	2.4				
Class 8599 Other Health Care Services n.e.c.	23.9				
<b>Subdivision 86 Residential Care Services</b>					
<b>Group 860 Residential Care Services</b>					
Class 8601 Aged Care Residential Services	14.2				
Class 8609 Other Residential Care Services					
<b>Subdivision 87 Social Assistance Services</b>					
<b>Group 871 Child Care Services</b>					
Class 8710 Child Care Services	7.8				
<b>Group 879 Other Social Assistance Services</b>					
Class 8790 Other Social Assistance Services	11.9				
<b>Health Care and Social Assistance Division</b>	<b>147.0</b>				

## Division R: Arts and Recreation Services

Fig 7.39  
**Arts and Recreation Services**  
 ANZSIC Division R

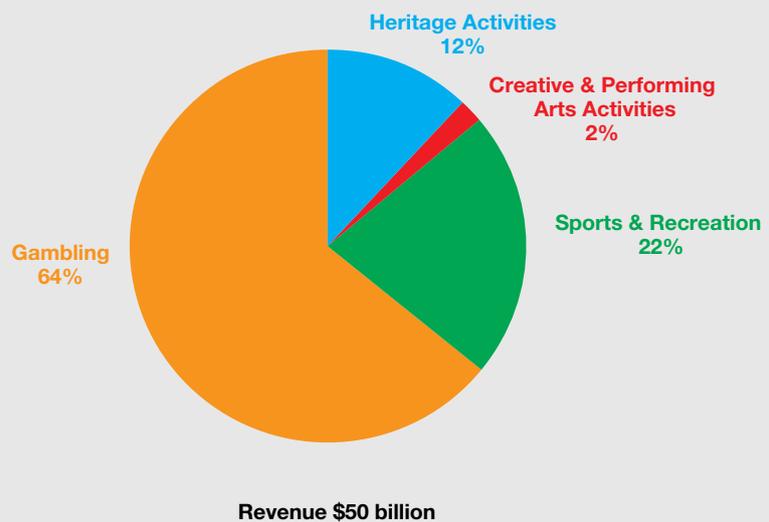
<b>Sector</b> .....	<b>Quinary</b>
<b>Revenue in F2012 (\$billion)</b> .....	49.9
<b>Rank (among 19 Divisions)</b> .....	18th
<b>Value Added (\$billion) and Share of GDP</b> .....	11.3 (0.8%)
<b>Rank in 2012</b> .....	19th
<b>Rank in 2050</b> .....	18th
<b>Employment ('000) and Rank</b> .....	210 (18th)
<b>Exports (\$billion)</b> .....	30

**Top Players**  
 (revenue, \$billion, c.2011)

Tatts Group	3.7
Tabcorp	3.0
Crown	2.4

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Fig 7.40  
**Arts and Recreation Services**  
 Shares of industry revenue F2012(E)



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Table 7.18  
**Division R: Arts and Recreation Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division R</b>	\$billion	T	S	G	D
<b>Subdivision 89 Heritage Activities</b>					
<b>Group 891 Museum Operation</b>					
Class 8910 Museum Operation	2.1	■			
<b>Group 892 Parks and Gardens Operations</b>					
Class 8921 Zoological and Botanical Gardens Operation	0.9		■		
Class 8922 Nature Reserves and Conservation Parks Operation	2.9		■		
<b>Subdivision 90 Creative and Performing Arts Activities</b>					
<b>Group 900 Creative and Performing Arts Activities</b>					
Class 9001 Performing Arts Operation	0.6		■		
Class 9002 Creative Artists, Musicians, Writers and Performers	0.2	■			
Class 9003 Performing Arts Venue Operation				■	
<b>Subdivision 91 Sports and Recreation Activities</b>					
<b>Group 911 Sports and Physical Recreation Activities</b>					
Class 9111 Health and Fitness Centres and Gymnasias Operation				■	
Class 9112 Sports and Physical Recreation Clubs and Sports Professionals				■	
Class 9113 Sports and Physical Recreation Venues, Grounds and Facilities Operation	3.0			■	
Class 9114 Sports and Physical Recreation Administrative Service				■	
<b>Group 912 Horse and Dog Racing Activities</b>					
Class 9121 Horse and Dog Racing Administration and Track Operation	5.2			■	
Class 9129 Other Horse and Dog Racing Activities	2.2			■	
<b>Group 913 Amusement and Other Recreation Activities</b>					
Class 9131 Amusement Parks and Centres Operation				■	
Class 9139 Amusement and Other Recreational Activities n.e.c.	0.8			■	
<b>Subdivision 92 Gambling Activities</b>					
<b>Group 920 Gambling Activities</b>					
Class 9201 Casino Operation	5.2			■	
Class 9202 Lottery Operation	2.2			■	
Class 9209 Other Gambling Activities	24.8			■	
<b>Arts and Recreation Services Division</b>	<b>50.0</b>		■		

## Division S: Personal and Other Services

Fig 7.41

**Personal and Other Services**  
ANZSIC Division S

Sector	Quinary
Revenue in F2012 (\$billion)	37
Rank (among 19 Divisions)	19th
Value Added (\$billion) and Share of GDP	23.9 (1.7%)
Rank in 2012	18th
Rank in 2050	19th
Employment ('000) and Rank	450 (10th)
Exports (\$billion)	30

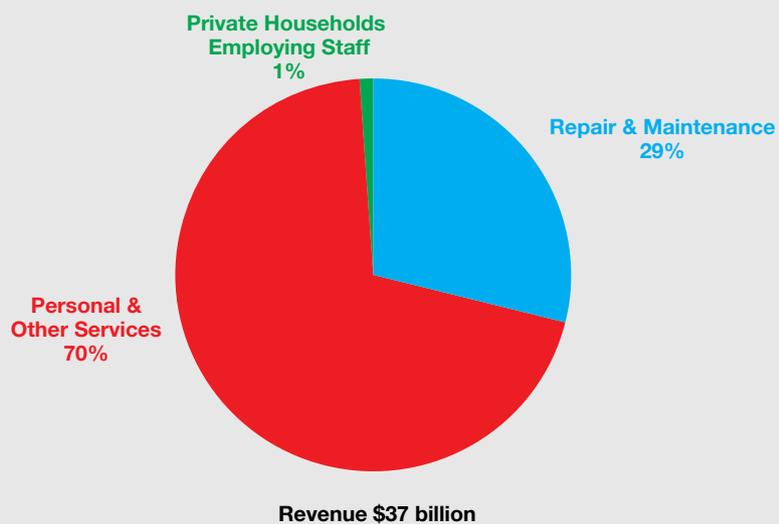
### Top 10 Players (revenue, \$billion, c.2011)

Transpacific	2.20	RACV	0.45
Salv Army	0.75	Mission Australia	0.43
RACQ	0.62	RAA (SA)	0.19
RAC (WA)	0.50	APRA	0.19
NRMA	0.47	CPA	0.14

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Fig 7.42

**Personal and Other Services**  
Shares of industry revenue F2012(E)



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Table 7.19  
**Division S: Personal and Other Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

<b>Division S</b>	\$billion	T	S	G	D
<b>Subdivision 94 Repair and Maintenance</b>					
<b>Group 941 Automotive Repair and Maintenance</b>					
Class 9411 Automotive Electrical Services	1.7				
Class 9412 Automotive Body, Paint and Interior Repair					
Class 9419 Other Automotive Repair and Maintenance	5.6				
<b>Group 942 Machinery and Equipment Repair and Maintenance</b>					
Class 9421 Domestic Appliance Repair and Maintenance					
Class 9422 Electronic (except Domestic Appliance) and Precision Equipment Repair and Maintenance	2.8				
Class 9429 Other Machinery and Equipment Repair and Maintenance					
<b>Group 949 Other Repair and Maintenance</b>					
Class 9491 Clothing and Footwear Repair					
Class 9499 Other Repair and Maintenance n.e.c.	0.4				
<b>Subdivision 95 Personal and Other Services</b>					
<b>Group 951 Personal Care Services</b>					
Class 9511 Hairdressing and Beauty Services	3.8				
Class 9512 Diet and Weight Reduction Centre Operation	0.8				
<b>Group 952 Funeral, Crematorium and Cemetery Services</b>					
Class 9520 Funeral, Crematorium and Cemetery Services	1.0				
<b>Group 953 Other Personal Services</b>					
Class 9531 Laundry and Dry-Cleaning Services	1.1				
Class 9532 Photographic Film Processing	0.5				
Class 9533 Parking Services	<1.0				
Class 9534 Brothel Keeping and Prostitution Services	1.2				
Class 9539 Other Personal Services n.e.c.	1.0				
<b>Group 954 Religious Services</b>					
Class 9540 Religious Services	2.4				
<b>Group 955 Civic, Professional and Other Interest Group Services</b>					
Class 9551 Business and Professional Association Services	4.9				
Class 9552 Labour Association Services	5.5				
Class 9559 Other Interest Group Services n.e.c.	3.8				

Table 7.19 *continued*  
**Division S: Personal and Other Services**  
 by revenue,  
 \$billion 2012(E)

- T** Transformational
- S** Significant
- G** Generalised
- D** Likely Demise

**Subdivision 96 Private Households Employing Staff and Undifferentiated Goods- and Service-Producing Activities of Households for Own Use**

**Group 960 Private Households Employing Staff and Undifferentiated Goods- and Service-Producing Activities of Households for Own Use**

Class 9601 Private Households Employing Staff		
Class 9602 Undifferentiated Goods-Producing Activities of Households for Own Use	0.3	
Class 9603 Undifferentiated Service-Producing Activities of Households for Own Use		
<b>Personal and Other Services Division</b>	<b>37.0</b>	

## 7.3 End Notes

- 1 [http://www.nbn.gov.au/files/2011/05/National\\_Digital\\_Economy\\_Strategy.pdf](http://www.nbn.gov.au/files/2011/05/National_Digital_Economy_Strategy.pdf)
- 2 [http://www.ericsson.com/networkedsociety/media/hosting/Need\\_for\\_speed.pdf](http://www.ericsson.com/networkedsociety/media/hosting/Need_for_speed.pdf)
- 3 'Augmented Reality in a Contact Lens: A new generation of contact lenses built with very small circuits and LEDs promises bionic eyesight', by Babak A. Parviz. IEEE Spectrum, September 2009; See also 'Self-assembled single-crystal silicon circuits on plastic' by Sean A. Stauth and Babak A. Parviz, Proceedings of the National Academy of Sciences of the United States of America, 2006.
- 4 Kei Nakatsuma *et al*, The University of Tokyo Department of Information Physics and Computing, Innovation News Daily, August 10, 2011.
- 5 'Epidermal Electronics', Dae-Hyeong Kim *et al*, Science, 12 August 2011.
- 6 'How to Control a Prosthesis With Your Mind', by Jose M. Carmena, IEEE Spectrum, March 2012.
- 7 The definitions of "transformational" and "significant" benefit can be found on page 39 of this report.
- 8 UN sets goal of bringing broadband to half developing world's people by 2015: <http://www.un.org/apps/news/story.asp?NewsID=40191&Cr=broadband&Cr1>
- 9 <http://tja.org.au/index.php/tja/article/view/9/30>
- 10 OECD Broadband Portal: Broadband penetration and GDP, June 2011 [http://www.oecd.org/document/54/0,3746,en\\_2649\\_34225\\_38690102\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html)
- 11 OECD Broadband Portal: Range of broadband prices for a monthly, September 2010 <http://www.oecd.org/dataoecd/22/42/39574970.xls>
- 12 OECD Broadband Portal: Average advertised broadband download speed, by country, September 2010 <http://www.oecd.org/dataoecd/10/53/39575086.xls>
- 13 Where Wireless Wireless Makes Sense: Where wireless networks can be rolled out as a substitute for fixed broadband networks <http://broadband.unimelb.edu.au/service/future/where-wireless-makes-sense.html>
- 14 'The economic benefits of intelligent technologies' report conducted by Access Economics <http://www-03.ibm.com/press/au/en/presskit/27567.wss>
- 15 [http://www.ericsson.com/networkedsociety/media/hosting/Need\\_for\\_speed.pdf](http://www.ericsson.com/networkedsociety/media/hosting/Need_for_speed.pdf)
- 16 The Connected Continent: How the Internet is Transforming Australia's Economy [https://www.deloitte.com/view/en\\_AU/au/news-research/media-releases/2182c69146c81310VgnVCM2000001b56f00aRCRD.htm](https://www.deloitte.com/view/en_AU/au/news-research/media-releases/2182c69146c81310VgnVCM2000001b56f00aRCRD.htm)
- 17 These applications have been available commercially for some time, but their use is limited as broadband speeds need to be fast enough to support them.
- 18 Cisco Visual Networking Index: Forecast and Methodology, 2010-2015 [http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white\\_paper\\_c11-481360\\_ns827\\_Networking\\_Solutions\\_White\\_Paper.html](http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html)
- 19 Prediction made by CEET, The Centre for Energy Efficient Telecommunications (CEET) is a partnership between the University of Melbourne, Alcatel-Lucent and the Victorian State Government.
- 20 These projects are being developed at the Institute for a Broadband-Enabled Society. Details are available at <http://www.broadband.unimelb.edu.au/main.php?id=140>
- 21 Telstra demonstrated a holographic 'tele-portation' in 2008 [http://www.youtube.com/watch?v=0efppCGqyHoandfeature=player\\_embedded#](http://www.youtube.com/watch?v=0efppCGqyHoandfeature=player_embedded#)
- 22 Indian inventor, Pranav Mistry has demonstrated several tools that help the physical world interact with the world of data, including using human skin as an interface. [http://www.ted.com/talks/pranav\\_mistry\\_the\\_thrilling\\_potential\\_of\\_sixthsense\\_technology.html](http://www.ted.com/talks/pranav_mistry_the_thrilling_potential_of_sixthsense_technology.html)

- 23 Terminator eyes: why we may soon be able to see like cyborgs:  
<http://www.theage.com.au/technology/sci-tech/terminator-eyes-why-we-may-soon-be-able-to-see-like-cyborgs-20111123-1ntlc.html#ixzz1f9zKJOS7>
- 24 <http://spectrum.ieee.org/biomedical/bionics/augmented-reality-in-a-contact-lens/0>  
See also Stauth and Parviz, 2006 <http://www.pnas.org/content/103/38/13922.full>
- 25 See Nakatsuma *et al*, 2011 <http://dl.acm.org/citation.cfm?id=2048278>
- 26 See Kim *et al*, 2011 <http://www.sciencemag.org/content/333/6044/838/suppl/DC1>  
Found on News Medical <http://www.news-medical.net/news/20110812/Researchers-develop-epidermal-electronic-system.aspx>
- 27 See Carmena *et al*, 2003 <http://www.ncbi.nlm.nih.gov/pubmed/14624244>  
and Chapin *et al*, 1999 <http://www.ncbi.nlm.nih.gov/pubmed/10404201>  
Found on IEEE <http://spectrum.ieee.org/biomedical/bionics/how-to-control-a-prosthesis-with-your-mind>
- 28 Found on MIT's blog Technology Review <http://www.technologyreview.com/blog/editors/24993/?a=f>

## 7.4 Glossary

**e-Health** Combined use of information technology and electronic communication in the health sector, giving healthcare teams and patients access to their medical records when they need them

**(E)** estimate

**(F)** forecast

**GDP** Gross domestic product

**haptic devices** Capability to simulate the sense of touch, based on a virtual 3D environment

**HFC** Hybrid fibre coaxial cable

**ICT** Information and Communications Technology

**IP** Intellectual property

**Mbps** Megabit per second

**megalopolises** A very large city, or region made up of large cities

**new utility** - ICT enhanced with ubiquitous high-speed broadband, plus analytics, learning systems, cognitive computing and more

**OECD** Organisation for Economic Co-operation and Development

**SOL** Standard of living

**SMEs** Small and medium enterprises/businesses

**TB** Terabytes

**telework** A flexible work arrangement where the daily commute to a central place of work is replaced by telecommunication links, and most work from home

