



Australian Government

Department of Broadband,
Communications and the Digital Economy

BENEFITS OF HIGH-SPEED BROADBAND FOR AUSTRALIAN HOUSEHOLDS



Deloitte Access Economics

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Executive Summary

High-speed broadband is transforming our economy and society, with major implications for households, business, governments and the environment.

The report looks over the horizon to 2020 when Australia's economy will be a fully digital economy, powered by the National Broadband Network (NBN). Recent developments like smartphones, apps and social media will be more deeply embedded, while video content, the cloud and machine-to-machine technologies will be widespread.

Households will benefit from improved communications, greater choice and competition from e-commerce, more online services, greater employment opportunities, including through telework, and savings in time and money from reduced travel. They will also experience improvements in goods and services quality and/or lower prices as businesses take up new productivity-boosting applications of the digital economy. There will also be environmental benefits from reduced travel and other applications.

Our estimate is average annual household benefits will be worth around \$3,800 in 2020, in current dollars. Around two-thirds of these benefits (\$2,400) are financial benefits, the rest are the equivalent monetary value of consumer benefits such as travel time savings and convenience of e-commerce.

Figure i: Benefits of broadband for households — a national framework

Benefit	Amount
COMMUNICATIONS > SOCIAL ENGAGEMENT & SOCIAL MEDIA	\$74
E-COMMERCE > TRAVEL SAVINGS, CHOICE	\$565
ONLINE SERVICES > ENTERTAINMENT	\$269
TRAVEL SAVINGS > E-HEALTH, E-EDUCATION, E-GOVT	\$217
EMPLOYMENT > TELEWORK, TRAVEL	\$634
PRODUCTIVITY > LOWER PRICES, BETTER QUALITY	\$1,930
TOTAL	~\$3,800

While this report is not a cost benefit analysis of high-speed broadband, we note that there are a range of costs of participation in the digital economy including on businesses and occupations that are affected by technology change. Equally, there are a range of social and environmental benefits and costs, which, while important, cannot all be fully quantified.

The second half of this report does a 'deep dive' analysis of 10 household scenarios, showing that there are many potential benefits of broadband. We quantify the financial and time saving, both on an annual basis for 2020, and where there are important impacts on others such as family members, employers and governments. We also analyse scenarios according to geographic location.

Deloitte Access Economics analysed the scenarios developed by the Department to highlight the financial and other impacts of high-speed broadband and how the impacts are different across cities and regional areas.

Figure ii: Summary of scenarios considered in this report

Fred — single person over 75. Benefits from improved health outcomes (medication compliance, reduced falls risk) and not having to travel to access government services.

Emma — student under 25. With broadband she does not have to move out of home for university, and can do her classes online.

Joshua — single professional, over 25. Makes use of video conferencing to avoid domestic and international travel, allowing him to study a Master's degree.

Lilly and Diane — double income, no kids. Telework for Lilly and productivity benefits for Diane's plumbing business bring significant financial benefits.

Lee Lin and Matthew — one income, two kids. Lee Lin's dress shop gains productivity benefits from being online, their son benefits from improved education, and Matthew and their daughter have reduced trips to medical appointments.

Jason — unemployed, under 21. With broadband, Jason is able to improve his education and obtain a teleworking job.

Marge and John — empty nesters, over 65. Smart meters help them save on electricity and develop their small garden business.

Tom and Dorothy — carer/disability household. Tom is able to resume part-time work via teleworking, Dorothy benefits from improved rehabilitation and entertainment while at home.

Carmela — single mother of baby. Social and communications benefits are available from an online mothers' group, and she is able to complete her HSC online, providing the opportunity for higher lifetime earnings.

Kimberley — single person household. Kimberley benefits from improved communications and entertainment available online. She is also able to attend stretching classes via video conferencing.

We find some evidence that the scenarios with greater impacts are where households face difficult circumstances, such as needing to find employment, move residence or where additional education is of significant benefit. This could suggest that broadband has the potential to play a role in improving opportunities for those in society facing disadvantage.

Impacts vary between household scenarios. For example, for some there are significant financial benefits, but only modest time saving benefits. In other situations, households may be spending money, but this is more than compensated by other benefits.

There are variations in benefits according to whether people live in the city or a regional area, mostly relating to travel. That said, broadband, particularly in regional areas, will open up opportunities to allow regional residents to better participate in the digital economy.

Table i: Scenarios — summary of benefits in 2020

	Scenario	Financial saving (\$)	Other impacts (\$)	Time saved (hrs/year)
1	Fred	7,402	14,586	58
2	Emma	5,074	651	268
3	Joshua	- 559	13,113	-377
4	Lilly and Diane	9,673	n/a	146
5	Lee Lin and Matthew	7,458	3,367	204
6	Jason	13,074	- 370	6
7	Marge and John	2,237	n/a	-33
8	Tom and Dorothy	23,154	6,392	275
9	Carmela	484	6,532	14
10	Kimberley	-1,844	5,367	35

The range of broadband impacts is extensive. This analysis only considers existing applications of broadband, and finds substantial benefits to many different households. Further developments in technology and applications are certain, and are likely to mean that realised benefits in 2020 will be greater still.

CHAPTER 01

INTRODUCTION

AUSTRALIA IS EXPERIENCING RAPID CHANGES FROM NEW DIGITAL TECHNOLOGIES. FACILITATED BY SUPER FAST BROADBAND INCLUDING THE NATIONAL BROADBAND NETWORK, THE EMERGING DIGITAL ECONOMY IS CHANGING MANY ASPECTS OF COMMUNICATION, WORK AND LIFESTYLES.

The NBN is a communications network that will bring high-speed broadband services to all Australian premises. Three technologies, namely fibre, fixed wireless and satellite will connect all households and businesses within the next decade.

Significant impacts on businesses from high-speed broadband include productivity enhancements, new business models and changes in where and how people work. There are also profound impacts on our society, such as changes to family relationships, and interaction in communities.

There have been many studies about aspects of the broadband revolution and the benefits provided to the whole economy or particular sectors such as health and education. Where this study is different is how it focuses on the impacts of broadband at the household level. The Department of Broadband, Communications and the Digital Economy commissioned Deloitte Access Economics to analyse the effect on households of the changes in lifestyle that are expected with greater availability and use of high-speed broadband.

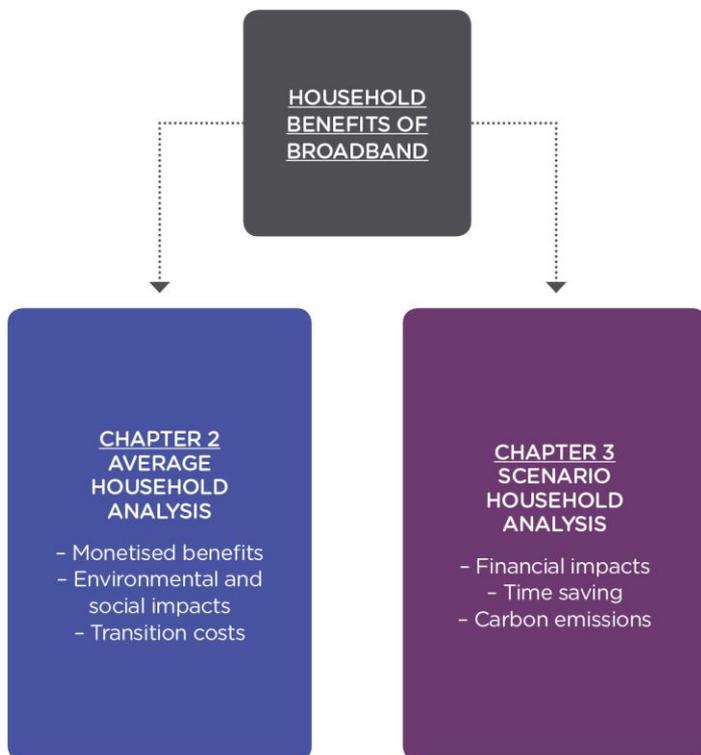
1.1 Outline of this report

This report approaches the task of analysing the household impacts of high-speed broadband in two ways. First it looks at potential benefits for the average household, based on national statistics and trends. Then it analyses 10 specific household scenarios that are affected by high-speed broadband.

The structure of the report is as follows:

- **Chapter 2** undertakes the quantified, monetised assessment of the potential benefits from broadband for an **average household**. This includes benefits from household uses like communications, e-commerce and online shopping, and the household benefits that flow from business use of IT, such as from telework and improved productivity. This effort converts benefits such as consumer welfare and time travel savings into monetary values so that benefits can be added and compared.
- **Chapter 3** analyses **10 scenarios** where a household's circumstances are dramatically changed by broadband. The scenarios are a static comparison of two worlds (for simplicity, the people in the scenarios do not age). We quantify the financial, time saving and carbon emission impacts, both on an annual basis for the year in question, i.e. a snapshot of life at a point in time for those in the scenario, and where there are important impacts on others such as family members, employers and governments. These scenarios are not expected to be representative of the whole country but illustrate the gains in scenario form. We do not include every benefit for every household. We also analyse scenarios accordingly to geographic location.
- **Chapter 4** provides some overall comments and conclusions following from our analysis.

Figure 1.1: Our approach



We recognise that estimating the benefits of broadband in 2020 is an exercise with an unusual level of uncertainty. Our analysis focuses on some of the benefits. It does not include analysis of the capital or operational costs of broadband networks. Chapter 2 does discuss some important territory in analysing broadband, including the transitional costs associated with changing business models, and the wider social and environmental impacts of broadband. Even so, this report is not a cost benefit analysis of broadband.

1.2 High-speed broadband in 2020

The analysis in this report is based on the step change in experience from high-speed broadband. There are inherent difficulties in defining a 'before' and 'after' for this analysis. Broadband has several definitions as does high-speed broadband. In 2013, some households and businesses already have fast broadband and are already experiencing benefits. By 2020, there will be a range of technology developments.

This report defines the 'before' as before the full emergence of the digital economy. Narrowly, this might be thought of as the current broadband speed — according to the *State of the Internet Report* (Akamai, 2012), Australia's average broadband connection speed was 4.2 mbps. But it was also before the adoption of many broadband applications.

In 2020, most people are expected to have access to high-speed broadband, primarily through the National Broadband Network. There will be a range of speeds including 25 mbps download speeds (and 5 mbps upload speeds), and higher, including 100 mbps or 1 gbps download speeds. But as important as the technology change itself, there will be increased exploitation of the technology. This report focuses on applications and services whose benefits are largely foreseeable now — i.e. it is not foresighting major new technology developments. It extrapolates existing trends, based on assumptions about the pace of take-up and changes in our economy and society.

CHAPTER 02

BENEFITS OF HIGH-SPEED BROADBAND

THIS CHAPTER DISCUSSES THE IMPACTS OF HIGH-SPEED BROADBAND ON AUSTRALIA'S ECONOMY AND SOCIETY, WITH A PARTICULAR FOCUS ON HOUSEHOLDS.

We analyse six areas of potential benefit, including communications, e-commerce, online services, employment, quality/price changes and travel savings.

We also discuss some other dimensions of high-speed broadband impacts: the take-up of broadband services, the transition costs of the digital economy, technology issues, and broader social and environmental impacts.

Our overall estimate is average annual household benefits worth \$3,800 in 2020, in current dollars. Around two-thirds of these benefits (\$2,400) are financial benefits, the rest are monetised consumer benefits such as travel time savings and convenience of e-commerce.

This analysis is based on gross domestic product (GDP) and the number of households in Australia in 2013. It does not look at forecast GDP or population estimates in 2020, as these would be influenced by a number of factors other than high-speed broadband.

2.1 A national framework

There are many potential benefits of high-speed broadband for households. There is no neat way to list the overlapping impacts of broadband on people's time, convenience, finances and way of life. Figure 2.1 is one way of categorising the benefits into six areas.

Figure 2.1: Benefits of broadband for households — a national framework

Benefit
COMMUNICATIONS > SOCIAL ENGAGEMENT & SOCIAL MEDIA
E-COMMERCE > TRAVEL SAVINGS, CHOICE
ONLINE SERVICES > ENTERTAINMENT
TRAVEL SAVINGS > E-HEALTH, E-EDUCATION, E-GOVT
EMPLOYMENT > TELEWORK, TRAVEL
PRODUCTIVITY > LOWER PRICES, BETTER QUALITY
TOTAL

2.1.1 Communication

A significant benefit from the National Broadband Network (NBN) will be improved communication opportunities. This will include improved internet telephone calls (VOIP), enhanced communication through social media and video calls.

It is difficult to estimate the value of this improvement in communication to consumers. We approach it by estimating the increase in consumer welfare based on willingness to pay. The steps are:

- Calculate the increase in expenditure. This is based on average broadband spending of \$53 per month today and \$69 per month in 2020, a figure based on forecasts for demand of different products (in NBN Co's corporate plan) and current prices for these different products.
- Calculate the increase in consumer surplus. We use an estimate of the consumer surplus associated with telecommunications spending from a Canadian report. This estimates consumer welfare at 1.53 times spending (Ovum, 2012).
- We attribute a share of all consumer welfare from broadband to communication, based on activity levels. Previous economic research has tried to measure the value of some services based on the time used in consuming them (Goolsbee and Klenow, 2006). Communication makes up over 40 per cent of online activity (Roy Morgan, 2012), with the rest being used for other activities such as searching, reading news, online shopping and internet banking. However, the value of communications as part of a broadband plan could be lower than this because some functions may be worth more than the time devoted to them. For example, internet banking might make up a only a fraction of the time spent on broadband in a month, but may be worth more than this because of the time saved in not having to go to the bank and the convenience of 24-hour banking. To be conservative, we use a lower figure of 25 per cent of broadband value being attributable to communications benefits.

- This approach suggests that the annual household benefit from improved communication is around \$74 per year.

2.1.2 E-commerce

Increased e-commerce will provide a range of potential benefits including avoided travel, and increased choice. It also enhances competition and produces benefits for consumers in terms of lower prices and/or improvements in quality — these are covered in a later section.

Calculating travel savings has several steps:

- Calculating time spent travelling. We use an estimate of 19 minutes per day from the ABS Time Use Survey. This is a daily average; it is likely shopping trips are less frequent than daily and, hence travel time for trips are longer than 19 minutes each.
- Estimating how much travel will be avoided. We calculate this based on a recent forecast of the online retail spending growth by 2016, projected out to 2020 (PwC and Frost & Sullivan, 2012). This is an additional 7.8 percentage points of retail spending being online by 2020. We use this as an estimate of the proportion of travel that will be avoided. We note that there is uncertainty here. It is possible that households will continue to travel to the shops just as much for leisure or other services in the future.
- We put a money value on people's time. We use a national average figure of \$9 per hour, based on the average weekly earnings after tax wage, minus expenses, divided by working hours plus travel hours, and discounted because the alternative use of shopping travel time is probably leisure activity. We also add an out-of-pocket cost for shopping travel of around \$7, based on some trips being public transport and some using a car, with costs for petrol, parking, depreciation, etc.

With this approach, the average annual household benefit of travel savings from e-commerce is \$156.

Another benefit of e-commerce is the increased choice and variety of goods. As explained in other reports (Deloitte Access Economics, 2011), it has been shown that an increase in variety increases consumer welfare like reductions in prices do. We present here one estimate of the benefit of choice. However, we note that it is likely that the increase in choice will be greater in regional areas compared with metropolitan areas. The steps are:

- Calculate household spending on items that could be bought online in the future. We calculate \$418 per household per week, which includes items such as food, drink, clothes and electronics. This comes from the ABS Household Expenditure Survey (2011).
- Calculate the annual spending that might shift online in 2020. We use the estimate of a further 6 percentage points.
- Divide the online spend by one minus the elasticity of substitution. Elasticity of substitution can range from 2 to 9 for many household items. Items with lower levels are less substitutable (like perfume), while items with a high number are more standard (like toilet paper). We use 4, because there will be a mix of goods.

Using this approach, the average annual household benefit of increased choice will be \$453 a year. This is not a financial benefit, but the benefit is equivalent to this amount.

In total, the benefits are \$565 per household.

2.1.3 Online services

There are benefits to households from being able to access online services. Most simply, this can be thought of as access to online movies and games, but it could include many more services in the future. We use the following steps to estimate the potential benefits to households:

- We take household spending on entertainment like DVDs and computers games from the household expenditure survey, \$22 per week, and calculate its growth over time (29 per cent over six years in real terms) (ABS Household Expenditure Survey, 2011).
- Based on the same growth rate, we project out the increase in entertainment spending to 2020, over seven years, on an annual basis, to \$1,522.
- We calculate the consumer surplus associated with this increase in spending, and then divide it by 3 (1 minus an elasticity of substitution of 4) to reflect the next best alternative of that spending.
- Using this approach, the average annual household benefit from online services is \$269 a year.

2.1.4 E-health, E-education, E-government services

There will also be travel savings from online services including e-education, e-health, and e-government services. Our steps involve:

- Estimating the number of trips avoided. This is based on the government's e-health target of 495,000 telehealth consultations delivered by 2015, averaging 99,000 per year for 5 years; we assume this continues.
- Estimating the proportion of tertiary students saying they find online education a substitute for in-person education (it is one-third, according to a University of Melbourne survey in 2010, we use half of this to be conservative).
- Estimating the number of trips saved to government service based on the National Digital Economy Strategy target for avoided in-person visits to government agencies.

- We use estimates of the time travel avoided, the value of time as explained above, and estimates of out-of-pocket costs of travel, assuming a mix of public transport and car transport.
- Using this approach, the average annual household benefit from avoiding travel is \$217 a year.

2.1.5 Telework

- A significant benefit of broadband in the world of work is telework. Telework means reduced travel for workers. It also has the potential to increase labour force participation and create jobs among those who might not be working.

Our estimate of the benefits of the travel avoided is based on the following steps:

- We assume telework increases by an additional 6 per cent by 2020 to the Government's target level of 12 per cent.
- We assume telework will be half the time — i.e. saving 5 return journeys a fortnight for a full time employee and an equivalent amount for a part time employee. A 2012 survey of people with a telework arrangement found that the average amount of telework was just under 50 per cent of days. So, in effect, we are assuming that the amount of telecommuting people with such an arrangement are doing each week stays the same between now and 2020. The results of that survey are in Deloitte Access Economics (2012).
- We use the travel time to work estimate of 55 minutes from the ABS time use survey (2006), the value of time estimate described above, and out-of-pocket expenses. Out-of-pocket expenses were averaged across the expenditure for driving and parking, and the expenditure on public transport. Driving expenses are estimated as 58c per kilometre, which includes depreciation, fuel, tyres, repairs and service costs (RACQ, 2012). Added to this was the average expenditure on parking per employed person (ABS, 2011). For public transport costs, these were estimated on a per trip basis, based on the proportion of the population that is employed (ABS, 2011).

Using this approach, the average annual household benefit from avoiding travel through telework is \$253 a year.

Another benefit of the NBN for households is changes to employment. Telework has the potential to increase labour supply and create more jobs. We have previously calculated that the possible economy-wide benefits from this change are in the order of an additional 25,000 full time equivalent jobs, worth an extra \$3.2 billion to the Australian economy in 2020 (Deloitte Access Economics, 2012a).

Spread across the nation's households, this is worth \$381 per year.

Together, telework employment and travel benefits are worth \$634 per household.

2.1.6 Productivity: lower prices and better quality

A major benefit of broadband for household consumers will come from business use of broadband to increase productivity. There are many applications that increase productivity such as:

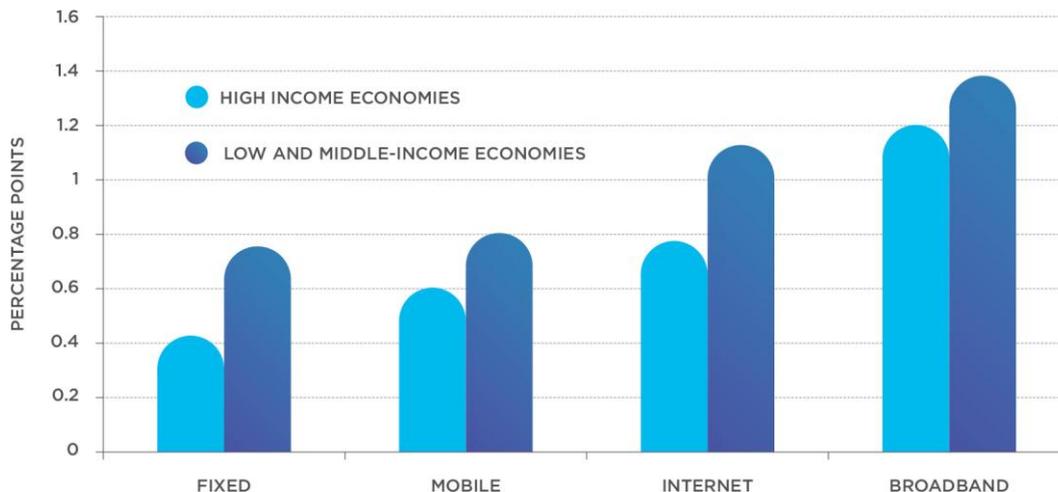
- improved communication tools
- better data management and software applications
- online, lower cost marketing
- online human resource recruitment and management
- applications that reduce administration costs
- online shops that reduce the need for bricks and mortar and reduce occupancy costs
- cloud technologies that can reduce IT spending; and
- machine to machine technologies that can improve capital productivity.

In a broad study of the growth effects of ICT for the World Bank, Qiang (2009) found that each more 'advanced' stage of ICT innovation had a larger impact than those which preceded it. The most recent technology analysed in this study was broadband, with the corresponding growth effects found to be larger than those of other ICT technologies. This study found that a 10 percentage point increase in broadband penetration in high-income economies such as Australia resulted in an increase in economic growth of 1.2 percentage points. The report also notes that these benefits become even larger once a critical mass penetration rate is reached.

The Qiang (2009) study cites a wide range of productivity benefits of broadband as a technology, before undertaking a cross-country growth analysis of the economic impacts of broadband. This study uses the average per capita GDP growth rate over 1980-2006 as a dependent variable and runs a regression analysis with a series of variables which enabled the study to analyse a range of telecommunications services for developed and developing countries.

The Qiang analysis found that the economic impact of each ICT innovation was larger than all those previously (Figure 2.2), and that differences in broadband penetration among countries may generate long-run gains to overall economic growth for those that are early adopters.

Figure 2.2: GDP impact of ICT development



Source: Qiang 2009

The finding that the impact of each new ICT development has a larger productivity impact than its forerunner implies that the NBN may be expected to have a higher productivity impact than traditional broadband in Australia. This may be driven by improved willingness to adopt and/or an improved understanding of how ICTs can improve productivity.

The productivity applications of broadband will be implemented by business and in the first instance enjoyed by business through lower costs, higher revenue and higher profitability. Depending on labour market conditions, some of these benefits will flow to workers, in the form of higher wages.

Some of these impacts will be on the health system. For example, Hendy et al (2012) does an organisational analysis of the implementation of telehealth.

However, in the end, all of the benefits of productivity eventually flow to households. Competitive markets mean that businesses will have to take up new technologies to stay in business and will then compete away most of these benefits as lower prices or improvements in quality of services of their offerings. This means households are likely to receive most of the benefits. Previous research has found that online goods and services provide consumers with between 9 and 16 per cent lower prices (Brynjolfsson and Smith, 2000).

Even if not all benefits are passed on directly to consumers, changes for employees or business owners are also in the household sector.

The steps to calculate productivity benefits are:

- Taking an estimate of the boost to productivity from the NBN. We use the 1.1 per cent from Access Economics 2009.
- Across the \$1.4 trillion economy (ABS, 2013a), the productivity increase will be in the order of \$16 billion by 2020.

Based on this approach, this suggests that households will receive benefits from broadband in the order of \$2,000 a year. This is made up of price reductions, improvements in quality, changes in wages, and higher profits from businesses they own.

As there are difficulties in measuring the non-market sector, including health and education, some productivity benefits arising from improved quality or reduced price of services may not be captured in this measure.

2.1.7 Conclusion

Added together, these estimates suggest very significant household benefits from broadband. These are not net benefits and do not take into account the costs of broadband or related equipment. Equally, they do not include many other potential benefits from applications and services that have not been thought of yet.

Our overall estimate is average annual household benefits worth \$3,800 in 2020, in current dollars.

This estimate is separate from the scenario estimates provided in the following chapter, which address specific case studies that highlight a range of benefits. The figures in this chapter cannot be added to the figures in the next chapter.

We observe that many benefits of broadband will not be discrete or highly visible to households like a new school in their area. Many of the benefits will emerge gradually, as consumers find price discounts and variety online, as more employees are allowed to telework, and as people get more accustomed to accessing services online. There will be a lot of change from the broadband revolution and there will be a gradual transition this decade, as outlined in the next section.

Figure 2.3: Benefits of broadband for households: quantified

Benefit	Amount
COMMUNICATIONS > SOCIAL ENGAGEMENT & SOCIAL MEDIA	\$74
E-COMMERCE > TRAVEL SAVINGS, CHOICE	\$565
ONLINE SERVICES > ENTERTAINMENT	\$269
TRAVEL SAVINGS > E-HEALTH, E-EDUCATION, E-GOVT	\$217
EMPLOYMENT > TELEWORK, TRAVEL	\$634
PRODUCTIVITY > LOWER PRICES, BETTER QUALITY	\$1,930
TOTAL	~\$3,800

2.2 Transition to the 2020 digital economy

The digital economy of 2020 will look very different from today. We discuss this by looking at households, businesses and government.

Households will undergo significant change in the transition to the digital economy of the future:

- households will have to purchase appropriate equipment
- there will be technical skills and familiarity with the new devices needed
- habits about work, travel, shopping and communications will change.

The most important force driving change among households will be the user benefits individuals will seek out. What are now new technological devices — like tablets and smart TVs — will become the norm. There has been a general downward trend in technology prices in recent decades.¹ Devices are becoming easier to use. The growth of social media in recent years, and the growth of text messaging during the first wave of mobile phone take-up, showed that major changes in communication are possible. E-commerce, while low in Australia compared with world leaders, is growing (OECD, 2012). Finally, research suggests that there is latent demand from employees for more flexible working arrangements, including teleworking (Deloitte Access Economics, 2012a).

Business will also undergo change to take-up the opportunities of the NBN and digital economy:

- IT changes require investment, planning and retraining of staff
- new business models will be required to take advantage of the digital economy (Deloitte Access Economics, 2012b)
- organisations can be inflexible to change.

Against this, there will be powerful catalysts for change. The most powerful ones will be financial. In changing markets with greater competition, businesses will be required to use new digital technologies including those facilitated by the NBN to reduce their costs and or reach out to new customers. Previous research suggests that trying to meet customer expectations will be the most important driver of change (Deloitte Access Economics, 2012c). There is also some evidence that businesses are becoming more open minded to changing workforce strategies in response to the NBN (Deloitte Access Economics, 2013a).

Governments will also change so that people can realise the benefits from the NBN future:

- departments and agencies will need to continue developing digital tools such as web portals and mobile apps
- like businesses, there will be organisational resistance to change
- regulations will need to change to reflect online service delivery.

There will be many drivers of change within government. Although market forces operate less strongly in government-dominated industries, there will still be pressures from the community to reduce costs and improve customer experiences. Explicit government policies, such as the National Digital Economy Strategy, drive change, as do the activities of agencies such as NBN Co, NICTA and CSIRO.

Overall, we believe there is sufficient evidence of change at the household, business and government levels to provide confidence that shifting to the digital economy sketched out in this paper is realistic.

¹ See, for example, the mobile phone price analysis in Access Economics (2010) report for AMTA

2.3 Technology differences

The scenarios and analysis in this report are based on a change from now to 2020. According to the *State of the Internet Report* (Akamai, 2012), Australia’s average broadband connection speed was 4.2 mbps. In 2020, most households are likely to be connected to the NBN. As outlined in the NBN Co Corporate Plan, there will be a minority of households not connected. In addition, we recognise that while 93 per cent of households will have access to fibre to the premises (FTTP) connections, 4 per cent will have fixed wireless connections and 3 per cent will have satellite connections. There will be a range of speeds including 25 mbps download speeds (and 5 mbps upload speeds), and higher, including 100 mbps or 1 gbps download speeds.

The NBN will greatly enhance capabilities for services like telework, e-health and e-education. Equally, we know that not all activities in the scenarios depend on the fastest broadband.

Our understanding is that the scenarios outlined in this report are compatible with each of the technologies that will be used by NBN Co. The satellite technology proposed by the NBN will be able to support video conferencing and online games. It is likely that there will be some latency with the use of satellite but we understand that as the best available technology in an area, it will be used as extensively as possible by households in those regions to get the full benefits. We include some brief commentary about the differences between the technologies.

FEATURES OF BROADBAND

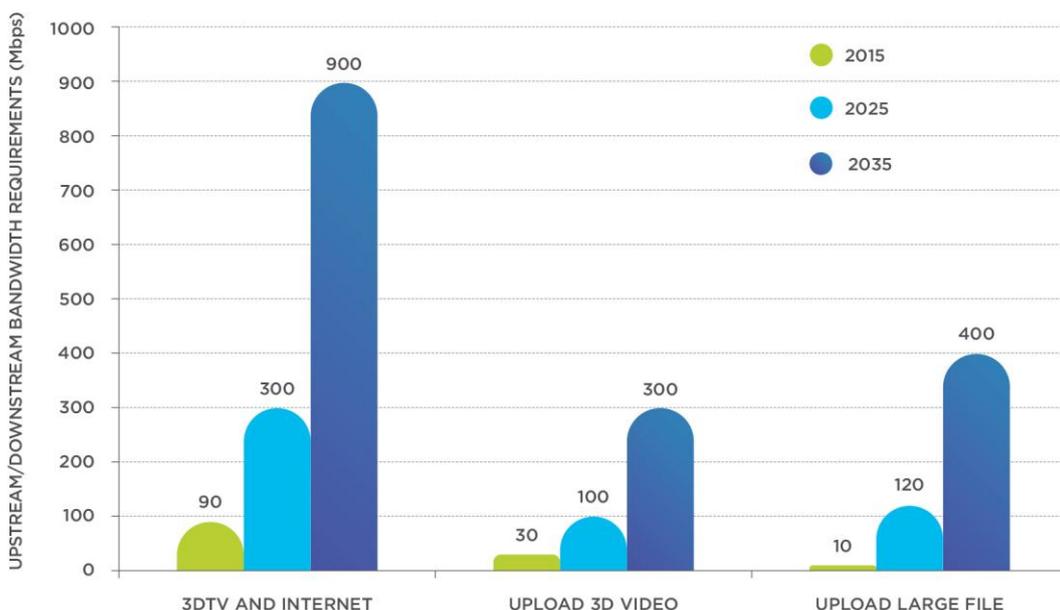
SPEED
VOLUME
LATENCY
SYMMETRY

There are four key features of broadband that affect the user experience. These are:

- download speed or throughput (measured in megabits per second)
- upload speed (symmetry)
- volume, measured by megabytes
- latency, which is the delay time to transmit data.

Some broadband applications and services require higher download and upload speeds. FTTP connections will offer faster speeds (100/40 mbps) compared with fixed wireless and satellite (25/5 mbps) and be better able to provide these services. For example, NBN Co’s Corporate Plan 2012-2015 outlines the growth in upstream and downstream bandwidth requirements for residential customers from 2015 to 2035. This applies to improvements to services including 3D TV, internet, uploading 3D video and large files.

Figure 2.4: Demand requirements for bandwidth 2015 to 2035



Source: NBN Co Corporate Plan 2012–15.

NB: 2015-2035 improvements are: 2-3DTV channel and 30 Mbps Internet, 2-HD 3DTV channel and 100 Mbps Internet, 2-ultra-HD 3DTV channel and 300 Mbps Internet. Upload 3D video, upload HD 3D video, upload ultra-HD 3D video. Upload large file (50Mb in 2 min, 300MB in 20 sec, 1GB in 20 sec)

It is also noted that the true benefit of increased speed will be realised with multiple connections to the internet in one household, for example a number of devices in several rooms streaming super high-definition video from the internet (Rod Tucker, cited in *Sydney Morning Herald*, 2013).

Volume will also be important in providing services, and there are differences between technologies. Satellite plans may offer 60GB per month download limits, compared with higher limits for fixed wireless and FTTP plans (up to 1,000GB per month).²

Fixed wireless has lower broadband latency than satellite. Whereas fixed wireless and other technologies have 'ping times' less than 50 or 100 milliseconds, satellite ping time can be 700ms or more — each packet of data must travel tens of thousands of kilometres. High latency can be an issue with some broadband applications, e.g. telesurgery, but there are many applications where it will not be as much of an issue (CSIRO, 2012).

A final benefit of the NBN is ubiquity — almost every household will have it. This means there are more people to benefit. There are also network benefits when both sides of a communication exchange need to have high-speed broadband.

2.4 Costs of participation in the digital economy

In overall terms, digital technologies have positive benefits for our economy. As the critical infrastructure to support the digital economy, the same is true for broadband.

However, it is important to recognise that while net benefits may be significant that does not mean that the changes from broadband come without economic costs. Here we briefly discuss some of these impacts as have been identified in the research. Our focus is not on the costs of technology or infrastructure itself, or impacts related to construction (such as amenity impact from overhead wires).

One significant cost of digital technology, like all major technology adjustments, is the transitional costs it imposes on businesses and employees.

A 2012 report from Deloitte, *Digital Disruption: Short Fuse, Big Bang?* found that two-thirds of Australian industries face a 'big bang' scenario of significant changes to their revenue sources over the next five years. That report said that while many businesses stand to gain, there will invariably be losers. In fact, recent years have witnessed a range of businesses face financial pressures directly related to online trends.

According to a 2012 IBISWorld report, *A Snapshot of Australia's Digital Future to 2050*, 15 of 509 industry classes analysed face a 'Likely demise' scenario, as listed below. Further, there will be impacts along the retail and wholesale supply chain that will put pressure on businesses.

- reproduction of recorded media
- book and magazine wholesaling
- entertainment media retailing
- newspaper publishing
- magazine and other periodical publishing
- software publishing (disc)
- motion picture exhibition
- radio broadcasting
- book publishing
- directory and mailing list publishing
- other publishing (except software, music and internet)
- free-to-air television broadcasting
- cable and other subscription broadcasting
- video and other electronic media rental and hiring
- photographic film processing.

Similarly, there will be impacts on occupations. Employees in occupations linked to processes that will not be used in the digital age or where there may be reduced demand, such as physical printers or video hire shop assistants, will of course have to move into new lines of work. But there will also be impacts on employees whose jobs are in businesses affected by digital disruption, such as reporters and journalists, whose positions are under threat from changing business models.

Further, there will be occupations that will continue to be important in the future, but may be performed overseas, such as for graphic design or other services. The Australian employees in these occupations too, could lose out in the digital economy.

² See for example, <http://www.activ8me.net.au/internet/nbn-satellite-broadband-plans> or http://www.internode.on.net/residential/wireless_broadband/nbn_plans/

In considering these potential impacts, it is important to recognise that changes to businesses and occupations, and offshoring are all trends that have been going on for decades, fuelled by technology developments.

2.5 Social impacts

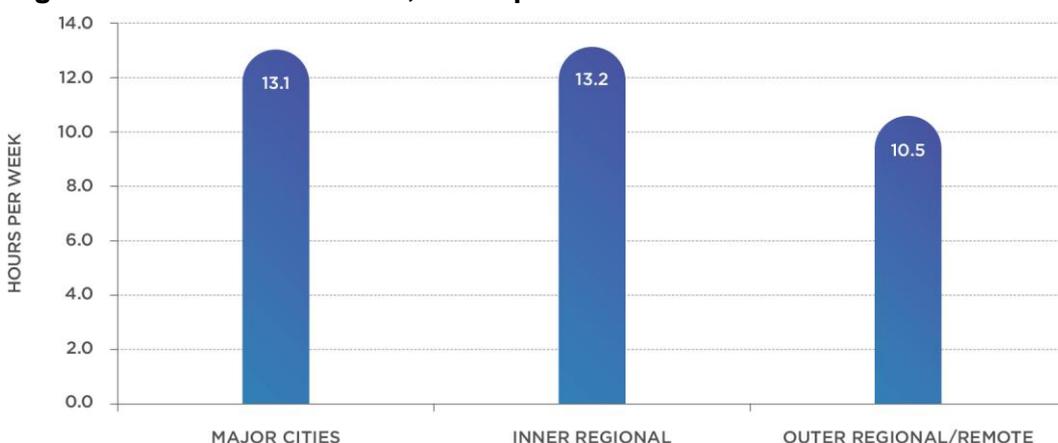
The NBN and broader digital economy trends are bringing profound changes to our society as well as our economy. There are many benefits, but some costs as well. Not all of these can be quantified or monetised, but are discussed in general terms here.

There are many studies about the social benefits of broadband. One study in the UK by PricewaterhouseCoopers (2009) analysed the benefits from education, employment, and improvements in government services. Another, funded by Huawei (Williams, 2011) outlines how broadband can play a role in connecting communities, particularly among older generations and those in regional areas.

A significant social benefit from improved communications is the increased opportunity for **social inclusion**. For example, people in regional and remote areas in particular will have more opportunities to communicate with their friends and family — overcoming the tyranny of distance — through broadband communication. This will particularly assist communities with large rural and remote populations such as farmer and Indigenous communities.

According to the latest Time Use Survey from the ABS (from 2006), people in outer regional and remote areas spend fewer hours per week spending time with their friends. This probably reflects the impact of distance more than a difference in preference for spending time with friends. Digital technologies and the NBN have the potential to help people in more remote communities stay in touch.

Figure 2.5: Time with friends, hours per week



Source: ABS (2008) Time Use Survey

Another social benefit is the potential positive equity impacts of the NBN. While higher income households spend more on telecommunications and have a higher level of broadband access, the NBN will offer equitable access and prices to fast broadband. By improving access to social services, including health and education, it has the potential to improve equity in Australia.

Improvements in health care are potentially very valuable. According to one study by Alcatel Lucent (2012), the benefits from broadband-enabled health care could reach around \$6 billion over a 20-year period. These benefits come from reduced hospital, travel and drug costs and improvements in care.

Like any significant change, there are potentially negative social impacts of the digital economy. For example, greater engagement with technology can affect work/life balance. More work during time at home can make people feel “always on” and affect the quality of leisure time. For example, 43 per cent of mobile workers keep their smartphone within arm’s reach when they sleep at night (iPass, 2011). Some businesses are becoming actively involved in ensuring that employees have personal time.

According to social researcher Hugh Mackay, digital communication can reduce the quality of personal communication and he says that full consequences of digital technologies need further analysis because the long term impacts will not be known for some time (see Deloitte Access Economics, 2012 for more details).

Digital technologies give users the ability to engage with multiple forms of media at the same time and also participate more in national debates.

Other potential negative social impacts from the digital economy include overuse of internet gambling, access to potentially damaging explicit content, and the personal consequences of internet crime or privacy breaches. These are social problems that exist in the non-digital world; however they may be potentially greater online. Continuing research will be required to monitor these trends over time.

2.6 Environmental impacts

The shift to the digital economy will also have environmental impacts. According to the OECD (2010) there are both positive and negative environmental impacts of ICTs. The impacts can be on all aspects of the natural environment including climate change, energy use, non-renewable resource use, toxicity, land, water, the ozone layer and biodiversity.

The OECD outlines how producing a 'net' impact figure requires assessment across a framework that includes:

- direct impacts, from the development, production and operation of ICTs
- enabling impacts through applications, and can include benefits from optimisation, dematerialisation (replacing physical goods), but there can also be negative impacts
- systemic impacts on lifestyles, work and patterns of production.

It is not possible to quantify and monetise all the potential environmental impacts of the National Broadband Network at this stage. Some of the other environmental impacts are outlined below.

One of the most important impacts of the NBN is expected to be on changes in travel. If the National Broadband Network reduces the need for travel for work, shopping and other purposes, it could reduce carbon emissions from transport and save many tonnes of carbon emissions per year. However, there are a range of complexities here. Rebound effects, improvements in traffic flow, and replacement of work trips with other trips can offset some of the reduced transport from online activities. The OECD cites studies showing telework can reduce transport by around 0.7–0.8 per cent. The US Department Energy (2013) includes telework as part of its policy program for reducing energy use.

Switching consumption from manufactured goods to digital goods can reduce carbon emissions and waste from manufacturing. For example, digital music reduces carbon emissions by at least 60 per cent compared with physical CD production (Kooimey, Weber and Matthews, 2009, cited in OECD 2010). Another study found dematerialisation could reduce material flow in economies by 20 per cent by 2020 (Erdmann et al, 2004, cited in OECD 2010). These dematerialisation costs are too complicated to explore properly in this analysis as it is difficult to estimate the net reduction in manufacturing goods due to electronic substitutes.

Another positive environmental impact will come from the facilitation of smart meter and grid infrastructure. These developments do not depend on NBN-grade service levels, but will be assisted by better broadband. The Origin Smart internet portal allows consumers to set goals for reducing their power use, potentially increasing the effectiveness of smart meters (Smart Grid Australia, 2012a). Also, according to Smart Grid Australia (2012b), ICT can be used to manage large volumes of data associated with energy networks.

According to the OECD (2010), around 8 per cent of electricity was lost before it reached final consumers. If smart grid technology could be used to reduce these losses, by using sensor-based networks to identify and locate leaks, that could reduce electricity use. This would result in fewer carbon emissions. With a carbon price, this environmental benefit could be quantified, but is beyond the scope of this report. There would be other complexities to consider as well, including rebound effects if costs of producing energy fell and the environmental impacts of constructing smart meters.

CHAPTER 03

BENEFITS OF BROADBAND FOR AUSTRALIAN HOUSEHOLDS

THIS CHAPTER ANALYSES 10 SCENARIOS WHERE A HOUSEHOLD'S CIRCUMSTANCES ARE DRAMATICALLY CHANGED BY BROADBAND.

The scenarios are a static comparison of two worlds (for simplicity, the people in the scenarios do not age). Deloitte Access Economics analysed the scenarios developed by the Department to highlight the financial and other impacts of high-speed broadband and how the impacts are different across cities and regional areas. They are not intended to reflect the experience of the average household but are stylised examples of the impact of broadband.

We quantify the financial, time saving and carbon emission impacts, both on an annual basis for those in the scenario, and where there are important impacts on others such as family members, employers and governments. These scenarios are not expected to be representative of the whole country but illustrate the gains in scenario form. We do not add every benefit from the national framework (such as lower online shopping prices) as they are designed to take a more in-depth look at selected areas of impact.

If we only focused on a representative or average household, the most common benefits of broadband would dominate, making it difficult to analyse the changes that affect a smaller number of households. Big changes such as gaining employment or not having to move house would get diluted and seem unimportant when averaged across all households even though they are very important for those affected.

These scenarios generally define the 'before' (2013 scenario) as a world without the NBN, 4G, fast broadband, or recent digital economy developments. Likewise, we analyse a 2020 scenario where most people have fast broadband, and they use it to exploit applications and services whose benefits are largely foreseeable now — i.e. it is not foresighting major new technology developments.

The scenarios extrapolate existing trends, based on assumptions about the pace of take up and change in our economy and society. We note that some of the applications of technology in the scenarios do not require high-speed broadband to operate, but may be more likely to be widely available as broadband capabilities improve.

Impacts vary between household scenarios. For example, for some there are significant financial benefits, but only modest time saving benefits. In other situations, households may be spending money, but this is more than compensated by other benefits.

We analyse the scenarios by location — metropolitan, inner regional, outer regional, remote — to highlight how broadband has differing impacts for people living in different parts of Australia. The Australian Bureau of Statistics provides examples of towns in these regional categories namely Perth (metropolitan), Ballarat (inner regional), Cairns (outer regional) and Broken Hill (remote). There are also two specific scenarios that have different circumstances for the people in the metro and regional areas.

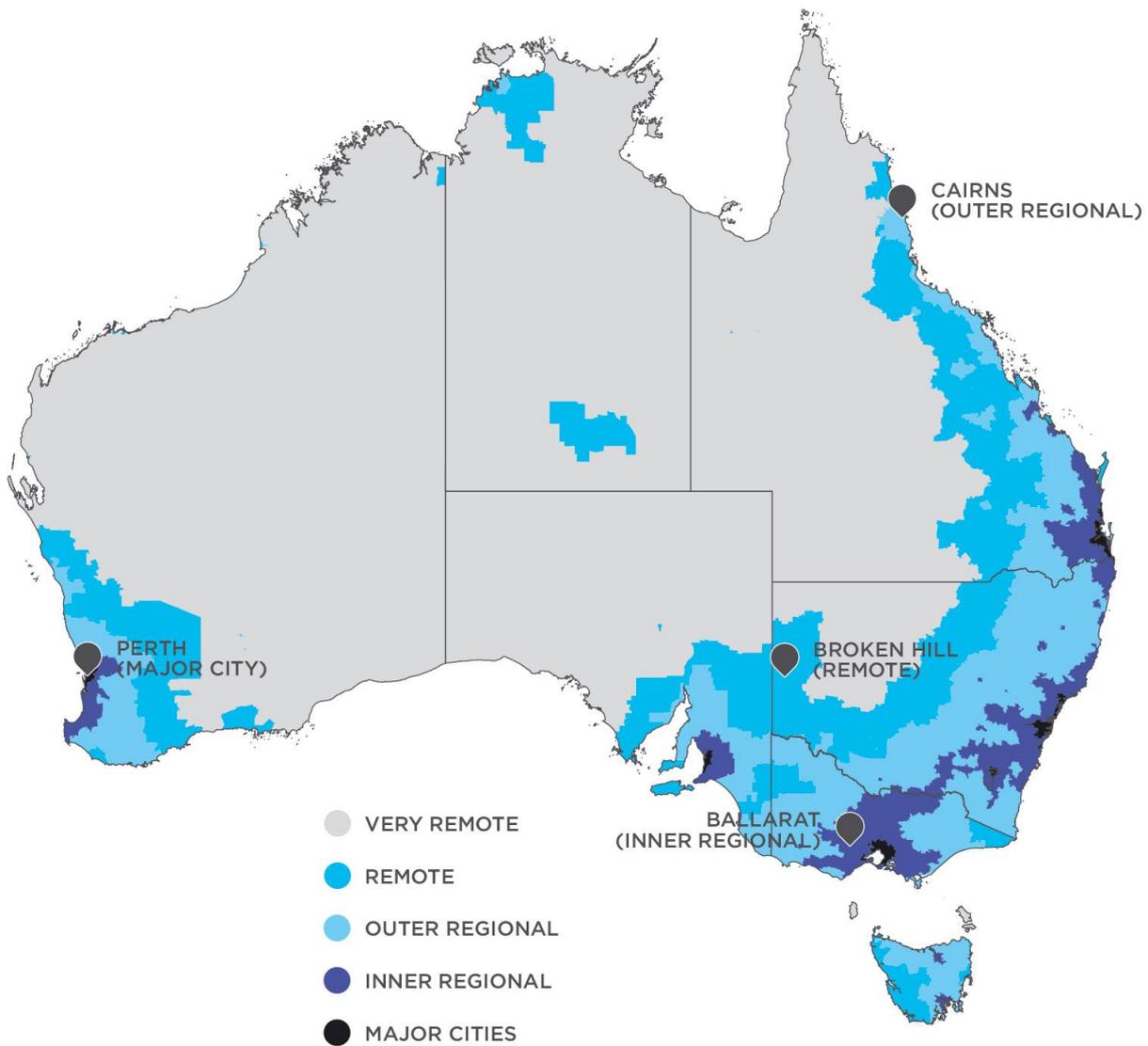
The scenarios are important because they highlight how a range of changes facilitated by broadband can have dramatic impacts on the lives of individuals. When calculated nationally, as we do in Chapter 2, the profound impacts of someone getting a job or not having to move into a nursing home are averaged away, but the impacts for the households affected are of course very significant. That is what these scenarios draw out.

Australian Bureau of Statistics — Remoteness Areas

There are seven Remoteness Areas for Australia, as defined by the ABS (2011a). These are the Major Cities of Australia, Inner Regional Australia, Outer Regional Australia, Remote Australia, Very Remote Australia, Migratory-Offshore-Shipping and No usual address.

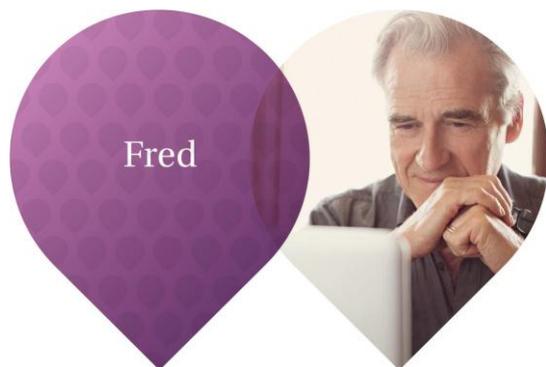
Remoteness Areas are defined by the Accessibility/Remoteness Index of Australia (ARIA+) values for a given locality. ARIA+ is an index with values ranging from 0 (high accessibility) to 15 (high remoteness) based on road distance measurements from over 12,000 populated localities to the nearest Service Centres in five population size categories.

Localities that are more remote have less access to Service Centres and those that are less remote have greater access. A map of the Remoteness Areas of Australia is shown below.



Source: ABS, 2011a

3.1 Older age household — single person over 75:



Situation in 2013

- Fred is a single aged pensioner who lives in his own home. His two adult children live in other parts of town with their own families.
- Fred is on an aged care package that provides him with support to continue living in his own home.
- He has a number of chronic conditions that require regular monitoring. Fred's daughter drives him to the medical clinic monthly to have tests done. His daughter also takes him to visit his doctors to discuss the results each month. He cannot receive regular home visits because of skill shortages in the town.
- Fred finds it hard to remember to take the mixture of medications he is on in a timely way. His aged care provider visits him every few weeks to check he is taking the medications properly.
- Doing the weekly shopping is becoming increasingly difficult for Fred as his mobility is declining.
- Fred finds it hard to visit government and utilities shopfronts when he has a query regarding the services he receives.
- His children are increasingly worried about him suffering a fall while he is at home. They consider that Fred will need to move to a residential care home but Fred is determined to stay in his own home.
- Fred wants to talk to his grandchildren more frequently and participate in family events but this is difficult due to his lack of mobility. He has tried Skype on his computer but it doesn't work well.
- He would also like to stay in touch with his friends, particularly those with whom he plays Bridge, but this is also restricted by his lack of mobility. He doesn't find playing Bridge online very satisfying without the personal interaction.

Situation in 2020

- The key change would be the capacity to use video interaction enabled by high-speed broadband to improve Fred's quality of life. Video interactions have become so simple in 2020 that they are as easy to use as the telephone.
- Fred now receives a number of health services by video. For example:
 - his house now has a falls monitoring system installed such that if Fred does suffer a fall, a provider and his family are immediately alerted.
 - Fred's care coordinator (a registered nurse employed by a provider) regularly talks to Fred over video to check that he is taking his medication correctly. He receives increased frequency of these checks because the nurse does not have to travel. It means his medication compliance has increased significantly.
 - the care co-ordinator also uses video interaction to help Fred undertake checks of his own key health indicators which he can now do at home. This data is monitored by the care co-ordinator who regularly discusses the results with Fred in terms of Fred's care plan that has been agreed with Fred's doctor. This has helped to both improve Fred's peace of mind and to reduce the frequency of visits to the doctor. The visits that Fred does do are now conducted by video.
- Fred does not have to move into a residential home, reducing his costs and improving his quality of life.
- Fred now does his weekly shopping online. He is able to view the specific products he purchases and, if needed, discuss these over video with staff at the supermarket. He finds this much more suitable as he likes to be able to check the freshness of the fish, meat, fruit or vegetables that he is buying. The online order that he places is usually delivered to his house on the same day for free.
- Fred also interacts with his government services by video to clarify any issues with his claims or pension payments, or other local services.

- Fred plays Bridge twice a week with his friends. He uses an application that combines an online version of the game with a four-way video link with his playing partners.
- whenever he cannot travel to see his family, he now is able to participate in family events via video with them using a 360 degree camera. This means he is much more engaged with his grandchildren in particular.

Table 3.1: Benefits and costs, Fred

Benefits	Costs
Improved medication compliance — savings from avoided medical expenses such as hospitalisation	Broadband upgrade — moving from dial-up and phone to basic broadband
Increased ability to respond to and provide timely treatment if Fred has a fall	Cost of free standing bed fall monitor, with remote alarm, and cost of medical alert system
Out-of-pocket travel savings — avoided trips to doctor, shops, DHS, utilities	Cost of remote monitoring equipment
Efficiency benefits of e-government services compared to in-person visits	Additional costs of regular contact with registered nurse
Savings from staying in own home, not moving to residential aged care	

Table 3.2: Estimation of benefits, Fred

	Metro	Inner regional	Outer regional	Remote
Net benefit to Fred in 2020 (1 year)	\$7,402	\$7,402	\$7,402	\$7,402
Net benefit (including monetised time savings)	\$7,918	\$8,069	\$8,179	\$8,140
Other impacts (reduced health and service provisions costs to government)	\$14,586	\$14,586	\$14,586	\$14,586
Travel time saved (hours/year)	58	75	88	83
Carbon saving (t/year)	0.1	0.2	0.2	0.2

Note: carbon savings only include car trips, not public transport. Other impacts do not include Fred's daughter's travel time or out-of-pocket costs.

Fred receives significant financial benefits, mainly from reduced health costs. There are also 'other impacts' — the majority of these are health-related impacts, which accrue to the government through avoided medical expenditure when Fred improves his medication compliance. Time saving benefits are modest, but higher in more remote areas.

Notes

- The benefit of improved medication compliance is based on the annual savings from increasing compliance from 50 per cent to over 80 per cent (Sokol et al, 2005). This takes into account the increased cost of medication from higher compliance (medications are taken in the right quantity, at the right time and in the right way) as well as the avoided medical costs of treatment. For Fred, these benefits were summed for diabetes, hypertension, hypercholesterolemia and congestive heart failure. These benefits accrue to government under 'other impacts' as the government would face the cost of any hospital admissions incurred in the case of poor medication compliance. (\$14,100)
- There is a cost associated with more regular contact with a registered nurse. We assume there is a video call every second day and a cost of these of \$6 each. It is assumed this is borne by the government. The cost is based on the Victorian Government's Nurse-on-Call program, which costs \$8.5m for 1.47m calls (Victorian Auditor General, 2010). (\$1,095)
- Benefits associated with falls are based on the average cost per fall injury treated (NSW Health, 2007), and the likelihood of a person over 65 years falling in a given year (World Health Organization, 2004). We assume that most costs associated with falls would be borne by governments or insurance providers, and therefore, cost reductions will accrue to them, so we have included the financial impacts in 'other impacts'. (\$1,400)
- Fred would need at least a computer and webcam to communicate with e-health professionals. He already has these in the 2013 situation and therefore they are not added as an additional cost.

- Out-of-pocket travel savings based on distances travelled to services (Corpuz, 2006), travel time per trip (ABS, 2008, Transport SA, 2002) and vehicle running costs (RACQ, 2012), also accounting for public transport trips. (\$160)
- Some online delivery of shopping is free, some is not. We have assumed it is free for this scenario.
- Efficiency benefits of e-government services based on the cost per transaction for government departments (PricewaterhouseCoopers 2009), and the switch to online/video conferencing costs compared to face-to-face meetings. These efficiency savings accrue to government, and are included under 'other impacts'. (\$130)
- Savings from staying in own home based on average expenditure on a range of items (ABS, 2011) compared annual out-of-pocket cost of aged care accommodation (Department of Health and Ageing, 2013, CPSA, 2011). (\$8,500)
- Costs of broadband upgrade (Telstra, 2013a, Whistleout.com.au, 2013). The retail prices used are current published retail prices. There are no retail prices available for 2020. NBN Co's Corporate Plan has an 'objective to reduce prices over time' (page 13). Therefore, the prices used may be conservative. We note that the Corporate Plan shows rising average revenue per user (ARPU) over time, but this will be influenced by the product mix chosen by customers as well as wholesale prices. (\$200)
- Costs of a bed fall monitor (Conseng, 2005), and a portable medical alert system (SOS Medi-Alarms, 2013) that contacts his family and remote monitoring equipment (Access Economics, 2010), amortized over life expectancy of a 75 year old today. (\$1,086)
- Travel time savings are estimated on avoided return trips. This is estimated for 24 avoided trips to the GP, 52 shopping trips and 12 DHS/utilities trips in one year. Travel times are based on ABS (2008) and regional variations in travel time (Transport SA, 2002). The monetised value of travel time is estimated in line with the methodology presented in Appendix C.
- Carbon savings only accrue for GP trips which Fred's daughter drives him to. This uses the national average carbon emissions per kilometre from passenger vehicles (National Transport Commission, 2009) and the distances to services by region based on Corpuz (2006).
- It is noted that cost savings for Fred would have an impact on his savings, thereby influencing his quality of life.

3.2 Young student aged less than 25:



Situation in 2013

- Emma is a first year, full-time university student. Under the metro scenario, Emma does not need to move out of home to attend university. She is able to commute from home to university.
- When Emma lives in an inner regional, outer regional or remote area, she must move out of home to shared accommodation nearer the university because she does not have a car. She is renting a share house in a metropolitan area with three other students. The house has an ADSL2+ internet connection that is regularly congested because of the household needs.
- Emma is ineligible for Youth Allowance and her parents support her financially. Emma also has a casual job to help pay her rent and cost of living.
- Sometimes Emma's job means that she has to skip lectures and has to download them from the university website onto her laptop. She has also missed some tutorials and has had to rely on another student's notes. Her tutor has warned her that if her attendance falls below the required level she may fail the course.
- Emma doesn't have a car and relies on public transport, which sometimes makes shopping, going to work and getting to appointments difficult, especially if she has to leave work or university early to make sure she gets somewhere on time.
- Emma has a pre-paid smartphone with a small data allowance. She uses her phone to call her family. She also uses her share house internet to email her family back home, however, she is unable to video call them as their broadband connection is poor.
- Although Emma has a good social life with her new university friends, she likes to stay in touch with friends from her home town. They usually use email and social media, but as with her family, the poor internet connection back in town makes using a program like Skype to talk face-to-face difficult.

Situation in 2020

- In 2020, high-speed broadband is available in Emma's hometown. Emma has decided to remain living with her parents and study at university via e-education, to save costs.
- The NBN has enabled her course to be delivered online in a fully interactive way. Lectures are streamed online and also recorded for download, along with lecture notes and other course materials. Tutorials are conducted via virtual classroom software where Emma can speak to her tutor and other students via high-definition video feed. Increased flexibility allows her to work during business hours.
- Emma's course requires her to complete ongoing practical and theoretical assessments. One type of assessment is a group task where students collaborate in a real time 'virtual laboratory'. Another is an online, role-playing game designed to test her understanding of theoretical concepts.
- Students studying this course are all over the country in different time zones and Emma's classes, tutorials and practical work are often late in the day.
- Emma has found a part-time job teleworking for an inbound contact centre. The contact centre uses video to enable better chat service due to the availability of high-speed broadband.
- She also has an active social life with her university friends online, as she can see them face-to-face when they chat.

Table 3.3: Benefits and costs, Emma

Benefits	Costs
Reduced accommodation cost — from staying at home rather than moving into shared accommodation*	Mobile upgrade — from pre-paid with small data allowance to smartphone
Education benefit of not missing lectures and tutorials — being able to do them online	Broadband upgrade — from ADSL (average) to 100 Mbps broadband
Increased earnings from contact centre job compared to previous casual job	Relocation scholarship cost (borne by government)
Communications benefit from video contact with university friends	
Avoided out-of-pocket expenditure on travel to work and university	

* inner regional, outer regional and remote scenarios only

Table 3.4: Estimation of benefits, Emma

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$5,074	\$14,322	\$14,322	\$14,322
Net benefit (including monetised time savings)	\$7,447	\$16,695	\$16,695	\$16,695
Other impacts (education and communications benefits)	\$651	\$4,699	\$4,699	\$4,699
Travel time saved (hours/year)	268	268	268	268
Carbon saving (t/year)	n/a	n/a	n/a	n/a

Note: carbon savings only include car trips, not public transport

Emma's most important benefits are financial. The net benefits in the metro scenario are smaller than those in the inner regional, outer regional and remote areas, as there is no need for Emma to pay higher accommodation fees from living out of home.

Notes

- Savings from not having to move out of home is based on average costs of a bedroom in shared accommodation (UQ, 2013) compared to paying board at home (estimated \$100 per week). (\$5,200)

- Relocation costs are expected to be small in metro areas and hence not included as a financial cost. The government provides financial assistance for relocation from regional and remote areas, where they were included as 'other impacts' (FaHCSIA, 2013). (\$4,000 in regional scenarios)
- Education benefit of not missing lectures based on the cost per contact hour (lecture/tutorial), estimated from the cost of a Bachelor of Arts (UNSW, 2013). Assumed that Emma misses 1 hour per week for a 12 week semester. These benefits are included in 'other impacts' as Emma does not receive this as a direct monetary saving, rather it is indicative of the value of the benefit she receives. (\$490)
- Increased earnings based on after tax earnings, comparing a casual call centre wage per hour (MyCareer.com.au, 2013) with the minimum wage for a 20 year old, including casual loading (FairWork Ombudsman, 2013). Assumed that Emma works 20 hours per week, 40 weeks per year. (\$4,700)
- Communications benefit estimated as the increase in spend on broadband (noting other members of her household) multiplied by a consumer surplus factor and the share of internet time used for communication (Ovum, 2012, Roy Morgan, 2012). These benefits are included in 'other impacts' as Emma does not receive this as a direct monetary saving, rather it is indicative of the value of the benefit she receives. (\$160)
- Out-of-pocket travel savings based on distances travelled to work and university (Corpuz, 2006) and public transport costs (NSW TransportInfo, 2013). (\$880)
- Cost of mobile phone upgrade from a pre-paid phone to a smartphone, including cost of plans (Telstra, 2013b) (\$360)
- Costs of broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$140)
- Travel time savings are estimated on avoided return trips. This is estimated assuming 5 return trips per week, including travel to university and work. Travel times are based on the times and distances to services (ABS, 2008, Corpuz, 2006) while it is assumed there is no regional variation in travel time because she moves to be closer to university in the regional scenarios, and is likely also to be the average metropolitan distance to work.
- Emma accrues no carbon savings as she travels by public transport, which would run regardless of whether she made her journeys.

3.3 Single professional in well-paid employment — aged 25+:



Situation in 2013

- Joshua rents a one-bedroom apartment and works full-time as a project manager. He travels interstate and sometimes overseas for work. He also spends a substantial amount of his work time in meetings with colleagues and clients.
- He is interested in studying a master's degree in economics but due to his extensive travel schedule, he does not have the time to attend class.
- Joshua has elderly parents who live nearby and he often has to manage health and financial matters on their behalf, wherever he is. He currently does this by phone and finds that he regularly has to wait on hold to get through to customer service. There are occasions where he has to take his parents to a medical or financial appointment, including at various government service agencies.

Situation in 2020

- High-speed broadband has vastly improved Joshua's life. He no longer has to travel regularly for face-to-face meetings as he can use high-definition multi-party video conferencing to communicate with colleagues and clients instead.
- This technology has allowed him to save on travel time and costs, as well as improve his responsiveness to work issues through impromptu video conferences with stakeholders all over the world.
- As Joshua no longer needs to spend substantial amounts of time travelling overnight for work, he is now able to study a master's degree in economics part-time via an online virtual class. The Degree is paid for by his employer.

- Also, thanks to government services being offered online, he can help his parents fill in forms and advise of changes to their circumstances via the Internet. He can also have three-way, face-to-face interviews with his parents and government customer service officers via high-definition video conferencing.

Table 3.5: Benefits and costs, Joshua

Benefits	Costs
Avoided costs of domestic and international travel and accommodation for work	Broadband upgrade — from ADSL (average) to 100 Mbps broadband
Higher lifetime earnings from master's qualification	Broadband upgrade — from no internet to 100 Mbps broadband for parents
Efficiency benefits of e-government services	Master's degree online*
Out-of-pocket travel savings — avoided trips to DHS office for parents	

* costs borne by employer

Table 3.6: Estimation of benefits, Joshua

	Metro	Inner regional	Outer regional	Remote
Net benefit for Joshua in 2020 (1 year)	-\$559	-\$555	-\$551	-\$552
Net benefit (including monetised time changes)	-\$3,901	-\$3,784	-\$3,719	-\$3,638
Other impacts (employer travel costs, NPV education, lifetime earnings, govt services costs)	\$13,113	\$13,113	\$13,113	\$13,113
Net time change (hours/year)	-377	-365	-358	-348
Carbon saving (t/year)	4.4	4.4	4.4	4.4

Note: carbon savings only include car trips, not public transport.

The financial impacts on Joshua in the short term are negative. Time savings are negative because he is studying. Long term impacts are substantial because of the benefits of education.

Notes

- Avoided flights and accommodation costs for work based on 8 domestic and 2 international trips per year, using Sydney-Singapore and Sydney-Melbourne flights as examples (Flight Centre, 2013). (\$10,300)
- Net present value over 10 years of the higher earnings from a Masters qualification after tax, compared to a bachelor degree (Graduate Careers Australia, 2011) net of the cost of the degree (University of Melbourne, 2013). This is included under 'other impacts' as it covers a different time horizon to the rest of the analysis, and because the costs are borne by Joshua's employer. While the monetary benefits directly accrue to Joshua, the costs are up front (cost of course), whereas the benefits (higher salary) are spread over the future years of his employment. (NPV over 10 years: \$24,500)
- Efficiency benefits of e-government services based on the cost per transaction for government departments (PricewaterhouseCoopers, 2009), and the switch to online/video conferencing costs compared to face-to-face meetings. These efficiency savings accrue to government, and are included under 'other impacts'. (\$125)
- Out-of-pocket travel savings to DHS based on distances travelled to services (Corpuz, 2006), travel time per trip by region (ABS, 2008, Transport SA, 2002) and vehicle running costs (RACQ, 2012). (\$110)
- Costs of broadband upgrade for Joshua (RBS, 2012, Whistleout.com.au, 2013) (\$560)
- Costs of broadband for parents (RBS, 2012, Whistleout.com.au, 2013) (\$1,200). This is included under 'other impacts' as Joshua's parents are supplementary to this scenario.
- Net time change includes travel time avoided on flights (Australlearn, 2013), processing time at airports and travel time to airport, varying by region. The average hours spent studying for the Master's degree (University of Melbourne, 2013) are subtracted from this travel time saving.

- Carbon savings accrued for avoided car trips — to DHS with Joshua’s parents, avoided trips to the airport, (National Transport Commission, 2009, Corpuz, 2006) and carbon emissions per passenger seat on Joshua’s avoided domestic and international flights (Qantas, 2013).

3.4 Couple, double income with no kids:



Situation in 2013

- Lilly and Diane have been living together for two years. Both of them are working and have been renting an apartment while saving for the deposit on a house. Lilly works as a lawyer and Diane is a plumber.
- Lilly would like to work part of her working week from home but this currently isn’t possible. Her workplace has told her it would be too expensive to courier confidential documents to her each day and that she would miss important meetings. She complains to Diane that she has no work-life balance and that they should spend more time together.
- As a self-employed plumber, Diane’s work is a mix of people needing quick plumbing jobs and contracts she tenders for and obtains from builders. She generally only uses the computer to email through quotes.
- A typical home-based appointment for Diane is for her to make the appointment by phone. This means her having to stop work and take a call or call someone back. When she gets to the appointment, she analyses the problem and either fixes it or if it is a bigger job, provides a quote.
- With new work, particularly subcontracting work through builders, the quote is based on a description from the builder. Sometimes this is incorrect so Diane prefers to look at the job in person, particularly if plans or measurements are incorrect. Lilly says Diane should find a simpler way to do the quotes but Diane can’t see how this can be done cheaply.

Situation in 2020

- Lilly and Diane’s work and home lives have been made easier and more balanced by high-speed broadband.
- Lilly still works full time, but is able to do three days a week teleworking from home. She is able to hold meetings with clients and her co-workers via high-speed broadband video conferencing facilities. There is no need to courier confidential documents to her as these are stored in her workplace’s secure cloud storage where she can easily access them. Her work-life balance is much better.
- Diane also has greater control over her work. Lilly has helped Diane set up an online appointment system so customers can book appointments directly. Diane uses a tablet and a smartphone so she can block off times when she is not available out on the road. Builders with whom she works also use the online diary.
- Diane now encourages people to send her high-definition photos or videos of their job. She has been able to talk people through fixing small repairs themselves, which saves them money and her time. The videos enable her to see what needs to be done and she can provide a more accurate quote.
- Video is also used by builders to show Diane a job and discuss it with her when they are onsite. They are also able to provide her with a 3D view and measurements of new builds and repair work. High-definition 3D plans, which also take a lot of bandwidth, allow Diane to see where current utilities are placed so she is able to be precise in providing quotes.
- Lilly and Diane spend much more time together.

Table 3.7: Benefits and costs, Lilly and Diane

Benefits	Costs
Lilly — avoided out-of-pocket travel expenditure from teleworking	Broadband upgrade — from ADSL (average) to 100 Mbps broadband

Benefits	Costs
Diane — avoided out-of-pocket travel expenditure for quotes/small repairs	Diane — work IT costs: basic webpage design, tablet
Productivity benefits from travel time saved by Diane — translated to increased earnings	Upgrade to smartphone from a basic mobile phone

Table 3.8: Estimation of benefits, Lilly and Diane

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$9,673	\$8,953	\$8,748	\$8,028
Net benefit (including monetised time savings)	\$10,970	\$9,952	\$9,662	\$8,645
Other impacts	n/a	n/a	n/a	n/a
Travel time saved (hours/year)	146	113	103	70
Carbon saving (t/year)	2.4	1.8	1.7	1.1

Note: carbon savings only include car trips, not public transport

There are substantial financial gains. Also, travel time saved by Lilly is high, given that she teleworks for 60 per cent of the working week. It is noted that these travel time savings decline by region from metro to remote, as the average work commute times decline due to reduced congestion and higher travel speeds.

Notes

- Benefit of avoided out-of-pocket travel expenditure from teleworking for Lilly, based on 3 days working from home, distance travelled to work (Corpuz, 2006), travel time per trip by region (ABS, 2008, Transport SA, 2002) and vehicle running costs (RACQ, 2012). (\$1,700)
- Avoided out-of-pocket travel costs for Diane for travel for quotes and small repairs, based on distances for work-related travel by region. Assumed 5 avoided return trips per working week. (\$1,400)
- Productivity benefit from travel time saved by Diane, with these hours used for increased work and hence higher earnings. This is based on the hours of travel time saved as a proportion of total hours worked per year, multiplied by her annual salary (ABS, 2013b) to determine the dollar benefit. This total benefit is then calculated after tax at the appropriate tax rate. (\$7,800)
- Costs of broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$560)
- Diane's work IT costs include basic webpage design (RedFox, 2012) and a tablet requiring 3G (Apple, 2013), both amortized over 3 years. Diane also upgrades from a basic mobile to a smartphone including an upgraded plan (Optus, 2013, Telstra, 2013b) (\$660)
- Travel time savings accrue to Lilly only (Diane's work trips count towards her productivity benefit, so to include them here would be double counting. Lilly's teleworking assumes 3 return trips to work per week avoided. Travel times consider regional variations in travel time (ABS, 2008, Transport SA, 2002).
- Carbon savings accrue for avoided car trips — to work for Lilly, and for work-related travel for Diane (National Transport Commission, 2009, Corpuz, 2006).

3.5 Couple household, one income, two kids:



Situation in 2013

- Matthew and Lee Lin are married and have two young children and a mortgage.
- Lee Lin runs her own dress-making and alterations small business from a shopfront in her local shopping centre. She buys fabrics from a wholesaler, but sometimes it is difficult to locate a fabric that matches the client’s exact needs. Lee Lin’s small business is under intense pressure from competitors and she is considering other business models.
- Matthew is a full-time carer/housekeeper. The elder child, Brendan, has just completed Year 10, while the younger child, Victoria is four years old and stays at home with Matthew.
- Brendan has excelled at maths, physics and chemistry but there are no specialist high level science teachers at his local school.
- Victoria has mild autism that requires support from an occupational therapist and speech pathologist. This requires Matthew to take Victoria to see the specialists on a regular basis.
- The difficulties both children face is such that the parents are considering re-locating to somewhere closer to the relevant schools/services.
- The lack of a car also makes getting the weekly shopping done very difficult as well as issues of accessing government services.

Situation in 2020

- In 2020, Lee Lin has bolstered her business’ online presence to give customers more flexibility. Instead of having to visit the shop, customers can now choose to make a video call to Lee Lin and view and discuss fabrics/designs in high-definition. They can also make a request on Lee Lin’s website at any time.
- Lee Lin has distinguished herself from competitors by offering clients the ability to create their own fabric designs online using a cloud-based service. Once the customer has created their design (or chosen one of Lee Lin’s designs), the order is placed with a custom fabric manufacturer and delivered to Lee Lin. This streamlined process means that Lee Lin does not need to spend time searching for, or transporting fabrics, and customers have a unique, creative control over their garment design.
- Matthew is able to manage his time better due to the availability of NBN-connected devices in the home.
- Brendan is able to remain attending his local high school while completing advanced mathematics via a nation-wide specialised virtual classroom for gifted students.
- Victoria no longer needs to be regularly taken to the specialists, as consultations are conducted via video interaction.

Table 3.9: Benefits and costs, Lee Lin and Matthew

Benefits	Costs
Productivity benefits — reduced business rent and increased revenue through online presence	Home broadband upgrade — from ADSL (average) to 100 Mbps broadband
Productivity benefits — avoided out-of-pocket costs for work-related travel	Cost of laptop for education
Avoided out-of-pocket costs for medical appointments and shopping travel	Work broadband upgrade — from no internet connection to 100 Mbps
Improved education quality for Brendan	Work — website development costs and laptop

Table 3.10: Estimation of benefits, Lee Lin and Matthew

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$7,458	\$7,267	\$7,213	\$7,022
Net benefit (including monetised time savings)	\$9,264	\$10,518	\$11,547	\$11,086
Other impacts (annual education lifetime benefits)	\$3,367	\$3,367	\$3,367	\$3,367
Travel time saved (hours/year)	204	367	489	459
Carbon saving (t/year)	n/a	n/a	n/a	n/a

Note: carbon savings only include car trips, not public transport

Travel time savings are particularly significant for this family. Video interaction with specialists allows for avoided trips to the occupational therapist and speech pathologist for Victoria. These result in significant savings as Matthew must accompany her on all journeys.

Notes

- Productivity benefits accrue to Lee Lin's business. She has reduced rent costs as she can run a smaller shopfront due to her online presence (Andersen Bowe, 2012). It is assumed that 90 per cent of the benefits flow through to her productivity, with the rest flowing through to customers as lower costs in the competitive environment. There are also productivity benefits associated with the online store, again with 90 per cent of these flowing through to Lee Lin (RustReport, 2012) (\$9,000)
- Productivity benefits also accrue from avoided out-of-pocket travel costs associated with work-related travel. These are based on regional variations in travel time (Transport SA, 2002) and distances travelled (Corpuz, 2006). (\$140)
- Benefits for Matthew and Victoria from avoided out-of-pocket travel costs for medical appointments (occupational therapist and speech pathologist) and shopping were also valued noting the regional variations in travel time (Transport SA, 2002) and distances travelled (Corpuz, 2006). (\$1,600)
- Improvements in Brendan's education quality are based on higher annual lifetime earnings from completing the HSC. While he is able to do it in the 2013 scenario, he cannot do three subjects he would like. The value of these subjects (half of his total HSC subjects) can be approximated as a share of the potential lifetime earnings of this education level, over that of not completing Year 11 (AMP.NATSEM, 2012). These are classified under 'other impacts' as they are higher annual lifetime earnings in future years, not directly attributable to Brendan while studying. (\$3,400)
- Costs of home broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$560)
- Costs of work broadband (RBS, 2012, Whistleout.com.au, 2013) (\$1,200)
- Amortized cost of 2 laptops (JB Hifi, 2013) over two years (one for work, one for home) (\$1,500)
- Travel time savings for Matthew and Victoria based on public transport fares and distances to medical specialists and shopping, noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006). Travel time savings not counted for Lee Lin as they already form part of her productivity benefit. (\$180)
- There are no carbon savings under this scenario as the family does not own a car and travels via public transport.

3.6 Unemployed, aged 21:



Situation in 2013

- Jason is 21 years old and unemployed.

- Jason's mother drives him to the nearest Department of Human Services (DHS) Service Centre so he can register his intent to claim for a Newstart Allowance.
- Jason is advised of his options to test his eligibility for the Newstart Allowance. Jason elects to use the self-service terminal at the Service Centre to complete an online claim. When his claim is submitted, Jason is advised of the supporting documentation required to be presented to the office and an appointment time is booked.
- He is required to setup an Employment Pathway Plan to record job searching progress, education and training activities. He has an in-person appointment with an Employment Service provider booked on his behalf. Jason was given another appointment time to return to speak to a customer service officer, provide his documents in person, and finalise his claim. He attends the appointment, again driven by his mother.
- Jason has to speak to the provider fortnightly to advise of his progress. He also has to have in-person appointments with the provider on specific occasions.
- At one appointment, the provider advises opportunities in a call centre have arisen but Jason will need to improve his literacy skills and move from home. There are no courses available in Jason's local area and he needs to travel in order to attend. This is difficult for Jason as public transport is not good and his mother is unable to take him as she is working.
- Jason is unable to do the training and misses out on the job.

Situation in 2020

- Jason's situation is a lot easier in 2020. He applies online for Newstart, including making an appointment via video-conferencing with a Customer Service Officer. He reads what identification documents are required on the DHS website, and gets them scanned, uploading them into his account for the CSO to see prior to the interview.
- The interview is conducted by video conferencing. He is advised via a message sent to his DHS account, that to access the appointment, he would need to go the DHS website, click onto the video-appointment icon and follow the prompts. Jason is able to do the video conference interview as the computer his mother owns has a HD webcam so that she can use the NBN to have video based conversations with her grandchildren who live in another State.
- At the interview video hook-up, Jason and the CSO are joined by an Employment Service provider who discusses Jason's interests and current opportunities in the services industry. Together they develop an Employment Pathway Plan. The Employment Service Provider sends Jason an agreed version, which Jason signs and uploads to the relevant DHS and Employment Service Provider's systems.
- Jason reports his progress online and on specific occasions, also links up with his Customer Service Advisor via video conference.
- When a number of ongoing opportunities for call centre staff in the service industry become available, the Employment Services Provider contacts Jason. However, Jason needs to improve his numeracy and literacy skills in order to take advantage of these positions.
- The Employment Service Provider suggests that Jason enrol in virtual classes in numeracy and literacy at University of New England in Armidale. To assist with this, the Employment Services Provider arranges a three way video interview with the University of New England for Jason to enrol. Jason attends virtual classes in literacy and numeracy from his home and completes a number of online assignments.
- The Employment Service Provider arranges for an interview online with a potential call centre employer based in another location. The employer — using a webcam in his office — interviews Jason via video hook-up.
- Jason is successful in gaining employment — he is employed as a call centre operator — and his employer allows Jason to telework from home. Jason receives a telework subsidy that he uses to purchase additional IT equipment and ensure that his home office set-up meets all OH&S requirements, etc.
- In his first two weeks on the job, Jason receives training in working as a call centre operator, including by participating in virtual classes.
- Jason's employer covers the additional cost of upgrading Jason's mother NBN plan — to ensure there is capacity for both Jason and his mother to simultaneously use their connection for work and private matters, etc.
- Most importantly, Jason is able to work and live in a location and community of his choice.

Table 3.11: Benefits and costs, Jason

Benefits	Costs
Avoided out-of-pocket expenditure on travel to DHS*	Broadband upgrade — from ADSL (average) to 100 Mbps broadband

Benefits	Costs
Half year of employment as a call centre operator (net of Newstart Allowance)	Literacy and numeracy course cost
	HD webcam*
	Home office setup*

* borne by employer or Jason's mother

Table 3.12: Estimation of benefits, Jason

	Metro	Inner regional	Outer regional	Remote
Net benefit for Jason in 2020 (1 year)	\$13,074	\$13,074	\$13,074	\$13,074
Net benefit (including monetised time savings)	\$13,126	\$13,168	\$13,199	\$13,191
Other impacts (education and communications benefits)	-370	-313	-271	-281
Travel time saved (hours/year)	6	11	14	13
Carbon saving (t/year)	0.04	0.1	0.1	0.1

Note: carbon savings only include car trips, not public transport. Other impacts do not include Jason's mother's travel time or out-of-pocket travel expenditure.

Jason obtains significant financial benefits from the NBN, which allows him to move into employment earlier. In comparison, other impacts are minor.

Notes

- Avoided out-of-pocket travel expenditure to DHS, based on nine return trips to CSA and ESP and noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006). This benefit is attributed to Jason's mother who drove him to DHS. As she is not directly part of this scenario, the savings are noted under 'other impacts'. (\$70)
- Jason receives increased earnings from an assumed half-year of employment as a call centre operator (net of Newstart Allowance, which is no longer received once he is employed). Estimated after tax income from the call centre operator (MyCareer.com.au, 2013) minus the Newstart Allowance payment rate (Department of Human Services, 2012) provided this benefit of increased earnings. It is noted that in future years, the benefit would be a full year's salary net of Newstart Allowance. (\$13,000)
- Costs of home broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$560)
- Cost of literacy and numeracy course (UNE, 2013) (\$500)
- Cost of HD webcam (JB Hifi, 2013) are included under 'other impacts' as Jason's mother purchased this to talk to her grandchildren. (\$50)
- Cost of home office setup is attributable to Jason's employer and also noted under 'other impacts'. This includes costs of an ergonomic chair, phone, headset, security software, external hard drive for backup. (\$400)
- Travel time saved is for Jason's avoided trips to DHS, noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006).
- Carbon savings accrue for avoided car trips to DHS, based on average passenger car emissions per kilometre, noting regional variations (National Transport Commission, 2009, Corpuz, 2006).

3.7 Couple household (empty nesters), aged 65+:



Situation in 2013

- Marge and John are recent retirees. They own their home in an outer suburban area and are on self-funded superannuation. This means that while they are comfortable, money is sometimes tight when interest rates fall.
- They supplement their income by selling vegetables and fruit from their garden at a local market, as they are both keen gardeners.
- Their garden is set up to be as water wise as possible and previous rain has helped but with hot summers forecast, they are considering changing their garden to low maintenance, even if this means not receiving the income from their fruit and vegetables.
- Another reason they are considering a lower maintenance garden is that like many retirees, they would like to travel. They have bought a small caravan for this purpose.
- As empty nesters, the house was bought for their family but their three children have now left home. They have concerns about the house being too big for them and the costs of running it, such as electricity. They have a ducted air conditioning but rarely use it, even on hot days as they are concerned about its running costs. They also switch off their appliances at the power point to conserve power and lower costs.
- They have an Internet connection at home, at the insistence of their children, but it is dial-up as they rarely use it and don't see a need for it.

Situation in 2020

- Marge and John's situation has been improved by the use of household smart technology and the NBN in 2020.
- They are now connected to a basic NBN package and their energy provider's web portal to control energy usage in their home and garden.
- Marge and John have also joined an online gardening forum, where they can chat via high-speed broadband with other home gardeners and swap information.
- Thanks to being online, they have been able to source an inexpensive sensor network for their garden, which not only tells them the best time to water but also the best places in their garden to plant and the best types of fruits and vegetables. Instead of downgrading their garden, they have increased the yield and are making more money at their local market.
- They are also able to advertise online via a local community website to people who can order fruit and vegetables online and have it delivered each day by Marge and John. Marge and John now have a thriving home business that supplements their income. They do not want to downsize as their spare room is now used as a home-office for their business.
- Thanks to the success of using a smart meter, the sensor network in their garden and a web interface monitoring device, they can now visualise the energy usage of various appliances in their house and determine what device to switch off, they can also control their energy use remotely when not at home ensuring no energy wasted when they are away.

Table 3.13: Benefits and costs, Marge and John

Benefits	Costs
Energy bill saving from using smart meter to reduce appliance energy use	Broadband upgrade — moving from dial-up and phone to basic broadband
Earnings from smart market garden	Smart meter purchase and running costs
	Out-of-pocket costs for delivery of market garden produce to customers

Table 3.14: Estimation of benefits, Marge and John

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$2,237	\$2,252	\$2,267	\$2,275
Net benefit (including monetised time changes)	\$1,942	\$1,972	\$2,002	\$2,016
Other impacts	n/a	n/a	n/a	n/a
Travel time saved (hours/year)	-33	-32	-30	-29
Carbon saving (t/year)	-0.5	-0.5	-0.5	-0.5

Note: carbon savings only include car trips, not public transport

Marge and John's market gardening activities limit financial, time and carbon savings, but there are quality of life benefits not fully reflected in the table.

Notes

- Annual energy bill saving from using smart meter to reduce energy use of home appliances, average taken from Energy Marketing Consulting (2009) and Premier of NSW (2012) estimates. We note that the scenario here uses low bandwidth applications but the general shift to a digital economy will facilitate more situations like this. (\$70)
- Earnings from smart garden, assuming small ½ acre market garden (Hendrickson, 2005) (\$2,800)
- Costs of home broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$240)
- Cost of smart meter purchase, amortized over 10 years, and running costs (Premier of NSW, 2012) (\$20).
- Out-of-pocket costs for delivery of market garden produce, based on 1 return trip each week for 50 weeks of the year, noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006).
- There are negative time savings for Marge and John as they spend time delivering produce in the new scenario, which they did not do previously. Taking into account regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006), the time changes are estimated for 50 return trips per year.
- Carbon emissions are incurred from these additional car trips to deliver produce, based on average passenger car emissions per kilometre and regional variations in distances travelled (National Transport Commission, 2009, Corpuz, 2006). On the other hand, there are carbon savings from reduced energy use following installation of the smart meter (Ericsson, 2012). For Marge and John, the change in carbon emissions is positive in the metro scenario, but becomes negative in the regional scenarios where greater distances are travelled to deliver their produce.

3.8 Household of two — carer/disability:



Situation in 2013

- Tom is a carer for his mother Dorothy, who is recovering from a stroke. She is now at home after extensive rehabilitation at a hospital care facility. She has a case manager and a number of therapists helping her on a daily basis. Dorothy is on a Disability Support Pension, having been assessed as having a permanent disability.
- Tom has taken leave without pay from his job as a public servant to care for his mother at home. He receives a Carer Payment from the Department of Human Services. Although he is eligible under the Carer Payment to work part of the week, he is unable to leave his mother for long periods, which leaves him bored and frustrated. He often plays video games or surfs the web while his mother is resting.

- Tom has local personal home care help come to help his mother a couple of days a week to shower her and he is eligible for respite for a few hours a week, where another carer comes to mind Dorothy while he goes shopping and pays bills.
- Dorothy has a number of out-patient visits each week to a rehabilitation centre where she sees a speech therapist and physio. Her physio has recommended Dorothy begin to exercise at home and has shown Tom how to help her. Tom is aware that his mother is also frustrated by her progress, particularly because her physical condition prevents her from even holding a book. Tom plays her audio books but these are not enough for this once active lady.

Situation in 2020

- Tom and Dorothy's situation has changed for the better in 2020.
- Tom is on a Carer's Allowance, a top up payment to his wage. He now teleworks part-time from home via his NBN connection. He is able to take part in meetings thanks to high definition video conferencing and is able to work on his team's project.
- Tom doesn't need to go shopping during respite as he now orders online, including fresh food, and gets it delivered to the house. He is now able to visit the office one day a week and have some time to himself when the carer arrives to take care of his mother.
- High-definition video is also helping his mother in her rehabilitation. Although Tom still takes her out for her physical therapy, this has reduced in hours because she is able to do her physical and speech therapy via video appointment.
- Dorothy also uses Tom's video console connected to the television and the Internet to access games for her rehabilitation, both physical and speech. Her therapists are able to see her results and talk her through improvements during the next appointment.
- Dorothy also uses a tablet to access rehabilitation games and uses it for entertainment, connected to a streaming service where she can watch videos and listen to music.
- Dorothy also belongs to an online rehabilitation group where she can interact with others recovering from stroke, including group exercise and speech therapy, and playing games. The NBN bandwidth allows Dorothy to see the others in her group and the rehabilitation equipment allows her difficult speech to be translated to text for others to be able to understand her more easily.

Table 3.15: Benefits and costs, Tom and Dorothy

	Benefits	Costs
Tom's earnings from part time telework, supplementing his Carer's Allowance	Broadband upgrade — from ADSL (average) to 100 Mbps broadband	
Avoided out-of-pocket costs of travel for paying bills and reduced in person rehabilitation visits	Medical equipment used for stroke rehabilitation at home — pedal exerciser and hand grips, Wii Fit console, controller and software	
Benefit of increased at-home rehabilitation hours	Tablet for Dorothy	
Communications, social and entertainment benefits for Dorothy		

Table 3.16: Estimation of benefits, Tom and Dorothy

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$23,154	\$23,789	\$24,262	\$24,132
Net benefit (including monetised time savings)	\$25,586	\$27,169	\$28,349	\$28,031
Other impacts (communications, consumer welfare and rehabilitation benefits)	\$6,392	\$6,392	\$6,392	\$6,392
Travel time saved (hours/year)	275	382	461	440
Carbon saving (kg/year)	0.6	0.9	1.1	1.1

Note: carbon savings only include car trips, not public transport

Tom receives significant financial benefits from being able to telework while still being at home to take care of Dorothy. Given that they are both at home much of the time, there are also substantial 'other impacts' from improved broadband,

including health, communication and social benefits. Travel time savings from being able to have health appointments from home also present large time savings in this scenario.

Notes

- There are wage benefits from Tom's part-time telework, after tax (ABS, 2013b), which supplement his Carer's Allowance as he stays under the working hours threshold (Department of Human Services, 2013) (\$22,800).
- Benefits from avoided out-of-pocket costs for travel, for 1 return shopping/bill trip per week, and 2 return trips for rehabilitation per week. It is noted that Tom substitutes one of his trips to go to work instead. The benefits are estimated, taking into account regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006) (\$1,100).
- The benefit of increased at-home rehabilitation hours for people who have experienced stroke is estimated as half of the benefit of the StrokeConnect program per person (Deloitte Access Economics, 2013). This benefit is included under 'other impacts' as it is not a direct monetary benefit to Dorothy, rather it provides an indicative value of her improved health (\$6,400).
- The NBN also brings communications, social and entertainment benefits for Dorothy. This is based on her expenditure on broadband, including half of the increase in broadband costs and the cost of a tablet, amortized over 3 years (Apple, 2013). Tom already has a laptop. This increase in broadband spend is multiplied by a consumer surplus factor and the share of internet time used for communication (Ovum 2012, Roy Morgan 2012). These benefits are included in 'other impacts' as Emma does not receive this as a direct monetary saving, rather it is indicative of the value of the benefit she receives (\$180).
- Costs of home broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$560).
- Cost of medical equipment required for at-home rehabilitation includes the costs of a pedal exerciser and hand grips (RehabMart, 2013) and Wii Fit console, controller and software, amortized over 2 years (BigW, 2013) (\$200).
- Time savings are based on avoided trips for shopping/bills and rehabilitation sessions for Dorothy, noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006).
- Carbon savings accrue for avoided car trips for shopping/bills and rehabilitation sessions, based on average passenger car emissions per kilometre, noting regional variations (National Transport Commission, 2009, Corpuz, 2006).

3.9 Single parent household with BABY:



Situation in 2013

- Carmela is a single parent. She is in rented accommodation and uses public transport to get everywhere. The infrastructure in the new housing estate where she lives is not good so she spends a lot of time waiting for buses then the train to get to appointments such as with the district nurse.
- Carmela attended neonatal classes after the baby was born. She found it difficult to travel to where the classes were held and had to rely on friends to get her there on time.
- Carmela has a basic internet connection at home. She mostly uses email and Facebook to stay in touch with her family and friends but doesn't use it for much else.
- Carmela feels very alone and is frustrated at the lack of services in her local area. She has joined a new mothers group but this is only once a week for an hour. She has put her name down for a play group and for a child care place so she can look for part-time work when her baby is older but still feels the lack of a current support network.
- Carmela has claimed a parenting payment from DHS and although this process has been relatively easy for her, she wishes the time spent on the phone and in the DHS office was much less.
- In a few years' time, Carmela wants to do a course to get some career qualifications. She is very motivated and has visited her local TAFE to speak to a career counsellor. Carmela is very interested in being a child care worker, having been impressed by the people at the child centre where she has put her name down for a place.

- Under the metro and inner regional scenarios, Carmela has finished high school, and is ready to go on to do further study to become a child care worker. She will start doing this when her daughter is a bit older.

Situation in 2020

- Carmela's status is much improved in 2020. Before she had her baby, Carmela took part in neonatal classes via her basic package NBN connection at home.
- The lack of transport infrastructure in her local area does not stop Carmela getting to appointments as many of these are done via the internet, including some of her appointments with her district nurse.
- Carmela also has an active online social life and support network, with a new mothers group, which has an online forum and more importantly, video chat facilities so she can connect with other people who are in the same situation.
- Carmela was able to claim parenting allowance online through the DHS website. She found making the appointment online very easy and she spoke to a customer service officer by video conference. She hasn't had to go into a DHS service centre at all.
- In the outer regional and remote scenarios, Carmela left high school early due to a range of factors, including education quality and transport issues. In 2020, she is doing a part-time online course at her local TAFE, even though her daughter is still a baby. She is aiming to do a couple of units a semester so she can finish school and then go onto further study.

Table 3.17: Benefits and costs, Carmela

Benefits	Costs
Avoided out-of-pocket costs to neonatal classes, nurse appointments, DHS meetings	No cost change to move from basic internet to basic NBN package
Efficiency benefits of e-government services	Cost of TAFE HSC course*
Social and communications benefit form interaction with online mothers' group	
Higher lifetime earnings from education — completing HSC*	

*only applicable under the outer regional and remote scenarios

Table 3.18: Estimation of benefits, Carmela

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	\$484	\$484	\$484	\$484
Net benefit (including monetised time changes)	\$611	\$713	-\$1,867	\$1,887
Other impacts (e and communications benefits)	\$6,532	\$6,532	\$13,013	\$13,013
Net time change (hours/year)	14	26	-265	-268
Carbon saving (t/year)	n/a	n/a	n/a	n/a

Note: carbon savings only include car trips, not public transport

While not directly attributable to Carmela as a financial benefit, there are large 'other impacts' from the NBN, as she is able to attend neonatal classes, nurse appointments, DHS appointments and mothers' club activities without being physically present, which is particularly useful as she is able to avoid public transport while looking after her newborn.

Notes

- Benefits include avoided out-of-pocket costs for 8 trips to neonatal classes, 12 nurse appointments and 2 DHS meetings in one year. It is assumed that there are no public transport fares required for her baby daughter (NSW TransportInfo, 2013). (\$480)
- There is an efficiency benefit of e-government services, based on the cost per transaction for government departments (PricewaterhouseCoopers 2009), and the switch to online/video conferencing costs compared to face-to-face meetings. These efficiency savings accrue to government, and are included under 'other impacts'. (\$30)

- The social benefit from the online mothers' group is valued as the average cost of facilitated mothers' group sessions/activities (baby and beyond.net.au, 2013) and the hours Carmela and her baby attend (assumed to be 5 hours per week). This is accounted for under 'other impacts' as it is not a direct financial benefit, but an indicative value of the services she is able to obtain via the NBN. (\$6,500)
- In the outer regional and remote scenarios, Carmela receives higher annual lifetime earnings from completing Year 12 compared with previously not finishing high school (AMP.NATSEM, 2012). This is net of the part time TAFE course to finish school (TAFE NSW, 2013). This is estimated on an annual basis and is included under 'other impacts' as the benefits will accrue in future years to come when Carmela's high school education is complete. (\$6,500)
- Carmela faces no change in her costs of home broadband, moving from basic broadband to basic NBN package (Whistleout.com.au, 2013)
- Travel time savings are based on avoided trips for neonatal classes, nurse appointments and DHS appointments, noting regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006). In the outer regional and remote scenarios, net time change also includes the average time spent studying part time to finish high school (TAFE NSW, 2013).
- There are no carbon savings in this scenario as Carmela uses public transport, which would operate regardless of her patronage.

3.10 Household with a single person:



Situation in 2013

- Kimberley is in her early 40s. At work, she runs the in-house graphic design and web studio. Storage is an issue at work as the server is slow and has to be constantly backed up onto other drives and disks.
- Kimberley is an early adopter of Internet technologies and spends a great deal of time online. She owns a smartphone and a tablet, as well as a home computer on which she spends most of her time. Kimberley has a moderate disposable income and does a lot of online shopping, though she wishes more were available.
- She is on a good ADSL2+ connection, though she complains to her online friends that her connection is too slow for downloads and online gaming, such as television shows from iTunes, and for multi-player online gaming. In particular, it is an issue for her online social gaming group. In the massive multi-player games Kimberley plays, she cannot see all the players at the same time as her computer cannot render everyone properly. Secondly, there is not enough bandwidth to know what other players are doing. Due to these issues, she and her friends have limited the number of players in the game.
- Kimberley has been visiting a physio for an injury and it has been suggested that she do a stretching class in order to further her rehabilitation. Unfortunately, the only local class available is during the day and Kimberley cannot get away from work.
- At home, Kimberley's life revolves around her three dogs. She is heavily involved in organising a national dog club. She spends a lot of time on the phone with other members locally and around the country to organise it and is finding the process frustrating, particularly as few people have conference facilities on their phones and not many have good enough Internet connections to Skype. Emails are also frustrating because they devolve into discussions about other things instead of, for example, ensuring the club procedures and rules are written. She has started a wiki but only a few people contribute, preferring face to face communication.

Situation in 2020

- Kimberley's life is very satisfying in 2020. Her workplace uses cloud servers to back up their work via the NBN. The connection is the fastest available so uploading large files is not an issue.
- Kimberley's internet connection at home is also the fastest NBN connection available. Downloading TV shows is not an issue as it is quick and she streams a lot of music. Online shopping has also become easier.
- Online gaming has also become much better. Kimberley and her gaming friends no longer have to cap the amount of players in streamed games due to rendering being done via the cloud, using minimal resources on the players' home computers. The bandwidth is now allowing every player to be seen.

- The NBN also allows Kimberley to take part in stretching classes via video conferencing. Her employer has created a space to allow other staff to also take part with the class teacher instructing them from elsewhere.
- Video conferencing is also assisting with the formation of the national dog club Kimberley is involved in. She has set up a wiki for people to contribute to and they have regular meetings via video to work on rules and procedures. They will be ready to launch the club much sooner than they had planned.

Table 3.19: Benefits and costs, Kimberley

Benefits	Costs
Communications benefit for contacting dog club members	Broadband upgrade — from ADSL (average) to 1Gbps broadband
Wage increase from ICT-related productivity	Online subscriptions to TV, music, games
Benefit of stretching rehabilitation hours	Cost of stretching classes
Avoided out-of-pocket costs for shopping travel	
Saving from shopping online due to cheaper prices on the internet compared to bricks and mortar stores	
Consumer surplus and choice benefits from the greater range of goods available for purchase online	

Table 3.20: Estimation of benefits, Kimberley

	Metro	Inner regional	Outer regional	Remote
Net benefit in 2020 (1 year)	-\$1,844	-\$1,836	-\$1,828	-\$1,824
Net benefit (including monetised time savings)	-\$1,537	-\$1,544	-\$1,552	-\$1,555
Other impacts (consumer surplus, choice and communications benefits)	\$5,367	\$6,089	\$6,811	\$7,533
Travel time saved (hours/year)	35	33	31	30
Carbon saving (t/year)	0.2	0.2	0.1	0.21

Note: carbon savings only include car trips, not public transport

Kimberley's use of the internet includes significant spending on goods and entertainment available online. That said, this also provides her the opportunity for savings from cheaper online shopping and substantial 'other impacts' including choice, communications and consumer surplus benefits.

Notes

- The communications benefit of being able to contact members of the dog club via video conferencing is estimated as the increase in spend on broadband multiplied by a consumer surplus factor and the share of internet time used for communication (Ovum 2012, Roy Morgan 2012). These benefits are included in 'other impacts' as Kimberley does not receive this as a direct monetary saving, rather it is indicative of the value of the benefit she receives. (\$1,000)
- Kimberley obtains a productivity-linked wage increase due to improved ICT (Kretschmer, 2012), after tax. (\$70)
- Benefits include avoided out-of-pocket costs for 52 return trips to the shops in one year. This takes into account the regional variations in travel time (Transport SA, 2002) and distances travelled (Corpuz, 2006). (\$160)
- There are savings from purchasing goods online which are cheaper than identical products in bricks and mortar stores (Brynjolfsson, 2000). The saving is based on an assumption that half of Kimberley's discretionary income spent on goods is spent online and the corresponding saving as she is a keen adopter of technology. (\$800)
- In addition, there are consumer surplus and choice benefits from the larger range of goods available for purchase online. These benefits are based on her online spending on entertainment and other goods, multiplied by a consumer surplus factor. These benefits are included as 'other impacts' as they are not direct financial benefits but indicative of the value of the increased online choice. (\$3,400)

- We also calculate premium choice benefits for those living outside metropolitan areas. There is evidence that lack of choice is a bigger issue in regional Australia (eBay, 2006). There is no precise estimate for the additional increase in choice that people in remote areas experience as a result of going online compared with those in metro areas. We assume that the choice benefit is double that for those in remote areas. This is based on figures in the book market quoted by Brynjolfsson (2003), which said that while online books stores had 23 times the choice as a large metropolitan bookstore, the increased from an independent bookstore (that might be in a regional area) was twice as big (57 times, in fact). For inner regional and outer regional areas we take mid points in between these two experiences.
- As Kimberley is able to attend stretching classes at work, she has the additional benefit of 48 weeks' rehabilitation above what she would otherwise have had. These sessions are valued at an average \$20 each (yogajivana.com.au, wellofflifecycle.com, 2013). This is assumed to be the magnitude of the benefit she receives. Stretching benefits are included as 'other impacts' as they are not a direct financial saving for Kimberley, though this does indicate its value to her rehabilitation. (\$960)
- Costs of home broadband upgrade (RBS, 2012, Whistleout.com.au, 2013) (\$1,300)
- Costs of online subscriptions to TV shows assuming 5 paid downloads per month (Apple, 2013), no charge for additional free TV shows, subscription for music streaming (Spotify, 2013), and subscription costs for 2 online games (Warhammeronline.com, 2013, Eveonline.com, 2013).
- The cost of stretching classes at \$20 each are a financial cost to Kimberley (yogajivana.com.au, wellofflifecycle.com, 2013), with 48 classes at work (\$960).
- Travel time saved relates to 52 avoided shopping trips per year, taking into account regional variations in travel time (ABS, 2008, Transport SA, 2002) and distances travelled (Corpuz, 2006).
- Carbon savings for these 52 shopping trips are based on average passenger car emissions per kilometre, noting regional variations in distance (National Transport Commission, 2009, Corpuz, 2006).

CONCLUSIONS

There are many significant impacts of broadband on households, society, businesses and the environment.

In this report, Deloitte Access Economics analysed six areas of potential benefit, including communications, e-commerce, online services, employment, quality/price changes and travel savings.

Our overall estimate is average annual household benefits worth around \$3,800 in 2020, in current dollars. Around two-thirds of these benefits (\$2,400) are financial benefits, the rest are the equivalent money value of consumer benefits such as travel time savings and convenience of e-commerce. It is noted that while this report is not a cost benefit analysis of high-speed broadband, it clearly shows very significant benefits from high-speed broadband.

Analysis of a range of household scenarios shows that there are many potential benefits of broadband. Beyond the most common benefits of broadband, such as reduced travel and price reductions, for some sections of society there are much greater impacts. There is some evidence that these greater impacts are where households face difficult circumstances, such as needing to find employment, move residence or where additional education is of significant benefit. This suggests that participating and engaging with opportunities provided by broadband has the potential to play a role in improving outcomes for those in society facing disadvantage.

It can also be seen that the type of impacts varies between different household scenarios. For example, for some there are significant financial benefits, but only modest time-saving benefits. In other situations, households may be out of pocket financially, but this may be more than compensated by other benefits. Further, there are a range of time factors to consider: in the single year of 2020 benefits may be low, but there can be significant long-term benefits, such as from additional earnings through education. Finally, we note that, partly reflecting the limited nature of the environmental analysis that is quantified, there are only small reductions in carbon emissions from broadband-enabled changes.

There are variations in benefits according to whether people live in the city or a regional area, mostly relating to travel. Households in metropolitan areas may experience higher travel time savings due to avoiding congestion during work commutes. Those in regional areas may save more time when distances are greater, such as travelling to for health or education services. In addition there are some scenarios where people in regions will benefit more than cities, because they will be less likely to have to move for education or employment. Broadband, particularly in regional areas, will open up opportunities to allow regional residents to better participate in the digital economy.

The range of broadband impacts is extensive. This analysis only considers existing applications of broadband, and finds substantial benefits to many different households. Further developments in technology and applications are certain, and are likely to mean that realised benefits in 2020 will be greater still.

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APPENDIX B REGIONAL DATA

This appendix presents the regional data used to estimate the benefits from avoided travel. Travel time per trip, kilometres travelled and out-of-pocket costs vary by region. These regions are based on the ABS Remoteness Areas, namely major cities, inner regional, outer regional and remote/very remote Australia. The values below have been estimated from a range of sources as there is no perfect database of regional travel times available.

Table B.1 presents the travel time values used in Deloitte Access Economics' analysis. The metropolitan travel time for work, shopping and education was based on the ABS time use survey (2008), including unpublished data, divided by two for the outbound and return journeys. Data was provided for participants, rather than the whole population. It is noted that the travel time for shopping was presented as travel associated with the purchase of goods and services. This includes many other trips (e.g. to the hairdresser, or to the furniture store) not associated with buying groceries. We assume half of the journeys are associated with grocery shopping, and that the average person shops three times a week.

The metropolitan travel time value for trips to the doctor was not able to be isolated in this way. Travel time averages were presented for the entire population, rather than the relevant cohorts. This value was therefore estimated based on the kilometres travelled to the services (Corpuz, 2006), as a ratio compared to the distance travelled for work.

The regional variations in travel times to the doctor/DHS are based on Transport SA (2002) which provided the percentage that regional travel times varied from city travel times to selected facilities.

Table B.1: Travel time per trip (minutes, one way)

	Metropolitan	Inner regional	Outer regional	Remote
Work	31	24	22	15
Doctor/DHS	20	35	47	44
Shopping	20	19	18	18
Education	34	36	25	16

Sources: ABS 2008, Transport SA 2002, ABS 2011, Deloitte Access Economics estimates

The number of kilometres travelled each way to access services is shown in Table B.2. Corpuz (2006) provides the metropolitan average distances travelled each way to work, the doctor (here assumed to be the same distance as travelling to DHS and similar services), shopping and education.

For calculations of kilometres travelled in inner regional, outer regional and remote areas, these have simply been extrapolated from the time use data, with the simplifying assumption that travel speeds in all areas are the same. There are likely to be differences between regions but to our knowledge, data at this level of granularity is not available.

Table B2: Kilometres per trip (one way)

	Metropolitan	Inner regional	Outer regional	Remote
Work	14	11	10	7
Doctor/DHS	9	16	22	20
Shopping	7	7	6	6
Education	16	17	12	8

Sources: Corpuz 2006, Transport SA 2002, Deloitte Access Economics estimates

Out-of-pocket costs per trip in the table below were based on RACQ (2012) estimates of the cost per kilometre of driving, including factors such as depreciation, fuel, repairs and maintenance. These were multiplied by kilometres travelled to estimate out-of-pocket costs.

These costs do not include parking, which was separately estimated based on the ABS Household Expenditure Survey (2011). Public transport fares were also separately estimated in the analysis based on the individual scenarios.

Table B.3: Out-of-pocket costs per car trip (\$, one way)

	Metropolitan	Inner regional	Outer regional	Remote
Work	8.10	7.30	6.50	4.10
Doctor/DHS	5.20	9.40	19.20	29.00
Shopping	4.10	8.90	19.00	29.00
Education	9.30	13.00	15.80	16.20

Source: RACQ 2012, Corpuz 2006, Deloitte Access Economics estimates

APPENDIX C THE VALUE OF LEISURE TIME

In this report, we estimate the value of travel time as equal to the value of leisure time to an individual. We use this measure for travel time as an individual is not likely to value it highly as the alternative, an hour of employment.

Firstly, we base the value of work on average weekly earnings (AWE) of \$1,315 from the Australian Bureau of Statistics, and subtract tax (\$270) and expenses (estimated as \$100 per week, including the cost of transport to and from work, and other work-related expenses) to estimate a net wage. This is then divided by the hours required to earn this net wage. This includes 38 hours of actual work hours, and 10 hours for travel, a total of 48 hours.

Secondly, to convert this hourly value into a value for leisure time, we use a discount factor of 0.45, based on Larson (2004). This implies that one hour of leisure is worth 45 per cent of the value of an hour of employment to an individual.

This results in a value of \$8.86 per hour. We do not present different values for people who are employed and unemployed or out of the labour force. While it is intuitive that an employed individual and a retiree value their time differently, this is not a major focus of this study. Our value of \$8.86 per hour is therefore an average across all people, with individuals likely to value their leisure time both more and less than this figure.

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