



Impacts of Teleworking under the NBN

July 2010

Report by Access Economics Pty Limited for

Department of Broadband, Communications and
the Digital Economy

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Assistant Secretary

Digital Economy and Convergence Strategy Branch

Department of Broadband, Communications and the Digital Economy

GPO 2154

CANBERRA ACT 2601

media@dbcde.gov.au

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Access Economics Pty Limited

ABN 82 113 621 361

www.AccessEconomics.com.au

CANBERRA

Level 1
9 Sydney Avenue
Barton ACT 2600

T: +61 2 6175 2000

F: +61 2 6175 2001

MELBOURNE

Level 27
150 Lonsdale Street
Melbourne VIC 3000

T: +61 3 9659 8300

F: +61 3 9659 8301

SYDNEY

Suite 1401, Level 14
68 Pitt Street
Sydney NSW 2000

T: +61 2 9376 2500

F: +61 3 9376 2501

Report prepared by

Susan Havyatt

Nicki Hutley

Dr Ric Simes

Dr Daniel Terrill

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Glossary

ADSL	Asymmetric digital subscriber line
CBA	Cost-benefit analysis
CBD	Central business district
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide-equivalent
EU	European Union
FTE	Full-time equivalent
GE	General equilibrium
GIS	Geographic information system
ICT	Information and communication technology
NBN	National Broadband Network
OH&S	Occupational health and safety

Executive Summary

Access Economics has been commissioned by the Department of Broadband, Communications and the Digital Economy to undertake an analysis of the benefits of teleworking, including a broad quantitative assessment of the benefits of teleworking.

The term 'teleworking' is used broadly to refer to any work that is conducted outside of the designated place of business. This includes work undertaken at home, use of mobile devices in transit, or at a different place of business. Within this study the focus is on teleworking at home, as this is the form of teleworking where the NBN will be a key enabler.

Teleworking remains relatively uncommon in Australia. Just 6% of workers in Australia reported having teleworking arrangements of any form with their employer in 2006 (ABS 2009). The international rate is higher, with 11% of US employees teleworking at least one day per month (World at Work 2009), while eight European Union (EU) countries report that more than 10% of workers were involved in telework 'a quarter of the time or more' in 2005 (European Foundation for the Improvement of Living and Working Conditions 2010).

Benefits of teleworking

Teleworking brings a range of benefits to the employee, employer and to society as a whole. Key benefits include:

- Time and cost savings from travel avoided – as teleworkers do not travel to work they avoid spending time in traffic, which can be used more productively for actual work, or balanced between work and leisure. They also avoid the expenses associated with travel to work, including fuel costs and vehicle maintenance costs.
- Office expenses avoided – Avaya (2008) estimate that office space can be reduced by one desk for every three teleworkers, with associated floor space and equipment savings. There are also gains through reduced electricity consumption. However these are at least partially offset by increased expenditure for the home office.
- Recruitment and retention gains – geographical location is not a constraining factor for teleworkers, meaning the best credentialed applicant can be employed regardless of location. This increases productivity as the successful applicant is better at the job. Additionally, when an existing employee relocates they may be able to stay on and telework, with the employer avoiding search and productivity costs associated with finding a replacement.
- Increased workforce participation – some of those not presently in the workforce cannot work in a conventional workplace and during conventional hours but may be able to telework. This is particularly true of those who are caring for children or an ill family member. The 'always open' nature of teleworking and ability to remain with those requiring care may see some of these individuals move into the workforce.
- Infrastructure savings – these flow from both teleworkers not using road transport during peak periods, reducing the need for road maintenance and upgrades at least temporarily, and from population decentralisation as teleworkers can live outside of major city centres. As the expenditure on road infrastructure in Australia in 2007-08 by governments totalled \$13.2 billion (BTRE 2009), this gain is potentially large.

Value of the NBN for teleworking

The NBN will be a potential catalyst for growth in teleworking.

The ubiquity and capacity of the NBN technology mean that there will be greater certainty of the technological capacity of teleworkers. This reduces uncertainty about whether an employee can retain their productivity levels when working from home. This also provides greater remote monitoring certainty to employers, as worker output differences more clearly relate to productivity differences.

The NBN will serve as an important enabler through the other technological services it unlocks. For example, high-quality videoconferencing that is available with the high speeds and bandwidth and lower latency of the NBN will improve connectivity with remote workers. Collaborative workplaces with shared desktop viewing and other capabilities are also more readily available, which can be utilised between business offices and with teleworkers.

The wide range of potential applications may mean that scope for teleworking is increased. Teleworking is presently viable in occupations that are predominantly desk-based, however service industries have relied upon face-to-face interaction, while many 'blue collar' industries have historically been location-specific, and these factors have limited the potential for teleworking. The NBN may unlock new applications and business models that make some of these roles amenable to teleworking.

Magnitude of the benefits – detailed methodology

Benefits from fewer workers in the office

The impact of teleworking on office expenses are best assessed through detailed cost-benefit analysis. A range of factors should be considered, including cost savings from reduced floor space and the associated reduction in furniture and ICT infrastructure, reduced expenditure on electricity and other utilities, and reduced rents from lower demand for office space.

Many of these benefits are at least partially offset by corresponding increases in costs for the home office. This is particularly true of ICT costs, where for part-time teleworkers there may be a duplication of costs for the office and home. Other costs in this area include the cost of OH&S compliance for the home office, and security provisions for working remotely across the internet.

Time and cost savings from reduced travel

This, too, is best approached from a CBA perspective, although the results are more unambiguously positive. Factors to be considered include the time spent and distance travelled, the value of that time and the amount of fuel saved and carbon emissions avoided, and the impacts on congestion from removing these vehicles from the road.

There are also time savings for those who do not telework from reduced congestion in the short term, and in the longer term there are gains to the government from reduced infrastructure maintenance expense. Under a sophisticated modelling approach, geographic information systems could be utilised in conjunction with information on which industries are most amenable to teleworking and where their employees live to develop a map of where

teleworking is likely to have the largest impacts on congestion. This will facilitate more detailed analysis of the congestion and infrastructure impacts of teleworking.

Benefits of increased workplace flexibility

The workforce participation impact represents a growth in the size of the labour force. This is readily converted into a proportional increase in Australia’s labour force. This can be used in a general equilibrium model to measure the impact of the increased workforce participation on gross domestic product and a range of other variables.

Gains from higher quality employees and improved employee retention represent increases in labour productivity. The recruitment benefit represents a permanent productivity increase, while retention represents a temporary productivity increase. These can both be converted to a proportional increase in labour force productivity and, again, general equilibrium modelling used to estimate the impact of these gains.

Magnitude of the benefits – high-level estimates

When the high-level benefits of teleworking are aggregated, it becomes clear that the benefits are substantial. If 10% of Australian employees were to telework 50% of the time, the total annual gains from teleworking are in the order of \$1.4-\$1.9 billion per year. These estimates measure the impact of teleworking compared to no telework rather than to the current rate of telework in Australia as there is insufficient data to determine this current rate.

Comparison is also made with the EU benchmark, as set by the Czech Republic. As of 2005, 9% of the Czech workforce reported teleworking ‘almost all of the time’ (held here to be 100%), while an additional 6.2% reported teleworking ‘a quarter of the time or more’ (held here to be 25%). If the Australian teleworking performance were to match these rates of teleworking, the benefits could be in the range of \$2.9-\$3.9 billion per year.

Table i: Total high-level benefits of teleworking (\$m)

Benefit of teleworking	10/50		Czech	
	Low real estate	High real estate	Low real estate	High real estate
Time and cost savings from travel avoided	1,270	1,270	2,760	2,760
Office cost savings (real estate high case)	(350)	130	(330)	680
Increased labour force participation	380	380	380	380
Retention of relocating staff	90	90	90	90
Total	1,390	1,870	\$2,900	3,910

Source: Access Economics estimates

Note: It is assumed that the Czech Republic benchmark does not result in a higher gain from labour force participation and staff retention as there is too much uncertainty concerning this.

These results also assumed that 10% of those that are currently out of the workforce for reasons that may be remedied by telework choose to take up telework for 15 hours per week, and that 10% of those who presently leave their current job because they are relocating would choose to remain in their current job and telework.

Reduced rent from regionalisation

Where businesses choose in the future to locate in an area other than a major CBD as a result of improved regional ICT under the NBN rather than increased teleworking, reduced rents represent a saving. Using a scenario of a business relocating from Melbourne to Bendigo, and a total office size of 200m², the annual saving in rent is some \$13,000.

Concluding remarks

These high level estimates demonstrate that the potential cost savings and productivity gains from teleworking are large. However there are several areas to analyse in greater depth to improve the quality of these estimates, including:

- improved understanding of the potential rate of teleworking;
- geographic location of those who are teleworking; and
- magnitude of the productivity impacts of teleworking.

Access Economics
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1 Introduction

The scope to undertake work while not at the formal workplace greatly increased with the advent of mobile telecommunications and personal computers. More recently, teleworking has become a more direct substitute for work in the office, with access to remote servers and telecommunications services in the home that are comparable to those in the office.

Nevertheless, uptake of teleworking in Australia remains low, with just 6% of employed persons having some form of regular teleworking arrangement with their employer (ABS 2009).

Adequate telecommunication services are critical in facilitating the adoption of telecommuting, both for ensuring teleworking is as productive as work in the office and for encouraging employer acceptance of teleworking. The forthcoming rollout of the National Broadband Network (NBN) and the rapid improvement to telecommunication services it promises has the potential to reduce this barrier to teleworking. As such, there is a clear link between the rollout of the NBN and the potential for additional remote working in Australia.

The NBN will also be important for facilitating remote office location, where businesses are able to decentralise their operations and locate their office in a regional area rather than a major CBD. The quality of service and ubiquity of the NBN will mean that a decentralised office location no longer comes at the expense of reduced ICT services.

Access Economics has been commissioned by the Department of Broadband, Communications and the Digital Economy to undertake an analysis of the benefits of remote working, and an assessment of how the magnitude of these benefits may be quantified.

The report is structured as follows:

- The remainder of Section 1 looks at the definition of teleworking and its uptake in Australia;
- Section 2 looks at the qualitative benefits of teleworking to the employee, employer and the community at large;
- Section 3 considers the approach to quantifying some key benefits of teleworking;
- Section 4 undertakes some very high-level estimates to provide an indication of the nature of the benefits; and
- Section 5 provides some concluding remarks.

1.1 Definition of teleworking

The term 'teleworking' is used broadly to refer to any work that is conducted outside of the designated place of business. This includes work undertaken at home, use of mobile devices in transit, or at a different place of business.

Within the context of this study, the focus is on teleworking in a home context. This is because the NBN will be, for the most part, a fixed broadband service, and therefore primarily of use in

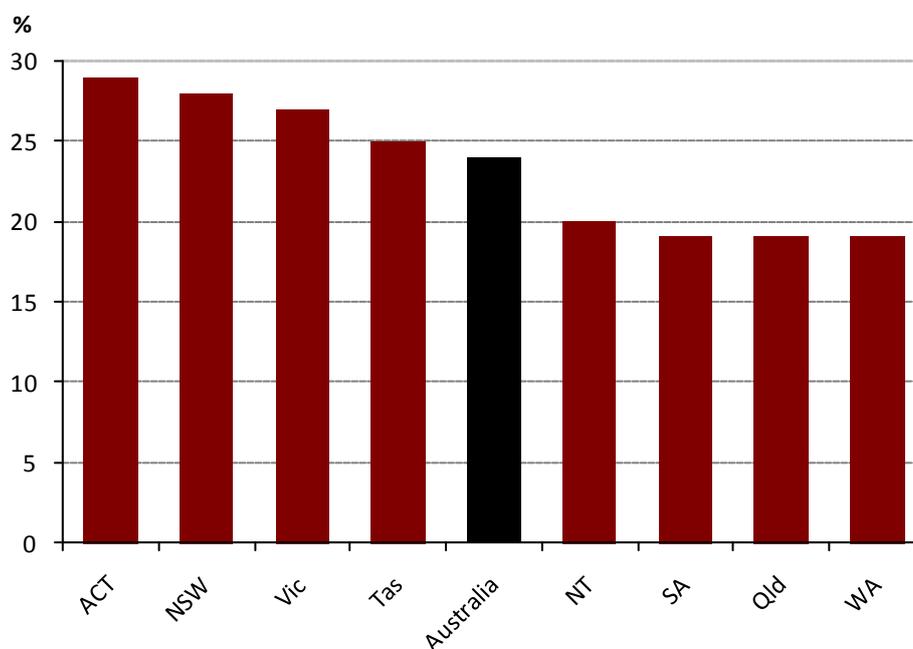
a fixed location, although it is acknowledged that mobile data services may also benefit from enhancements to the backhaul network made possible through the NBN.

1.2 Extent of teleworking in Australia

According to Sensis (2009), 24% of surveyed businesses across all industries had employees that undertook some form of teleworking. This includes all forms of work while away from the office, and this figure does not incorporate any estimate of regularity.

When these figures are viewed on a state-by-state basis, there is a clear trend for higher rates of teleworking in states and territories where a higher proportion of workers are in ‘white collar’ occupations, and lower in states and territories where a higher proportion of workers are in ‘blue collar’ occupations. This relationship intuitively makes sense, as desk jobs are readily performed at a desk that is not in the office, while many blue collar forms of employment have traditionally been highly location-specific.

Chart 1.1: Incidence of teleworking, by employer, 2009



Source: Sensis (2009)

The relatively high proportion of businesses that report at least one employee who teleworks does not accurately reflect the experience of Australian employees, with just 6% of all workers reporting teleworking arrangements with their employer in 2006 (ABS 2009). This figure incorporates all arrangements, from full-time teleworking through to occasional arrangements.

Table 1.1: Teleworking arrangements, Australia, 2006

	Total Employed Persons (000s)	Employed Persons with a Teleworking Arrangement (%)
Type of employment		
Full time	6,786	7
Part time	3,298	5
Sector of employment		
Public sector	1,832	9
Private sector	7,897	6
Household type		
With children under 15	3,721	8
Without children under 15	6,362	5
Total employed persons	10,083	6

Source: ABS (2009)

The Australian experience falls well short of teleworking rates in other countries. WorldatWork (2009) reports that 11% of US employees telework at least one day per month. Teleworking is also more common in the EU, where eight countries¹ report that more than 10% of workers were involved in telework 'a quarter of the time or more' as of 2005. This rate is lower across the EU as a whole, with 7% of employees involved in telework at this same frequency (European Foundation for the Improvement of Living and Working Conditions, 2010). There is a relatively low rate of full-time teleworking in the EU overall, however, with only 1.7% reporting teleworking 'almost all of the time'.

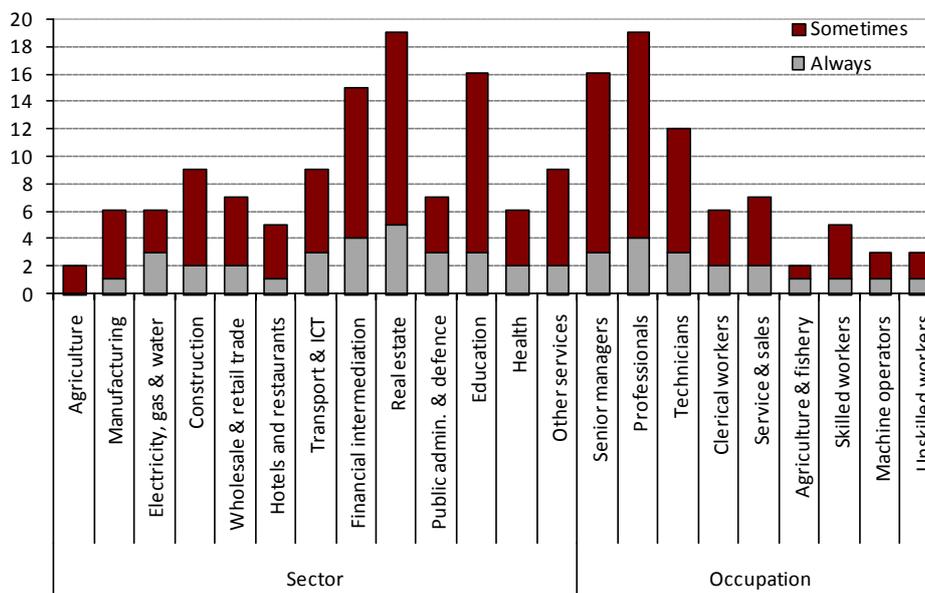
1.3 Industry-level role of teleworking

Teleworking is not equally suited to all industries or roles. It typically suits white-collar roles – particularly those which are predominantly desk-based rather than more hands-on roles such as health care, or teaching at the junior stages, where active supervision of students remains important. Those positions which are presently highly location-specific such as construction or mining will continue to have some site specific roles, which cannot be as readily undertaken by teleworking without incurring very large capital costs. Additionally, customer service-centric industries, such as accommodation and food services, still require face-to-face contact and as such may be less amenable to teleworking.

To date there has been little in the way of analysis of the Australian experience of teleworking by employees. However a study of teleworking rates in the EU (European Foundation for the Improvement of Living and Working Conditions, 2010) broadly demonstrates the relationship between desk-based work and propensity to telework (Chart 1.2).

¹ Czech Republic, Denmark, Belgium, Latvia, the Netherlands, Estonia, Finland and Poland.

Chart 1.2: Level of telework in the EU27, by sector and occupation (%)



Source: European Foundation for the Improvement of Living and Working Conditions (2010)

Based upon these broad trends, around 2.3 million Australian workers may be readily able to undertake teleworking using present-day technology (Table 1.2).

Table 1.2: Employment by telework-ready industries, June 2009

	Employment (000s)
Information media and telecommunications	175,000
Rental, hiring and real estate services	371,000
Professional, scientific and technical services	922,000
Administrative and support services	732,000
Public administration and safety	66,000

Source: ABS 2010a

The NBN will likely expand the scope of telework potential, with scope for some teleworking in sectors that require use of high-quality videoconferencing or similar services not reliably available using existing broadband speeds. Information about these possible applications is not yet widely known, making the potential for additional telework under the NBN difficult to ascertain.

2 Benefits of teleworking

The potential benefits of teleworking are wide-ranging, and accrue to the teleworking employee, their employer, and society as a whole. Some of these benefits are direct financial impacts, while others are more qualitative.

2.1 Employees

Travel savings

For an employee, adopting telework (be it part or full time) brings financial gains from avoiding travel to work. This is primarily in the form of the cost of fuel avoided (or, where the worker takes public transport, the cost of that transport) and varies according to the distance between home and work. For those who use a private vehicle to travel to work, there are also reduced vehicle maintenance costs and, in some cases, parking expenses avoided.

Teleworking employees also avoid the time cost of travelling to and from work. In 2005 this amounted to three hours and 37 minutes on average per week for all workers (The Australia Institute 2005). This time could instead be spent increasing the employee's productivity through undertaking additional work, or split between additional work and leisure time.

In addition to the improved time flexibility avoiding travel creates, teleworking has broader workplace flexibility outcomes. Teleworking enables the employee to manage their workload around family needs, as – where the workload permits – unconventional hours can be worked. This has the potential to ease the costs of childcare for families where both parents work, although it should be noted that teleworkers should not be caring for children (or anyone else) while they are 'at work'. This may mean the employee is able to work more hours than would otherwise have been the case, making up for the hours they are not available during the conventional business day at other times.

Workforce participation

The scope for this improved work/life balance and ability to work around family needs means teleworking makes employment more accessible for those who are carers. The inability to leave those they are caring for, be they a dependant child or a family member with a long-term illness, to go to work forces many carers out of the workforce altogether. The ability to undertake paid work from home will enable some of these individuals to join or return to the workforce.

Carers are not the only group for whom teleworking is such an enabler. Those who have a long term illness or disability that makes a conventional workplace inappropriate – due to accessibility or need for specialised equipment – may be able to telework in their own home where accessibility is not a concern and the equipment is likely already in place.

Qualitative benefits

These impacts, while clearly beneficial, are very qualitative and subjective in nature, making them difficult to quantify.

Teleworking gives individual employees greater scope to choose where they live. The location of work has long been a key determining factor for individuals when choosing a home, as the home and office have needed to be in reasonably close proximity. Full-time teleworking, however, eliminates this need, meaning an individual who would prefer to live in a more remote area is no longer constrained by their employment.

The scope to work from home around personal circumstances, and avoiding the time, expense and stress of daily commuting, may lead to those who telework gaining greater job satisfaction. The building of arrangements to suit the individual's needs, and the flexibility demonstrated by employers to show that they value the contribution of teleworkers, leads to the employee having a generally more positive perspective of their employer and work. This improved morale and reduced stress from not travelling may result in higher productivity from the worker.

2.2 Employer

Recruitment and retention

The option to telework means that the firm finds it easier to recruit and retain staff. When seeking new employees, individuals who do not live in the city where the employer's office is located can still be hired if teleworking is available. This means that the employer is able to recruit the 'best employee' rather than the 'best employee in the area'. The ability to recruit these superior workers brings real productivity gains to the employer.

Similarly, there may be gains to staff retention through allowing telework, particularly for relocating staff. When an employee resigns as they are moving away from the location of the employers business, they take with them important corporate knowledge and particular job skills, and the employer incurs hefty expenses in search costs as well as lost productivity in finding a replacement. However if teleworking were available as an option to such an employee, they may be able to stay, avoiding these costs to the firm. The ubiquity of the NBN will mean that teleworking can be offered to such an individual without concerns about the quality of communications infrastructure in their new location.

Office expenses

As more employees take up teleworking, the requirements of the office decline. More teleworkers equates to fewer 'in-office' workers, and as the number of teleworkers grows there is scope to cut the overall size of the office, reducing the amount of rent paid. This flows through to lower utility expenses as air conditioning and lighting is used less, and some reductions in ICT and other infrastructure. As the number of teleworkers across all firms in a location increases, the overall decline in demand for office space may see rental rates decline.

However these office savings are effectively shifted to the employee, who pays for the power and floor space in their own home. The office space savings to the business may therefore be at least partially offset by the need for employers to cover some portion of these costs. This is particularly true if the NBN does become a major catalyst for teleworking, as there will be a need for ICT infrastructure in the household to take advantage of the gains to teleworking from high-speed broadband, including webcams for video conferencing and security equipment for work over the internet.

Office relocation

As the office no longer necessarily needs to be in close proximity to all employees, there is less need for it to be centrally located or in a major transport hub. High levels of teleworking lead to scope for head office to choose to locate in an area where rent is cheaper, or where there may be other location benefits such as proximity to suppliers or customers.

The ubiquity of the NBN means that, after its rollout, location in a more regional area will no longer come at a cost of reduced ICT service quality, and that productivity can be maintained. This has not been feasible under existing ICT services, where moving out of major CBDs involves moving from ADSL2+ services to, in some cases, basic broadband.

There is a limit to how far this decentralisation may go however as some administrative staff, including IT and recruitment staff, will still need to work in this office. It is realistic to expect that some businesses may choose to locate their operations in regional centres; however it is unlikely that these relocations will venture as far as small towns.

Absenteeism

Higher rates of teleworking can make a firm more resilient to the impacts of adverse events such as extreme weather events or outbreaks of disease. While weather is generally a less critical factor in Australia than in other countries, adverse events such as epidemic threats (for example the H1N1 virus in 2009) or transport failures are likely to have a reduced impact on a firm whose employees are able to telework through the event.

As well as reduced absences in adverse events, the availability of teleworking may lead to a reduction in absences due to illness of either the employee or a family member. Where an employee has a minor illness such as a cold that forces them to stay home to avoid spreading disease, even though they are capable of working, they would instead be able to complete a full day of work at home. Similarly, when a child or other family member is at home ill, a teleworker will be able to retain at least some productivity.

2.3 Society as a whole

Workforce participation

As noted above, those who are currently outside of the workforce due to disability or illness, or because they are providing full-time care for a dependant child or family member with a disability or illness may be able to join or return to the workforce if they could participate through teleworking.

Engagement in the workforce by some of these individuals will increase total economic output, increasing the overall welfare of citizens.

Transport and infrastructure gains

As well as the private financial savings attained by teleworking individuals from avoiding travel to work, this avoided travel generates a reduction in greenhouse gas emissions. This reduction in emissions is a benefit of the private decision that extends to all residents through lower pollution levels.

Those who are teleworking also create travel benefits for those who continue to travel to work. The removal of the teleworkers' vehicles from the roads leads to lower road congestion, with improved traffic flow for those who are driving in peak periods. Some time and cost of travel benefits are therefore passed on to those who are not teleworking.

As the rate of teleworking becomes significant, infrastructure benefits emerge, as there is less need to build additional transport capacity as demand declines. This represents a financial saving to governments, however in the long run the value of gains to reduced congestion may decline as the reduced investment in infrastructure may see congestion increase again.

Further, the population decentralisation that may result from teleworkers choosing not to live in major centres reduces infrastructure pressures. Such population decentralisation would see infrastructure use more evenly spread across regions, spreading the load and reducing the incidence of critical infrastructure black spots.

Participation in the local community

The improved work/life balance that teleworkers are able to achieve may see them find more time to be involved in the community. The time that was previously spent travelling to and from work may instead be put towards community organisations and volunteer activities. This may occur as parents seek to be more involved in their children's activities, or as teleworkers are able to structure their workload around community-based activities that would otherwise have taken place at a time when they were in the office.

2.4 Potential downsides of teleworking

While there are many potential benefits of teleworking, some potential downsides do exist to temper enthusiasm. For individuals, there is a risk of loneliness that arises from not interacting with co-workers in the workplace. This may be mitigated somewhat through effective use of ICT services that will be readily available at home under the NBN, such as high-quality video conferencing.

Overall acceptance among employers for regular teleworking remains low, and this is partly because employers are concerned about lower productivity from teleworkers. Although there is little evidence that those who already telework are any less productive than their in-office counterparts, employers are concerned that the lack of direct supervision of a teleworker may see them lower productivity due to the distractions of home. While some employees may genuinely not be suited to teleworking because of the lack of motivation, this is a problem that can in most cases be remedied through plans to use alternative productivity metrics, for example volume and quality of output.

Some of the scale economies of employees sharing an office space may also be lost with teleworking. A key example of this is in internet connections, where pricing per unit of data is substantially lower for high volume plans, but household connections for a single teleworker (with associated smaller volume plans) mean the average cost of data increases for the firm. There may also be substantial costs involved in setting up networked phone systems (where the employee has the same direct extension line in the office and at home), appropriate OH&S arrangements, and other services required to ensure the home office is as functional as the traditional workplace.

These lost scale economies may be partially mitigated through encouraging the use of digital solutions, for example the use of 'soft' phone systems where the phone line connects to the computer an individual is working on, reducing phone network costs.

2.5 Impact of the NBN

Teleworking as it stands is broadly available under current internet standards, at least for those who live in metropolitan areas where ADSL or higher speeds are commonplace. However there are several reasons why the NBN may have an impact on the uptake of telework in the future.

- Fibre is a more reliable technology than existing broadband infrastructure. Fibre results in fewer slow downs due to congestion than other technologies, while the wireless and satellite solutions under the NBN will also be more reliable due to greater in-built capacity and fibre backhaul. The improved quality and reliability will reduce uncertainty about whether it is possible for teleworkers to remain as productive as when they are in the office and encourage employers to utilise teleworking as part of their business.
- The ubiquity and cross-network reliability of the NBN will ensure that the workload will be spread more evenly among teleworkers, as there will no longer be discrepancies among teleworker productivity due to differences in household technology. This provides greater remote monitoring certainty to employers, as worker output differences more clearly relate to productivity differences rather than differences in technical capacity.
- New applications that will make it easier to work remotely will become available under the NBN. A key example is quality of service video conferencing, as high speeds and low latency mean video conferencing approaches the physical reliability of face-to-face discussion.
- The speed of data transfer will facilitate more reliable use of remote servers, as files can be downloaded and uploaded faster and with more reliability about the speed at which transfer will take place. This will be particularly important where the nature of the business involves very large files, such as in architecture and the planning approvals process where electronic file transfer is presently a laborious process.
- The NBN will likely widen the potential for teleworking, with some industries and careers opened to teleworking for the first time as new applications become available. Tertiary education is one such example, where high quality video conferencing means both the teacher and student can attend lectures remotely, improving the productivity of the lecturer and increasing access to classes.
- The NBN will facilitate a more collaborative workplace across businesses and offices. An individual teleworking can participate in this process, while a business can be located in a regional area rather than a major CBD and continue to work effectively with other firms.

These gains may mean the NBN rollout acts as a catalyst for teleworking. The improved technology standards enable employers to view remote working in a more positive light, stimulating uptake of both employees working from home and large firms relocating to more regional areas.

3 Approaches to quantifying the benefits

Certain benefits associated with teleworking, such as improved work/life balance and staff morale, are less readily quantified than others. The focus of this chapter is on those benefits that *can* be readily measured in dollar value terms.

There are two main preliminary steps required to quantify the benefits of teleworking that will flow from the rollout of the NBN:

- identification of the teleworking *take up scenarios* – this will be established using a range of data based on the experiences of other countries, augmented by local research and/or surveys to ensure relevance to the Australian workforce; and
- the *direct and indirect consequences* of take up of teleworking, as detailed in the previous chapter.

Suggested approaches to these steps are described in this chapter.

3.1 The teleworking take-up scenario

The first challenge is to quantify the take up rate for teleworking: this can be developed drawing on existing evidence from other countries, augmented with local research and additional surveying to ensure relevance to, and consistency with, Australian employment, economic and demographic trends.

In order to fully quantify the link between the NBN and future uptake of teleworking, it would be necessary to identify the existing barriers to teleworking in an Australian context. This could be done using a behavioural model where the quality of the telecommunication services is one of the variables explaining the degree of adoption of teleworking. Unless suitable data already exist, this may require additional social research.

In designing the take-up scenarios, considerations include:

- whether any increased teleworking is in the form of full-time or part-time teleworking:
 - this distinction is important as some gains will be driven by the number of teleworkers while others will be driven by the hours spent teleworking;
- industry focus – not all industries are equally suited to teleworking, even allowing for the fact that the NBN is likely to widen the future applicability of teleworking:
 - it is therefore important that only those occupations where teleworking is viable are considered;
- regional implications – teleworking will have higher take-up rates in areas where amenable industries form a proportionally greater share of the economy; and
- sensitivity analysis – the methodology will necessarily be based on a number of hypothetical factors and testing of assumptions is therefore important.

3.2 The primary effects of teleworking

There are three distinct categories of benefits that may be derived from teleworking:

- *in-office benefits* accruing to the employer from fewer workers at the business premises;
- those related to *reduced commuting distance or time*; and
- those related to *greater workplace flexibility*.

3.2.1 Benefits of fewer workers in the office

Benefits from this category would be quantified by a Cost Benefit Analysis (CBA) type framework, recognising that some of the benefits of reduced workplace operational costs may be offset by the potential for a corresponding increase in resource requirements in the home. Considerations in such a CBA would include:

- Estimates of how much floor space and in-office infrastructure could be reduced if the given change in teleworking occurred – savings are larger if employees work from home full time or if the day(s) employees work from home are staggered over the week. By way of indication, the Canadian Telework Association² suggests that teleworking enables the elimination of one desk in the office for every three teleworkers.
- Location considerations – this could be moving to a cheaper area, or remaining in the CBD and benefiting from the fact that smaller square metre requirements push demand and therefore rents in the CBD down.
 - Differences in average per square metre rents between regions can be used to estimate overall savings of relocating the office. However this should be offset for the first year with an estimate of relocation costs.
 - The impact of the fall in demand on rental prices in the CBD area may be small as there may already be unmet demand.
- These benefits need to be offset by additional home office operational costs, where considerations include:
 - What infrastructure is to be provided in the home by the firm – some of these costs could be minimised, for example use of a laptop that is used both at home and in the office, however utility costs are likely to be high for the frequent teleworker. Some of these may need to be compensated for by the employer, but either way these costs are merely transferred rather than eliminated, and so should not be counted as a benefit of teleworking.
 - There may be a need for additional ICT infrastructure in the principal place of business as well as the home office. While the NBN will facilitate the rapid transfer of data, equipment such as remote servers are required to make files available for transfer. Additionally, there may be a need for security equipment (e.g. tokens) to mitigate security risks.
 - OH&S in the home office remains the concern of the employer – this may imply OH&S checks on the home office and remedial action by the firm.

3.2.2 Benefits of reduced travel time

There are two main ways that teleworking can reduce travel time:

- benefits to teleworkers from the reduction in distance travelled, and

² www.ivc.ca/costbenefits.htm

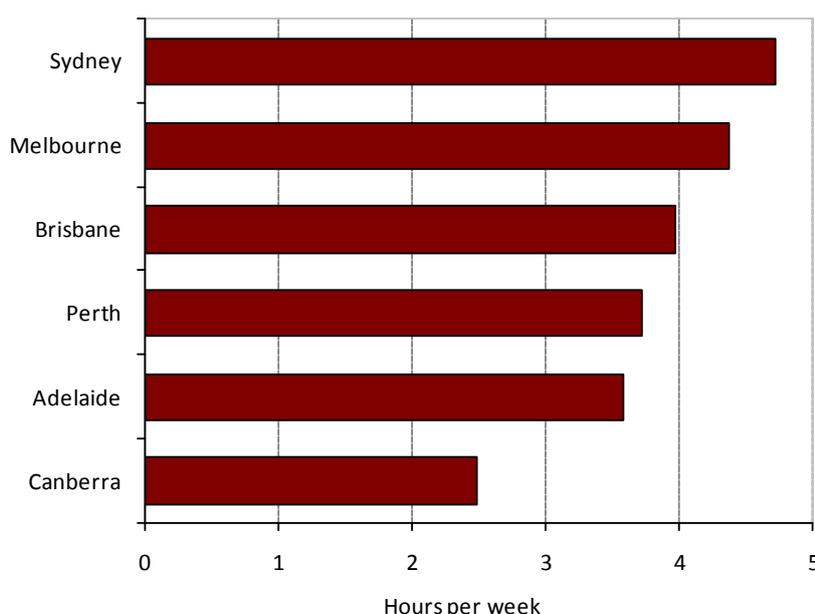
- benefits to those who do not telework, who gain from increases in travel speed that flow from the reduced congestion created by teleworkers staying off the roads.

To quantify the reduction in commuting time and distance when the place of work changes – a reduction that is a direct function of reduced distance travelled – it is possible to utilise detailed spatial data held by Australian statistical agencies and road traffic authorities, generally in GIS form. These data typically start with Census Journey to Work data, which measures the origin and destination of commuter’s travel to work and the mode by which they travel. The resulting distance travelled by each commuter can then be calculated and, when the data is crossed with travel time and congestion data on the transport networks, the travel time of each commuter can be estimated. The data recognise that the travel time saving potential is not simply a function of distance travelled, but also reflects road type, road quality and congestion.

The true potential of teleworking to reduce travel time and distance is best appreciated when travel time data are further crossed, once again in GIS, with the industries in which people work, recognising the different take-up rates for teleworking across different industries. This enables detailed analysis of the travel time and distance avoided through teleworking, and mapping of the roads where the potential benefits of teleworking may be large.

The average time spent travelling to and from work for capital cities can be derived at a high level from The Australia Institute 2005 report. The report found that, among Australians who travel to and from paid work, the mean commuting time is three hours 37 minutes per week. Among full-time employees, this is four hours and ten minutes per week. Most significantly, this report highlights the limitations of using national averages because of the stark differences between regions, as illustrated in Chart 3.1 below. The regional dimension of where teleworking is likely to occur is critical to accurate quantification of the benefits.

Chart 3.1: Average weekly commuting times in selected capital cities



Source: The Australia Institute (2005)

The quantification also needs to recognise the gains to those who continue to travel to work, as while they travel the same distance, their travel time is reduced.

Quantification of the reduction in travel time due to reduced congestion is more challenging. Ultimately, it requires the use of the results of traffic modelling that, in simplistic terms, relate travel speed and time to the level of traffic on any given road. This benefit may be short-term as, in the longer term, these additional benefits may instead be realised through reduced or deferred infrastructure expenditure on road and public transport networks (see below).

Once changes in travel times and distances due to telecommuting are quantified, it is then possible to estimate a range flow-on benefits. These include:

- the value of the reduced commuting time – this can be estimated using standard wage rates for industries and regions;
- the value of fuel savings – using average fuel consumption rates applied to the travel distance data; and
- CO₂ emissions avoided – based on fuel savings and the relevant fuel emissions factors, which are in widespread use in national greenhouse accounting.

It is also possible that the adoption of teleworking may change both the location of peoples' work and residence; indeed the structure of entire cities may change if adoption is widespread. Benefits accruing from this would be very difficult to reliably quantify, but a qualitative consideration of how telecommuting may change the layout of cities, and where such changes are likely to be consistent or inconsistent with contemporary urban planning principles, is possible. In the broadest planning context, commuting patterns have heavily influenced how our cities have developed, where people have chosen to live and do business, and the policies planners have pursued. With the underlying force of people needing to live close to their place of employment (or vice versa) reduced, the cities may evolve very differently in the future.

Infrastructure and planning impacts

The benefits from reduced congestion above may decline over time, replaced with gains from deferred infrastructure spending. As teleworking is adopted and there are fewer vehicles on the road, there is less need to upgrade roads to stop congestion from getting worse. Similar deferral of infrastructure spending is likely with public transport networks and rolling stock.

This deferred infrastructure spending will be highest in the areas where teleworking has been most widely adopted and congestion has been reduced the most. These are identified through the GIS process for estimating congestion benefits above. The rate of teleworking for those who would otherwise utilise these roads for the journey to work can be used as an estimate for the proportional decline in road maintenance expense.

Information on current road maintenance costs (to be obtained from road and transport bodies) can be used to derive information of maintenance expenses in the absence of teleworking. The proportional decline in road maintenance expense is then applied to derive an estimate of the decline in road maintenance expense for the first year.

According to BTRE (2009), 2007-08 government expenditure on roads totalled \$13.2 billion across all levels of government. This figure incorporates road maintenance, upgrades and the

construction of new roads, and is largely induced by the use of roads and need to ease quality and congestion concerns. This expenditure is growing rapidly, with average annual growth in road expenditure over 2000-01 to 2007-08 at 8.2% (BTRE 2009). Therefore, even if the impact of teleworking on congestion allows for a relatively small proportional decline in the rate of road maintenance the infrastructure savings will be large.

The benefits to infrastructure will decline over time as congestion slowly increases again, until eventually congestion is the same as it was without teleworking, and road maintenance expenses reach the same level as previously. However how quickly this occurs may be impacted by the rate at which teleworking increases flexibility in working hours. As the benefits of a flexible workplace in terms of teleworking are realised other flexible work practices may also be adopted, including greater flexibility in working hours for those who still work in the office. This would further reduce road congestion in peak periods, allowing for further savings in infrastructure expenditure.

3.2.3 Benefits of greater workplace flexibility

The benefits of greater workplace flexibility are more challenging to quantify, as there is less publicly available data to inform the task. The benefit of greater workplace flexibility is realised by both the employee and employers, so the gains from workplace flexibility must be considered from both perspectives.

On the employee side, the key interest is in quantifying how much the employee requires the flexibility afforded by teleworking, alongside all other attributes of an employer that they may value. The emerging research tool of choice modelling is suited to this task, as it focuses on modelling how individuals behave under different scenarios. Depending on the choices they make, the value of different scenarios can be revealed.

On the employer or company side similar social research would be equally valuable, focussing this time on experiences with teleworking in the past, or their expectations in the future.

The two main flow-on benefits of this greater workplace flexibility appear to be in improved workplace participation and in improved recruitment and retention rates.

Improved workforce participation rate

The first step in this process is to determine an estimate of how much the participation rate will increase. This involves identifying those who could be attracted to join the workforce by the availability of teleworking.

A breakdown on those not in the labour force in Australia and their reasons for being out of the workforce is detailed in Table 3.1.

These figures suggest that around one third of those outside of the work force are so for reasons that may be remediable in some way by the availability of teleworking positions. However not all of these individuals will work simply due to the availability of teleworking. It is necessary to develop estimates of what proportion of these people may be encouraged into the workforce if working from home were an option.

This estimate derives an improved workforce participation rate. The resulting proportional change in the size of the labour force can be used for modelling (i.e. a change from the status quo), with this fed into Access Economics' in-house general equilibrium (GE) model to derive the economic impact.

Table 3.1: Persons not in the labour force, by reason, 2009

Main reason	Persons	% of those outside labour force
No jobs in locality or line of work	24,000	2.9
Own short-term illness or injury	25,500	3.1
Own long-term health condition or disability	74,400	9.0
Pregnancy	2,400	0.3
Ill health of family member	22,400	2.7
Caring for children	150,800	18.3
All other reasons	523,900	63.6
Total	823,400	100.0

Source: ABS 2010c

Improved recruitment and retention

Telstra (2008) suggest that the cost of staff turnover – incorporating search costs, training costs, and temporary reduction in productivity as the new employee learns the role – is as much as 15% of the annual salary of the staff member lost. The US Department of Labor suggests a higher figure of around 33%³.

It is estimated that in the UK, around 7% of all voluntary staff departures occur due to the staff member relocating (CIPD 2009). The costs of replacing these individuals could be avoided by the availability of teleworking, allowing them to effectively take the job with them. The impact of this includes the saved search costs, but also a productivity increase.

- This is a temporary increase in productivity relative to a baseline as eventually the new employee who would have replaced the existing staff member develops the corporate knowledge and skills, closing the gap.
- Bliss & Associates in the US estimate that the new employee has only 25% productivity in weeks 1-4, 50% productivity in weeks 5-8, 75% productivity in weeks 9-12, and 100% productivity thereafter.
- There is an additional productivity gain to staff involved in the recruitment process, and for those who would have trained the replacement.

There are further productivity gains from being able to hire the 'best' worker for the job at any time. Without teleworking employers are able to recruit the 'best in the area', however under teleworking the best employee and the employer no longer have to be in the same city, or even state.

- This superior worker will represent a permanent increase in productivity as they will be able to do the job better than the 'best in the area' at all times.

³ <http://www.referenceforbusiness.com/encyclopedia/Eco-Ent/Employee-Turnover.html>

- The value of this productivity gain will depend upon the difference between the ‘best’ and ‘best in the area’ and will not be consistent from position to position.

The two resulting proportional gains to productivity – for retention and recruitment – can be fed into the GE model to generate estimates of the economic impact of teleworking on staff turnover and recruitment.

3.3 Costs of additional teleworking

While the benefits from teleworking are potentially large for both employer and employee, there are likely to be some costs (beyond mere home office expenses) from teleworking.

- Transition costs – there are likely to be some temporary productivity costs as employees commence teleworking. Both the teleworker and their colleagues with whom they previously shared an office space will require some time to adjust to new ways of approaching their work, through online communications and, in the case of the supervisor in particular, remote supervision. As time is spent making these adjustments, there will be a short-term dip in productivity levels.
- Workflow management procedures – this is particularly the case where formal workflow arrangements are not in place or are limited. While the employer does not need to have constant monitoring processes to ensure employees who telework remain productive, there is a need for formalised structures around workload management as teleworking means it is less obvious when an employee is over or under worked. These are unlikely to impose a significant cost in the long run but may involve some initial start up productivity costs as systems are developed.
- Culture change costs – if the NBN is to lead to gains in the rate of teleworking in Australia there is a need for some cultural change in workplaces. Presently the co-workers and employers of those who telework tend not to view it favourably; it is commonly seen as something to be tolerated rather than encouraged. If teleworking is to be utilised as a business solution more regularly there is a need for employers to induce a cultural change and improve worker acceptance of teleworking.

4 High-level estimates of benefits

Utilising publicly available information about the experience of teleworking outside of Australia, as well as some Australia-specific data, some broad estimates of what the benefits of teleworking in Australia may look like can be generated. This approach has been adopted for four benefits of teleworking:

- Time and cost savings from reduced travel to and from work;
- Savings from reduced office space requirements;
- Gains from increased labour force participation; and
- Savings from improved employee retention of relocating workers.

In addition, an estimate of the potential savings to a business from relocating the office to a more regional area is developed.

These estimates assume that the workforce is represented by the total employed persons in Australia in April 2010, some 11.0 million workers (ABS 2010b). No assumption is made for these high-level estimates regarding industry of employment or geographical location of workers.

4.1 Time and cost savings

10/50 scenario

Each impact for time and cost has been estimated using a 'what if' scenario of 10% of all employed Australian workers teleworking 50% of the time. These representations do not mean that all teleworkers do so exactly half of the time, but rather that this captures a broad spectrum of teleworking frequency. Similarly, use of these numbers is not intended to provide any indication of whether this is an attainable rate of teleworking.

These estimates measure the impact of teleworking compared to no telework rather than to the current rate of telework in Australia. This is because, while it is known that some Australians have teleworking arrangements with their employer (6% of the workforce, ABS 2009) no information is available as to the frequency of this teleworking. As a result it is not possible to establish an Australian baseline rate of telework.

The Australia Institute (2005) estimated the average commute per week in Australia to be three hours and 37 minutes, an average of 43 minutes per day⁴. Under this teleworking scenario, over 41 million hours in commuting time would be avoided each year. Using the average full-time hourly wage in Australia of \$30.58, this time saved is valued at \$630 million.

There is little in the way of readily available data concerning the distance driven to work in Australia. However Avaya (2008) have developed an estimate for the average US round commute of 29 miles (46.4km), which is used here for broad comparison. Based on this figure,

⁴ See previous footnote.

the mileage saving from 10% of employed Australians teleworking 50% of the time would total more than 1.3 billion kilometres per year.

In order to convert this into the value saved on fuel expenses, a fuel consumption rate and price of fuel are required. The average cost of fuel for the week ending 9 May 2010, 130.2 cents per litre (Australian Institute of Petroleum) is used for price, while the fuel consumption rate is derived as the average of the five most popular vehicle models⁵ in Australia by sales in 2009 (Federal Chamber of Automotive Industries). This yields an average fuel consumption rate of 9.32L/100km, or 10.7 kilometres per litre.

Based on this figure, over 120 million litres of fuel will be saved from 10% of Australian workers teleworking half of the time. This equates to a cost saving to households of around \$160 million per year. This is a conservative figure as it does not include the benefits of reduced full consumption for those who continue to travel to work that result from improved traffic flow.

Based on the saving in fuel emitted, it is possible to estimate the saving in greenhouse gas emissions. The burning of one litre of petrol produces 2.56kg CO₂-e (National Greenhouse Accounts, 2009). The 120 million litres of fuel saved under this scenario, therefore, avoids the emission of some 320,000 tonnes of CO₂-e. A standard value of \$20 per tonne of CO₂-e avoided yields a value of \$6 million in emissions avoided. Again, this only includes the emissions of those who telework and not the flow-on impacts of emissions from improved traffic flow.

There are some infrastructure benefits from the reduced traffic demand, as the volume of traffic on the roads eases. Assuming teleworking is spread evenly across the working week, teleworking reduces the amount of traffic at peak periods by around 5%, although the actual decline will be slightly less than this as not all vehicles presently on the roads during congested periods are travelling for work.

BTRE (2007) estimated the cost of congestion in Australian cities to be \$9.4 billion annually. Assuming there is a linear relationship between traffic volume and congestion, along with its costs, this implies that this hypothetical rate of teleworking would result in a \$470 million reduction in congestion costs.

Table 4.1 presents a summary of these results. Overall the value of 10% of the population teleworking 50% of the time would be over \$1.2 billion.

Table 4.1: Time and cost savings of teleworking – 10/50 scenario

Impact	Change	Approx. Value (\$m)
Time savings	20 million hours in commuting	630
Fuel savings	120 million litres of fuel	160
Carbon emissions avoided	320,000 tonnes CO ₂ -e	6
Congestion costs avoided	5% fall in traffic	470

Source: Access Economics Estimates

⁵ These are: Holden Commodore, Toyota Corolla, Toyota Hilux, Mazda3, and Ford Falcon.

Sensitivities

In order to assess the sensitivity of these results to changes in the rate and frequency of teleworking, a range of different scenarios are used to compare the results. These are:

- 20% of the workforce teleworking 50% of the time – this results in a doubling in overall number of hours of teleworking, providing evidence of how the number of teleworkers drives these results.
- 10% of the workforce teleworking 100% of the time – again, this is designed show the impact of the frequency of teleworking on the benefits. The total number of hours teleworked here are the same as for the second scenario.

In addition to these sensitivity analyses, two additional scenarios are considered. The first of these considers a scenario where the rate of teleworking matches that of the EU average in 2005 (European Foundation for the Improvement of Living and Working Conditions 2010, 2010). This implies that 1.7% of the population telework ‘almost all of the time’ (held here to be 100% of the time) and an additional 5.3% of the population telework ‘a quarter of the time or more’ (held here to be 25% of the time).

The second of these scenarios considers a rate of telework that matches the EU benchmark, the Czech Republic (European Foundation for the Improvement of Living and Working Conditions 2010, 2010). In this scenario 9% of the population telework ‘almost all of the time’ (again held to be 100% of the time) while an additional 6.2% telework ‘a quarter of the time or more (again held to be 25% of the time).

These estimates are run through the same estimates process as the initial estimates above.

Table 4.2: Sensitivity estimates (\$m)

	10/50	20/50	10/100	EU	Czech
Time savings	630	1,260	1,260	380	1,330
Fuel savings	160	320	320	100	340
Carbon emissions avoided	10	10	10	4	10
Congestion costs avoided	470	940	940	290	990
Total	1,270	2,530	2,530	774	2,670

Source: Access Economics estimates

These results suggest that time and cost savings associated with teleworking are related to the total time teleworked rather than the number of people teleworking. This is broadly in line with expectations as, provided teleworking is spread evenly across the days of the week, the number of vehicles and load on roads moves in proportion with the rate of teleworking by number of days teleworked rather than the number of individuals teleworking.

High-level figures suggest that, if the Australian teleworking rate could equal that of the Czech Republic, the benefits in terms of time and cost of travel to work could be some \$2.7 billion. The relatively high frequency of telework in the Czech example, with 9% of the workforce teleworking almost 100% of the time, makes the overall result for the Czech Republic relatively high.

4.2 Office cost savings

As with time and cost savings above, these have been estimated using a ‘what if’ scenario of 10% of all employed Australian workers teleworking half of the time.

According to the Canadian Telework Association, there is a ratio of roughly three to one for teleworkers and office savings. That is, for every three full-time equivalent (FTE) teleworkers, one less desk is required. Where each teleworker is working from home one day per week, five teleworkers would equate to one FTE teleworker, meaning that for every fifteen part-time teleworkers one desk space is saved⁶. Overall, 10% of Australian employees working from home 50% of the time would enable Australian businesses to remove more than 180,000 desk spaces.

The associated real estate costs are highly uncertain. Avaya (2008) indicate that the floor space saving from each FTE teleworker varies between 30 and 100 square feet, depending upon the seniority of the teleworkers. The rental savings in the US range from \$US900-\$US3,000 per desk per year, or \$1,006-\$3,355 in Australian dollars. No assumption regarding the difference between rental rates in the US and Australia is made here.

These rental rates give us a range of the total real estate costs saved from teleworking in Australia in this ‘what if’ scenario, with a low case of \$210 million in rental expenses avoided, and a high case of \$690 million in rental expenses avoided. As the rate of teleworking increases, lower demand for office space will also see rents fall however this is not quantified here.

The impact of reduced energy consumption in the office is not immediately clear, and will be highly dependent upon the characteristics of the individual and firm. As a broad indicator, Sun Microsystems⁷ conducted an audit of electricity consumption by employees working in the office compared to its teleworkers, and found that those in the office consumed more than twice as much as teleworkers, some 130 watts per hour compared to 64 watts per hour for the teleworker. This implies a saving of 66 watts per hour from teleworking.

Applied across the hypothetical 10% of the Australian workforce 50% of a full time load, this results in a total reduction in energy consumption of around 75 million kWh per year. Using a base price of electricity of 16.72 cents per kilowatt hour⁸, this would lead to approximately \$13 million in reduced electricity expenditure, even if the employer covers the cost of electricity consumption by the teleworker while they are working.

There are also ICT impacts of teleworking. This includes savings from reduced in-office infrastructure, but also increased costs of providing ICT infrastructure in the home office.

It is assumed that ICT needs in the office decline at the same rate as desk requirements – i.e. one desktop computer plus phone for every three FTE teleworkers, with both upgraded every

⁶ This analysis effectively assumes that these teleworkers are located across businesses in multiples of 15, as saved desk space cannot be shared across firms.

⁷ From Computer World, “Sun’s ‘Open Work’ program sheds light on telecommute savings, accessed via http://www.computerworld.com.au/article/251218/sun_open_work_program_sheds_light_telecommute_savings/?fp=512&rid=1&fpid=477786036

⁸ EnergyAustralia NSW price for general supply, first 2,500kWh per quarter

three years. Across Australia with 10% of workers teleworking 50% of the time, this would reduce spending on ICT in the office by \$110 million per year.

However there are also significant increases in ICT costs as a result of having, effectively, parallel infrastructure. Details of assumptions regarding per-user ICT costs for teleworkers are detailed in Table 4.3. These costs assume that no use is made of existing at-home ICT infrastructure, with new items purchased for the home office, and assumes a generous provision for the additional ICT costs from the employer, whereas in reality many teleworkers may make do with their own at-home infrastructure and receive no compensation for any additional requirements.

Within these estimates it is assumed that of those who telework 10% of teleworkers are full time teleworkers, 10% are infrequent teleworkers, and the remainder are mid-range teleworkers.

Table 4.3: Additional ICT costs for teleworker

Category	Cost	Details
Full time teleworker	\$1,300 per year	\$2,400 every three years for a PC plus printer, \$300 annually for work share of internet connection plus phone system costs, \$200 annually for ancillary costs including off-site support
Mid-range teleworker (i.e. once or twice per week)	\$500 per year	Use laptop in office and home, need \$200 every three years to upgrade additional docking station at home, \$700 every four years to replace screen at home, \$100 annually for work share of internet connection plus phone system costs, \$100 annually for ancillary costs
Infrequent teleworker (sporadic teleworking only)	\$0 per year	Remote access expenditures only
Remote access networks	\$87 per year	For all levels - \$90 over three years per worker for server and start up software (assumes \$10,000 server for 200 workers), \$80 every three years for security token software and licences, \$30 a year for software upgrades

Source: Access Economics

These assumptions yield an average per-user cost of \$617. Applied to the teleworking population as a whole (10% of the workforce) the increased ICT spend is some \$680 million, considerably larger than the ICT infrastructure savings.

Offsetting these increased costs are benefits derived from the more efficient use of residential capital stock.

Table 4.4: Office space savings - 10/50 scenario

	Change	Approx value (\$m)
Real estate savings (low)	180,000 fewer desks	210
Electricity saving	75 million fewer kWh consumed	10
ICT savings	\$600 per desk	110
ICT expenses	\$647 per user	(680)

Source: Access Economics estimates

Based upon these estimates, if the real estate savings fall in the low case, the net impact of office changes from teleworking is a cost of \$350 million where teleworking is undertaken 50% of the time by 10% of all workers. Where the real estate savings are in the high case, this is a benefit of \$130 million.

Sensitivities

As with the travel savings above, additional scenarios are estimated to provide a clearer picture of what the results may look like as the rate of teleworking varies. These are shown with the high case real estate savings in Table 4.5 below.

Table 4.5: Office cost savings sensitivities (\$m)

	10/50	20/50	10/100	EU	Czech
Real estate savings (high)	690	1,380	1,380	410	1,450
Electricity savings	10	30	30	10	30
Computer expenses (net)	(570)	(1,140)	(460)	(410)	(800)
Total gains	130	270	950	10	680

Source: Access Economics estimates

These results indicate that the real estate and electricity savings are driven by the total hours teleworked instead of worked in the office. However computer expenses are driven by the number of teleworkers, rather than the amount of time spent teleworking. This implies that the overall office cost gains to the employer from teleworking are maximised through encouraging those who do telework to do so as often as possible.

Indeed, unless teleworking is undertaken at a high frequency, the benefits of teleworking from an office cost savings perspective are only small as the costs of home office set-up are high.

There are further office costs involved that have not been quantified here. Among these is the requirement to ensure home offices are OH&S compliant. OH&S requirements remain the duty of the employer even when the employee is working from home, and as a result it is imperative that the employer ensures the safety of the home office.

This is an expense for the employer, and is incurred a flat rate for each teleworker, regardless of how often the individual employee teleworks. The cost of ensuring OH&S compliance in the home office may also be incurred on a semi-regular basis, with the need for the employer to ensure the home office has not changed over time to become unsafe. The value of these costs

is potentially large, and as with the ICT expenses, are likely to lead to employers encouraging teleworkers to maximise the frequency with which they work from home.

4.3 Increased labour force participation

As noted in Table 3.1, around 340,000 adult Australians are presently out of the workforce for reasons that may be at least partially remedied through the availability of telework. In the absence of any evidence as to what proportion of these individuals may take up telework, however, a hypothetical scenario is considered.

If 10% of those currently outside the Australian workforce for reasons that could be remedied by teleworking were to take up the option, working 15 hours per week, this would result in an increase of more than 26 million labour force hours per year, a 0.1% increase in the number of hours worked by Australians. If these new teleworkers were to be paid at the current Australian minimum wage, the increased wages received would total \$380 million.

Because the wage rate here is consistent, the gains from this increased labour force participation move in line with the number of hours worked. The benefits accrue on additional hours worked regardless of whether these are additional hours by the same worker or an additional individual moving into the workforce. It is unclear whether this would be the case in a real-world scenario where wages may vary from the minimum hourly wage for different individuals.

4.4 Improved workforce retention

Once factors such as lost productivity, search and training costs are taken into account, the cost of replacing a lost employee is high. According to Telstra (2008) these costs may be as high as 15% of the annual salary of the person who leaves.

In 2009, large companies across Australia had a voluntary turnover rate of 12.2% (Australian Institute of Management, 2009). Further information about the reasons for voluntary departures in Australia is not readily available.

In the UK, however, CIPD (2009) found that around 7% of all voluntary departures were due to relocation. This is the share of departing workers who may be able to stay on if teleworking from their new location were available, equivalent to around 94,000 workers in Australia each year.

However it would be naïve to expect that all these relocating workers will stay on because of teleworking. Relocating employees may wish to take up employment in their new town for different opportunities, or may simply not like the idea of teleworking. Similarly firms may not be interested in taking action to try and keep some relocating employees, while not all roles of those relocating are suited to teleworking. Consequently Access Economics has assumed that 10% of those who leave due to relocation may stay on if teleworking is available.

This would mean some 9,000 fewer workers change jobs each year due to the availability of teleworking. Using the 15% of salary figure to represent the avoided costs of replacing the employee and average earnings in Australia, this represents a saving of over \$90 million to business each year in search and training costs avoided.

It is important to note that this is not entirely a financial cost. Some of this represents lower workplace productivity rather than direct financial outlay, and the actual outcome depends upon the role of the person who does not leave. These costs are likely to be higher for a more specialised role.

4.5 Reduced rent from office relocation

Reduced rent values accrue where businesses relocating from major CBDs to more regional areas, although there are flow-on benefits in the form of reduced rents from reduced office space demand in the CBD. In this high-level example a comparison is drawn between rental rates in the Melbourne CBD and the town of Bendigo.

Average office rental rates in Melbourne are derived from Urbis (2009). The low-end face value rent for an A Grade office building is used, costing some \$310 per square metre per annum. The office rental rate for Bendigo is based upon the rate paid for the Victorian Department of Human Services for its office space, some \$243 per square metre per annum⁹.

This means the saving from relocation is around \$67 per square metre per annum. Using a moderately sized office space of around 200m² (adequate for around 50 employees), this equates to an annual saving of \$13,400 for each firm that choose to locate in the regional area rather than the major centre.

However this will be partially offset by the one-off cost of moving expenses. It is unclear what the exact value of this would be, and estimates are not undertaken here, but it is likely to be a substantial portion of the first year of rental savings.

4.6 Total high-level benefits

When the high-level benefits of teleworking are aggregated, it becomes clear that the benefits are substantial. Using the basic 10% of employees teleworking 50% of the time, the total annual gains from teleworking are in the order of \$1.4-\$1.9 billion per year. If the Australian teleworking performance were to match the current EU benchmark in the Czech Republic, the benefits could be in the range of \$2.9-\$3.9 billion per year.

The total benefits of these two scenarios are detailed in Table 4.6.

⁹ www.governmentpropertytrust.com.au/GP_DoHS_Bengido.html. This figure is based upon a 2005 rental rate of \$210 and agreement that the rate would increase by a rate of 3% per annum compounded.

Table 4.6: Total high-level benefits of teleworking (\$m)

Benefit of teleworking	10/50		Czech	
	Low real estate	High real estate	Low real estate	High real estate
Time and cost savings from travel avoided	1,270	1,270	2,760	2,760
Office cost savings (real estate high case)	(350)	130	(330)	680
Increased labour force participation	380	380	380	380
Retention of relocating staff	90	90	90	90
Total	1,390	1,870	\$2,900	3,910

Source: Access Economics estimates

Note: It is assumed that the Czech Republic benchmark does not result in a higher gain from labour force participation and staff retention as there is too much uncertainty concerning this.

It remains unclear what the potential for teleworking is in Australia, however the gains are potentially large as the number of teleworkers and frequency of teleworking grows. To maximise the potential of these gains it is important to ensure that those who telework do so regularly, maximising the potential office cost savings.

There are a number of important benefits of teleworking that have not been estimated here, including some that could be quantified using more sophisticated modelling techniques. These include the improved productivity from recruiting better staff and retaining staff that relocate; the reduced costs of absenteeism in the workplace; and, importantly, the gains from reduced infrastructure investment.

5 Concluding remarks

It is clear from the high-level estimates presented above that the potential cost savings and productivity gains from increased teleworking are large. However if these gains are to be realised there is a need for significant infrastructure, particularly ICT infrastructure, to ensure that teleworking presents a working experience as efficient as being in the office itself.

Additionally, there is a need for cultural change among workers. Attitudes towards work remain geared towards the idea of travelling to a specific workplace each day rather than working from home regularly. There is a need for government and employers to smooth the path towards teleworking in order to harness its benefits. The rollout of the NBN, which will provide quality of service and greater certainty about ICT infrastructure for teleworkers, may serve as a catalyst for such change.

As well as change among employees, there is a need for change among employers. Employer acceptance of teleworking in Australia to date has been very low, with many viewing it as something to be tolerated around employees with special requirements rather than a viable and potentially profitable business practice. The potential gains from teleworking will need to be demonstrated to businesses.

The numbers outlined above provide an indicative picture of the magnitude of benefits from teleworking. There are several key areas to be considered in greater depth and improve the quality of estimates.

- A better understanding of the current level of telework in Australia, particularly by economic sector, and the sectoral potential for additional teleworking, will enhance the analysis. International experiences are not necessarily applicable to the Australian case.
- Use of GIS and Census data to develop a geographic picture of where current teleworkers and potential teleworkers live would enhance in particular analysis of infrastructure and congestion impacts of teleworking. This data could be further enhanced through use of traffic authority data on where roads are most congested, improving upon the linear relationship used here.
- Use of productivity impacts and modelling through general equilibrium models would demonstrate the flow-on effects of teleworking as well as the direct impacts on those who are teleworking.

References

ABS 2010a, *Australian Industry, 2009*, cat. no. 8155.0, Canberra, May.

- 2010b, *Labour Force, Australia, April 2010*, cat. no. 6202.0. Canberra, May.
- 2010c, *Persons Not in the Labour Force, Australia, Sep 2009*, cat. no. 6220.0, Canberra, March.
- 2009, *Household Use of Information Technology, Australia, 2008-09*, cat. no. 8146.0, Canberra, December.

Australian Institute of Management 2009, *National Salary Survey: Large Company*, Sydney.

Avaya 2008, *Contact Center Costs: The Case for Telecommuting Agents*, January.

BTRE 2009, *Public road-related expenditure and revenue in Australia 2009*, Information sheet 37, Canberra, November.

- 2007, *Estimating urban traffic and congestion cost trends for Australian cities*, Working Paper No. 71, Canberra, April.

CIPD 2009, *Recruitment, retention and turnover: Annual survey report*, London.

Department of Climate Change 2009, *National Greenhouse Accounts (NGA) Factors*, Canberra, July.

European Foundation for the Improvement of Living and Working Conditions 2010, *Telework in the European Union*, Dublin, January.

Telstra 2008, *Towards a High-Bandwidth, Low-Carbon Future: Telecommunications-based Opportunities to Reduce Greenhouse Gas Emissions*, prepared by Climate Risk Pty Ltd, Sydney.

The Australia Institute 2005, *Off to Work: Commuting in Australia*, Discussion Paper Number 78, April.

Sensis 2009, *The Sensis Business Index: Teleworking*, July.

WorldatWork 2009, *Telework Trendlines 2009*, Scottsdale, February.

Urbis 2009, *Melbourne CBD Office Market Outlook*, Melbourne, October.