concept economics

REPORT

NEXT G PRODUCTIVITY IMPACTS STUDY

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Telstra

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1. EXECUTIVE SUMMARY

Telstra's Next G mobile network is a third-generation digital mobile network that can achieve very high data transfer speeds (for a mobile network) of up to 21 Mbps burst speed.[1] A technology called High Speed Downlink Packet Access (HSDPA) makes the Next G network considerably faster than regular third-generation networks. The Next G network has been described as the world's fastest cellular network.[2] It covers 99% of the Australian population.

On behalf of Telstra, Concept Economics undertook a study of the productivity benefits of the Next G network. A number of our key findings are summarised below.

- Our modelling indicates that, in the long term, annual real household consumption will be 1.4% greater than it would be in a scenario without mobile broadband services. This translates to gains of $7.4 billion per annum, of which approximately $5.4 billion can be attributed to Next G.

Box 1 GrainCorp

"GrainCorp has achieved productivity realisation estimates of over $1.5 million thanks to the deployment of the Telstra Next G wireless broadband network. These savings are a result of increased employee productivity, a reduction in temporary office set-up time and kilometres travelled by our software engineers."

- Glenn Mason, *Chief Information Officer, GrainCorp*

- Real GDP increases by 0.9% more than it otherwise would without mobile broadband, with average real wages increasing by more than 1.0%. The Next G network alone could lead to real GDP increases of up to 0.7% per year in Australia.
- Industries such as passenger transport, real estate, construction, finance, trade, education and health in particular benefit from high-speed mobile broadband.
- Next G has been aggressively deployed by local councils and authorities, particularly in rural and regional Australia. 83 per cent of respondents to a recent online survey (including 95 per cent of regional councils interviewed) use some form of 3G technology at present, with most of these (94 per cent of 3G users and 78 per cent of all respondents) using Telstra's Next G technology. 94 per cent of current 3G users expect to expand their usage in the next 6-12 months. Two of the seven councils interviewed who currently do not use 3G expect to begin to use it over the next 12 months.
- Next G is also being used by a large number of small and medium sized enterprises (SMEs). Of the 305 SMEs interviewed, 64 per cent currently use 3G broadband services, with the majority of these (73 per cent of 3G users and 47 per cent of all respondents) using Telstra Next G services. This proportion was highest for SMEs located in remote locations (87 per cent using 3G and 79 per cent using Next G), compared with regional SMEs (60 per cent using 3G and 44 per cent using Next G) and metropolitan SMEs (59 per cent using 3G and 37 per cent using Next G). 58 per cent of respondents who currently use 3G expect to expand their usage in the next 6-

[1] Telstra is planning to provide higher speeds over the Next G network in the near future. Upgrades undertaken towards the end of 2008 upgraded network capacity to 21Mbps, with further upgrades to 42Mbps still planned.

[2] 'Ericsson readies 42Mbps HSPA launch', *Communications Day*, 13 February 2009

12 months. Of the businesses surveyed, 37 per cent of SMEs who currently do not use 3G technology are considering switching over in the next 12 months.

- Most organisations interviewed saw the productivity benefits of Next G in terms of increased staff mobility and accessibility, the reduction in paperwork/double-handling of information, a reduction in downtime for the mobile workforce, increased reliability and coverage, the ability to access operations in real time, the ability to set up a mobile office, and the scope for remote site monitoring.
- A number of less easily quantifiable innovation benefits were identified, which varied significantly between respondents. Some organisations had integrated Next G with new devices and/or software, and had been able to offer new services or attain new benefits as a result. For example:
  - GrainCorp now uses Next G to provide its customers with instantaneous inventory and stocking information, whereas previously this information could take longer than 4 hours to get to the customer.
  - The Australian Institute of Marine Science has been able to deploy multiple Next G enable environmental monitoring buoys in the Great Barrier Reef. This has not only substantially reduced their costs, but also allowed them to monitor environmental conditions in real time and from a larger number of sites.
  - Exit Films now uses Next G to transfer data between their production office in Melbourne and remote filming locations. This has meant a level of integration between editing facilities and the film crew never before possible.
  - Kalgoorlie Consolidated Gold Mines uses Next G senses to monitor noise, vibration and air blast around its mine sites. This has made it easier for the company to comply with environmental regulations, and reduced the chance that the nearby township will be disturbed by mine operations.
  - Cancer Screening Tasmania uses Next G to transmit x-rays and other diagnostic data from mobile screening facilities to the head office in Hobart. Medical imaging data is extremely large, and used to have to be transported by courier. Next G has made this process immediate – rapidly decreasing the time taken to make a diagnosis, and thereby potentially saving lives.

The evidence from this study is that the benefits from mobile broadband continue to grow as organisations find new business applications and solutions enabled by the mobile broadband platform. In this sense, Next G is more than an incremental upgrade to second-generation (2G) services. That is, it does more than simply allow old applications to run faster, or more reliably. Instead, it provides the platform for new applications, new processes, and previously unrealised efficiencies.

2. INTRODUCTION

This report was prepared on behalf of Telstra with the aim of gaining a better understanding of the potential productivity benefits and importance of mobile broadband services to the Australian economy. By deploying a mix of surveys, interviews and modelling, this report reveals a number of important trends. Crucially, it finds that mobile broadband has not only led to cost reduction benefits in a number of sectors, but has also brought about important (but less easily quantifiable) innovation benefits.

This report is structured as follows:

- Section 2 describes the various surveys of Next G customers undertaken as part of this study, including a series of in-depth interviews, telephone interviews with local government/council representatives and an online survey with representatives from SMEs. It also includes a number of larger case studies; and
- Section 3 describes the computable general equilibrium (CEG) modelling undertaken for this study.

The remainder of this section provides a summary of the Next G technology, and a summary of this paper's conclusions.

2.1. THE NEXT G NETWORK

Telstra's Next G mobile network is a 3G digital mobile network that can achieve very high data transfer speeds (for a mobile network) of up to 21 Mbps burst speed.[3] This compares favourably to the maximum ADSL broadband speeds currently available in many rural and remote, and some urban, areas. The Next G network is also faster than other Australian 3G networks. For example, Optus' 3G/HSPA network has typical speeds of between 512 kbps and 1.5 Mbps, and has a theoretical maximum speed of 3.6 Mbps. Next G utilises the 3GSM mobile standard on the 850 MHz frequency band and covers 99 per cent of the Australian population.

The Next G network uses High Speed Downlink Packet Access (HSDPA) technology to transmit data. HSDPA is a software-based enhancement that increases the capacity and downlink speeds of 3GSM networks. HSUPA (High Speed Uplink Packet Access) allows for improvements to the uplink speed. HSPA (High Speed Packet Access) refers to the joint enhancements offered by HSDPA and HSUPA.

Because of the high speeds achievable on the network, not only can audio, graphics and text data be transmitted efficiently through the network, but high speed wireless broadband access and high quality streaming videos can also be transmitted across the network. Thus, Next G allows for users to make and receive high definition video calls. Specialised handheld devices that have the capabilities to handle these high end applications are required. Alternatively, a Next G compatible laptop card can be used to access high speed wireless broadband with a laptop computer.

[3] Telstra is planning to provide higher speeds over the Next G network in the near future. Upgrades undertaken towards the end of 2008 upgraded network capacity to 21Mbps, with further upgrades still planned.

The economic benefits from Next G relative to 2G stem from either or both of the new network's improved reliability and coverage of service and its enhanced capacity to transmit data. Importantly, the scope for Next G enabled applications is not limited to mobile telephones and laptop computers. Instead, our study clearly shows that organisations are putting Next G to work in a multitude of different devices and in conjunction with complex software. For example, the Australian Institute of Marine Science has deployed "Next G buoys" at the Great Barrier Reef, which stream real-time environmental observations to their research facilities (see Section 3.4.2.) Likewise, a company called Novecom uses Next G technology to remotely upgrade and access its SentineX monitoring stations. These organisations clearly show that Next G is a platform, not only a service – and is able to be used to foster new and innovative communication services.

2.2. ABOUT THIS STUDY

This study aims to provide an overview of the productivity benefits that Next G broadband services can potentially provide to business and government customers and to the Australian economy as a whole. The necessary research was structured in several stages.

Stages 1 through 3 consisted of progressive research and interviews in order to establish a detailed understanding of how different types of government or business users apply Next G and what the benefits are:

- Stage 1: This was an initial research stage to identify important Next G business applications, the key market segments for these applications, and important Next G users within those segments.
- Stage 2: This consisted of in-depth interviews with leading users of Next G services in order to identify how Next G services are applied in the course of their operations, and the nature of the resulting cost savings or service improvements.
- Stage 3: This stage drew on the results of the detailed interviews undertaken in Stage 2 in order to structure two detailed surveys:
  - A telephone survey of local councils that are using Next G or considering using mobile broadband to deliver services; and
  - An online survey of small and medium enterprises (SMEs) that are using or contemplating using mobile broadband services.

Stage 4 applied a macro economic perspective to the research task. This stage drew on the surveys that were undertaken, as well as on additional sector research, to estimate the productivity benefits from mobile broadband. Specifically, computable general equilibrium (CGE) modelling was used to gain an understanding of the potential magnitude of the regional, industry sector and full economy-wide effects of productivity improvements from mobile broadband in general and Next G specifically.

2.3. SUMMARY OF RESULTS

2.3.1. In-depth interviews

In-depth interviews were conducted with fifteen business and government users covering the health, education, local government, resources, and energy sectors, as well as with three SMEs. The responses given showed that preferred Next G applications and their perceived advantages depend on the characteristics of the sector, such as the need for:

- The transfer of images and large data files;
- Functions to be undertaken outside of head office;
- Remote monitoring of facilities and activities; and
- Remote voice and data applications to underpin more efficient and reliable service delivery.

Security, high speed, and reliable access emerged as the criteria that were most valued by customers. However, other aspects of Next G were also important:

- Ease of use;
- The ability to hold conference calls, including video calls; and
- Low ongoing costs of usage.

One particularly interesting aspect of the interviews was the wide-range of uses that organisations were finding for Next G. While respondents placed an obvious "high value" on the range and reliability of the network, less easily summarised benefits emerged from the interviews. Many organisations were deploying Next G in association with their own software solutions, leading to new and innovative ways of doing business.

Box 2 Cancer Screening, Tasmania

The Tasmanian breast cancer screening program uses Next G technology to digitally transmit X-ray images from their mobile screening unit to the head office in Hobart.

This has saved up to two weeks processing time and reduced staff time spent on administration.

"This solution was so easy it was quite mind-boggling … It's just been revolutionary in terms of the difference it has made to our everyday service delivery."

"What we used to have to do was package up [medical files] in a suitcase and have a courier deliver [them] all around the countryside, with, of course, the potential risks of losing suitcases, files, and the interchangeable hard drive that contained all of these images."

When asked to comment on potential barriers to the future uptake of Next G technologies, the key issues raised included affordability, network coverage in remote areas, and handset reliability. That said, many respondents indicated plans for increased use of Next G, software upgrades, or further staff training.

2.3.2. Local government/council interviews

The great majority of the 40 local government/council respondents interviewed already use Next G and expect to expand their usage of the technology, with the most commonly used applications being:

- Mobile communications;
- Access to the (main) office IT network for mobile staff; and
- Access to the Internet/email for mobile staff.

Those applications most frequently cited as being important in the future are:

- Real time data entry/reporting by mobile staff;
- Vehicle tracking; and
- Remote asset tracking/management.

In the great majority of instances, Next G enabled local government/council users to achieve cost efficiencies, and most respondents could also provide new services as a result of the technology. For example, Hinchinbrook Council, a small shire in the north of Queensland, was able to offer a 24-hour on-call IT manager operating remotely – something that it simply was not able to do prior to taking up Next G services. This particular council also drew attention to the importance of affordability for small and regional councils – and how Next G allowed a level of service delivery in these areas commensurate with that offered by larger, better resourced local authorities. Those Next G benefits that were thought to have had the greatest impact on local government/council operations were:

- The increased staff mobility and improved accessibility;
- The reduction in paperwork or double-handling of information;
- The better ability to access remote operations;
- Higher employee satisfaction; and
- A reduction in downtime for the mobile workforce.

While metropolitan councils viewed the benefits of Next G more in terms of more efficient processes and the immediate client service delivery, regional and remote councils additionally valued improved staff mobility and accessibility, the ability to access information on operations in real time, and the reduction in downtime for the mobile work force.

2.3.3. Small and medium enterprises survey

The online survey of 305 SMEs covered a very broad cross-section of businesses of different sizes, operating in different industries and located across Australia. Around 64 per cent of SMEs interviewed currently use 3G technology with the majority of these (73 per cent of 3G users and 47 per cent of all respondents) using Telstra Next G services. This proportion is highest:

- For SMEs in remote locations (87 per cent), compared with 60 per cent of regional SMEs and 59 per cent of metropolitan SMEs;
- For SMEs with between 20 and 49 mobile staff (80 per cent); and
- For SMEs operating in certain sectors, including mining, transport & storage, agriculture, forestry & fisheries, culture/recreation, and the wholesale sector.

Box 3 Bishop Collins Accountants

"Next G [gives] us a great competitive edge in the current economic environment."

"It no longer matters that we are based on the Central Coast because don't need to be in the office. We have been able to expand our geographic reach."

"Our clients love the fact we work face to face. Not only does it nullify any security fears they may have had, they actually see what we do and can solve problems faster."

"When you pick up over $120,000 of work outside your normal area it is great and Next G has played a big role in that success."

Almost all current SME users of Next G rely on and value mobile communications in all locations, and access to the Internet/email and the main office IT network for mobile staff.

Overall, around three quarters of SMEs surveyed thought that Next G applications had helped their business run more efficiently, and more than 40 per cent of respondents thought Next G applications had enabled them to offer new or substantially improved services. Although there were differences in emphasis between metropolitan SMEs and regional/ remote SMEs, the Next G benefits that were thought to have the greatest impact on the business were:

- Improved staff mobility and accessibility and the increased satisfaction of mobile staff;
- The ability to provide an immediate service to clients;
- A reduction in paperwork/double-handling of information;
- A reduction in downtime for the mobile workforce; and
- The ability to set up a mobile office.

2.3.4. CGE modelling

The results reflecting the introduction of mobile broadband in Australia (the impacts of Next G specifically are given below) are as follows:

- Our modelling indicates that, in the long term, annual real household consumption will be 1.4% greater than it would be in a scenario without mobile broadband services.
- Real GDP increases by 0.9% more than it otherwise would.
- Average real wages are increased by 1.0%.

The gain in real consumption of 1.4% relates to the provision of mobile broadband services as a whole. This translates to gains of $7.4 billion per annum.[4]

To determine the impact of Next G mobile broadband services as opposed to the impact of other 3G networks, we apportion this gain according to Telstra's current market share of wireless broadband. This is estimated to be 73%. Thus, the long term gains from the provision of Next G mobile broadband services are estimated to be about $5.4 billion a year. Similarly, the Next G network alone could increase real GDP by up to 0.7% per year over the longer term.

The sectors that stand to gain the most from wireless broadband services are Passenger transport, Real estate services, Construction, Finance, Trade, Education and Health. The

[4] Based on ABS data. Real consumption is used as the welfare measure here instead of real GDP.

regions that are most impacted (based on consumption expenditure impacts) are the Gold Coast, Brisbane and Inner Queensland regions, the Inner and Outer Adelaide regions, South West Western Australia, Regional Tasmania, Inner Victoria, and Inner Regional New South Wales.

3. SURVEYS OF NEXT G CUSTOMERS

This section describes the results of the interviews and surveys that were undertaken during July and August 2008 in order to develop an understanding of the uses of Next G and benefits to key customers. The Market Intelligence Co. (TMIC) was commissioned to conduct the following interviews and surveys:

- Fifteen semi-structured in-depth interviews with leading Next G customers identified by Telstra to explore their use of Next G technology;
- Structured telephone interviews with 40 local government/council representatives; and
- An online panel survey of around 300 SMEs.

After presenting these results, we conclude this section with brief descriptions of how three very different organisations have incorporated Next G in both innovative and interesting ways. These concluding studies highlight the diverse ways in which Next G is impacting on productivity, and the wide-range of organisations affected.

3.1. IN DEPTH INTERVIEWS

In-depth interviews were undertaken with fifteen existing business and government users of Next G services to investigate, in turn:

- The Next G applications they currently use, the reasons why they chose these, and the benefits they had identified with the use of Next G technology;
- What Next G applications they expected to use in future;
- Which aspects of Next G they considered to be most important; and
- Whether they had identified any barriers to the future uptake of Next G.

Table 1 describes the companies and service providers that were interviewed as part of Stage 2 of this study, as well as the main area of operations where Next G services play a role.

Table 1 **In-depth interviews with Next G users**

Health • Department of Health and Human Services Tasmania – Remote image transfer for cancer breast screening services • Kimberley Aboriginal Medical Service Council (KAMS) – Mobile communications and data transfer	**Education** • University of the Sunshine Coast – Remote access to university facilities • Charles Sturt University, Speech Therapy Department – Videocalling
Local government/councils • Mildura Rural City Council – Ability to access server remotely and remote asset management • City of Joondalup – Remote monitoring and mobile email • Townsville library – Remote access to library	**Resources** • Department of Sustainability – Remote monitoring • Kalgoorlie Consolidated Gold Miners – Data transfer and monitoring • G&S Engineering – Mobile office and data transfer • Chris Richards & Associates – Video streaming
Energy • Roaring Forties – Operation of wind farms	**SMEs** • Bhagwhan Marine – Offshore communications • Zylotech – Video surveillance • Manufacturing/sales operation – Data transmission

Source: TMIC

3.1.1. Current Next G applications

Table 2 describes the responses that current users of Next G gave when they were asked how they currently use the technology, why they use this technology, and how they perceive the key benefits associated with Next G. The responses suggest that the applications used, their rationale, and their benefits vary according to the sector in which they are used:

- In health, Next G enables the transfer of images and large data files, which in turn results in a broad range of benefits for the service provider and for patients (e.g. mobile diagnostics, earlier and faster diagnosis, time and cost savings);
- In education, Next G enables students to be taught remotely and provides for more effective distance learning;
- Local government and councils are able to undertake a range of functions outside of head offices and in turn deliver more efficient and better services (e.g. improved asset management);
- In the resources sector, Next G enables remote monitoring and other activities away from the head office with associated benefits in terms of greater efficiency and flexibility of services;
- In energy (power generation), Next G enables the ability to monitor facilities remotely and allows for mobile communications; and
- For SMEs, Next G enabled staff to use a range of voice and data applications remotely, making for more efficient and reliable service delivery.

Table 2 **Current applications, reasons for and benefits associated with using Next G technology**

Segment	Application	Reasons for Using Next G	Benefits
Health	Transmission of radiographic images	To enable time effective mobile digital breast screening	Immediate communication/real time, especially for diagnosis
	Email access	To offer access to communications in remote locations	Virtual consultations (removes 'tyranny of distance')
	Access to office IT network		Workflow improvements
	Phone/mobile communications		Can screen more women/detect more cancers early
	Data transfer		Less risk of radiographic images getting lost/damaged in transit (and hence less repeat appointments and associated costs)
			Access to communications in remote areas
			Workplace safety (in remote areas)
			Time savings (less manual work)
Education	Remote access to teacher/virtual classroom	To providing effective remote/ distance learning	More efficient delivery of services
	Video streaming		Student access in remote areas
	Imaging field trips		Reliable data transfer
	Virtual art gallery		Faster/real time
			Can access network from previously inaccessible places
			Ease of use/portability
Local government/councils	Data entry/reporting	To communicate with mobile staff	More efficient delivery of services
	Purchase ordering	To enable greater mobility for Directors and managers	Ability to provide new services (e.g. immediate response services)
	Image transfer	To achieve wider coverage	Field staff not office-bound
	Access to office IT network/library		Less paperwork
	GIS mapping		Better forecasting/reduced risk

Segment	Application	Reasons for Using Next G	Benefits
	Wireless broadband		Time savings
	Email		Faster issue resolution/decision making
	Phone		More efficient reticulation/less water usage
	Asset management e.g. roads	Immediate communications from the field	Cost saving from early detection of damage and alerts on imminent severe weather conditions
	Remote monitoring		
Resources	Remote monitoring	To achieve better coverage	More efficient delivery of services and can provide new services
	Data transfer	To improve reliability	More reliable service
	Mobile office/access to office IT network	To comply with environmental legislation	Greater flexibility/one stop shop
	Phone	To maximise staff availability on site	Greater functionality for data capture
	Email		Less paperwork
	Purchase ordering		Increased safety
	Data entry/reporting		Less time spent travelling/less downtime
	Image transfer		Immediate data availability/real time reporting/diagnosis
	Video streaming		Cost savings
			Faster data transfer
			Better project management
			Early warning system (via SMS)
			Employee satisfaction
Energy	Remote monitoring	To achieve speedy access to remote information	Business is more mobile
	Data transfer		
	Mobile gateway		
SMEs	Internet	To take advantage of natural technology progression	More efficient delivery of services
	Phone		More reliable

Segment	Application	Reasons for Using Next G	Benefits
	Video streaming Data transfer		Speed/faster data transfer Deliver better quality video images; audio and video at the same time Cost reduction per image Better coverage than CDMA

Source: TMIC

3.1.2. Future Next G applications

The same companies were also asked about future Next G applications that they expected to make use of over the next 1-2 years (see Table 3). The range of future applications described is again indicative of the broad range of activities that businesses and service providers in each sector access, including:

- Beyond data and voice, greater use of video services;
- Greater reliance on Next G to operate and monitor remote assets; and
- More sophisticated value-added services that rely on broadband technology and can be used in a mobile context.

Table 3 Expected future expansion applications for Next G

Segment	Future Applications
Health	Video conferencing On-site printing Virtual consultation with specialists Voice, data and video services in remote areas
Education	Video streaming Virtual classrooms
Local government/councils	Work orders to vehicles Vehicle tracking
Resources	Barcode scanning and auditing Video streaming and conferencing
Energy	Video conferencing
SMEs	Remote management Distance education Entertainment

Source: TMIC

3.1.3. Important Next G criteria

As part of this stage of the conversations, respondents were asked to rank (on a scale of 1 to 5), in order of importance, a number of criteria that describe Next G services (see Figure 1). Security, high speed, and reliable access emerged as the most important criteria across the board. The importance of other individual criteria varied across businesses and service providers:

The two health service providers interviewed particularly valued reliable access, ease

- of use, the ability to transfer data at high speeds, and the ability to hold conference calls;

- The two education institutions most valued the ability to transfer data at high speed, high security, and the ability to hold conference calls;
- The three councils considered reliable access, high speed data transfer, high security and low ongoing costs to be the most important attributes of Next G;
- The four resources businesses rated reliable access most highly;
- The energy business rated reliable access, high speed data transfer, ease of use, high security, video calling, conference calling, and reliable access to email equally highly; and
- The three SMEs interviewed placed the greatest value on the ability to transfer data at high speed and at low ongoing costs.

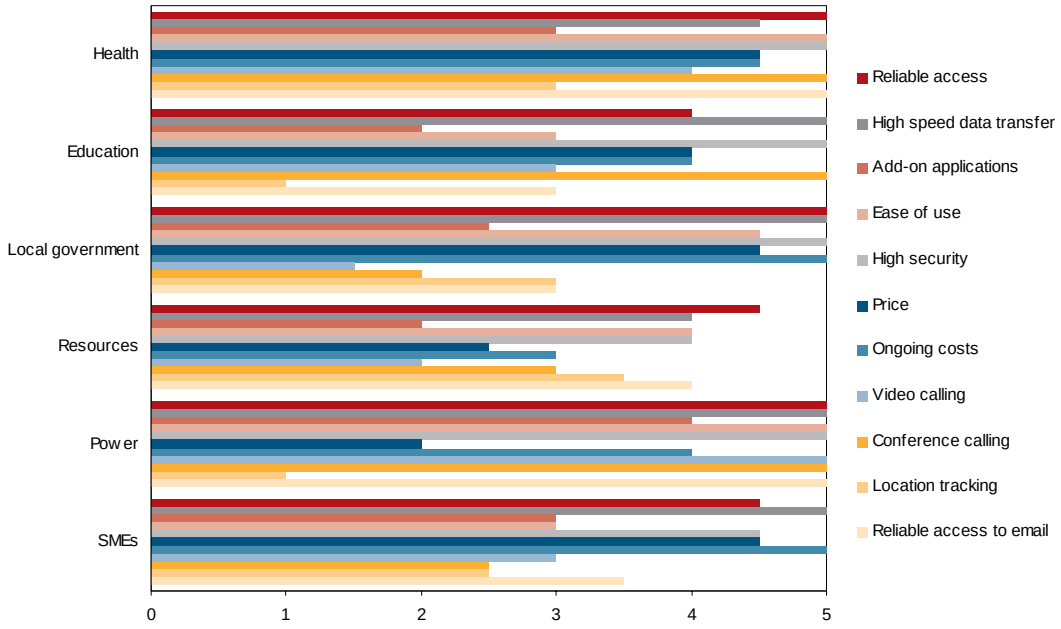
Box 4 Pacific Hydro

Previously, connectivity "meant laying hundreds of kilometres of copper line. That cost us three-to-six months and tens-of-thousands of dollars per facility. Then some rain would cause ground movement, a pipe would crack, damaging the copper and taking our phones out."

"Our dollar cost of installing comms has been cut by up to 95%, and our time cost by up to 99%! Instead of laying miles of copper, we just plug in a modem, turn it on, and our network is up and running."

- Daniel Hayward, Global IT Manager

Figure 1 Importance of Criteria and Attractiveness of Next G



Data source: TMIC

3.1.4. Potential barriers to uptake of Next G

As part of the interviews, businesses and service providers were asked to comment on what they viewed as potential barriers to the future uptake of Next G technologies. Responses included:

- Affordability/cost, in particular data costs;

- Network coverage/range in remote areas;
- The reliability of handsets;
- A lack of awareness and knowledge about specific business solutions or the potential business advantages of Next G;
- Existing technology/business practices (e.g. where there are incompatibilities between established technologies and processes and using Next G);
- Insufficient skills to benefit from Next G; and
- Concerns about the inappropriate use of Next G technology by staff.

3.2. LOCAL GOVERNMENT AND COUNCIL RESEARCH

To gather information about the how Next G applications are perceived and used by local government, 40 telephone interviews were undertaken with local government or council representatives. Different departments, including ICT, asset management, operations, and library services were represented, and the survey covered both current users of Next G and those that do not (yet) make use of this technology. The local government/council entities interviewed covered all Australian states and territories, and included 15 metropolitan respondents, 22 regional respondents, and 3 remote respondents. A wide range of questions was asked to local councils in order to investigate:

- whether and how these users currently use Next G applications;
- what applications they consider to be useful and how they view the benefits of these applications; and
- what criteria they use to assess the usefulness and benefits of Next G technology.

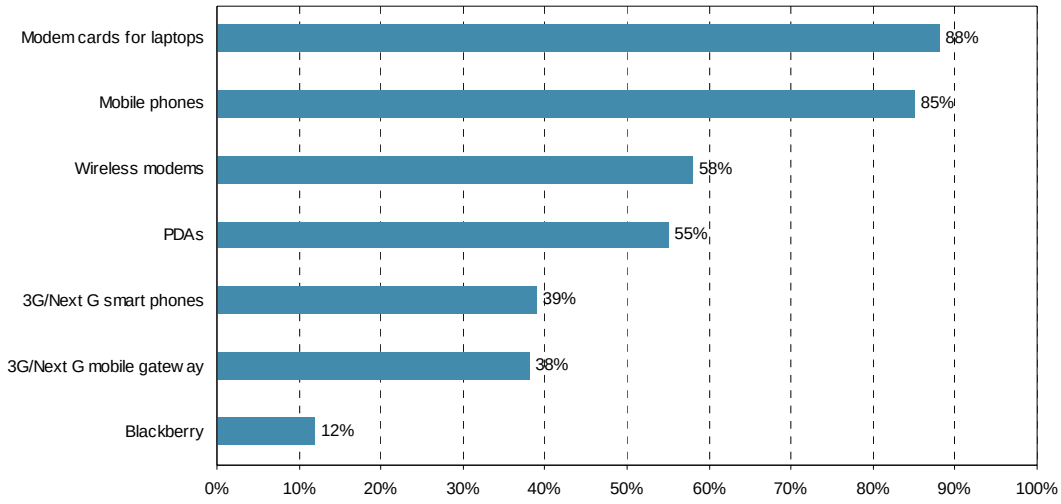
3.2.1. Current use of Next G technology

Overall, 90 per cent of local government/council respondents said telecommunications is very important or critical in their council/department's strategic planning. The great majority of local government/councils interviewed currently use Next G technology and plan to expand their usage:

- 83 per cent of respondents (including 95 per cent of regional councils interviewed) use 3G technology at present with most of these (94 per cent of 3G users and 78 per cent of all respondents) using Telstra's Next G technology;
- 94 per cent of current 3G users expect to expand their usage in the next 6-12 months; and
- 2 of the 7 councils interviewed who currently do not use 3G expect to begin to use it over the next 12 months.

Figure 2 below shows the equipment most frequently used by local government/councils for those respondents who already use 3G. Modem cards and mobile phones top the list.

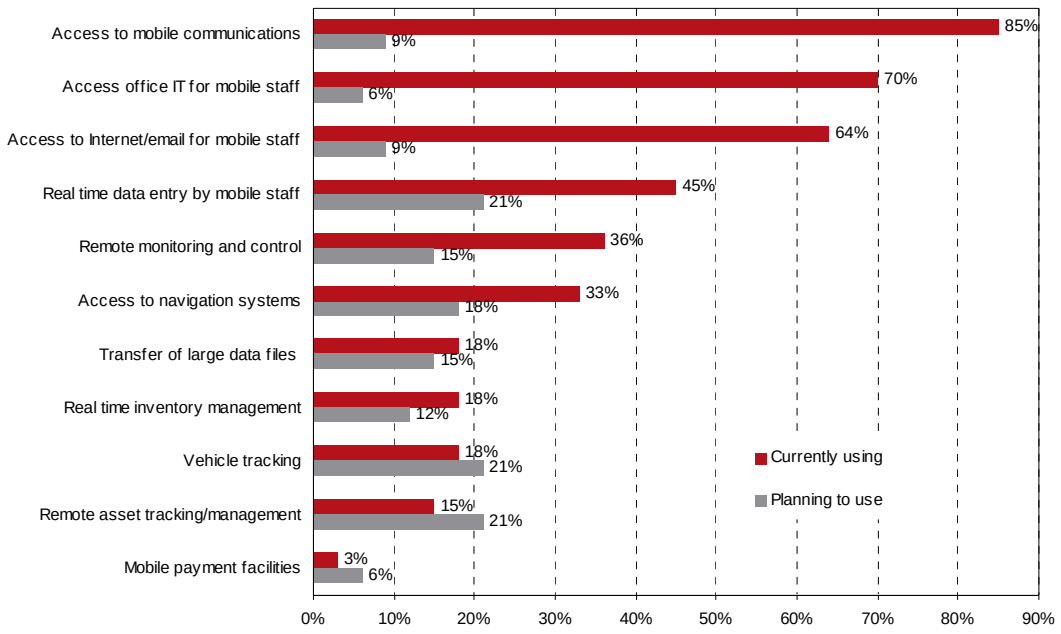
Figure 2 3G hardware used by local government/councils (% respondents)



Data source: TMIC

Figure 3 shows the Next G applications that are most commonly used by local government/ councils, or that are being planned to be implemented over the next 6 months. Access to mobile communications, access to the (main) office IT network for mobile staff, and access to the Internet/email for mobile staff were cited most frequently. Looking forward, the most frequently cited planned applications are real time data entry/reporting by mobile staff, vehicle tracking, and remote asset tracking/management.

Figure 3 Current and planned use of Next G applications (% respondents)

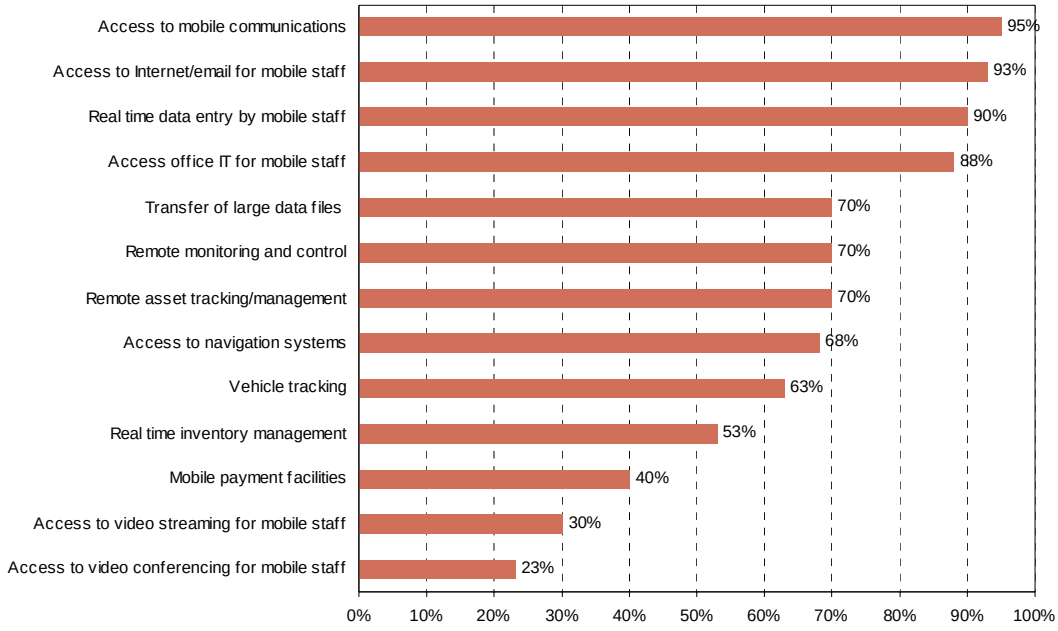


Data source: TMIC

3.2.2. Benefits of Next G technology and applications

Local government/council respondents (irrespective of whether or not they currently use Next G services) were also asked about the specific applications that they considered to be the most useful (see Figure 4). Across all respondents, those applications that either enabled mobile communications[5] in all locations or enabled mobile staff to access the Internet/email, data services or the main IT system were ranked most highly. Mobile payment facilities, video streaming and conferencing were seen as less useful.

Figure 4 **Next G applications considered useful (% respondents)**



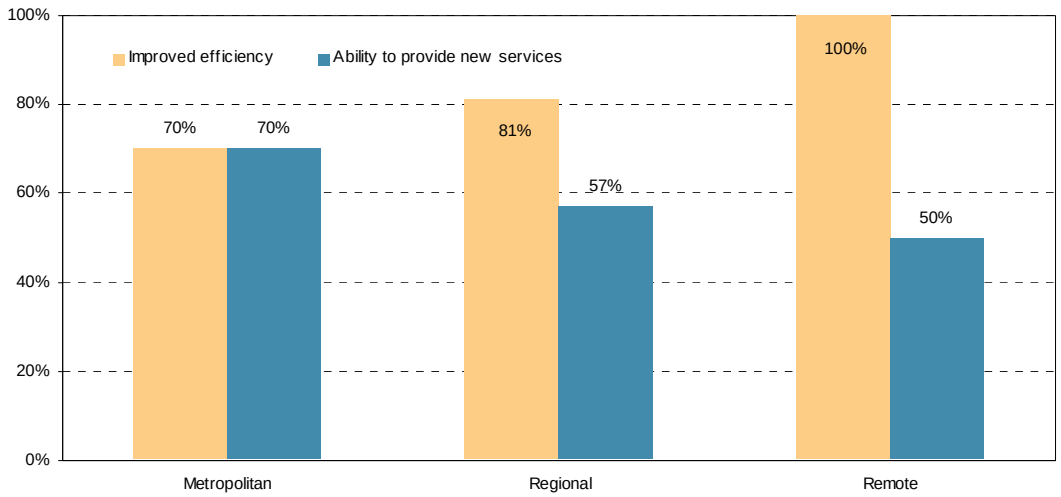
Data source: TMIC

Among existing local government/council users, there was very substantial agreement that Next G provides improved efficiency and new service delivery (see Figure 5):

- 82 per cent of respondents said that the technology had helped their council/ department run more efficiently overall; while
- 67 per cent of respondents said they could now provide new services, including remote access to the office, access to email for mobile staff, and a mobile library service. Other new services cited included the monitoring of remote facilities, the immediate on-line availability of inspection results, and the use of mobile devices for council rangers.

[5] Note that 2G already allows for mobile communications, hence this is not an incremental benefit of 3G/Next G.

Figure 5 Key Next G benefit to council/department (% respondents)

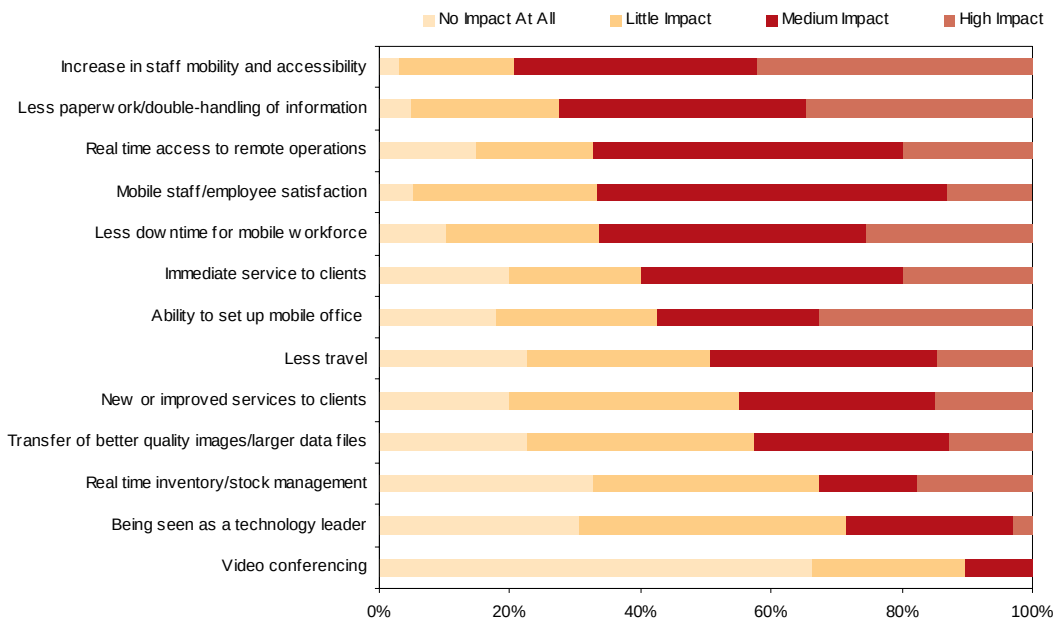


Data source: TMIC

Respondents were then asked to rank the different benefits associated with Next G technology according to the impact on their operations. Figure 6 shows the responses, sorted in order of decreasing importance:

- Those Next G benefits that were thought to have had the greatest impact on local government/council operations were increased staff mobility and accessibility, the reduction in paperwork or double-handling of information, the better ability to access remote operations, higher employee satisfaction, and a reduction in downtime for the mobile workforce.
- The Next G benefit that was thought to have had the least impact was video conferencing.

Figure 6 **Impact of Next G benefits on council/department (% respondents)**

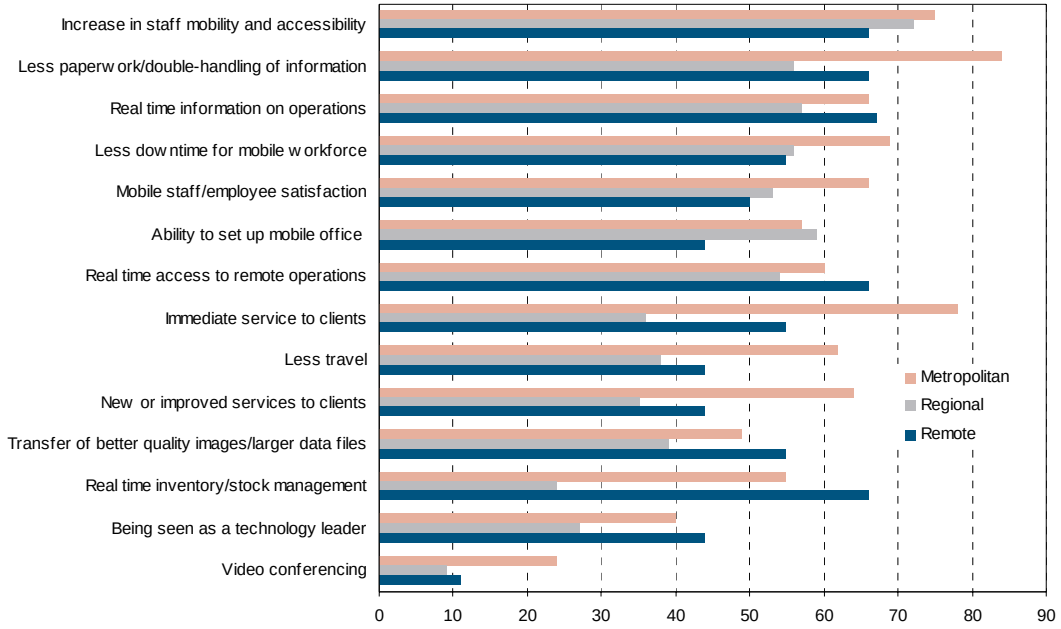


Data source: TMIC

When these benefits are translated into mean impact scores (so that a score of 100 suggests the greatest impact) it becomes apparent that the benefits of Next G to government/councils vary significantly by type of respondent (see Figure 7):

- Metropolitan councils thought that the greatest impact of Next G had come from the reduction in paperwork and the ability to provide clients with an immediate service;
- Regional councils viewed the biggest impact of Next G as resulting from an increase in staff mobility and accessibility, the reduction in paperwork, the ability to access information on operations in real time, and the reduction in downtime for the mobile work force; while
- Remote councils also saw the increase in staff mobility and accessibility, the reduction in paperwork, and the ability to access information on operations in real time were very important, but additionally valued the importance of accessing remote operations in real time and the importance of inventory management.

Figure 7 **Impact of Next G benefits by type of council/department (mean impact scores out of maximum 100)**



Data source: TMIC

3.3. SMALL AND MEDIUM ENTERPRISES

In addition to the telephone surveys of local government/councils, an on-line questionnaire was presented to the pureProfile on-line business panel.[6] 305 completed interviews were achieved, of which 125 respondents were located in metropolitan locations, 128 in regional locations, and 52 in remote locations. SME respondents were asked a broad range of questions, including:

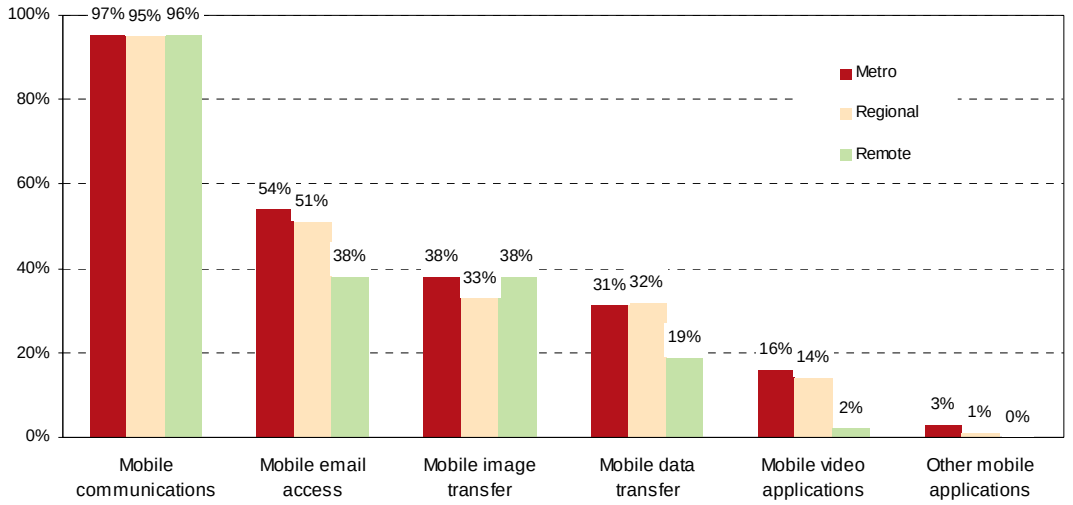
- What use they currently make of mobile technology;
- What use they currently make of Next G technology;
- What applications they consider to be useful and how they view the benefits of these applications; and
- What criteria they use to assess the usefulness and benefits of Next G technology.

[6] This is a list of businesses compiled by pureProfile.

3.3.1. Current use of mobile telecommunications

Figure 8 shows how the interviewed SMEs currently use mobile telecommunications. Apart from voice communications (including text messaging), SME respondents also commonly use mobile telecommunications to access email, and to transfer images and data.

Figure 8 **Current use of mobile telecommunications (% respondents)**



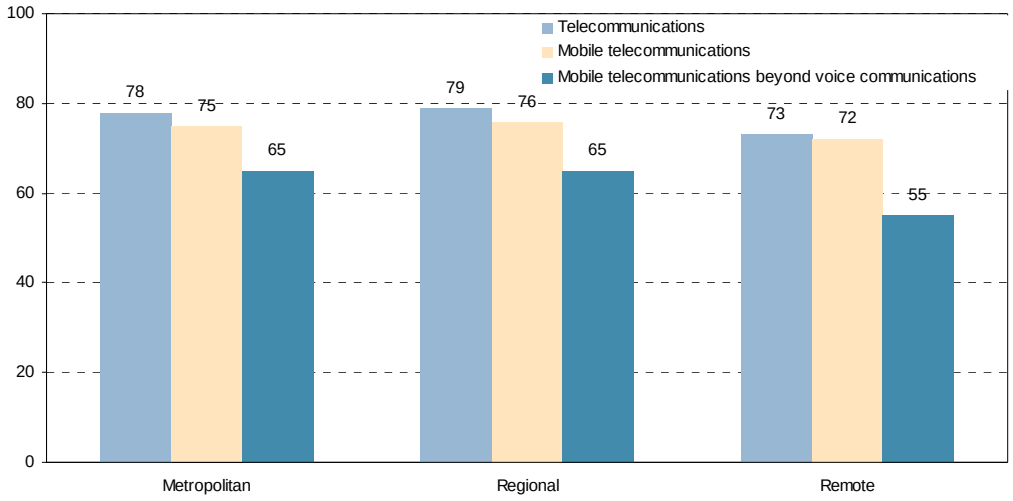
Data source: TMIC

Overall, 78 per cent of SME respondents said telecommunications is very important or critical in their organisation's forward strategic planning, 75 per cent said that this was the case for mobile telecommunications, and 52 per cent for mobile telecommunications beyond voice and text (see Figure 9).

In the present sample, mobile telecommunications beyond voice and text was found to be more important for larger businesses with between 20 and 99 mobile staff, for SMEs with multiple offices/distributed operations, and for the following industry sectors:

- Finance & insurance;
- Wholesale; and
- Transport and storage.

Figure 9 **Importance of telecommunications in strategic planning (mean importance scores out of maximum 100)**



Data source: TMIC

Box 5 **Gold Coast Water**

Next G enabled handsets for field staff has had a major impact on the overall productivity of this water utility. Next G has removed the need for a number of paper based processes, saving at least 1.5 hours per day. This has assisted in providing at least a 20% increase in field time, removing the previous requirement of returning to base for individual job types.

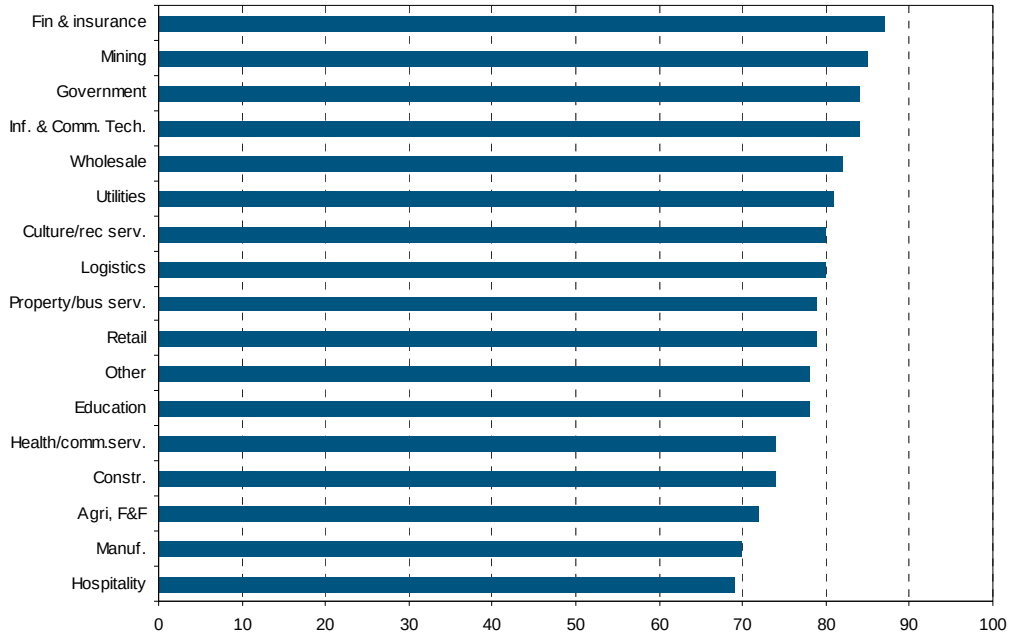
Gold Coast Water estimates that further software upgrades, in conjunction with Next G, will reduce unproductive time by a further 1.5 hours per day. Gold Coast Water also plans to introduce field staff tracking, which it expects will produce efficiency gains within the region of 15% - 20%.

Figure 10 plots the importance of telecommunications in a strategic planning context for the

SMEs interviewed, by sector. Telecommunications was considered to be most important by SMEs operating in the finance & insurance sector, the mining sector, in government services, and in the information and communication technology (ICT) sector.[7]

[7] As the respondent base was low in some cases, these results should not be treated as being statistically significant.

Figure 10 **Importance of telecommunications in strategic planning – by sector (mean importance scores out of maximum 100)**



Data source: TMIC

3.3.2. Current use of Next G technology and applications

Of the 305 SMEs interviewed, 64 per cent currently use 3G broadband services with the majority of these (73 per cent of 3G users and 47 per cent of all respondents) using Telstra Next G services. This was highest for:

- SMEs located in remote locations (87 per cent), compared with 60 per cent of regional SMEs and 59 per cent of metropolitan SMEs;
- SMEs located in Western Australia (82 per cent);
- SMEs with between 20 and 49 mobile staff (80 per cent); and
- For SMEs operating in certain sectors, namely in:
  - Mining (100 per cent);
  - Transport & storage (86 per cent);
  - Agriculture, forestry & fisheries (84 per cent);
  - SMEs providing cultural/recreational services (80 per cent); and
  - SMEs in the wholesale sector (79 per cent).

Box 6 **G&S Engineering**

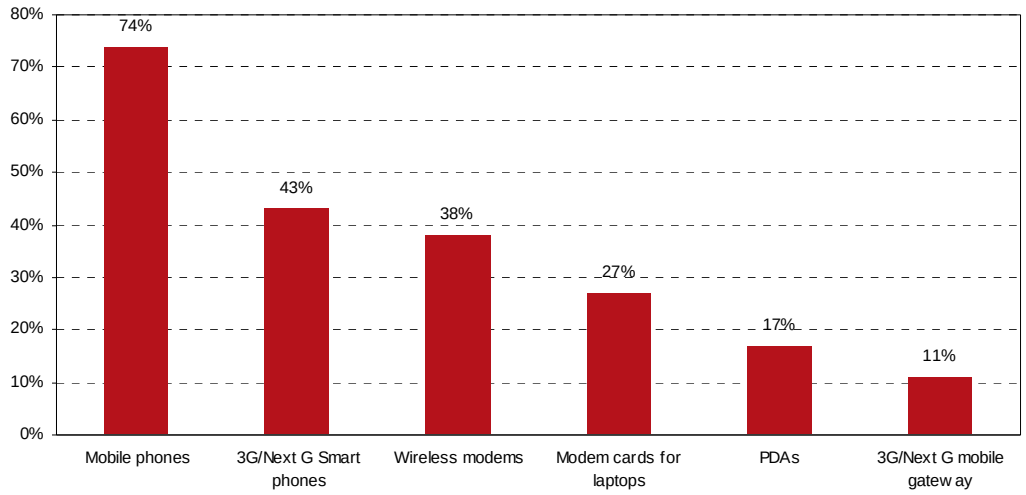
We've used satellite internet in the past and we wouldn't have reception in most of the places we've got – … Without Next G we would be stuck without communications … we used to have a lot of sites where guys would have to drive an hour up the road to find a hill to make a phone call, so we don't have to do that type of stuff anymore.

Now we can get in touch with people on site, less commuting, timesheets used to have to be faxed in, or drive to regional office to fax in timesheet – mostly just halving travel time required.

- Graeme Lodge, IT Manager

The most commonly used hardware on the part of SMEs that currently use Next G technology is mobile phones, followed by 3G/Next G smart phones and wireless modems (see Figure 11).

Figure 11 3G hardware used by current users (% respondents)



Data source: TMIC

Box 7 Exit Films

"As is often the case with filming, you can't always shoot what you need to on any given day. On one such occasion, I was able to speak with the editing suite in Melbourne because we had phones that worked in remote locations, along with the ability to send emails too.

I estimate we saved around $15,000 in potential lost production time that day as a result of being able to communicate with the team back in Melbourne and keep the film moving."

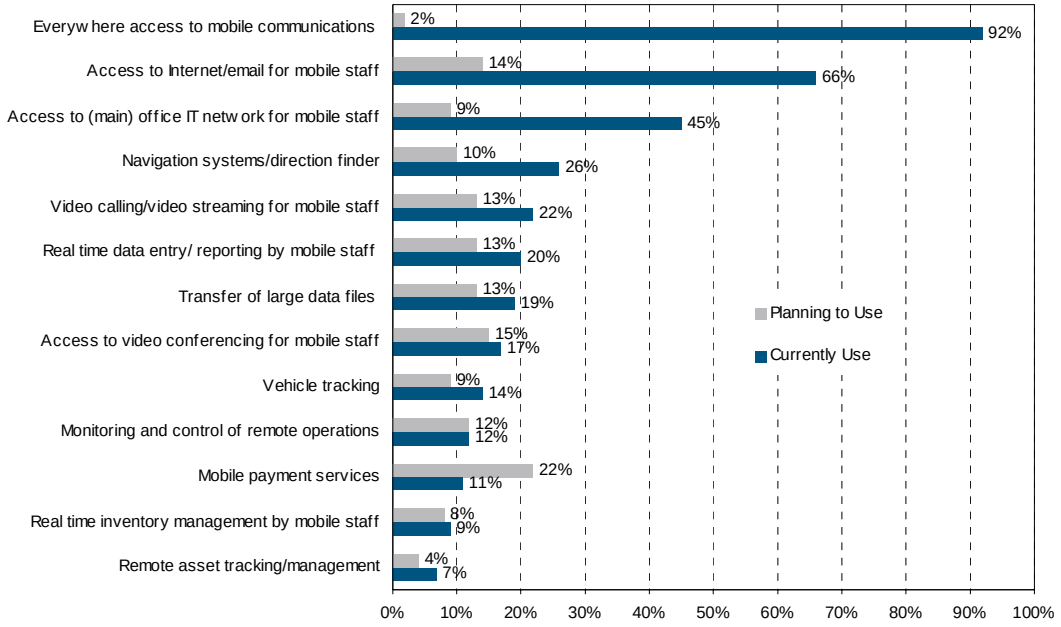
- Antonia Barnard, Producer

58 per cent of respondents who currently use 3G expect to expand their usage in the next 6-12 months. This proportion was highest for:

- SMEs located in metropolitan areas (69 per cent), as compared to regional SMEs (60 per cent) and SMEs located in remote locations (38 per cent);
- SMEs with 20-199 staff (77 per cent) and 200+ staff (73 per cent);
- SMEs with 20-49 mobile staff (88 per cent) and SMEs with 50-99 mobile staff (80 per cent); and
- SMEs with multiple offices/sites (75 per cent).

When asked which applications SME users of Next G currently use, almost all referred to access to mobile communications in all locations (92 per cent), with the next most frequently used applications being access to the Internet/email for mobile staff and access to the main office IT network for mobile staff (see Figure 12). The most frequently cited planned application was the introduction of mobile (EFTPOS/credit card) payment services (22 per cent).

Figure 12 **Next G applications currently used or planned by current SME users (% respondents)**



Data source: TMIC

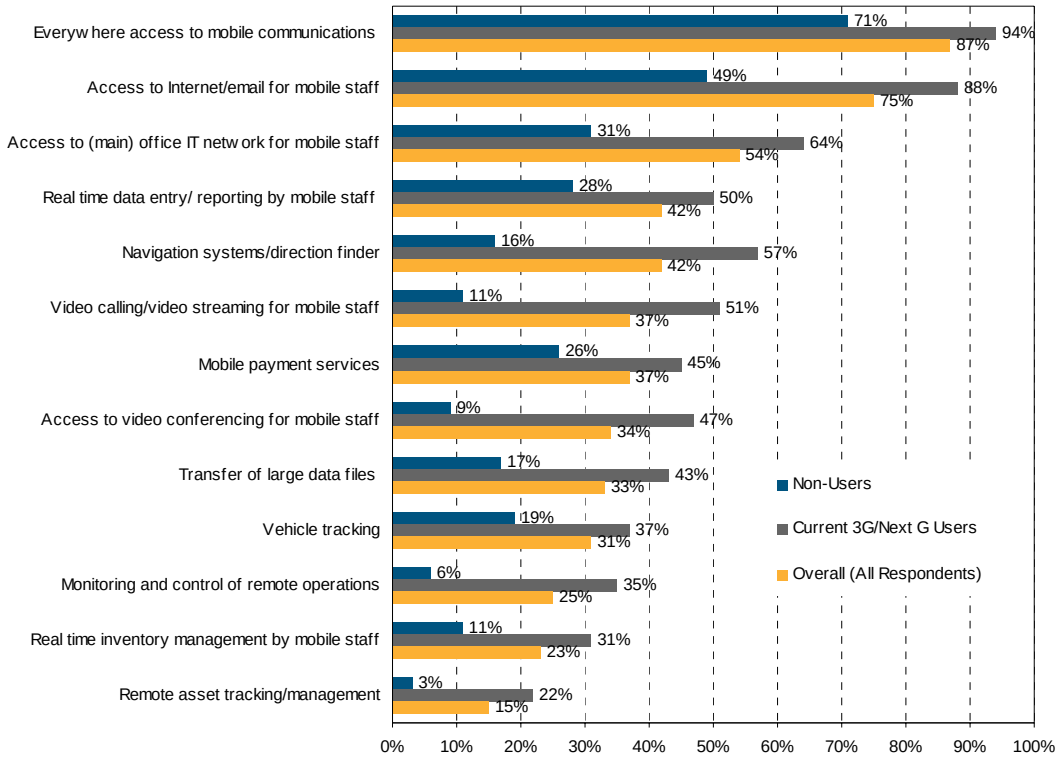
Of the businesses surveyed, 37 per cent of SMEs who currently do not use 3G technology are considering switching over in the next 12 months. This percentage is highest for SMEs located in metropolitan areas (39 per cent), compared with regional SMEs (35 per cent), and remote SMEs (29 per cent). The two main reasons given by respondents as to why they do not currently use Next G technology is that they are satisfied with their existing mobile technology (45 per cent) or that it is too costly (31 per cent).

3.3.3. Benefits of Next G technology and applications

All respondents were asked which Next G application would be most useful. Non-users generally nominated fewer applications as being useful to them, while users thought the following applications were most useful (see Figure 13):

- Access to mobile communications wherever you are;
- Access to Internet/email for mobile staff; and
- Access to the main office IT network for mobile staff.

Figure 13 Next G applications considered useful (% respondents)



Data source: TMIC

SMEs currently using Next G were asked about the operational and other benefits to their business resulting from the technology. 72 per cent overall thought that the technology had helped their business run more efficiently overall in terms of the delivery of services. This proportion was highest for:

- SMEs located in metropolitan locations (84 per cent), compared with regional SMEs (74 per cent) and remote SMEs (51 per cent);
- SMEs with 20-199 staff (89 per cent) and 200+ staff (80 per cent);
- SMEs with 20-49 mobile staff (96 per cent) and SMEs with 50-99 mobile staff (100 per cent); and
- SMEs with multiple offices/sites (85 per cent).

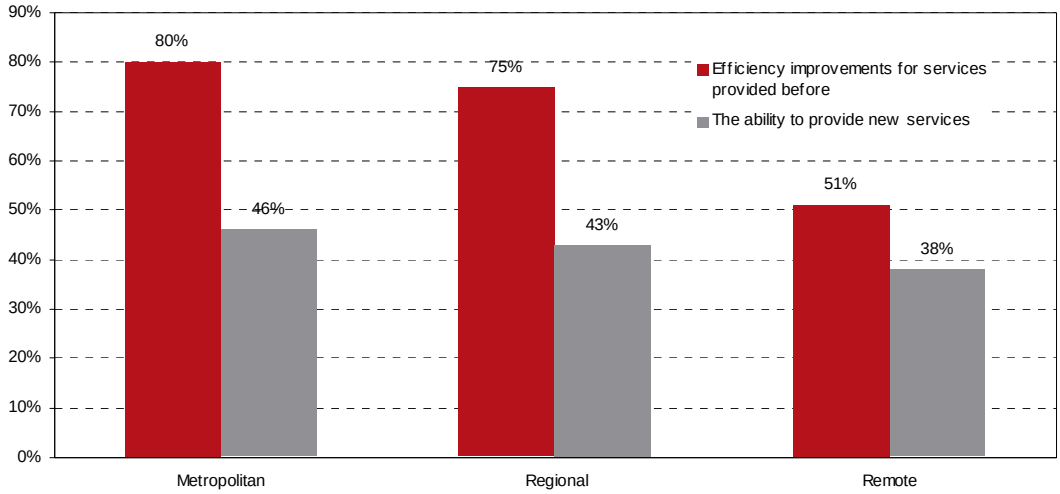
Additionally, 43 per cent of SMEs currently using Next G said that the technology had enabled them to offer new or substantially improved services that could not be provided previously. Among those businesses, this proportion was highest for SMEs located in metropolitan locations (46 per cent), compared to 43 per cent in regional locations and 38 per cent in remote locations. The services mentioned by these respondents include:

- Better remote access as a result of better/wider coverage;
- Improved contactability and communications with clients;
- The ability of mobile staff to remotely access the company server or network;

- The ability of staff to order supplies remotely or access the supplier database;
- Faster service;
- Video; and
- The ability to produce more efficient 'paperwork', such as plans, invoices and reports.

Overall, the great majority of current SME users of Next G considered that they had gained efficiency and service benefits as a result of the technology (see Figure 14).

Figure 14 Benefits of Next G for current SME users (% respondents)



Data source: TMIC

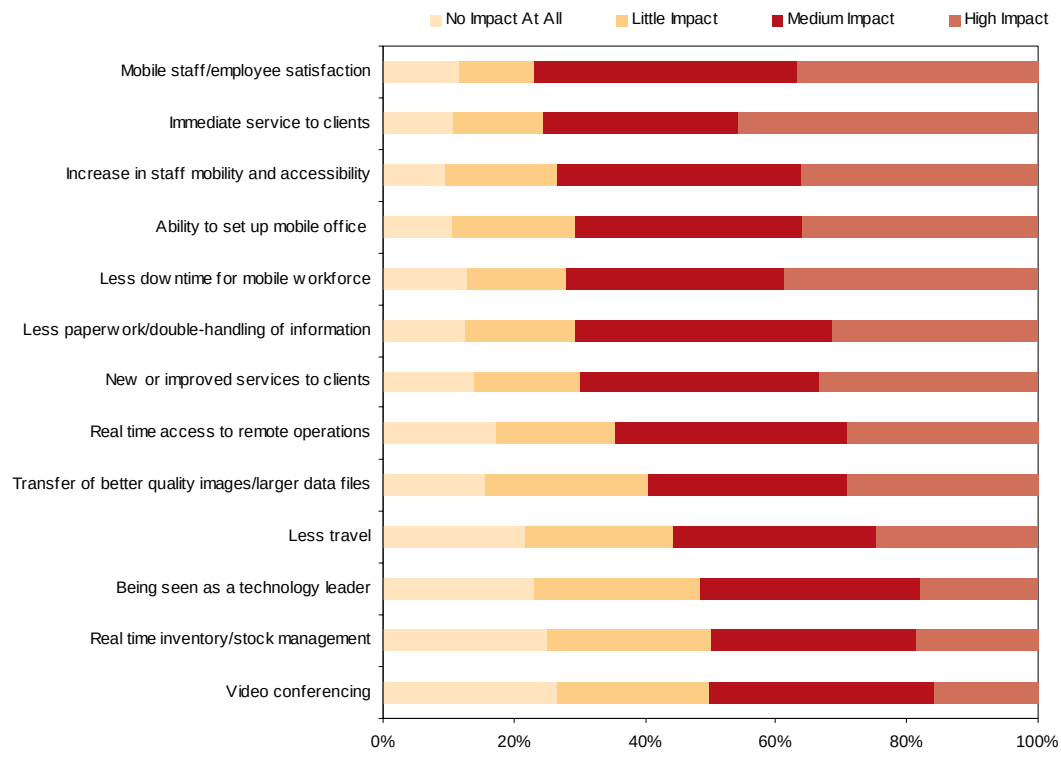
Respondents were also asked to rank the different benefits associated with Next G technology according to the impact on their operations and business. Figure 15 shows the responses, sorted in order of decreasing importance:

- Those Next G benefits that were thought to have the greatest impact on the business were the increased satisfaction of mobile staff, the ability to provide an immediate service to clients, increased staff mobility and accessibility, the reduction in paperwork/double-handling of information, a reduction in downtime for the mobile workforce, and the ability to set up a mobile office.
- The Next G benefits that were thought to have had the least impact were video conferencing and real time inventory/stock management.

Box 8 Novecom

Novecom used the Next G platform to upgrade its remote SentineX environmental monitoring stations. Being able to do this remotely saved around 20 hours in travelling time and 20 hours of field work, equating to a $3000 saving to Novecom, as well as saving 1500km of car travel.

Figure 15 **Impact of Next G on the business (% respondents)**



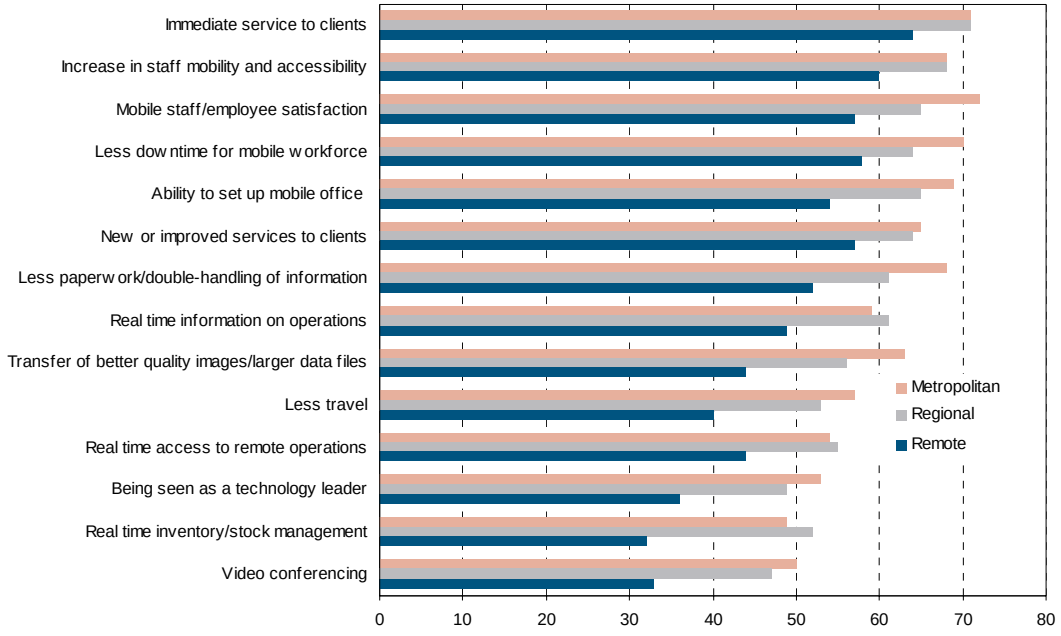
Data source: TMIC

Translated into mean impact scores (whereby a 100 per cent score suggests the greatest impact), the impact of Next G usage on SMEs varies by the location of the SME (see Figure 16):

- Metropolitan SMEs thought the greatest impact had come from the ability to provide an immediate service to clients, higher mobile staff/employee satisfaction, and less downtime for the mobile workforce;
- Regional and remote SMEs viewed the biggest impact as being a result of the ability to provide an immediate service to clients and improved staff mobility and accessibility.

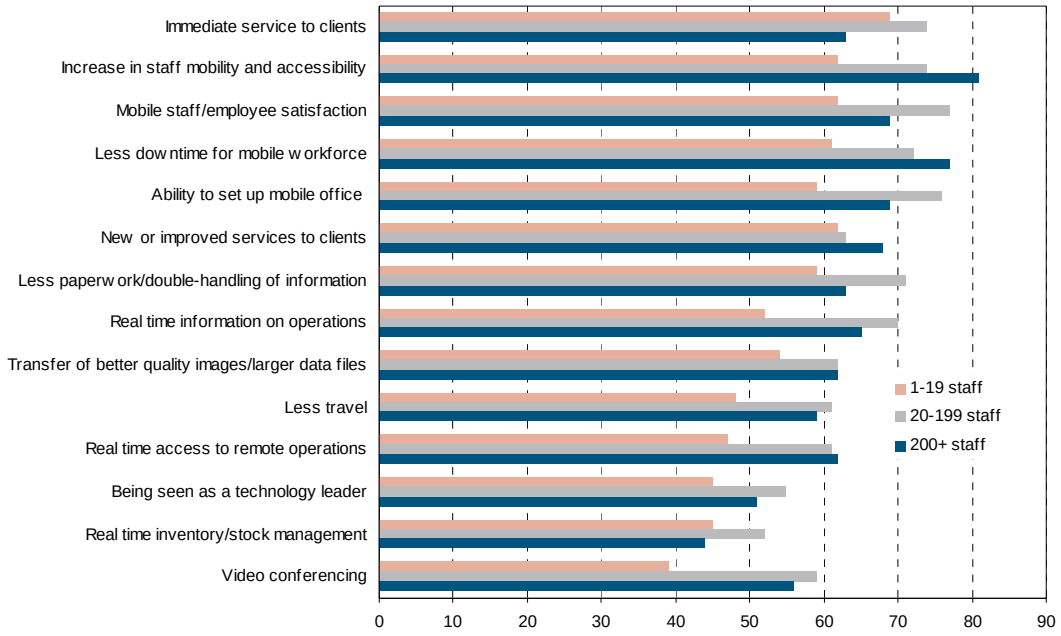
Figure 17 below shows the same information by size of SME. It is apparent that across the sample the perceived impact of Next G usage on the business is greater, the greater the size of the SME by number of employees. The same relationship holds for the number of mobile staff – that is, the bigger the number of mobile staff, the greater the perceived benefits of Next G usage.

Figure 16 **Impact of Next G usage by location of SME (mean impact scores out of maximum 100)**



Data source: TMIC

Figure 17 **Impact of Next G usage by size of SME (mean impact scores out of maximum 100)**



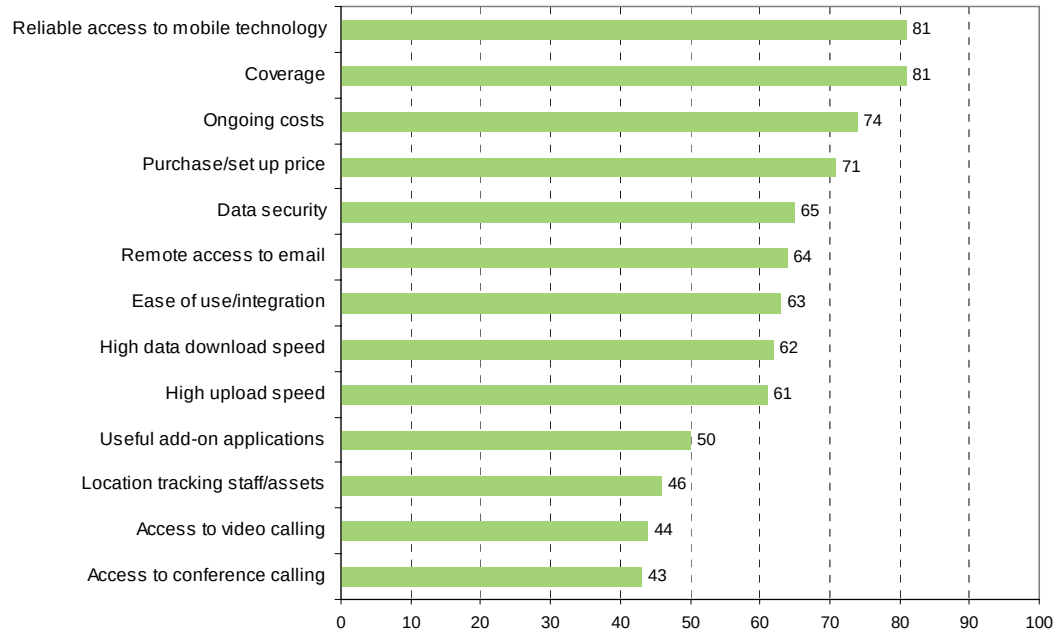
Data source: TMIC

3.3.4. Importance of specific Next G criteria for mobile communications

SME respondents were finally asked to list the specific criteria that they thought were most important with regards to mobile communications and providing access for mobile staff (see Figure 18). The key criteria, irrespective of location, and for users and non-users alike, were:

- Reliability of access;
- Coverage;
- Ongoing costs; and
- The initial purchase/set up price.

Figure 18 **Importance of performance criteria for current mobile technology (mean importance scores out of maximum 100)**



Data source: TMIC

3.4. CASE STUDIES

In this section, we highlight three very different uses for Next G, illustrating how the network is not only leading to productivity gains by lowering costs, but also how it allows organisations to innovate and deploy resources in new ways.

3.4.1. GrainCorp

GrainCorp is one of Australia's largest and most important agricultural companies. It operates over 250 grain accumulation sites in Queensland, NSW and Victoria. It receives and stores grain for growers in south-east Australia, amounting to nearly 6 million metric tonnes in 2008. By operating an extensive rail and logistics network, linked to ports throughout the region, it runs a highly complex supply-chain serving both domestic grain customers and grain exporters. Next G has assisted GrainCorp manage this supply-chain across a wide geographic area, often in remote areas.

Glenn Mason, the CIO of GrainCorp, has indicated that GrainCorp has achieved productivity realisation estimates of over $1.5 million thanks to the deployment of the Telstra Next G network. These savings are the result of increased employee productivity, a reduction in temporary office set-up time and the kilometres travelled by software engineers.

> *"We used to deploy two or more software upgrades per year, a process that entailed five people each driving up to 40,000 kilometres to install software across dispersed sites. These upgrades are now deployed remotely saving many hours. In fact, the company has realised a 20% productivity improvement in system management and maintenance, coupled with vehicle overhead savings, which combined equate to a productivity realisation estimate of around $240,000 per year."*
>
> *"Our team of IT software deployment engineers have reduced the time in which they are travelling by a staggering 200,000 km. Not only has this made the team more efficient and productive in their working weeks, but the achieved productivity realisation estimate in vehicle costs alone has been $140,000 each year across the fleet, not to mention the environmental benefits in reducing GrainCorp's carbon footprint."*
>
> *We have around 180 Next G mobile workers, all of which have saved an additional three and a half hours per week. In addition, our regional managers have each gained five hours per week. These two factors combined have injected almost $1.3 million worth of employee hours back into the business to further add value along the entire grain supply chain for both growers and customers."*

Interestingly, GrainCorp reports that Next G has not only improved its productivity by lowering its costs and allowing it to redeploy resources, but also that it has allowed it to offer new and innovative services to its customers.

> *"Grain deliveries to our customers are now recorded in real-time, whereas previously there was a lag of four hours before stock reports were visible on the system to the customer. So the Telstra Next G™ solution is benefiting our customers as well."*

3.4.2. Australian Institute of Marine Science (AIMS)

AIMS is a Commonwealth Government authority, tasked with researching the sustainable development of marine resources. It is a world class institution, with highly developed capabilities across a number of areas. It works out of a number of sites, as well as operating a fleet of vessels. The largest of these are designed to facilitate research across the expanse of the continental shelf. AIMS is using the Next G network across its Great Barrier Reef research sites.

The transmission of scientific observations across the 350,000 square kilometre expanse of Barrier Reef has always been a challenge. However, Scott Bainbridge, a project manager for AIMS, has identified to this study a number of ways that Telstra Next G is making AIMS' important work that much easier.

> *"The Telstra Next G solution provides us with a high bandwidth communication system that gets us where we want to be, even 70km offshore. The beauty of this is the whole system costs less than $1,000, when if you look at traditional ways of getting connectivity to sites like Heron Island, we are talking around $450,000 for each microwave link… and we would need at least three to service all of the island sites. So instead of spending $1.3 million for three microwave links, we can spend just $1,000 for each Next G system."*
>
> *"Our Telstra Next G buoys are easy and quick to deploy. We literally bolt them on to the site in less than a day, compared with up to 18 months, which is the time it will take us to complete the microwave links that we are currently working on. Just to manage the feasibility study to install one microwave link would take around two months and cost $50,000, and this is before even getting relevant approvals to start the installation. With the Telstra Next G solution, it takes two weeks to program the modems and get everything working – a fraction of the cost."*
>
> *"The Telstra Next G solution [also] saves AIMS tens of thousands of dollars per year in maintenance costs. Maintenance of a microwave link is around 10% of its cost each year, as a lot of the infrastructure is external and subject to weathering and damage by cyclones. With the Next G buoys, you are looking at a possible aerial replacement each year costing $300, which is a lot less than $45,000 for maintenance costs for a microwave link."*
>
> *"Data collection from a Next G buoy is instantaneous and 24/7, compared with the traditional methods, whereby we receive the logged data after the event, often months after, which can then be too late to be of value … A trip out to the reef for data collection would take a week, with only four days on site. This typically costs about $20,000 in vessel and employee overheads."*

According to Mr Bainbridge, not only has Next G meant significant cost savings, but it has also changed the nature of their work, leading to real improvements in AIMS' conservation activities.

> *"Access to real time data has changed the way in which we do our jobs. It gives us information about what is happening now, meaning we can be proactive in putting measures in place to protect the coral reef systems, rather than just being reactive … Having 25 Next G buoys is almost like having 25 full-time researchers. We just don't pay them an annual salary."*

3.4.3. Hinchinbrook Shire Council

The Hinchinbrook Shire area is located approximately one hour north of Townsville, and covers a considerable area of 2,600 square kilometres. Centred around the town of Ingham, the Council has around 160 employees, and provides services to around 12,000 residents. The size of the local government area, combined with the small and dispersed population, makes connectivity critically important in Hinchinbrook. Moreover, as it is a small council, cost-control is extremely important.

Colin Valnoti, the IT Manager for the Council, provided the following information to this study.

> *"The Telstra Next G solution enables the Council's IT operations to achieve 99.9% uptime, which is a key requirement for the management team, staff and State Emergency Services to provide essential facilities and services to the 12,000 residents of the Hinchinbrook Shire."*
>
> *"If we didn't have the Telstra Next G solution, we would need about an extra four full-time staff across the Shire … we just don't have budget for that."*
>
> *"It is well known for North Queensland to have storm activity between September and March. With the Telstra Next G solution, when our UPSs lose power, I can shut down the servers remotely. This helps us to avoid server crashes that can take us 7 to 8 hours to get back to a stable state of production – saving the Council over $15,000 during the storm season alone."*
>
> *"We currently have 160 employees covering 2,600 sq km, which is a huge geographical area, with a very streamlined workforce. The Telstra Next G solution has increased employee productivity in some departments by around 30%, as there is less wasted time travelling and it enables us to be better equipped to respond to issues."*
>
> *"The Telstra Next G solution has enabled the water and sewerage plant in the Shire to improve its productivity by improving efficiency, by being able to remotely identify where a pump is failing and go straight to the site to fix it. On average, this saves the supervisors 15 hours a week management and travelling time. Translated to dollars, this would equate to over $50,000 a year."*

It is important to note however, that Next G has not just reduced costs for the Council. It has also allowed the Council to provide new services which were not previously offered, such as IT-support on call.

> *"The Telstra Next G solution has enabled our supervisors at Hinchinbrook Shire Council to increase their productivity. By reducing the time they need to spend in the office by about 30%, they now have more time to deliver a higher level of service to the Shire's constituents. If we were to translate that to a cost saving, I would estimate a saving over the coming financial year, of over $50,000 a year for seven supervisors."*
>
> *"The Telstra Next G solution enables the Council to have one IT manager on call 24 /7, 365 days a year. To provide this same level of service without the Telstra Next G solution, we would be looking at a team of three at an additional cost to the Council of around $100,000."*

3.5. CONCLUSION

There are a number of broad themes that can be drawn out of the survey and interview data. First, many firms reported substantial immediate cost savings – these cost savings were often in employee hours, but also across IT and communications spending. In some cases there were very significant savings in capital expenditure. Respondents reported that Next G allowed them to improve operational processes, often by allowing workers remote access to sites or customers. This, in turn, resulted in less travel time and less paperwork. Some cost savings, particularly in employee hours, allowed business to free up resources – which, not only resulted in improvements to existing products, but also allowed firms to offer new services.

Estimates provided to this study by some Next G users suggest that productivity enhancements in specific operations may be in the order of $7,000 per worker per year. For example the Hinchinbrook Shire Council estimates cost savings of around $50,000 across seven employees using Next G, while the much larger GrainCorp estimates savings of around $1.3 million across a Next G enabled work force of 180 people. Of course, the magnitude of potential productivity enhancements accruing to a particular business will vary widely depending on the size and operating circumstances of the business in question. Nonetheless, the survey responses provide some indication of the possible quantum of Next G impacts.

Some issues will need to be addressed within organisations however, including the lack of awareness and knowledge about the business advantages of Next G. Many respondents indicated that they did not have the training to operate Next G systems. Lastly, organisations were concerned about the cost and reliability of handsets, and the scope for existing business software to integrate into a Next G solution.

The vastly different applications using Next G was notable. Equally notable was the range of different firms and industries which had deployed Next G. This, combined with reports that Next G was being incrementally rolled-out across businesses, suggests that further innovations are likely. That is, the scope for Next G to facilitate a ‘discovery’ process within organisations will lead to further productivity improvements.

4. CGE MODELLING

The interviews and surveys described in Section 3 of this report focused on gaining an understanding of the use and value of Next G technology to different types of government and business users. These studies served to highlight the very wide range of Next G applications and the value they can potentially add to users in terms of greater efficiency and improved services, both to the users themselves and to their customers.

The computable general equilibrium (CGE) modelling that is the focus of this section builds on these insights to derive some indicative estimates of the value of Next G to the wider economy by applying sector-specific estimates of productivity impacts

4.1. THE TERM MODEL

TERM (The Enormous Regional Model) is a general equilibrium model of Australia using a 2005-06 database. The model was developed by the Centre of Policy Studies at Monash University as a more disaggregated tool than the Monash Multi-Regional Forecasting (MMRF) model for regional policy analysis. The economy is classified into 144 industry sectors and 57 regions, although for the purposes of the current analysis, the TERM database was aggregated into 31 industries and 20 regions.

. Each region is modelled as a separate economy with links to the other regions to account for product and factor mobility between regions. TERM draws on national input-output data and disaggregated regional data.

The theoretical structure of TERM consists of equations describing:

- producers' demands for produced inputs and primary factors;
- producers' supplies of commodities;
- demands for inputs to capital formation;
- household demands;
- export demands;
- government demands;
- the relationship of basic values to production costs and to purchasers' prices;
- market clearing conditions for commodities and primary factors; and
- numerous macroeconomic variables and price indices.

Demand and supply equations for private-sector agents are derived from the solutions to the optimization problems (cost minimisation, utility maximization, etc) which are assumed to underlie the behaviour of the agents in conventional neoclassical microeconomics. The agents are assumed to be price-takers, with producers operating in competitive markets which prevent the earning of pure profits.

A technical description of the model and database are provided in Horridge, M., J. Madden and G. Wittwer 2004, *Using a highly disaggregated multi-regional single-country model to analyse the impacts of the 2002-03 drought on Australia*.

TERM is a comparative static model, and in this application is run with a long run closure.[8] It shows, in the long term, the differences produced in regional economies by changes in the chosen exogenous variables once all adjustments to the "shock" (in this case the introduction of Next G) have taken place.

The disadvantage of the comparative static approach necessitated by use of the TERM model is that it cannot analyse effects of changes over time of various inputs such as the adoption profile of Next G or the time-path of adjustment costs.[9] However, a comparative static approach is still a reasonable approach to use to determine the long term effects (in annual terms) of the provision of Next G services as it still allows the comparison of macroeconomic indicators with and without Next G. The TERM allows analysis along regional and sectoral dimensions, and it is this aspect of the TERM which makes it suitable for analysing the effects of Next G on the economy.

In the long run closure, aggregate employment at the national level is exogenous. Thus, real wages adjust to keep aggregate change in employment zero. Capital is mobile in the long run and adjusts accordingly.[10]

4.2. CGE METHODOLOGY

As a comparative static model, the results from the TERM do not relate to any particular year. Hence, no adjustment paths can be inferred. The results must be interpreted as the difference between the case "with" the shock (i.e. having the Next G network) and the case "without" the shock (i.e. not having the Next G network). These results are not forecasts of some future point in time but are rather *projections* of the effect of the shock on its own.

In order to model the incremental gains from Next G services, we assume that the majority of these gains result from the provision of mobile broadband services, as opposed to mobile voice services, since competing mobile networks already allow for the provision of mobile voice services. The study excludes the impact of fixed broadband services as well. The incremental gains we estimate are from the mobility aspect of mobile broadband (irrespective of location) and from remote access not available from fixed broadband alternatives. The productivity gains would be a result of both process and production gains that arise from doing things differently (e.g. more efficient management and documentation) or doing different things (e.g. remote diagnostic capabilities in healthcare).

In estimating productivity gains from mobile broadband, we have used as an input the results of a study estimating the gains of mobile broadband in the US released by Ovum recently

[8] The term "long run" means, in an economic context, a period sufficiently long that all factors of production (including capital) and consumption patterns, have had time to adjust to the shock in question. Note, however, that in the long run closure of the TERM model, aggregate employment is exogenous.

[9] An alternative to using the comparative static TERM model is to have dynamic CGE modelling conducted using the model developed by Access Economics. While this would have certain advantages (e.g. being able to model closely the anticipated year-by-year take-up of Next G, a limitation of this approach is that it does not allow effective regional disaggregation of the impacts.

[10] In the short run, capital is fixed.

(see Appendix A.1), with modification and additional inputs to reflect the situation in Australia.[11]

The maximum take up rates for mobile broadband are first estimated by industry. These are obtained by first determining the occupations by industry that would be likely to benefit from the availability of mobile broadband. From this, and using the employment figures for each occupation, we estimated that mobile broadband could be potentially beneficial to 88 per cent of the workforce in the finance and insurance sector down to 31 per cent of the workforce in the accommodation, cafes and restaurants industry. Following Ovum, we then assumed that in the long term approximately 80 per cent of workers who could potentially benefit from mobile broadband would eventually acquire such a service. If we multiply the proportion of the workforce that would benefit by mobile broadband by the assumed proportion that would take up broadband we obtain the expected maximum saturation rates for wireless broadband. Over all industry it is calculated that approximately 55 per cent of the workforce would eventually acquire a mobile broadband service.

We then took Ovum's estimated productivity benefits and applied this to the individual service level. The individual service benefits were scaled to the individual industry level by the ratio of an industry's intensity of use of telecommunications services, thus giving the benefit per service by industry applying to the Australian economy. We then obtain the expected long run benefits for each sector by taking the estimated maximum services for each industry (this is the maximum take up rates multiplied by current persons employed in Australia for each industry) and multiplying this by the benefit per service. We also find that the maximum assumed saturation rate of 70 per cent is achieved by 2018 in both urban and non-urban regions, thus negating the need to estimate shocks differentiated across regions. Hence, by dividing the long run benefits for each sector by the value of sales and other income in the respective sectors, we obtain the sectoral shocks resulting from the provision of mobile broadband services.

A detailed description of the methodology can be found in Appendix B.

In summary, we find that the productivity shocks from the provision of mobile broadband services for the various sectors for the Next G take-up levels expected are as follows:

[11] Ovum, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, 2008.

Table 4 **Sectoral productivity shocks from mobile broadband used in long run closure of TERM**

Sector	Shock (%)
Sheep	0.1926
Grains	0.1926
BeefCattle	0.1926
OthLivestck	0.1926
OthAgricult	0.1926
ForestFishng	0.1926
Mining	0.0273
MeatProducts	0.0725
OtherFoodBev	0.0725
TCF	0.0725
OthManufact	0.0725
PetrolChems	0.0725
NonMetMins	0.0725
MetPrdsMach	0.0725
EGW	0.0492
Construction	0.0769
OtherTrade	0.1989
RetailTrade	0.3368
RoadFrght	0.3715
RdPasAirRail	0.3715
RailFreight	0.3715
OthTransport	0.3715
OtherSrvces	0.5658
Telecomms	0.3124
BankFinInsur	0.5373
GovAdmin	0.5658
SchoolEduc	1.1767
OthEducation	1.1767
Health	0.4754
OthPubSrvces	0.6100

Source: Concept Economics calculations

By 2018, both urban and non-urban uptake in all sectors reaches close to saturation levels. As such, the shocks across regions are virtually identical.

These shocks are applied in the TERM CGE model to the general productivity variable and run using a long run closure. The simulation applies the maximum take up and industry-specific productivity benefits per service to the current workforce and determines the effects over the long run (i.e. after around 10 years of adjustments).

4.3. CGE RESULTS

The results reflecting the introduction of mobile broadband in Australia (the impacts of Next G specifically are given below) are as follows:

- Real household consumption increases by 1.4% more than it otherwise would without Next G.
- Real GDP increases by 0.94% more than it otherwise would.[12]
- Average real wages are increased by 1.00%.[13]

The gain in real consumption of 1.4% relates to the provision of mobile broadband services as a whole. This translates to gains of $7.4 billion per annum.[14] To determine the impact of Next G mobile broadband services as opposed to the impact of other networks, we apportion this gain by Telstra's current market share of wireless broadband. This is estimated to be 73%.[15] Thus, assuming that Telstra maintains its market share throughout the period, the long term gains from the provision of Next G mobile broadband services are about $5.4 billion a year. Similarly, the Next G network alone could increase real GDP by up to 0.7% per year over the longer term.

The regions that are most impacted (based on consumption expenditure impacts) are the Gold Coast, Brisbane and Inner Queensland regions, the Inner and Outer Adelaide regions, South West Western Australia, Regional Tasmania, Inner Victoria, and Inner Regional New South Wales. Regional results do not differ a lot because the shocks applied across regions are identical – with the variance observed primarily the result of differences in the industry composition of each region. Detailed regional results are shown in Table D1 in Appendix D.

The sectors that stand to gain the most from wireless broadband services are passenger transport, real estate services, construction, finance, trade, education and health. The variance in sectoral results is partially explained by the differences in the applied shocks. However, some sectors (e.g. passenger transport) have gains that are disproportionately larger than their shocks, reflecting indirect general equilibrium effects. Detailed sectoral results are shown in Table C1 in Appendix C.

It should be noted that these gains reflect a world in which the uptake of mobile broadband services increases from almost nothing in 2006 to around 55 per cent in 2018. The actual uptake will be affected by various factors, including the existence of competing broadband networks, notably fixed broadband and fixed wireless, and the degree of complementarity between fixed and mobile broadband services.[16]

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12 On the income side, most of this change (60%) can be attributed to productivity gains and 30% can be attributed to capital adjustments with the remainder coming from taxes. On the expenditure side, the majority (77%) of the gains in GDP is from an increase in household consumption and an increase in investment (19%) which is offset by a small decline in the terms of trade.

13 As previously noted, in the long run closure, aggregate employment at the national level is exogenous. Thus, real wages adjust to keep aggregate change in employment zero.

14 Real consumption is used as the welfare measure here instead of real GDP. Household consumption expenditure for 2005-06 was $547,138 million. Source: ABS, *Australian System of National Accounts, 2005-06*, Cat. No. 5204.0, Table 5.

15 As at June 2008, Telstra had 588,000 wireless broadband subscribers according to its 2008 Financial Results and the ABS (Cat. No. 8153.0) reports a total of 809,000 wireless broadband subscribers.

16 Furthermore, these gains may be overstated as it is possible the Ovum report has reported gross gains (without subtracting the cost of provision of mobile broadband services).

APPENDIX A CGE STUDIES OF THE IMPACT OF BROADBAND

The following presents a brief overview of relevant studies that have been undertaken in an Australian and international context. Most of the studies, aside from the 2008 Ovum study, relate to the impact of fixed line broadband, and as such have limited use to our analysis because the characteristics of the productivity improvements arising from mobile broadband are distinct from fixed line broadband, particularly those relating to the mobility aspect of mobile broadband. However, the 2008 Ovum study focused primarily on the impact of mobile broadband and analysed in detail the exact type of economic benefits that result from mobile broadband (e.g. enhancements in field service automation). Hence, the results from this study were used in our analysis.

This appendix first summarises the results of the 2008 Ovum study, then discusses the other broadband studies (Australian studies are discussed first, followed by other international studies).

A.1. OVUM (2008)

Ovum's 2008 report on the impact of mobile broadband technology in the US is probably the most relevant study found as it distinguishes between gains from mobile voice services and mobile broadband services.[17] This study conducted case studies on the productivity gains of mobile broadband on businesses. Ovum identified the uptake of mobile broadband among workers and which jobs would benefit from the use of mobile broadband to calculate the economic benefits of mobile broadband in the US. Our study also uses a similar methodology as detailed in Appendix B.

The key points from the 2008 Ovum report are:

- In 2005, mobile broadband services generated productivity gains to the US economy worth USD 31 billion annually.[18]
- In 2005, 68.8 million US business users had mobile services, with a quarter using mobile broadband. That is, Ovum estimates that 17.2 million business users had mobile broadband in 2005. By 2016, Ovum projected the US to have 81.9 million mobile business users (out of a total of 130.3 million workers), with 83 per cent using mobile broadband. This was done by identifying job types that would benefit from mobile voice and mobile broadband services.
- The forecast demand for mobile broadband services was increased from a previous report in 2005 due to demand forecasts in the previous report that were lower than actual uptake. This suggests that mobile broadband has the potential to grow significantly once it is introduced.

[17] For example, Ovum estimated that in 2004 mobile voice services generated productivity gains to the US economy worth USD 157 billion per annum, whereas mobile broadband services were estimated to generate gains worth USD 28 billion per annum in 2005 (Ovum, 2008, page 2).

[18] Ovum, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, 2008, page 19. Page 11 gives a similar, though slightly different, figure of USD 33.1 billion.

- Broadband services directly benefit businesses of all sizes, but especially small businesses due to the mobility aspect of these services. These benefits include not having to staff a head office, more ready access to corporate information, field service automation and better use of travel time. The study found that mobile broadband enables better decision making, more efficient use of resources, and reduction in costs.[19]

- Ovum identified six sources of tangible economic benefits from mobile broadband. These are resource and inventory management and documentation, health care efficiency enhancements, field service automation, inventory loss reduction, sales force automation, and replacement of desk phones with mobile wireless devices.

A.2. AUSTRALIA

A number of studies have been done on the impact of broadband on the Australian economy that utilise CGE modelling. All of these studies draw on research undertaken by the Productivity Commission and on behalf of NOIE/the Department of Communications, Information Technology and the Arts (DCITA) to model the productivity impact of ICT innovations on the Australian and the Victorian economy in a CGE context.[20] The following sections briefly summarise the approach taken and key assumptions.

A.2.1. OVUM (2003)

A 2003 research project undertaken on behalf of the (then) National Office for the Information Economy (NOIE) relied on a series of case studies to assess how organisations in various industry sectors invest in ICT (this includes but is not limited to broadband) in order to increase productivity, improve processes and strategically position their businesses.[21] That study drew on research from a number of sources to estimate the average historical productivity gains from ICT. Table A1 shows the assumptions that were made for selected sectors.

[19] Ovum, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, 2008, page 6.

[20] For the most recent research by the Productivity Commission, see: Productivity Commission, *ICT Use and Productivity: A Synthesis from Studies of Australian Firms*, Commission Research Paper, 2004.

[21] Ovum, *Productivity and Organisational Transformation: optimising investment in ICT*, 2003.

Table A1 Estimated overall contribution of ICT investment towards productivity growth (2002-2005)

Sector	Average % per annum productivity gains from ICT	Exemplar ICT scenario – 25 per cent increase	Exemplar ICT scenario – 50 per cent increase
Manufacturing (light manufacturing and other manufacturing)	0.88	1.10	1.32
Financial services, Insurance, business services	1.20	1.50	1.80
Education, health	0.80	1.00	1.20
Transport	0.62	0.78	0.94
Trade	0.96	1.20	1.44
Minerals	0.21	0.26	0.31
Total economy (sector weighted)	0.84	1.05	1.26

Source: Ovum, *ICT and productivity – an economic analysis of Australian industry*, pages 158-159.

The figures in the second column in Table A1 formed the basis of the reference case scenario modelled using the Tasman-Global model. Ovum then modelled a number of hypothetical scenarios that investigated the effect of improved ICT deployment practices on these reference levels, by increasing the productivity gains by 25 per cent and 50 per cent, respectively (columns 3 and 4).

A.2.2. ALLEN CONSULTING (2003)

The Allen Consulting study applies a similar approach to the Ovum study (using previous studies on ICT), but using the Monash GE model. Table A2 summarises the resulting output gains arising from the rollout of broadband network with symmetric speeds of more than 10 Mbps of a vertically integrated network operator over a 15 year period.[22]

Table A2 Output gains by sector

Sector	Increase in output (%)
Manufacturing	0.66
Agriculture and mining	0.59
Communications	0.43
Other services	0.39
Construction	0.23
Government	0.14

Source: Allen Consulting Group

A.2.3. ACIL TASMAN (2004)

This study, prepared on behalf of Multimedia Victoria, explored and quantified the economic importance of broadband Internet to the Victorian economy, also using the Tasman Global model.[23] Table A3 shows the assumptions used in that study for a limited number of relevant

[22] Allen Consulting Group, *True Broadband: Exploring the Economic Impacts in a Specific Region*, September 2003, page 17.

[23] ACIL Tasman, *Economic Impacts of Broadband Adoption in Victoria*, June 2004.

sectors. ACIL Tasman report that their projections were informed by a variety of publications, including the ABS, the Productivity Commission, ABARE and the OECD. The figures presented in this table represent the business as usual scenario, or what ACIL Tasman considers to be the most likely for the next 10 years based on the available evidence, but are far from a definitive guide.

Table A3 Average sectoral productivity gains 2004-2015

Sector	Average annual productivity shocks
Minerals	0.10
Manufacturing	0.19
Transport	0.19
Construction	0.19
Communication	0.47
Financial services & insurance	0.44
Public admin. and defence, education, health	0.27
Whole economy	0.23

Note: For the Whole economy shock, sectors are weighted according to each sector size in the economy
Source: ACIL Tasman

A.3. INTERNATIONAL STUDIES

A.3.1. SQW (2006)

A study was undertaken in Scotland to investigate the effect of an incremental upgrade in broadband technology and is additionally described in Table A4 below. This study also uses sectoral shocks (as informed by a literature review), albeit in the context of an incremental upgrade from one generation of fixed broadband to the next generation:

- 1st generation broadband has an incremental impact on productivity of 1 per cent per annum for 5 years (5 per cent eventual total) for medium impact sectors, and 2 per cent per annum for 4 years (8 per cent eventual total) for high impact sectors, and 0.25 per cent per annum for 6 years (1.5 per cent eventual total) for low impact sectors.
- 2nd and 3rd generation broadband technologies each have an incremental impact on productivity that is 33% of that of 1st generation.

The sectors for low, medium and high impact sectors are shown in Table A4 below.

Table A4 Low, medium and high impact sectors

Broadband impact category	Sector
Low	Agriculture, hunting and forestry
	Fishing
Medium	Mining and quarrying
	Manufacturing
	Electricity, gas and water supply
	Construction
	Transport, storage and communication
	Wholesale and retail trade
	Repair of motor vehicles, motorcycles
	Personal and household goods
	Hotels and restaurants
	Other community, social and personal service activities
High	Financial intermediation
	Real estate, renting and business activities

Source: SQW Ltd

A.4. SUMMARY TABLE OF EMPIRICAL STUDIES

Table A5 below provides an overview of international studies that have been done to investigate the wider economic impact of new ICT technologies.

Table A5 **Empirical studies on the economic impacts of broadband**

Name	Year	Methodology	Impact	Remarks
Ovum – The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy	2008	Identify the uptake of mobile broadband among workers and which jobs would benefit from the use of mobile broadband to calculate the economic benefits of mobile broadband in the US.	In 2005, mobile broadband services generated productivity gains to the US economy worth USD 31 billion annually. In 2005, 68.8 million US business users had mobile services, with a quarter using mobile broadband. By 2016, Ovum projected the US to have 81.9 million mobile business users (out of a total of 130.3 million workers), with 83 per cent using mobile broadband. This was done by identifying job types that would benefit from mobile voice and mobile broadband services.	A study specifically on the productivity gains from mobile broadband, as opposed to broadband in general.
Journal of Applied Business Research – The Economic Impact Of Broadband: Estimates From A Regional Input-Output Model	2008	An Input-Output matrix by industry sector is used to model economic impacts of broadband on businesses and consumers. First, determine total broadband expenditure (household and business connections * annual fee). Then input the bb expenditure into the "telecommunications" sector of the model. The model will generate the impacts of bb on the economy.	The authors find that household broadband expenditures over the period 2001-2005 supported 548 jobs and contributed $109.8 million in income and taxes to Hamilton County. Further, they estimate that while a new fiber-to-the-home project would cost $195.5 million over ten years, the economic impact of such a project would result in income and taxes exceeding $352 million while creating over 2,600 new jobs.	Relies on a sector-based input-output model. But use of sectors is simplistic.
SQW Ltd – Next Generation Broadband in Scotland	2006	Calculate incremental economic impact of each of 3 generations of broadband services – 1B (10 times faster than dialup), 2B (100 times faster than dialup; at least 5 Mbps), 3B (1000 times faster than dialup – 50+ Mbps). Assumptions: • Penetration and takeup of 1B/2B/3B+ by geography and by sector • Marginal change in GVA per employee associated with takeup of 1B/2B/3B+, by year of adoption. 1B has an incremental impact on productivity of 1% per annum for 5 years (5% eventual total) for medium impact sectors and 2% per annum for 4 years (8% eventual total) for high impact	Gross Value Added (GVA) of Scotland's market sector in 2015 will be GBP 2-6 billion higher due to business takeup of broadband than it would have been otherwise (at 2000 prices). 45% of the economic benefit is expected to accrue to financial services, real estate, renting and business services – the services that have adopted broadband most rapidly, and the sectors in which ICT has a disproportionately large effect.	Sector-based analysis. Year by year projections, depending on level of uptake for each year. Assumed an eventual impact of 1st generation bb of 5% per annum for medium impact sectors. Has substantial literature review (page 39 onwards). Concluded that studies usually take one or both of

Name	Year	Methodology	Impact	Remarks
		sectors and 0.25% per annum for 6 years (1.5% eventual total), 2B and 3B each have an incremental impact on productivity that is 33% of that of 1B (page 52). Total broadband connections by sector and by technology (1B/2B/3B+) estimated. The marginal change for each sector is multiplied by the total connections by segment and by technology to get the market sector GVA change. Because takeup is calculated annually, the impact on GVA is also calculated annually and generally follows an S-shaped curve (page 65).		a) estimating consumer and producer surplus, and b) estimating impact on GDP. The surplus method is problematic because must be able to estimate price elasticity of bb services at some future point when bb penetration has reached saturation.
ACIL Tasman – Economic Impacts of Broadband Adoption in Victoria	2004	Estimate each sector's takeup curve and sort according to early, mid and late adopters to determine the productivity gains from broadband use. The direct productivity gains arising from broadband use were then fed into the Tasman-Global general equilibrium (international) model, to estimate the resulting macroeconomic impacts. Three distinct scenarios were analysed: 1. Reference case – an estimation of Victoria's growth in the absence of any further broadband productivity gains. 2. Conservative case – an estimation of broadband's impact on Victoria's growth, keeping the unemployment rate constant. 3. Less conservative case - an estimation of broadband's impact on Victoria's growth, allowing the unemployment rate to be variable (this allowed for some indirect impacts of broadband to be measured). The sectoral breakdown of forecasts has been informed by a variety of publications, most notably the ABS (2002), Goldman Sachs (1999), the Allen Consulting Group (2002), the Productivity Commission (2001, 2003), ABARE (Graham et al, 2000), and the OECD (2001, 2003). The projections for the effects on broadband take-up on Victorian productivity by sector reflect internationally recognised trends as well as existing data on the effect of IT take-up on Australian productivity, particularly as it is relevant to broadband Internet use. The effect on productivity is influenced	Under the least conservative scenario (that is, inclusive of employment effects), the average annual contribution of broadband to GSP growth over the projection period is 0.82%. Under this scenario, the annual contribution of broadband to the Victorian GSP is expected to peak in 2008 at just over $2.5 billion (following a period when uptake amongst the various sectors of the economy will have been rapid, the network effect is expected to be strong due to a sizable consumer base, and the resulting productivity gains will be highest). Under more conservative assumptions with a constant unemployment rate, the average annual contribution to Victoria's economic growth of broadband is 0.47%. Table 5 shows ACIL Tasman's average annual productivity gains (2004-2015) for all target sectors. The sectorally weighted economy-wide annual productivity shock is 0.23.	Has productivity shocks by sector. Seems to have done sensitivity analysis.

Name	Year	Methodology	Impact	Remarks
		by the rate at which a given industry is expected to take-up ICT. That is, the total productivity gains that will accrue to each sector, and the average annual growth that this implies, is then distributed over time by the takeup rate.		
Allen Consulting Group – True Broadband: Exploring the Economic Impacts in a Specific Region	2003	Uses the Monash CGE model. This paper mainly contrasts the impacts of a vertically integrated broadband network with an open access broadband network. These impacts are divided into a few categories: • Real output (in telecommunications and in other industries) and aggregate consumption • Employment and wages • Investment and capital	Increase in Gross State Product for Queensland of $854 million per annum after 15 years. Manufacturing and agriculture and mining will experience an increase in output of over 0.5%. Communication services will experience an increase in output of around 0.43%. Other industry segments (including government) in the State will experience increased output of between 0.14% and 0.39%.	Region-specific and sector-based analysis. Uses Monash model.
Ovum – Productivity and Organisational Transformation: optimising investment in ICT	2003	Relied on a series of case studies to assess how organisations in various industry sectors invest in ICT in order to increase productivity, improve processes and strategically position their businesses. Drew on research from a number of sources to estimate the average historical productivity gains from ICT.	Overall average per annum productivity gains from ICT is 0.84%.	Used case studies and other research.
CEBR – The Economic Impact of a Competitive Market for Broadband	2003	Used sensitivity analysis. Analysis is based around three steps: • Developing forecasts for broadband adoption by households and businesses • Using data on the historic impact of communications technology to estimate productivity gains (this is done by a survey of the literature) • Modelling the wider economic impacts of increased productivity with the use of UKMOD, CBER's UK macroeconomic model	By 2015 the productivity benefits of broadband could result in UK GDP being up to £21.9 billion higher than it would otherwise have been. Annual UK fixed investment will be around £8bn per annum higher than otherwise. Annual government borrowing will be reduced by around £13bn per annum.	Used sensitivity analysis.
Criterion Economics – The Effect of Ubiquitous Broadband Adoption on Investment, Jobs and the US Economy	2003	Use of two related approaches to estimating the potential benefits to consumers from the diffusion of broadband services: • First, estimate the direct benefits from the prospective demand for greater high-speed connectivity by calculating the potential consumer surplus attributable to this.	Criterion finds that ubiquitous broadband adoption of current generation technologies will generate $63.6 billion in capital expenditures by DSL and cable modem providers over the next nineteen years. They find that the cumulative increase in capital expenditures associated with the	Uses investment to determine impacts. Use sensitivity analysis – "high" and "low" case. Does not seem relevant to our case, other than use of sensitivity

Name	Year	Methodology	Impact	Remarks
		• The second approach is based on indirect evidence of the potential value of the greater diffusion of broadband and more powerful home computing equipment by examining the new services that households could obtain from faster Internet connections. This approach involves estimating the increase in consumer welfare generated by the new services themselves, in addition to the savings in time and commuting that this new technology will allow. Increased consumer spending is linked to increased employment. Criterion also estimates the effect of broadband adoption on investment using historical data and assuming an S-curve trend. They then translate increased investment to effects on employment and economic growth.	ubiquitous adoption of current generation technologies will result in a cumulative increase in gross domestic product (GDP) of $179.7 billion and will sustain an additional 61,000 jobs per year. Adopting next generation technologies will result in $93.4 billion more investment but will displace $10.6 billion of investment in current technologies, and will result in 140,000 new jobs per year.	analysis.

APPENDIX B CGE METHODOLOGY

As a comparative static model, the results from the TERM do not relate to any particular year. Hence, no adjustment paths can be inferred. The results must be interpreted as the difference between the case "with" the shock (i.e. having the Next G network) and the case "without" the shock (i.e. not having the Next G network). These results are not forecasts of some future point in time but are rather *projections* of the effect of the shock.

In order to model the incremental gains from Next G services, we assume that the majority of these gains result from the provision of mobile broadband services, as opposed to mobile voice services, since competing mobile networks already allow for the provision of mobile voice services. In estimating productivity gains from mobile broadband, we have used as an input the results of a study estimating the gains of mobile broadband in the US released by Ovum recently (see Appendix A.1), with modification and additional inputs to reflect the situation in Australia.[24]

In particular, in parallel with Ovum's methodology, we determined the occupations by industry that would be likely to benefit from the availability of mobile broadband. The analysis was undertaken at the 1-digit ANZSIC industry level[25] and at the 4-digit ANZSCO occupation level[26]. A total of 475 occupations, and their respective employment figures, were available for classification.

The results of the analysis of occupations by industry are given in Table B1 where it can be seen that mobile broadband was calculated to be potentially beneficial to 88 per cent of the workforce in the finance and insurance sector down to 31 per cent of the workforce in the accommodation, cafes and restaurants industry.

Following Ovum, we assumed that in the long term approximately 80 per cent of workers who could potentially benefit from mobile broadband would eventually acquire such a service.[27] If we multiply the proportion of the workforce that would benefit by mobile broadband by the assumed proportion that would take up broadband we obtain the expected maximum saturation rates for wireless broadband given in the last column of Table B1. Over all industry it is calculated that approximately 55 per cent of the workforce would eventually acquire a mobile broadband service.

[24] Ovum, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, 2008.

[25] This is the broadest level of the ANZSIC industry structure.

[26] This is the next to narrowest level of the ANZSCO occupation structure.

[27] Our figure of 80 per cent is more conservative than Ovum's. In page 2 of their 2008 report, Ovum assumes 83 per cent of business users will take up mobile broadband by 2016.

Table B1 Calculation of the take up rate of mobile broadband by industry

Industry	Proportion of workforce that would benefit from a mobile broadband service	Assumed take up proportion	Calculated maximum take up rate
AGRICULTURE FORESTRY AND FISHING	0.68	0.8	0.55
MINING	0.71	0.8	0.57
MANUFACTURING	0.45	0.8	0.36
ELECTRICITY GAS AND WATER SUPPLY	0.68	0.8	0.54
CONSTRUCTION	0.46	0.8	0.36
WHOLESALE TRADE	0.69	0.8	0.55
RETAIL TRADE	0.33	0.8	0.27
ACCOMMODATION CAFES AND RESTAURANTS	0.31	0.8	0.25
TRANSPORT AND STORAGE	0.62	0.8	0.49
COMMUNICATION SERVICES	0.75	0.8	0.60
FINANCE AND INSURANCE	0.88	0.8	0.70
PROPERTY AND BUSINESS SERVICES	0.72	0.8	0.58
EDUCATION	0.77	0.8	0.62
HEALTH AND COMMUNITY SERVICES	0.57	0.8	0.45
CULTURAL AND RECREATIONAL SERVICES	0.46	0.8	0.37
PERSONAL AND OTHER SERVICES	0.43	0.8	0.35
Simple average	0.69	0.8	0.55

Source: Concept Economics calculations

To obtain the impact of mobile broadband in Australia, we used Ovum's estimated productivity benefit but applied this at the individual wireless broadband service level. We assumed these per service benefits would apply in Australia as well. Ovum estimated that in 2005, the use of 17.2 million wireless broadband services[28] in United States industry generated productivity benefits of approximately USD 31 billion[29] or approximately USD 1,924 per service. Converting this figure to Australian dollars at a Purchasing Power Parity rate of 1.388 gave an average productivity benefit per service of AUD 1,386.

To obtain benefits per service at an individual industry level, we scaled the average overall Ovum benefit per service by the ratio of an industry's intensity of use of Telecommunications

[28] Ovum, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, 2008, page 2. One quarter of 68.8 million is 17.2 million.

[29] Ibid, page 19. Page 11 gives a similar, though slightly different, figure of USD 33.1 billion.

services relative to the average intensity of telecommunications use over all industries. This gave the benefit per service figures by industry given in column 4 of Table B2. Also given in Table B2 is data on employment by industry. If we multiply the employment levels by the maximum calculated wireless take up rates given in Table B1, we obtain an estimate of the maximum number of wireless services used by industry given existing workforce levels. A total of 3.9 million wireless services is indicated which is calculated to generate $6.2 billion in productivity benefits to Australian industry based on 2005-06 employment levels (see Table B2).

Table B2 **Calculation of the take up rate of mobile broadband by industry**

Industry	Average benefit per service ($)	Relative telecommunications use intensity	Adjusted benefit per service ($)	Persons employed	Calculated maximum take up rate	Maximum services	Expected long run benefit ($m)
AGRICULTURE FORESTRY AND FISHING	1,386	0.32	440	497,700	0.55	271,987	119.7
MINING	1,386	0.31	433	112,600	0.57	64,149	27.7
MANUFACTURING	1,386	0.49	677	1,070,400	0.36	389,524	263.9
ELECTRICITY GAS AND WATER SUPPLY	1,386	0.54	748	67,200	0.54	36,467	27.3
CONSTRUCTION	1,386	0.42	580	722,800	0.36	263,743	153.0
WHOLESALE TRADE	1,386	1.95	2,701	480,900	0.55	265,426	716.9
RETAIL TRADE	1,386	2.11	2,930	1,387,100	0.27	370,700	1,086.2
ACCOMMODATION CAFES AND RESTAURANTS	1,386	0.76	1,048	460,400	0.25	113,006	118.5
TRANSPORT AND STORAGE	1,386	1.39	1,924	436,100	0.49	215,240	414.0
COMMUNICATION SERVICES	1,386	1.35	1,873	138,900	0.60	83,824	157.0
FINANCE AND INSURANCE	1,386	1.17	1,624	348,585	0.70	244,944	397.8
PROPERTY AND BUSINESS SERVICES	1,386	1.42	1,971	1,524,500	0.58	877,815	1,729.7
EDUCATION	1,386	0.96	1,332	259,700	0.62	160,580	213.8
HEALTH AND COMMUNITY SERVICES	1,386	0.66	915	751,500	0.45	339,765	310.8
CULTURAL AND RECREATIONAL SERVICES	1,386	2.30	3,195	208,800	0.37	77,531	247.7
PERSONAL AND OTHER SERVICES	1,386	1.95	2,709	276,800	0.35	95,710	259.3
Total	1,386	1.00	1,386			3,870,410	6,243.2

Source: Ovum; Concept Economics calculations.

The data on productivity benefits given in Table B2 represent the long run benefits from mobile broadband. To examine the time frame over which these benefits could be expected to accrue we fitted an "S" shaped adoption curve to the available data. In particular, ABS data indicated that in June quarter 2006 there were 101,000 wireless broadband services in use. By June quarter 2008 this number had grown to 809,000 services.

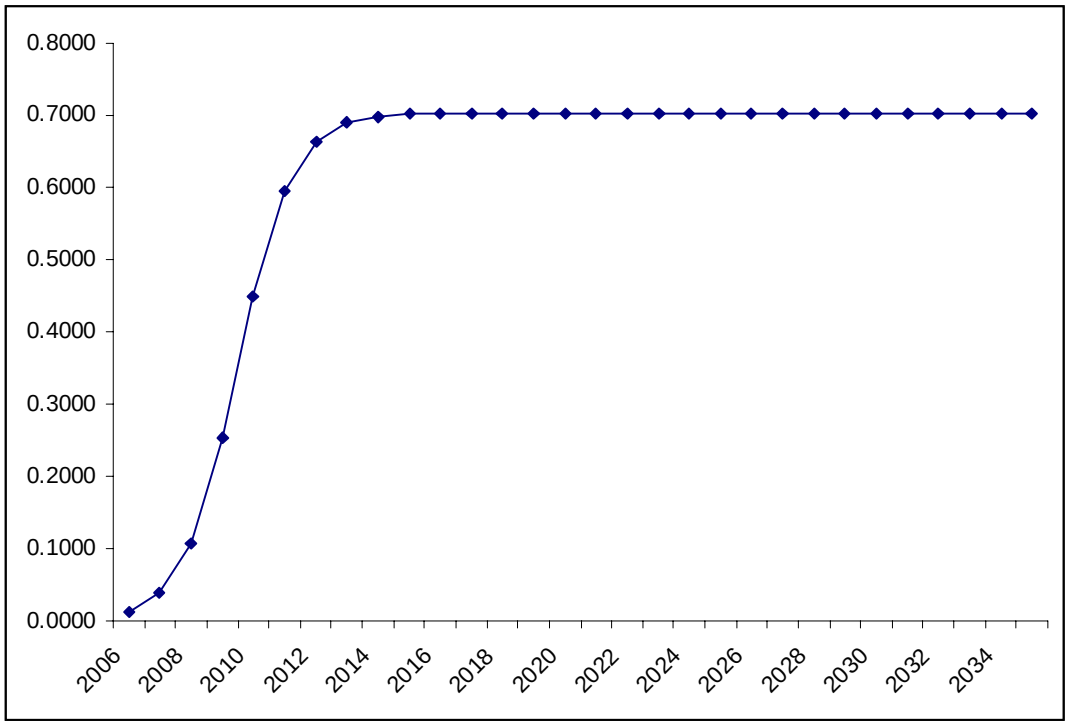
Given these numbers of services and respective employment levels in June 2006 and June 2008 it can be calculated that wireless penetration in industry was about 2 per cent in 2006 and 17 per cent in June 2008 (see Table B3). Given these adoption rates and an assumed maximum saturation rate for, say, finance and insurance of 70 per cent (see Table B1) we found that by about 2014 the maximum assumed saturation rate of 70 per cent had been achieved (see Figure B1). This means that the productivity benefits from mobile broadband given in Table B2 could be used to derive shocks for a long run simulation in a GGE Model.

Table B3 **Calculated adoption rate of mobile broadband by industry**

Variable	Jun-06	Jun-08
Employment	10,183,000	10,712,000
Assumed proportion that would take up mobile	0.44	0.44
Assumed target workforce	4,507,372	4,741,527
Wireless numbers	101,000	809,000
Adoption rate	0.02	0.17

Source: Concept Economics calculations

Figure B1 **Calculated adoption function for mobile broadband in Finance and insurance industry (the proportion of target workforce that adopts mobile broadband)**



Data source: Concept Economics calculations

When we divided the productivity improvements given in Table B2 by the value of sales and other income in the respective industries, we find that the long run sectoral shocks resulting from the provision of mobile broadband services are as shown in Table B4:

Table B4 Sectoral productivity shocks from mobile broadband used in long run closure of TERM

Sector	Shock (%)
Sheep	0.1926
Grains	0.1926
BeefCattle	0.1926
OthLivestck	0.1926
OthAgricult	0.1926
ForestFishng	0.1926
Mining	0.0273
MeatProducts	0.0725
OtherFoodBev	0.0725
TCF	0.0725
OthManufact	0.0725
PetrolChems	0.0725
NonMetMins	0.0725
MetPrdsMach	0.0725
EGW	0.0492
Construction	0.0769
OtherTrade	0.1989
RetailTrade	0.3368
RoadFrght	0.3715
RdPasAirRail	0.3715
RailFreight	0.3715
OthTransport	0.3715
OtherSrvces	0.5658
Telecomms	0.3124
BankFinInsur	0.5373
GovAdmin	0.5658
SchoolEduc	1.1767
OthEducation	1.1767
Health	0.4754
OthPubSrvces	0.6100

Source: Concept Economics calculations

By 2018, both urban and non-urban uptake in all sectors reaches close to saturation levels. As such, the shocks with and without regional differences are virtually identical.

These shocks are applied in the TERM CGE model to the general productivity variable and run using a long run closure.

APPENDIX C SECTORAL IMPACTS OF NEXT G

Table C1 Change in industry output

Sector	Gains (%)
Sheep	0.2651
Grains	0.2597
BeefCattle	0.2525
OthLivestck	0.3021
OthAgricult	0.4475
ForestFishng	0.4276
Mining	0.2861
MeatProducts	0.3425
OtherFoodBev	0.4152
TCF	0.4246
OthManufact	0.3215
PetrolChems	0.4251
NonMetMins	0.4945
MetPrdsMach	0.5457
EGW	0.5293
Construction	0.7646
OtherTrade	0.6214
RetailTrade	0.5342
RoadFrght	0.3924
RdPasAirRail	1.3314
RailFreight	0.383
OthTransport	0.4366
OtherSrvces	0.4267
Telecomms	0.4791
BankFinInsur	0.6882
DwellingAsst	1.3606
GovAdmin	0.0142
SchoolEduc	0.0142
OthEducation	0.6447
Health	0.5247
OthPubSrvces	0.5247

Source: Concept Economics calculations

APPENDIX D REGIONAL IMPACTS OF NEXT G

Table D1 Real Household Consumption Impacts by Region

Region	Real Household Consumption Impact (%)
InnerQld	1.4196
OtrAdelaidSA	1.4180
SouthWestWA	1.4021
RoTAS	1.3874
BrisbneGCQLD	1.3839
AdelaideSA	1.3780
InnerVic	1.3672
InnerRegNSW	1.3664
RoSA	1.3598
MelbourneVIC	1.3561
SydneyNSW	1.3550
GrtHobartTAS	1.3542
PerthWA	1.3515
OuterRegVic	1.3315
DarwinNT	1.3221
WestNSW	1.3190
RoWA	1.2999
OuterQld	1.2823
RoNT	1.2562
ACT	1.1375

Source: Concept Economics calculations