The Allen Consulting Group

True Broadband

Exploring the economic impacts

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An Ericsson contribution to public policy debate

ERICSSON

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Executive summary

This study evaluates in detail the economic impact of a true broadband network throughout a major urban centre in Australia. Specifically the study examines the impact on the host region, which in this case is the Brisbane and Moreton statistical divisions, as well as for the State of Queensland at large. It also examines the impact for industries within the State.

A true broadband network is a broadband infrastructure capable of supporting at a minimum video, voice and data services and applications simultaneously over a single physical infrastructure. True broadband delivers symmetric services at speeds greater than 10 Mbps.

The analysis factors in a network cost of approximately $850 million over a four-year construction period. This includes backbone infrastructure costs as well as the hardware, software and installation costs of delivering fibre-to-the-home connectivity.

It is foreshadowed that the development and use of a true broadband network would involve four broad direct impacts including:

- an expansion of the communications activity in the region as the new business is developed and provides services (buying and selling inputs, employing staff etc);
- enhancing competition in telecommunications — in a range of areas, but especially in Internet Service Provision;
- opening up scope for productivity gains that are apparent from the use of broadband technologies in business; and
- competitive gains for key industries that are particularly dependent upon affordable broadband Internet access.

The thrust of the study was to estimate these impacts and assess their value as they work their way through complex, interconnected economies in the region and the State at large. The magnitude and timing of the impacts were found to vary according to the level of competition that will accompany its construction, takeup and use.

The findings of the study suggest that if the network is owned and operated by a *vertically integrated retail service provider*, there will be substantial benefits for the region, including:

- an increase in output (GRP) for the region. This increase has a net present value (NPV) over 15 years of $2,640 million; and
- an increase in employment of around 15,000 jobs over 15 years to 2018-19.

The model results also suggest that, similarly to other more traditional forms of infrastructure, the use of a true broadband network will not only benefit people and businesses in the immediate area but will also benefit those further away that rely on services delivered in major cities that become more efficient. The changes are also large enough to have macro-economic significance. That is, it may change wages, prices and factors such as capital flows and the exchange rate.

The findings suggest that the Queensland economy would benefit in the following ways:

- increase real output or gross state product (GSP) by $854 million per annum at the end of 15 years (i.e., by 2018-19). The increases in output have a value today (i.e., NPV) of $4,180 million;
- additional employment equivalent to 1,155 new jobs in the year 2018-19; and
- increase annual aggregate consumption by around $499 million in 2018-19. This has a value today of $2,835 million.

Every industry segment located in the State will benefit from a vertically integrated true broadband network throughout the region. Over the simulation period, industry will benefit in the following ways:

- manufacturing and agriculture and mining will experience an increase in output of over 0.5 per cent;
- communication services will experience an increase in output of around 0.43 per cent; and
- other industry segments (including government) in the State will experience increased output of between 0.14 per cent and 0.39 per cent.

The study also analysed what the economic impacts would be if the infrastructure was operated as an *open access true broadband network*. This approach leaves the network operation in the hands of a neutral carrier, while it was open for a number of retailers to offered a range of different services that would be carried over the network. This would introduce more choice and innovation in the bundles of services offered or carried over the network with even more competitive prices. Under this scenario it was expected that better services and lower prices would stimulate faster subscriber takeup and use of the network.

The simulation results suggest that there are additional economic benefits for the region and the state from additional competition in the provision of true broadband services. These include:

- an earlier realisation of increases in regional output. Additional competition raises the NPV of the increases in GRP to $3,160 over the period (relative to $2,640 million if the network is owned and operated by a vertically integrated retail service provider);
- additional increases in GSP. This raises the NPV of increases in GSP to $4,900 million (compared to $4,180 million assuming a vertically integrated retail service provider); and

- increased consumption. The NPV of the increases in aggregate consumption assuming additional competition is $3,414 million relative to $2,835 million if the network is owned and operated by a vertically integrated retail service provider.

For the communications industry there is an additional gain from increased competition. This incremental gain is equivalent to 0.07 per cent of output by the year 2018-19. Other industry segments would experience a slightly lower growth in output relative to the vertically integrated scenario. Relative to the base case, however, all industries benefit from the construction of an open access true broadband network in the region.

The findings of the study suggest that the majority of the above benefits accrue from the increased productivity gains experienced by industry generally and to a lessor extent, expansion of the telecommunications sector (i.e., the businesses providing the true broadband network), with expansion of digital content industries making a relatively modest contribution.

The overall message of the analysis is that there are substantial net economic gains available to the region in the analysis, and probably many other major urban areas in Australia from the development and use of a true broadband network. These gains far exceed the initial investment costs required to finance the network.

Chapter 1
Study Context

This section places the study into context. It sets out the study aims and discusses how they are achieved. It also provides an outline of the remainder of the report.

1.1 The study

This study has been commissioned by Ericsson and undertaken by The Allen Consulting Group, in conjunction with the Centre for Policy Studies.

Aims and goals

The study aims to evaluate, in some detail, the economic impact of a true broadband network throughout a major urban area in Australia. A true broadband network is a broadband infrastructure capable of supporting at a minimum video, voice and data services and applications simultaneously over a single physical infrastructure.[1]

To make the findings tangible the study focuses on a distinct urban area. The region selected comprises the Brisbane and Moreton Statistical Divisions within Queensland. This region incorporates a city of more than a million people with a diversified economic base. It is likely that much the same impact would be obtained from true broadband accessibility and use in any major urban area throughout Australia.

There are three key challenges. The first is to identify how a true broadband network differs from other telecommunications networks (i.e. ADSL, HFC cable and PSTN networks) and what this means for users. The second is to assess how the identified differences translate into economic implications. The third is to apply these understandings to a particular urban area within Australia while not losing track of the larger economic story.

Study approach

The study combines the application of an economic model, with qualitative and quantitative inputs sourced from a range of relevant sources.

Inputs were sourced from:

- The Allen Consulting Group Business Database;
- Ericsson Australasia;
- previous studies into the benefits of e-commerce and the application of ICTs; and
- discussions with relevant experts in the areas of broadband and network ICTs.

[1] Packetfront, 2003 The Future of Broadband. Today, Packetfront, Sweden sourced from www.packetfront.com/tbn.php accessed on 7 August 2003.

The Monash Multi-Regional Forecasting (MMRF) model was used as the framework for the main quantitative part of the analysis. Appendix B contains further details about the MMRF model and the assumptions that underpin it.

1.2 Structure of this report

Chapter 2 of this report explores the technical and economic feasibility of a true broadband network throughout the region. It also identifies what would be the likely key characteristics of such a network.

Chapter 3 introduces the Monash Multi-Regional Forecasting (MMRF) model and reports the insights about the economy wide implications of a true broadband network in the Brisbane and Moreton regions based on model simulations.

Chapter 4 details the findings of the study.

Appendix A examines in greater detail what impact the construction, takeup and use of a true broadband network will have on the selected region.

Details about the key economic assumptions used in the study are presented in Appendix B. This also examines what economic changes would be likely to flow from the takeup and use of a true broadband network throughout the region.

Appendix C details the nature of the MMRF model and the assumptions that underpin it.

Chapter 2

The Network and its use

This chapter explores the technical and economic feasibility of a true broadband network throughout the selected region. It seeks to identify the likely key characteristics of such a network including geographical reach, subscriber takeup, construction costs and likely technology.

2.1 The region

To make the findings of this report tangible and relevant the study has focused on the Brisbane and Moreton regions of South East Queensland. These areas were chosen because, taken as one region, they exhibit the following characteristics:

- Population of over a million people — according to the ABS the Brisbane statistical division has a resident population of approximately 1.6 million people while the Statistical division of Moreton has a resident population of around 700,000 people.[2] Since 1996 the combined statistical divisions of Brisbane and Moreton have experienced an annual average population growth of 2.6 per cent.[3]

- A diversified economic base — consisting of agriculture and mining, tourism, retail and wholesale trade, infrastructure provision including electricity gas and water as well as education, research and development and significant levels of government activity.[4]

In addition to its population and economic characteristics the Brisbane and Moreton Statistical divisions are geographically large covering an area of 22, 298 square kilometres with a significant hinterland and costal topography.[5] Figure 2.1 provides maps for both the Brisbane and Moreton statistical divisions.

While every major urban area in Australia is different, the Brisbane and Moreton regions share many of the above characteristics with other major urban centres in Australia.

[2] ABS, 2001, Census Basic Community Profile and Snapshot, ABS, Canberra.

[3] Office of Economic and statistical Research, 2002, *Regional Profiles: Brisbane and Moreton*, Queensland Government, Brisbane.

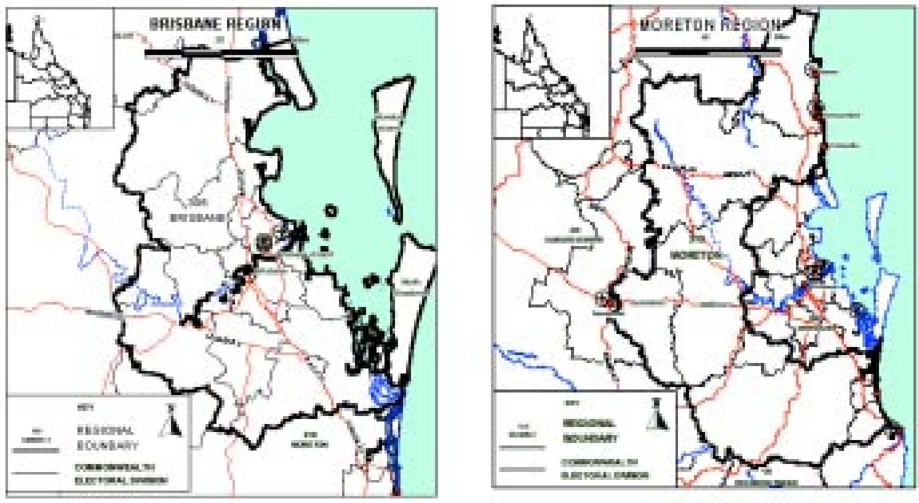
[4] Office of Economic and statistical Research, 2002, *Regional Profiles: Brisbane and Moreton*, Queensland Government, Brisbane.

[5] Office of Economic and statistical Research, 2002, *Regional Profiles: Brisbane and Moreton*, Queensland Government, Brisbane.

Figure 2.1

BRISBANE AND MORETON STATISTICAL DIVISIONS

Brisbane	Moreton



Source: ABS

2.2 What is true broadband?

Broadband is a generic term representing high-speed data services.[6] At its most basic level it can be said that broadband is characterised by high downstream speeds (at least compared to dialup modem technology) and always-on connectivity. In Australia the most widely accepted definition of broadband is that adopted by the Australian Competition and Consumer Commission (ACCC):

> any high speed connection greater than 200kbits/sec over a mix of media. This definition of broadband excludes PSTN dial up connections that run at 56 kbit/sec and ISDN dial up connections which run at either 64 or 128 kbit/sec.
>
> ACCC, 2003, *SNAP SHOT OF BROADBAND DEPLOYMENT AS AT 31 MARCH 2003*, ACCC, Canberra p.6

Omitted from many commonly used definitions are the characteristics including upstream speed, symmetric capabilities and the ability to support many applications and user devices simultaneously. These important omissions have led to the use of terms such as ‘true broadband’, ‘ultra broadband’ or ‘next generation broadband’ when referring to high speed data services that provide *symmetric* data streams of greater than 10Mbps and that are capable of supporting multi-user, multi-device applications.

Table 2.1 compares the key characteristics of a true broadband network with early broadband and narrowband technologies.

[6] Gartner, Inc and CENIC, 2003, *One Gigabit or Bust Initiative: A broadband vision for California,* Gartner Inc, California, p.6.

Table 2.1

THE EVOLUTION OF BROADBAND

Narrowband	Early Broadband	True/Ultra Broadband
Downstream speeds of up to 56Kbps	Downstream speeds over 200Kbps	Symmetric speeds (downstream and upstream) over 10Mbps
Single user	Multi-user	Multi-user, multi-appliance/devise
Single service (Internet or phone)	Dual service (Internet plus telephony)	Multi-service (Internet plus Phone plus Video/TV plus other)
Basic e-mail, Basic web-browser	Media rich email and web-browser	Media rich email and web browser
Basic information exchange/ e-commerce	Rich information exchange/ e-commerce	Multi-media applications and Multi-appliances
Asymmetric (simple consumer) — no interactivity	Asymmetric (sophisticated consumer) — limited interactivity	Multi-node interaction (sophisticated producer/consumer/peer) — full interactivity
Text capable	Graphics capable	Video capable

Source: The Allen Consulting Group and Ericsson

Speed

At a minimum, true broadband networks are capable of delivering *symmetric* speeds of 10Mbps per second. Hence, true broadband networks are 50 times faster than currently available ADSL and cable Internet access technologies.

Functionality

The critical aspect of true broadband technologies is what it allows users to do. Faster download speeds and data transfer rates increase functionality and quality. Additional functionality means that users have the option of performing more online activities.

True broadband also enables true interactivity. This in turn will enable a new generation of technology and online applications including on-line class-rooms and health clinics where teacher and student and doctor and patient can interact in real time.[7] It also creates the potential for a new generation of entertainment services such as Video-on-Demand (VoD) and online gaming. Applications such as these have, to date, not been enabled by ADSL and cable technologies.

Use

True broadband allows users to communicate more richly, perform more activities online, and engage in a greater range of e-commerce activities. True broadband reduces concerns about file sizes and allows users to take advantage of the full processing power of computers and information and communications technologies (ICTs). This in turn enables the expansion of research and knowledge sharing capabilities. True broadband also means interactive services which increases the

[7] OECD, 2001, *The Development of Broadband Access in OECD Countries*, OECD, Paris.

relevance of the Internet and encourages users to make the Internet and online activities more a part of everyday life.[8]

For business, true broadband makes e-commerce more viable. In particular, interactivity makes business-to-consumer (B2C) e-commerce more attractive for both consumers and businesses. A greater integration of B2C e-commerce by businesses will allow for the further re-engineering and rationalisation of distribution channels in order to obtain cost efficiencies and productivity gains. In fact true broadband may deliver to many industries the cost efficiencies that were realised by the banking sector from the introduction and adoption of telephone and Internet banking.

2.3 Delivering true broadband

A true broadband network throughout the region

A true broadband network capable of delivering voice, data and video services may take several forms. The network's geographic coverage, design, capacity, service capability and choice of access technologies are all variables that depend on the investor, or group of investors, willing to construct and operate such a network.

The benefits that would accrue from the construction and operation of a true broadband network will also vary according to:

- the capacity and service capability of the network;
- which investor, or group of investors undertook the investment;
- the ability of third parties to access the network;
- the geographic coverage of the network; and
- the period over which the network was constructed.

To evaluate the economic impacts of a true broadband network The Allen Consulting Group, in consultation with Ericsson, have used the following parameters as a starting point.

A point-to-point fibre–to-the-home network

Fibre-to-the-home (FTTH) offers almost unlimited bandwidth and enables the highest possible Internet speeds. FTTH can also handle bandwidth-hungry services such as VoD, TV broadcasts and Internet Protocol (IP) telephony. According to many industry analysts, fibre is the only available technology that is currently capable of handling future service demands.[9]

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8 Electronic Industry Alliance, www.eia.org/policy/broadband.phtml accessed on 6th September 2003.

9 Ericsson, 2003, *Future is Bright for fibre-to-the-home*, Melbourne, http://www.ericsson.com/multi-servicenetworks/printFeatureArticle.asp?ArticleId=E24E8813-7BCB-491C-9693-90B047F559B4, Accessed 7 August 2003.

Box 2.1

WHAT IS FIBRE-TO-THE-HOME?

Fibre-to-the-home is a broadband network solution where optical fibre runs from the telephone switch to the customer premises in a point-to-point configuration. Its point-to point configuration allows dedicated bandwidth and eliminates the need for additional electronics such as Optical Network Units. FTTH networks can be rolled out via overhead cabling and or underground trenching.

FTTH networks are scalable (capable supporting several generations of electronics) and offer almost infinite bandwidth. Accordingly, they are considered by many in the industry to be the only solution for a future proof, high capacity, true broadband network over which a bundle of bandwidth intensive communications, information and entertainment services can be delivered.

In addition to providing Internet access at speeds of up to 100 Mbps, FTTH networks are capable of delivering higher quality telephony services as well as video-on-demand (VOD) services.

Source: DG Information Society, 2001, *The Development of Broadband Access Platforms in Europe*

Geographic coverage and network rollout

The mass-market rollout of a true broadband network will be undertaken covering 50 per cent of the businesses and households in the region. This scale of rollout will provide critical mass. Given that the construction and operation of telecommunications networks involve a high proportion of fixed costs, which are of a sunk nature, critical mass is a key success factor in the efficient operation of a true broadband network as well as in the delivery of a broad range of consumer and business service offerings.[10]

Table 2.2

GEOGRAPHIC COVERAGE OF THE PROPOSED NETWORK

	2004-05	2005-06	2006-07	2007-08	2008-09 to 2018-19
Per cent of Dwellings	12.5	25	37.5	50	50
Coverage number of Households	120 000	240 000	360 000	480 000	480 000
Coverage number of Businesses	15 000	30 000	45 000	60 00	60 000
Total Coverage	135 000	270 000	405 000	540 000	540 000

Source: The Allen Consulting Group

The network will be rolled out over a four year period with services being offered to both businesses and households after six months.

[10] See Stephen Inglis, 2003, *Identifying winning applications and strategies to stimulate the growth of broadband,* Ericsson Australasia, Sydney.

Box 2.2

TRUE BROADBAND IN SWEDEN — SOLLENTUNA ENERGI

In 1999, the local energy company in Sollentuna Sweden began installing ducts and fibre alongside power cables to provide broadband Internet access to local businesses and households. By May 2002 Sollentuna Energi had constructed a fibre-to-the-home network passing over 12,000 homes.

This network provides, around 4,500 customers (an estimated takeup rate of around 38 per cent) with a range of services including:

- symmetric high speed Internet access of either 10Mbps or 100Mbps;
- music downloading;
- dedicated Internet and LAN access to businesses; and
- video services, such as VoD and broadcast TV.

The company also plans to offer VoIP and alarm services in the near future.

The Sollentuna network is an open access network. Sollentuna Energi owns the access network, while a number of third party (or external) service providers provide Internet connectivity.

Key factors in the success of this network include:

- the low cost fibre deployment strategy which relies on the use of community infrastructure (primarily power poles and energy ducts);
- low end user subscriber charges; and
- Government subsidies for new installations.

Source: Ericsson, 2002, Sollentuna Energi: A Broadband Pioneer, Ericsson, Sydney

A competitive network

The network to be modelled will be a 'competitive' network prepared to compete with existing networks and service offerings.

More importantly, the network to be modelled will be a 'greenfields network'. For end-user access it will not utilise legacy infrastructure owned by existing or incumbent carriers to enable the achievement of true broadband capability. However it may benefit from community or utility infrastructure such as trenches, power poles and/or rights of way.[11]

A bundled product offering

The network as modelled will be able to support a bundled product offering of, at a minimum:

- voice telephony;
- high speed Internet services with asymmetric speeds of greater than 10Mbps; and
- video/television services such VoD or pay TV content.

[11] As demonstrated by TransACT and Bright Communications in Australia as well as a number of overseas broadband ventures (including Fastweb in Italy and Sollentuna in Sweden) the use of community or utility infrastructure allows for the economically efficient rollout of broadband networks by avoiding the unnecessary duplication of utility infrastructure.

Economically efficient design

Similar to Bright Communication's FTTH network in Western Australia the network to be modelled will be deployed using existing trenches, telecommunications ducting and rights of way. It will also involve the deployment of low visibility aerial optical fibre using existing electricity poles. These initiatives will ensure that deployment of the network is achieved at low cost.

The network design also seeks to minimise fixed costs in favour of variable costs. This is due to the fact that a significant proportion of the expected costs can be deferred until subscribers takeup a service. Per subscriber connection costs represent approximately 45 per cent of the total capital costs.

Implications for competition

The construction of a true broadband network as described in the previous section would enable an operator to earn multiple revenue streams. For example an operator could:

- *provide retail services* — this would provide households, businesses and government agencies throughout the region with a real alternative to existing carriers;
- *sell wholesale end-to-end services* — this would provide retail service providers with a greater choice of suppliers and create greater competition in the wholesale markets; and
- *sell wholesale capacity* — this would enable a greater number of competitive telecommunications providers to offer a range of telecommunications services in the region, via access based competition.

The presence of such a provider would imply a fundamental change in the telecommunications environment in the region. A true broadband network would deliver not only affordable and accessible broadband Internet and telephony services, but it would also deliver facilities based competition as opposed to resale competition to the current incumbent broadband and telecommunications carriers.

The impact of competition would depend upon its extent. All of the services mentioned above could be provided by a single vertically integrated supplier competing with other telecommunications carriers and technologies. Alternatively, additional competition could be injected by introducing competition in different levels of service provision in the true broadband network itself, especially in relation to the provision of retail services.

Cost dimensions

Ericsson has provided The Allen Consulting Group with cost estimates for constructing a FTTH network. The network as described previously would cost approximately $850 million. A likely breakdown of these costs by broad economic category of input is detailed in table 2.3

Table 2.3

ESTIMATED CAPITAL COST FOR A TRUE BROADBAND NETWORK

Cost item	Per cent of total expected costs
Network construction costs	37
Electronics	41
Other costs	22
Total	100

Source: Ericsson

Chapter 3

Simulation results

This chapter uses a multi-region, multi-sector model of the Australian economy to extend the analysis undertaken in Appendix A and to identify how such initial changes will impact upon the region as well as the Queensland economy.

3.1 Modelling approach

To evaluate the regional implications of rolling out a true broadband network in the region, the Monash Multi-Region Forecasting (MMRF) model has been used. The MMRF model is a multi-regional, multi-sectoral dynamic computable general equilibrium (CGE) model of the Australian economy.

Box 3.1

THE MMRF MODEL

The Monash Multi-Region Forecasting (MMRF) model is a multi-sector dynamic computable general equilibrium model of the Australian economy. The model specifically takes into account the interconnectedness that is a feature of modern economies, permitting assessment of the final outcome of an assumed policy change, once changed costs and prices have worked their way through the economy. The model is useful in this context because it:

- permits the disaggregation of results down to the level of ABS statistical divisions;
- provides a reasonably high level of disaggregation of industrial activity — the underlying analysis divides the economy into 22 industry categories;
- places that focus in the context of competition, trade, capital and labour flows with the rest of Australia and the world;
- is a dynamic model and permits analysis of change over time;
- reports economy wide outcomes including GSP, GDP, changes in employment, trade impacts and many other that allow full analysis of interconnected factors that drive change and provide opportunities and challenges for investors, economic managers and policy makers; and
- identifies impacts upon households. This is important for evaluation of changes in economic wellbeing.

The MMRF model and its foundations are completely transparent and have been subject to extensive peer review. It is widely used by government agencies in conducting their own evaluations.

Finally, it is notable that the 1999 Bandwidth Inquiry report identified that the strongest contenders for analysing these issues are computable general equilibrium models such as the MONASH model developed by the Centre of Policy Studies at Monash University.[12]

MMRF has been applied in this case by the Centre of Policy Studies at Monash University, the developers of the model.

Source: The Allen Consulting Group

Further details about the MMRF model and the assumptions that underpin it are provided in appendix B

[12] Australian Information Economy Advisory Council, 1999, *National Bandwidth Inquiry,* DCITA, Canberra, p.170.

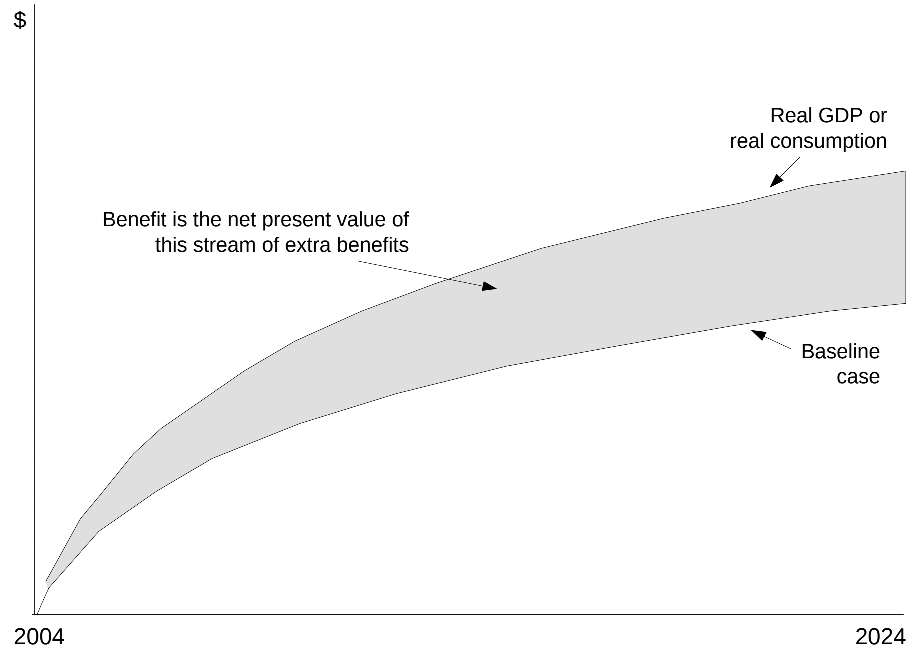
3.2 The base case

Like other CGE models, the MMRF model starts with a base case forecast of the economy at large. The base case reflects expected outcomes in terms of value added, employment, sales, prices, imports and exports. It also reflects expected outcomes regarding the availability of telecommunications infrastructure, products and services including the takeup of broadband and dialup Internet technologies.[13] The taxing and spending activity of governments is also included. Adding these up forms a macroeconomic picture of the Australian economy, where the assumed scenario does not occur. The base case scenario is detailed further in Appendix B of this report.

Analysis is conducted by evaluating the changes in economic outcomes brought about by the rollout and takeup of a true broadband network in comparison to the base case. Figure 3.1 depicts the way in which a positive economic impact (i.e. an economic gain) from an assumed scenario is represented compared to the base case (i.e. where the assumed scenario does not occur).

Figure 3.1

REPRESENTATION OF ECONOMIC IMPACTS FROM A TRUE BROADBAND NETWORK



Source: The Allen Consulting Group

3.3 Scenarios modelled

As previously mentioned this study analyses two different scenarios. Each scenario applies a number of direct economic changes (or shocks) brought about by the rollout and takeup of a true broadband network (as described in Appendix A) in the region.

[13] The base case does not reflect the construction take up and use of a true broadband network within Australia.

The two scenarios are:

- *A vertically integrated true broadband network* — this scenario involves the rollout of a true broadband network to 50 per cent of the businesses and residential dwellings in the region. Of the total number of businesses and households serviced by the network 30 per cent subscribe to either one or more of the services. This scenario assumes that the rollout of the network and the provision of services to end-users will be undertaken by a vertically integrated service provider and that there will be no third party access permitted. Hence, there will be only one new market entrant at both the retail and wholesale levels.
- *An open access true broadband network* — this scenario looks at what would happen if the true broadband network (as rolled out in the limited competition scenario) were open to third party access. This scenario assumes that several market entrants will provide a range of retail voice, data and video services to end-users over the true broadband network. It also assumes that additional competition will accelerate the take up of true broadband services bringing forward the associated benefits to business and residential users.

3.4 Outcomes for the region

The construction takeup and use of a true broadband network is foreshadowed to have significant economic impacts throughout the region. Table 3.1 summarises the expected impacts for the region arising from both a true broadband network and an open access true broadband network:

Appendix A discusses these impacts in more detail.

Table 3.1
REGIONAL IMPACTS — SUMMARY (DEVIATION FROM BASE CASE)

	A Vertically Integrated True Broadband Network ($m)	An Open Access True Broadband Network ($m)
Gross Regional Impact (Net Present Value over 15 years)	2,640	3,160
Average Additional Employment	1,030	1,005

Source: MMRF Modelling Results

3.5 Outcomes for the Queensland economy

A true broadband network throughout the region can be expected to have significance for the state of Queensland at large.

The use of a true broadband network will not only benefit people and businesses in the immediate area but will also benefit those further away that rely on services delivered in major cities that become more efficient. Clearly expansions in an airport, port or a bridge in a capital city would be expected to make the activities of service providers that need smoother, more efficient gateways, more efficient. With competition, many of these cost reductions are passed on to customers, including customers in outlying cities and rural regions. Similarly, many of the gains from the enhanced connectedness within the region, and between the region and the rest of the world brought about by the true broadband network would be passed onto others elsewhere in the state.

The changes are also large enough to have macro-economic significance. That is, growth in one area may spillover into increased demand in others. The changes may also may lead to flow on changes in wages, prices and factors such as capital flows and, in relation to trade, the exchange rate.

Reflecting these factors, while the Network's impacts are concentrated in the region, the host region, it will be large enough to materially alter outcomes over the entire Queensland economy.

A vertically integrated true broadband network

Forecasts about the key impacts of a true broadband network in the Brisbane and Moreton region as they flow on to the rest of the state are reflected and discussed in figure 3.2.

Figure 3.2

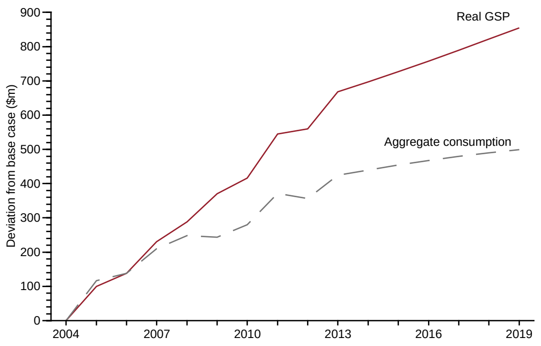
IMPACTS FROM A VERTICALLY INTEGRATED TRUE BROADBAND NETWORK (DEVIATION FROM BASE CASE)

(a) — Real output and aggregate consumption

A true broadband network throughout the region is expected to stimulate significant growth in the Queensland economy. There is potential to expand output (i.e. GSP) by around $854 million per annum (in real terms) by the year 2018-2019

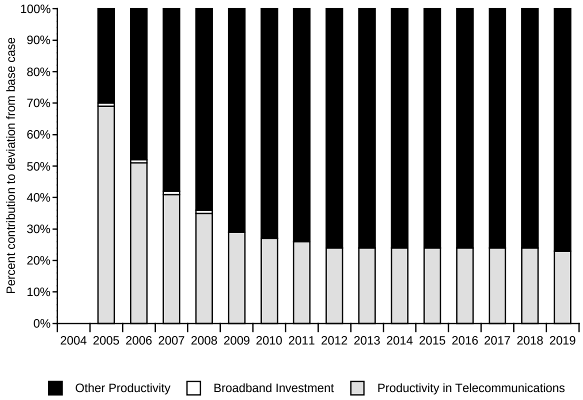
Consumption in Queensland is expected to enjoy a sustained rise as a result of the efficiency gains made possible by the takeup and use of the network. Consumption rises by some $499 million per annum by the year 2018-19.

The gap between increased output and consumption gains is explained by the investment required to fund further growth and leakage through imports from other States.



(b) — Contributions to Queensland real output

Nearly almost all of the increased output arising from a true broadband network is the result of increased productivity either in the telecommunications industry or in Queensland's digital content industries. The increased investment in broadband contributes a small contribution to the overall gains.

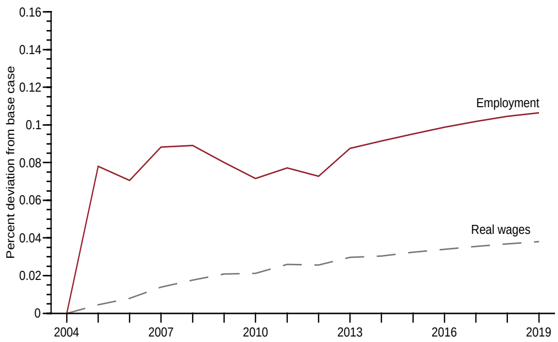


(c) — Queensland employment and real wages

Employment in Queensland increases sharply in the rollout phase of the project and is maintained over the period in which there increasing takeup of true broadband services. Employment remains above the base case for the entire simulation period.

In 2018-19 an additional 2,172 additional job will be created in the state of Queensland.

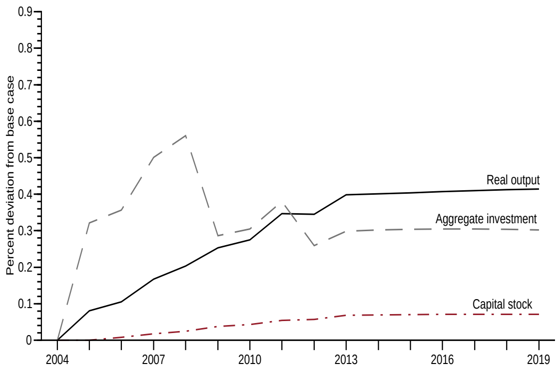
Real wages continue to be higher than otherwise as employees seek to obtain their share of the productivity gains. Aggregate employment eventually recovers and remains above base case levels over the later part of the simulation reflecting underlying expansion of the economy and consequent demand for labour (which migrates to Queensland from other States).



(d) — Queensland Real Output, Investment and Capital

There is an initial spike in aggregate investment in Queensland peaking in 2007-08 at a variation of about 0.56 per cent higher than the base case. This reflects the construction phase of a true broadband network. Higher than base case investment is sustained reflecting the capital inflows stimulated by the productivity advantage that Queensland obtains as a result of the use of a true broadband network.

The stock of capital grows reflecting the cumulative effect of the change in aggregate investment. The change in factor endowment as a result of a true broadband network is a key factor driving increases in economic output (GSP).



Source: MMRF Modelling Results

An open access true broadband network

Figure 3.3 details how the additional competition benefits that result from an open access true broadband network impact on the Queensland economy.

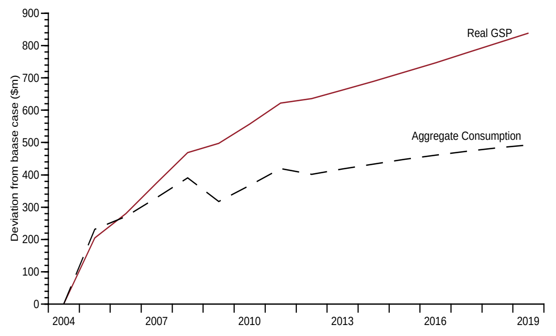
Figure 3.3

IMPACTS FROM AN OPEN ACCESS TRUE BROADBAND NETWORK (DEVIATION FROM BASE CASE)

(a) — Real output and aggregate consumption

An open access true broadband network throughout the region is expected to increase GSP by $840 million by 2018-19. This compares to $855 million expected from the true broadband network scenario where there is no additional competition benefits from a third party access regime. Despite real output being lower in 2018-19 (relative to the true broadband scenario) the additional competition benefits result in an overall increase, in NPV terms, in the GSP.

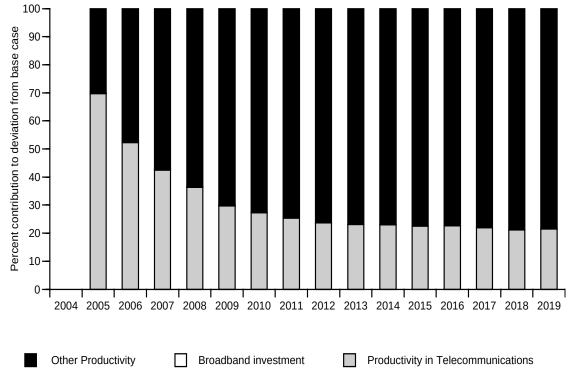
Consumption in Queensland is expected to rise by some $492 million per annum by the year 2018-19. Again aggregate consumption is lower in 2018-19 than in the previous scenario however the NPV of the increases overtime is higher as a result of the additional competition benefits.



(b) — Contributions to Queensland real output

As is the case in the previous example nearly almost all of the increased output arising from an open access true broadband network is the result of increased productivity either in the telecommunications industry or in Queensland's digital content industries.

The impact of the additional competition benefits that results from third party access to the network are reflected from the increased contribution made by productivity gains in telecommunications. The accelerated takeup of services also makes a small additional impact to the contribution made by the telecommunications productivity gains.

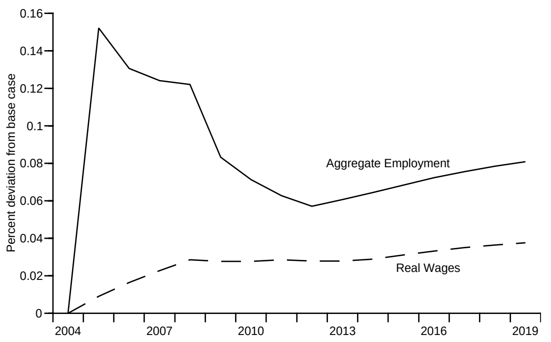


(c) — Queensland employment and real wages

Employment rises sharply in the construction phase of the network. It peaks in 2005 at 015 per cent above the base case. This peak is higher than the peak experienced under the vertically integrated scenario reflecting the accelerated takeup of services. The subsequent drop off in employment relative to the base case is also more pronounced under this scenario.

Employment remains above the base case for the entire simulation period and in 2018-19 there is an additional 1650 jobs throughout Queensland.

Real wages rise by 0.037 per cent under this scenario. This compares to 0.038 per cent under the vertically integrated true broadband network scenario.

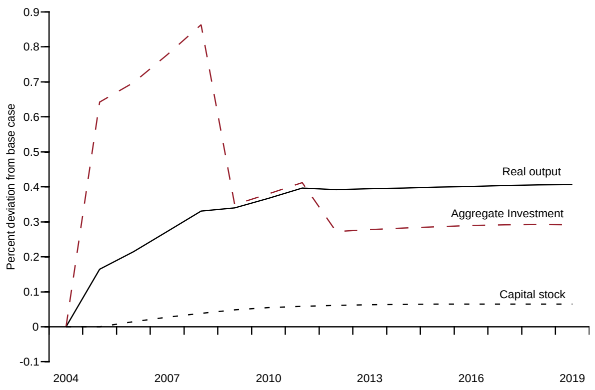


(d) — Queensland Real Output, Investment and Capital

The initial spike in investment is more pronounced in this scenario reflecting the accelerated takeup of services. Investment peaks in 2007-08 at 0.86 per cent above the base case (0.30 per cent higher than the vertically integrated scenario). Under this scenario there is a more pronounced drop off in investment which levels out in 2012-13 at around 0.28 per cent higher than the base case.

Aggregate investment in Queensland is 0.29 per cent higher relative to the base case in 2018-19 reflecting the capital inflows stimulated by the productivity advantage obtained as a result of the use of a true broadband network

The outcomes reflecting changes in Queensland's capital stock are identical under the two scenarios. In both cases Queenslands capital stock increases by around 0.007 per cent by 2018-19.



Source: MMRF Modelling Results

Table 3.2 summarises the net impacts arising from a true broadband network and an open access true broadband network for Queensland at large:

Table 3.2

QUEENSLAND IMPACTS — SUMMARY

	A Vertically Integrated True Broadband Network ($m)	An Open Access True Broadband Network ($m)
Gross State Product — NPV over 15 years	4,180	4,900
Contribution of Improvement in Telecommunications Productivity — NPV	1,155	1,440
Contribution of Improvement in Other Industries Productivity — NPV	3,050	3,470
Contribution of Additional Broadband Investment — NPV	(4.9)	(5.3)
Average Additional Employment (in a typical year)	1,630	1,586

Source: MMRF Modelling Results

3.6 Industry outcomes

Every industry sector in Queensland is expected to gain as a result of a true broadband network throughout the region. The extent of the gain however is expected to differ by industry sector and whether or not the network is subject to open third party access.

Over the simulation period the gains for industry from the construction, takeup and use of a *vertically integrated true broadband network* in the region include:

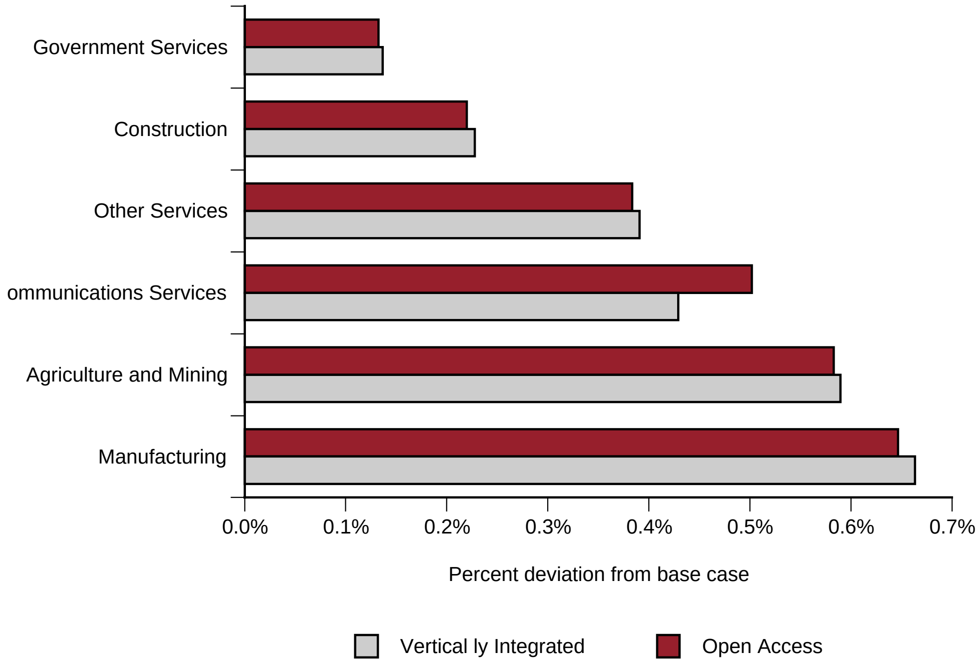
- an increase in output of 0.66 per cent for manufacturing;
- an increase in output of 0.59 per cent for the agriculture and mining sector;
- a 0.43 per cent increase in output from the communications services sector (which obtains a significant part of the this benefit from assumptions factored into the model shocks);
- output gains of around. 039 per cent for other services sector;
- a 0.23 per cent increase in output for the construction industry; and
- gains of around 0.14 per cent for government services.

The picture is much the same if the true broadband network were subject to *third party open access*. The main difference is that there would be additional gains for the communications sector of around 0.07 per cent. The other industry sectors are largely unchanged relative to the vertically integrated scenario (being smaller by between 0.01 and .002 per cent).

The expected impact by industry sector in the state is depicted in figure 3.4.

Figure 3.4

INDUSTRY OUTCOMES



Source: MMRF Modelling Results

The overall gains in industry output are portrayed in figure 3.4. The 22 industries used in the MMRF model have been reclassified into 6 categories to simplify presentation of the findings. The composition of industry categories is explained in appendix C.

Chapter 4

Findings

This study has investigated the impact of the development and use of a true broadband network within a major urban centre in Australia. The region analysed was the Brisbane and Moreton statistical divisions of Queensland, although implications for the wider state economy have also been assessed.

A true broadband network is defined as a network that delivers symmetric data services at speeds greater than 10Mbps. True broadband networks are capable of supporting multi-user, multi-device applications that have, to date, not been supported by either ADSL or cable networks.

The true broadband network analysed would:

- require an initial investment of around $850 million over a period of seven years. This would involve investment in the backbone network, fibre-to-the-home connections and facilities within each establishment to access and use the communications capabilities;
- make true broadband access available to some 50 per cent of the households and businesses in the region;
- provide a competitive stimulus in telecommunications in the region comparable to the impact of competition experienced by the industry since 1997;
- provide the capacity for businesses in Queensland to obtain expected cost savings from the takeup and use of true broadband services consistent with those experienced by businesses which have already used or taken up an earlier broadband technology; and
- provide a competitive advantage to the region's creative industries and to digital content activities undertaken in the State.

The wider implications of these changes were evaluated using a sophisticated model of the Australian economy — the Monash Multi-Region Forecast (MMRF) model. This is used by government economic policy agencies, including the Queensland Treasury, and examines changes at the national, state and regional levels.

Two different approaches to the true broadband network were examined in two scenarios. These were:

- *A vertically integrated network* — in this scenario the construction, operation and supply of services over this network is undertaken by a vertically integrated service provider and there is no third party access permitted. Under this scenario there is only one new market entrant at both the retail and wholesale levels.

- *An open access network* — this scenario examines what would happen if the true broadband network (as rolled out in the limited competition scenario) were subject to open third party access. Under this scenario there will be more than one (and possibly several) market entrant that will provide retail services over the network as well as an accelerated takeup of true broadband services by businesses and households. This scenario assumes competition between retail service providers of true broadband services in addition to competition between service providers of different access technologies.

The simulation results indicate substantial net gains to the region from the development and use of a vertically integrated network. This is indicated by:

- an overall increase in gross regional output for the region. The NPV of this benefit is $2,640 million; and
- an increase in employment of around 1,030 jobs in the year 2018-19 or a total of 15, 494 'job-years' over the fifteen year simulation period.

The outlook if an open access true broadband network is developed and used is also very favourable. The long terms results are similar, although this approach delivers many of the gains a little earlier, resulting in a higher net present value for the increase in GRP.

The true broadband network shares many characteristics of more traditional infrastructure. Similar to the use of a major bridge or airport in a capital city, the use of a true broadband network benefits people and the business community in the immediate area as well as people further away. The changes are also large enough to have macro-economic significance. That is, it may change wages, prices and factors such as capital flows and the exchange rate.

The model results indicate significant benefits for the Queensland economy at large. These include:

- increasing real output or gross state product (GSP) by between $839 million and $855 million in 2018-19 depending on scenario. The higher value relates to the development of an open access true broadband network. In today's terms (i.e., in NPV terms) the increases in output are equivalent to raising Queensland's GSP by between $4,180 million and $4,906 million;
- creating between 1,650 and 2,170 new jobs by 2018-19; and
- increasing aggregate consumption by between $492 million and $499 million in 2018-19. This has a net present value of between $2,835 million and $4,680 million.

In addition to the above benefits the construction, take-up and use of the true broadband network in the region will raise aggregate investment and the State's capital stock. It will also raise real wages throughout Queensland.

The analysis suggests that regardless of the ownership structure of the network all industries in Queensland will benefit from a true broadband network. The communications sector, however, will benefit the most (relative to the vertically integrated scenario) if the network is subject to third part open access. By contrast other industry segments obtain a larger increase in output (of between 0.01 per cent and 0.02 per cent) under the vertically integrated scenario.

The analysis indicates that the majority of the benefits obtained accrue from the increased productivity gains experienced by industry generally and to a lesser extent, expansion of the telecommunications sector (i.e., the businesses providing the true broadband network), with expansion of digital content industries making a relatively modest contribution.

This study analysed the impact of a true broadband network on the Brisbane and Moreton areas of South East Queensland in order to make the results specific and tangible. Much the same impact could be obtained from the construction, take up and use of a broadband network in any major urban area throughout Australia.

Other states may also discern that there would be benefits in rapid adoption of a true broadband network and take steps to accelerate development of such a network. This is likely to erode some of the competitive gains to be obtained by the region focused upon in this study, although the region would still retain the underlying productivity gains which form the largest part of the net gains (taking into account the economic costs of the initial network investment).

The main message of the analysis is that there are substantial net economic gains available from the development and use of a true broadband network in major urban areas in Australia. These gains tower over the initial investment costs required to finance the network.

Appendix A

Outcomes for the region

This Appendix examines in greater detail what impact the construction, takeup and use of a true broadband network has had on the region.

As detailed in section 3.4 the construction, takeup and use of a true broadband network is likely to deliver significant economic benefits to the region. These expected benefits are more pronounced if the network is subject to open third party access.

A.1 A vertically integrated true broadband network

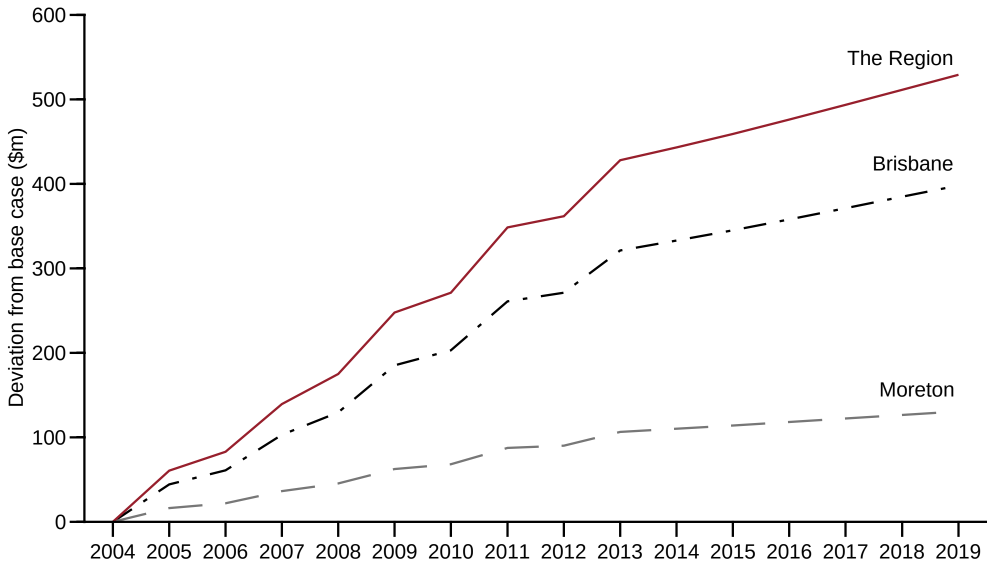
The impact of a true broadband network upon the region is to:

- Raise Gross Regional Product (GRP) increases for the region by around $529 million by the year 2018-19. Using a seven per cent real discount rate the NPV of the increase in GRP over the simulation period is around $2,900 million.
- Increase employment in the region by around 1,375 jobs in the year 2018-19. On average, over the simulation period there is an additional 1,033 extra jobs throughout the region relative to the base case.

These outcomes are shown in figures A.1 and A.2.

Figure A.1

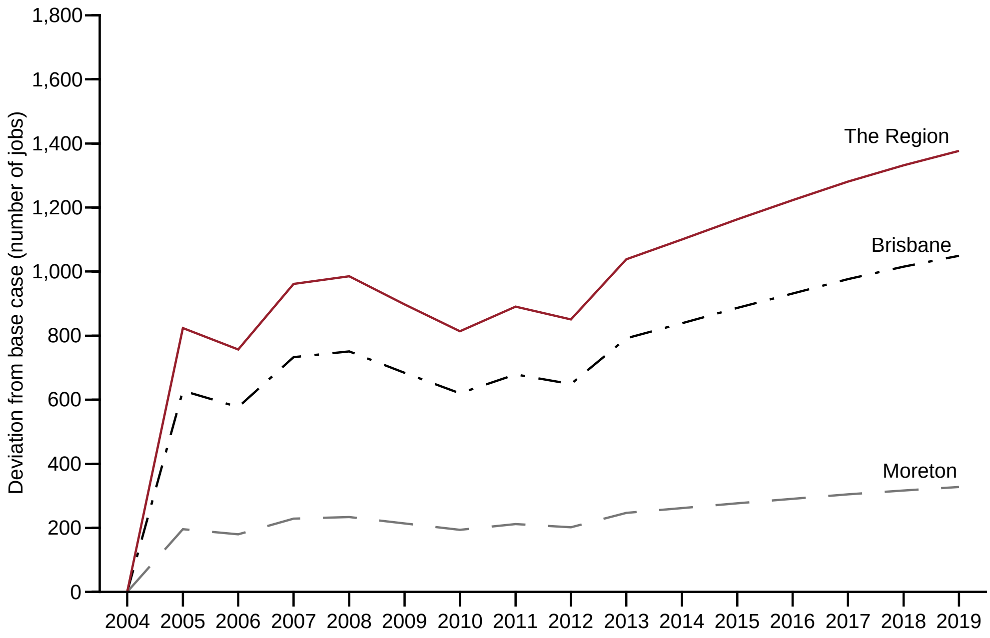
GROSS REGIONAL OUTPUT — A VERTICALLY INTEGRATED TRUE BROADBAND NETWORK



Source: MMRF Modelling Results

Figure A.2

EMPLOYMENT — A VERTICALLY INTEGRATED TRUE BROADBAND NETWORK



Source: MMRF Modelling Results

A.2 An open access true broadband network

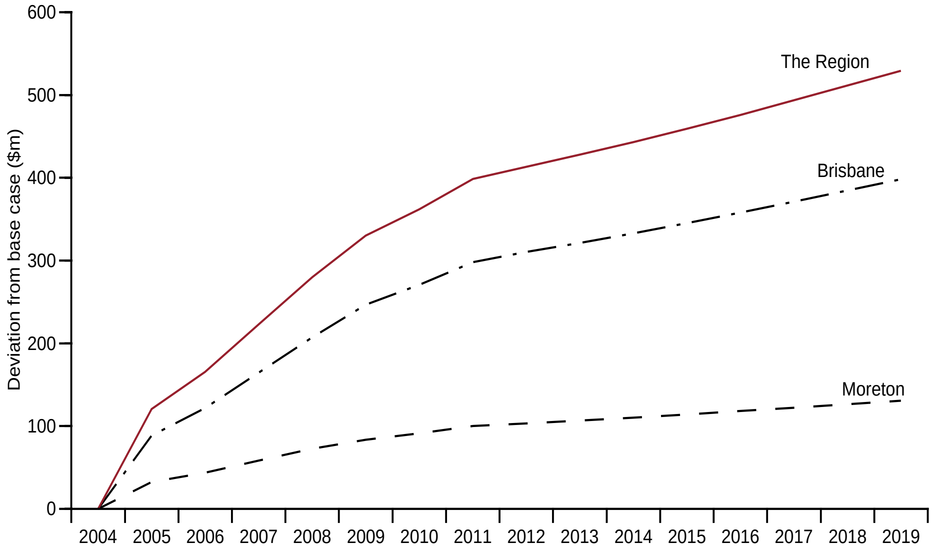
If the additional competition benefits are realised from a true broadband network by allowing third parties to provide services over it, the following benefits will accrue to the region:

- Raise Gross Regional Product (GRP) increases for the region by around $528 million by the year 2018-19. Using a seven per cent real discount rate the NPV of the increase in GRP over the simulation period is around $2,640 million.
- Increase employment in the region by around 1,045 jobs in the year 2018-19. On average, over the simulation period there is an additional 1,005 extra jobs throughout the region relative to the base case.

These outcomes are shown in figures A.3 and A.4.

Figure A.3

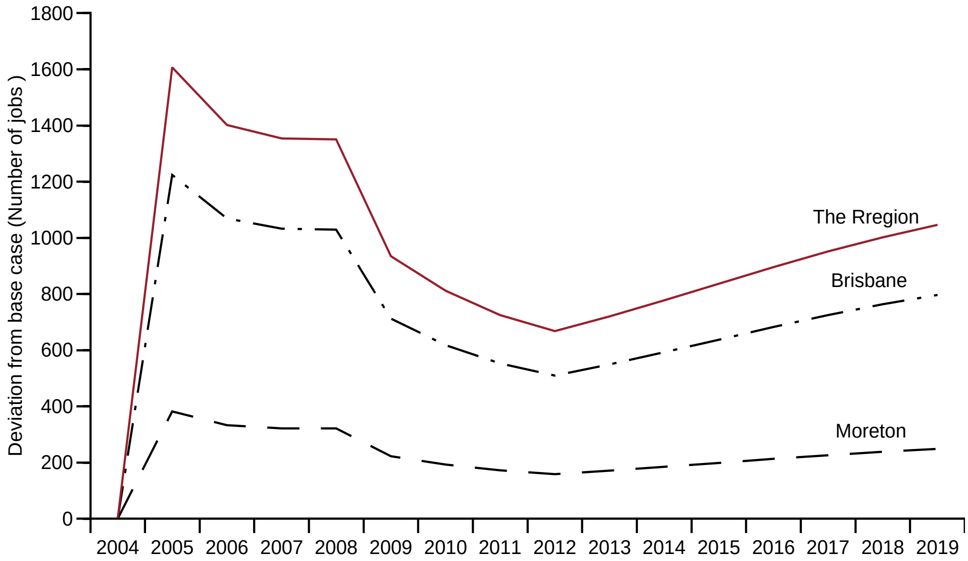
GROSS REGIONAL OUTPUT — AN OPEN ACCESS TRUE BROADBAND NETWORK



Source: MMRF Modelling Results

Figure A.4

EMPLOYMENT — A OPEN ACCESS TRUE BROADBAND NETWORK



Source: MMRF Modelling Results

Appendix B

Direct impacts

This Appendix examines how and why changes in ICT systems and true broadband has broader relevance for economic outcomes. It identifies the direct impacts before they work their way through the economy at large

The expected impacts of a true broadband network in the region can classified into four broad categories:

- expansion of telecommunications/activity;
- enhanced telecommunications competition;
- user productivity gains; and
- competitive gains for local creative industries.

B.1 Expansion of the telecommunications sector

At its core, a true broadband network throughout the region entails an expansion of the telecommunications industry. Key elements of this impact include:

- infrastructure development;
- geographic reach and subscriber takeup of the network;
- business and consumer development inputs;
- industry operating costs; and
- industry capital costs.

Each of these key elements are discussed below.

B.2 Infrastructure development

Construction of a true broadband network involves the application of resources as inputs.

An initial economic implication is that the network inputs represent an addition to economic activity in Queensland.[14] The capital expenditure required to construct a true broadband network and the expected timing of this expenditure based on information provided by Ericsson has been adjusted to conduct the analysis on the financial year basis used in MMRF modelling. The projected costs, sorted by the economic classification of the inputs[15], is summarised in table B.1

[14] This is arrived at through the application of the with/without test. The with/without principle is the basic principle of any type of economic evaluation. In practice it means that the evaluation looks at 'the state of the world' as it will exist with a True Broadband Network in existence. This is contrasted with the 'state of the world' in the absence of a True Broadband Network. See NSW Treasury, *NSW Government Guidelines* for *Economic Appraisal*, Policy and Guidelines Paper, 1997. This test underpins all of the values analysed in this evaluation. Naturally, development of the Network itself is a key difference in the 'with' and 'without' scenarios.

[15] Drawing on ANZSIC economic classifications.

Table B.1

CAPITAL EXPENDITURE FOR A TRUE BROADBAND NETWORK ($ MILLION IN 2003-04 PRICES)

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 to 2018-19	Total
Domestic									
Manufacturing (C)	-	-	-	-	-	-	-	-	-
Construction (E)	68	68	68	68	15	15	15	-	317
Finance and Insurance (K)	9	9	9	9	2	2	2	-	44
Property and Business Services	29	29	29	29	7	7	7	-	139
Imports									-
Manufacturing (C)	75	75	75	75	17	17	17	-	349
Construction (E)	-							-	-
Finance and Insurance (K)	-							-	-
Property and Insurance	-							-	-
Total									-
Manufacturing (C)	75	75	75	75	17	17	17	-	349
Construction (E)	69	68	68.	68	15	15	15	-	317
Finance and Insurance (K)	9	9	9	9	2	2	2	-	44
Property and Insurance	30	30	30	30	7	7	7	-	139
CAPEX	182	182	182	182	40	40	40	$ -	850

Source: Ericsson with The Allen Consulting Group Classifications
Note: ANZSIC code in Brackets

Table B.1 indicates an infrastructure development cost of $850 million over the evaluation period considered in this study (the fifteen financial years from 2004-05 to 2018-19).

It is expected that a significant proportion of the capital expenditure (59 per cent) will be spent on inputs obtained from within Australia. This reflects the significance of the construction activity and business service inputs that will be required to rollout a true broadband network.[16] This will stimulate the expansion of these activities (and supporting activities that provide intermediate inputs) throughout the region as well as elsewhere in Queensland.

Some 41 per cent of the capital expenditure is expected to comprise imported items. Such items are likely to include head end and electronic equipment and cabling components). These components do not stimulate domestic economic activity. They represent a leakage of value from the economy. However benefits flow from imported items because they contribute to Queensland's stock of economic assets and their use in Queensland generates productive returns.

These costs are accommodated into the MMRF model. Within this process they are analysed in real terms.[17]

Geographical reach and subscriber takeup

Rolling out a true broadband network is merely a means to an end. Ultimately, the aim is to connect customers including households, businesses and government agencies. However, while network access may become available in a given area, the extent to which end users will subscribe is an uncertain variable.

It is clear, however, as evidenced by the success of TransACT in the ACT and Bright Communications in Western Australia that there is demand for broadband. This experience indicates that availability of broadband network infrastructure attracts a takeup by subscribers of:

- 21 per cent of households over a six month period;[18] and
- 40 per cent of businesses and residences passed over a 19 month period.[19]

Based on the above market evidence it is assumed that during the rollout period 20 per cent of those households and businesses which the network passes will subscribe to either a single broadband Internet service or a bundled service offering (i.e. broadband Internet plus either telephony, or television/video services).

If the network is owned and operated by a vertically integrated retail service provider it is assumed that upon completion of the network, service takeup will increase over a 4 year period to reach 30 per cent of households and businesses.[20]

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16 This figure is dependant on the extent to which additional trenching and the construction of new cable ducts is undertaken.

17 The modelling process is conducted in real terms. That is, the effect of inflation is removed from the data providing estimates in constant dollar terms to facilitate monetary comparison with today's dollars.

18 Bright Communications, 2003, *Western Power Broadband Telecommunications Initiatives*, Western Power, Perth.

19 TransACT, 2001, *TransACT connects 10000th Customer:* TransACT, Canberra, see www.transact.com.au.

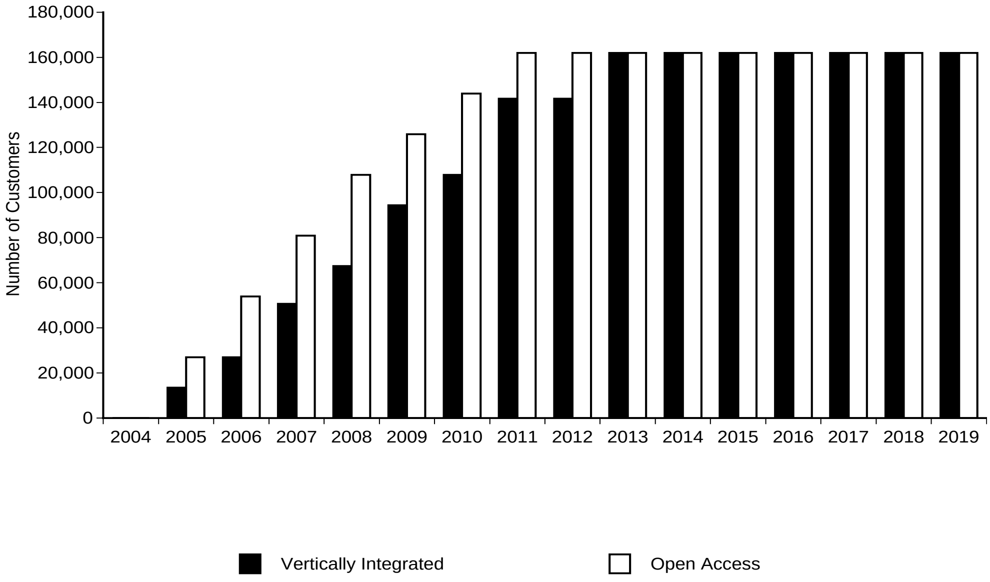
20 The network will ultimately provide services to 15 per cent of the businesses and households in the Brisbane and Moreton regions.

By contrast, if the network is subject to open third party access, it is assumed that there will be faster takeup of services so that 30 per cent takeup will be reached over a three year period.

The differences in takup under different market structures are reflected in figure B.1. Notably, the same level of takeup is achieved in the medium to long run in both scenarios.

Figure B.1

EXPECTED TAKEUP OF TRUE BROADBAND SERVICES IN THE REGION

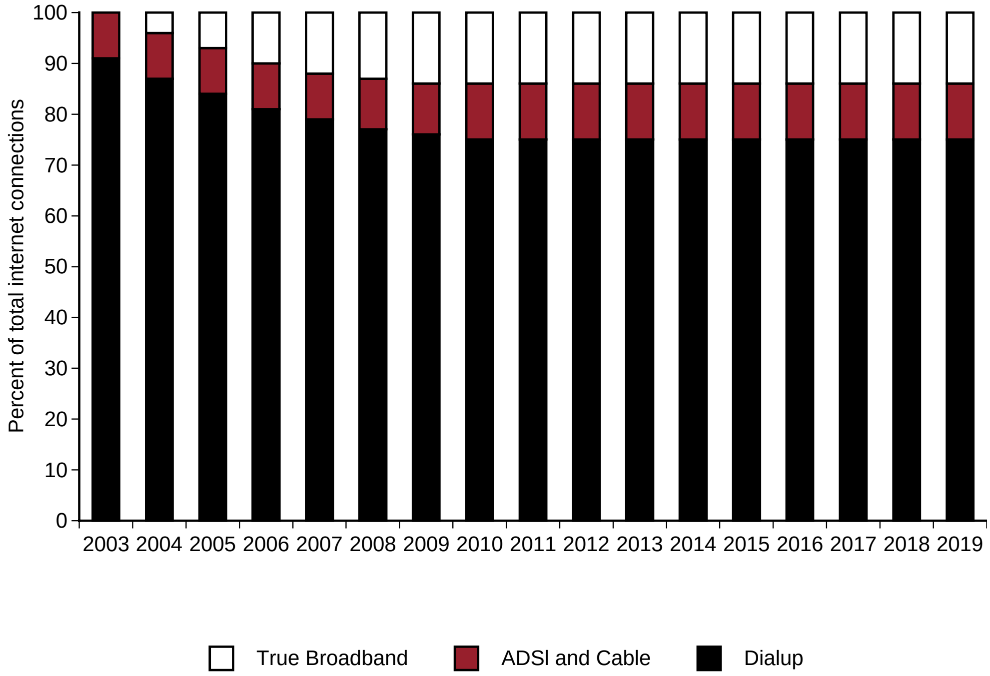


Source: The Allen Consulting Group

Figure B.2 depicts the assumed takeup and mix of a true broadband network in the region. This takeup will be additional to the existing and forecast takeup of current dial up and broadband access technologies (such as dialup Internet, ADSL and HFC cable). This additional takeup is depicted (as modelled for an open access true broadband network) in figure B.3 as the white area. This is considered to be a realistic, yet conservative forecast, as it does not take into account substitution between these three types of access technologies (for example some subscribers may disconnect their existing ADSL connection in favour a true broadband service).

Figure B.2

COMPOSITION OF INTERNET ACCESS IN THE REGION — AN OPEN ACCESS TRUE BROADBAND NETWORK



Source: ACCC, ABS and The Allen Consulting Group

End user access equipment

To access to the proposed true broadband network new equipment will be required at the consumer's premises. This involves capital expenditure upon items such as modems and Ethernet cards. While the consumer could meet this expense, it is current industry practice for retailers to either partially or fully subsidise these costs. In turn these costs are recovered from the overall package price charged to consumers over time.

Industry operating costs

To assess the full range of direct impacts associated with the ongoing operation of the proposed infrastructure, an accounting approach for the network as if it were an extension of the existing telecommunications industry in Queensland has been adopted. That is to expand revenue, costs and margins in line with the average already observed and forecast for the telecommunications industry in Queensland. This can be achieved by using the detailed inputs — output tables that underpin the MMRF model. This approach also requires that the scenario, as modelled, redirects spending from households and businesses to purchase the service of the expanded facility.

The intent of the proposed approach is not to assess the economic viability of the true broadband network (i.e. identify its chances of obtaining an economic rate of return). Instead, the analysis will indicate what the economic implications of a true broadband network are if it has broadly similar cost, revenue and margin characteristics to current telecommunications activity.

Industry capital costs

The economy wide impacts of an increase in investment are not straightforward. Given a predominately fixed pool of domestic savings in Australia an increase in investment in Australia will necessarily result in increased foreign borrowing. The cost of this is not the capital itself, but the cost of paying foreigners for the use of their capital.

The costs of finance is normally project specific and varies according to underlying characteristics and the level of risk associated with the specific investment. However when taking an economy wide perspective debt servicing costs do not vary a great deal between projects. Data from the Australian Bureau of Statistics (ABS) balance of payments data indicates that currently the average cost of capital seems to be around 6 to 7 per cent per annum (nominal).

To evaluate the cost of capital for a true broadband network in the region the MMRF model simulation will be configured to allow the additional investment funds to be financed from foreign savings. This approach also applies the cost of capital as an annuity spread out over time. This allows the matching of costs and revenues.

Spreading the costs out over time, even where it adds to the overall cost of the proposed network, is a consistent feature of infrastructure finance in the Australian economy. For the proposed network, the annual servicing costs over the first 15 years, given nominal rates of seven per cent, amounts to approximately $1,750 million. This compares to the expected capital cost of $850 million. It is also notable that the Net Present Value (NPV) of the CAPEX spend and the annuity should be equal.

B.3 Competition in telecommunications markets

To date the progressive entry of competition coupled with a number of regulatory safeguards has resulted in significant gains for the Australian economy. Broadly competition benefits in the telecommunications market can be seen as arising from one of three sources:[21]

- Facilities based competition — results from providers building their own network infrastructure to compete either as a wholesale or as an integrated retail provider or as both.
- Access based competition — providers that combine some of their own network elements (such as switches) with services supplied by facilities based providers to compete in wholesale and retail markets.
- Resellers — providers that compete in retail markets by reselling the services offered by facilities based providers.

[21] Productivity Commission, 2001, *Telecommunications Competition Regulation,* Productivity Commission, Canberra, p.100.

Benefits arising from facilities based competition

Infrastructure based competition results in benefits for consumers. This is evidenced by current market prices for broadband services (i.e. cable and ADSL Internet access) in Australia. Cable Internet access is offered competitively by both Telstra (via the Foxtel HFC cable) and Optus which compete head to head each other as well as with ADSL service offerings.[22] This creates a competitive dynamic in the provision of cable Internet services that is not experienced elsewhere in the Australian market. This competitive dynamic results in lower prices than for those services not subject to infrastructure based competition.

As detailed in table B.2 cable Internet access is on average 23 per cent less expensive than ADSL services [23]

It follows therefore that the price differential between ADSL and Cable Internet access provides some measure as to the price reduction that may result from the construction and operation of a significant infrastructure based network provider.

Table B.2

PRICE DIFFERENCES DUE TO INFRASTRUCTURE BASED COMPETITION

Plan	ADSL	Cable	Difference	% Saving
Residential 500MB	76.45	54.95	21.5	28
Residential 1GB	93.45	64.95	28.5	30
Residential 3GB	111.45	87.95	23.5	21
Residential 5GB	196.45	159.95	36.5	19
Residential 10GB	346.45	299.95	46.5	13
Business 500MB	96.45	54.95	41.5	43
Business1GB	93.45	64.95	28.5	30
Business 3GB	111.45	87.95	23.5	21
Business 5GB	196.45	159.95	36.5	19
Business 10GB	329.95	299.95	30	9
Average Price Difference	n.a	n.a	n.a	23

Source: Telstra www.telstra.com.au

The price benefits detailed in table B.2 are relatively small when compared to the 66 per cent decrease in long distance telephony prices experienced by the Queensland government as a result of the construction and operation of the Reef network.[24]

22 Cable and ADSL Internet access are effective substitutes.

23 This is despite the fact that there is greater resale and partial facilities based competition for ADSL services relative to cable services and the fact that the wholesale price of ADSL network elements is price regulated by the Australian Competition and Consumer Commission (ACCC). Wholesale cable Internet access is not price regulated.

24 http://www.iie.qld.gov.au/public.

Benefits arising from competition in general

As evidenced by a recent study conducted for the Australian Communications Authority, the introduction of competition into Australia's telecommunications market has had the following key impacts:

- *Lower prices* — except for basic access, there has been a general decline in the price of telecommunications services since the introduction of competition.
- *Increased output* — since 1997 there has been a growth in output for all telecommunications services.
- *Increased productivity* — between 1997 and 2002 total revenue for the telecommunications sector has grown by 81.8 per cent. By contrast total employment over the period has increased by around 11.2 per cent. Hence, the industry as whole is producing more output with relatively fewer resources. This reflects a significant productivity gain over the period.
- *Increased GDP* — the introduction of competition into Australia's telecommunications industry in 1997 has contributed to a 1.62 per cent rise in GDP. This is equivalent to an increase of around $10 billion per annum.

Further analysis of the data that underpins table B.3 indicates that the weighted average price reduction for the industry at large over the five years of open competition was a price reduction of 7.83 per cent.

Table B.3

TELECOMMUNICATIONS PRICE AND OUTPUT CHANGES SINCE DEREGULATION

Macroeconomic Variables	1997-98	1998-99	1999-00	2000-01	2001-02
Outputs of telecommunications services					
Access	5.90	7.06	12.00	14.67	9.87
Local calls	11.68	3.32	5.37	-2.53	6.28
National long distance	9.54	8.23	9.31	1.15	8.60
International	13.65	12.68	20.37	8.16	15.71
Calls to mobiles	21.69	48.21	10.61	18.10	13.75
Mobiles	3.89	27.76	42.21	34.20	19.96
Other telecommunications services	n.a	n.a	n.a	n.a	n.a
Prices of telecommunications services					
Access	0.30	-0.90	8.45	8.07	14.37
Local calls	-3.00	-0.72	-9.66	-18.51	-11.92
National long distance	-9.70	-6.20	-9.68	-7.97	-12.08
International	-14.10	-23.86	-28.13	-17.45	-13.85
Calls to mobiles	5.90	-5.38	-8.08	-5.86	-2.12
Mobiles	-3.40	-3.93	-12.61	-10.48	-3.99

Source: The Allen Consulting Group, 2002, *Benefits Resulting From Changes in Telecommunications Services, Report for the Australian Communications Authority,* The Australian communications Authority, Melbourne.

Although a true broadband network will be utilised for the provision of voice, data and video service offerings it is expected that the scope of competition will be focused upon Internet and data access. On this basis it seems that a conservative approach to measuring the competition benefits that are likely to accrue from a true broadband network would be to narrow the scope of the benefits to that portion of telecommunications activity that is represented by Internet and data services. Based on limited information available from telecommunications companies' annual reports and ABS data, it is estimated that this activity accounts for about 16.8 percent of telecommunications activity at present.

It is expected that a true broadband network would sustain competitive pressure in Queensland. However the level of competition would vary according to the extent to which the network was open to third party access.

From the above findings it is possible to quantify the expected price reductions that would result from a competitive true broadband network in the Brisbane and Moreton regions reflecting the following (see table B.4):

- the network will not be ubiquitous, covering only 50 per cent of households and businesses in the Brisbane and Moreton regions;
- the network will be rolled out over four years;
- there will be an incremental takeup of services by households and businesses; and
- the scope of competition, in the case of such a true broadband network will be focused upon Internet access (with service being VOIP ready, allowing gains to spill over into other telecommunications activities as these applications are enabled with further technological change). Internet and data services currently account for 16.2 per cent of telecommunications activity across Australia.

Table B.4

TELECOMMUNICATIONS PRICE REDUCTIONS (% CHANGE COMPARED TO THE BASE CASE)

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13 to 2018-19
A Vertically Integrated True Broadband Network	0.35	0.69	1.29	1.71	2.06	2.06	2.40	2.40	2.74
An Open Access True Broadband Network	0.80	1.58	2.38	3.17	3.17	3.17	3.17	3.17	3.17

Source: The Allen Consulting Group

B.4 Business users productivity gains

To date there are no known studies on how the takeup and use of true broadband by businesses impact on cost structures and business efficiency. This is largely due to the fact that, apart from businesses located in the ACT, true broadband is not currently widely available to businesses located in Australia. However, to the extent that the past is an indication of the future, it is useful to examine what impact the takeup and use of broadband (i.e. moving from narrowband Internet access to broadband Internet access) has had on the efficiency and cost structure of businesses in Australia.

There is considerable evidence, which suggests that Australian businesses obtained a significant benefit from upgrading their Internet connection from narrowband to broadband. In particular, a study undertaken by The Allen Consulting Group provides considerable insight.[25] The study, based on the collection and analysis of detailed information obtained from a reasonably large and representative sample of Australian businesses,[26] found that businesses with broadband access:

[25] The Allen Consulting Group, 2002, *Built for Business II: beyond Basic Connectivity, The Internet Economy and Australian Business in 2002,* Cisco Systems, Sydney.

[26] Firms were selected randomly and included firms that did not use the Internet, those that had a narrowband connection and those that had broadband access.

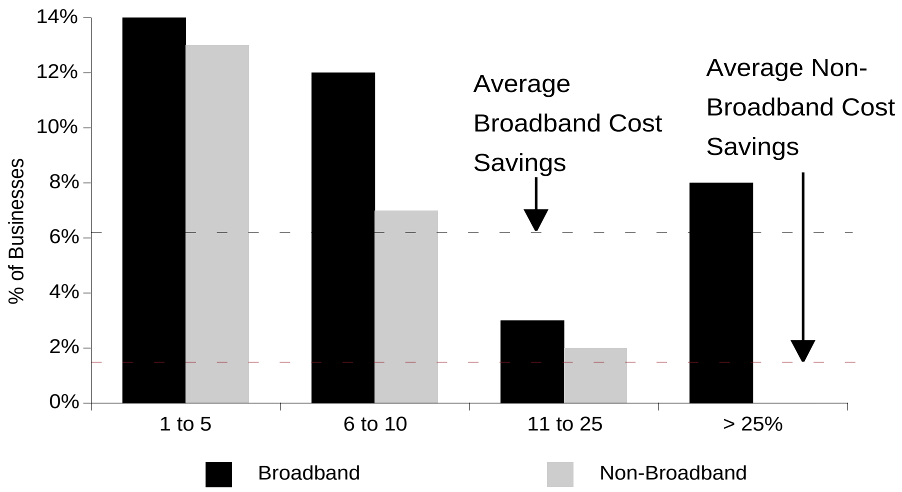
- have a higher level of Internet 'intensity' in their business (i.e. give a higher proportion of their employees access to the Internet) compared to those with dial-up access;
- make greater use of Internet applications in their business;
- have made greater progress towards networked engagement through the use of intranets and extranets in their business;
- have made much more substantial progress in comprehensive 'enablement' in terms of making use of the Internet to receive and place orders and to receive and make payments online; and
- obtain a significantly higher proportion of their revenue from the Internet than their non–broadband counterparts.

Thus the study suggests that moving from narrowband dial up Internet access to broadband Internet access (i.e. increasing bandwidth) is accompanied by a greater use of e-commerce and a greater integration into the Internet economy.

The Allen Consulting Group study also provides insight into what increased bandwidth (i.e. moving from a dialup narrowband connection to a broadband connection) means for businesses in terms of productivity and cost savings. Specifically, businesses were asked what cost savings were attributable to their use of the Internet. Those businesses with narrowband Internet access reported costs savings, on average, of 1.5 per cent. By contrast, businesses with broadband access to the Internet reported savings of 6.3 per cent. Hence, the additional cost savings from moving to a narrowband connection to a broadband connection are equivalent to 4.8 per cent. The results of this study are illustrated in figure B.3.

Figure B.3

COST SAVINGS FROM USE OF THE INTERNET — BUSINESS REPORTED SAVINGS



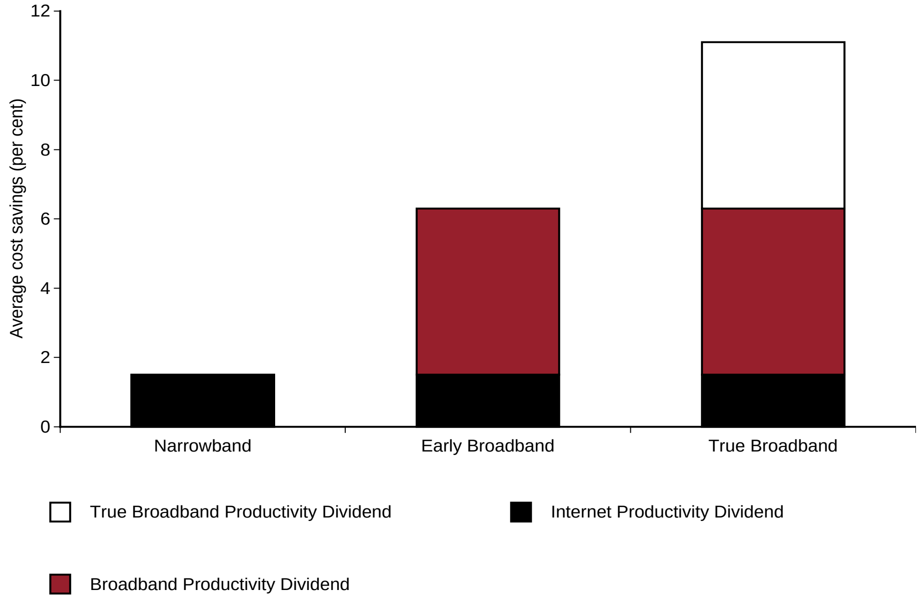
Source: The Allen Consulting Group database

The dark bars in figure B.3 reflect cost savings from use of the Internet reported by businesses with a broadband Internet connection. The lighter bars reflect cost savings reported by businesses with a narrowband connection. The dotted lines across the bars reflect the weighted average cost saving reported by each category of Internet connection.[27]

Given the superior speed, functionality and bandwidth of true broadband networks it is reasonable to expect that there will be a further increase in productivity and cost savings for businesses that move from existing broadband access technologies (such as ADSL and Cable) to true broadband. This is shown in figure B.4. For example, the Narrowband column in figure B.4 represents the expected average cost saving from its adoption. The Early broadband column in figure B.4 however depicts the additional expected average cost saving from adoption of Early broadband. Hence in total Early broadband (i.e. the grey area) users receive a total benefit equal to the grey area plus the black area.

Figure B.4

THE BENEFITS OF IMPROVED BANDWIDTH



Source: The Allen Consulting Group

For the purpose of estimating the magnitude of this effect and evaluation of its economy wide and regional impacts it is necessary to adjust the above productivity gain to reflect the expected takeup of the network by businesses as a proportion of the total number of businesses in the State. Doing this suggests an average productivity gain for businesses of 0.32 per cent.

Table B.5 reflects an estimate of the productivity gains enjoyed by businesses based on the figures above and the time taken as the infrastructure is developed and accommodated within normal business operations.

27 The weighting takes into account those businesses that report no cost savings.

Table B.5

BUSINESS COST REDUCTIONS (PER CENTAGE CHANGE COMPARED TO BASE CASE)

Year	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2011-12 to 2018-19
A Vertically Integrated True Broadband Network	0.025	0.05	0.10	0.13	0.19	0.21	0.28	0.28	0.32
An Open Access True Broadband Network	0.05	0.11	0.16	0.21	0.25	0.28	0.30	0.32	0.32

Source: The Allen Consulting Group

B.5 Enhanced competitiveness of local digital content industries

A true broadband network throughout the region will impact those industries which are heavily dependant on access to high bandwidth services and/or applications. These industries include those that either produce and/or distribute digital content (such as the film and post production industries, architects and music production) as well as those that use digital content intensively (such as accountants, engineers and Internet Service Providers).

While digital content industries are spread throughout Australia, the majority are located in urban centres such as the capital cities of Brisbane, Sydney and Melbourne as well as in other cities of significant size including the Gold Coast, Newcastle and Wollongong.

Queensland has a significant and healthy digital content industry. In particular, the Gold Coast Brisbane Corridor is home to several digital content intensive firms such as Movie World, Dream World (the home of Australia's Big Brother TV series) Austar Communications and the Blue Shadow Group.

The construction of a true broadband network within a region will provide locally based digital content industries and firms with a key competitive advantage relative to industries and firms in other regions and States. This is because a true broadband network will support bandwidth dependant projects such a film production as well as allow greater and more innovative use of digital content.

Research undertaken by The Allen Consulting Group for a forthcoming report on Digital Content estimates that Australia's digital content industries in aggregate account for around 4.0 per cent of total value add or around $23 billion. While there is some uncertainty regarding the future outlook of these industries it is expected that they will continue to grow, on average, at rates similar to those experienced over the last five years. Taking Queensland's share of this growth suggests that Queensland's digital content industries will continue to grow at an annual average rate of around 3.0 per cent per annum.

For the purposes of this study, it has been assumed that a true broadband network will have the impact of doubling the current rate of growth experienced by Queensland's digital content industries. The net impact of this on the Queensland economy adjusting for the gradual rollout, geographic coverage, and expected takeup and use of the network is detailed in table B.6

Table B.6

IMPROVED COMPETITIVENESS OF CREATIVE INDUSTRIES IN QUEENSLAND (PER CENTAGE CHANGE COMPARED TO BASE CASE)

Year	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2011-12 to 2018-19
A Vertically Integrated True Broadband Network	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.08	0.09
An Open Access True Broadband Network	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.09	0.09

Source: The Allen Consulting Group

Appendix C

The Monash Multi-Regional Forecasting Model

C.1 Introduction to the MMRF model

The Monash Multi-Region Forecasting (MMRF) model is a dynamic multi-regional, multi-sectoral model of the Australian economy. It was developed at the centre of Policy Studies at Monash University. Like its predecessors, ORANI and MONASH, MMRF has a high level of microeconomic detail. In contrast to ORANI the MMRF model has a strong forecasting capability.

Most importantly MMRF has a regional forecasting capability. It is able to project annual time paths for variables describing: macroeconomic prospects for the Australian economy and for the economies of the six States, two territories and 57 statistical divisions (regions). It models each region as an economy in its own right and can disaggregate results down to sub-state regions.

MMRF describes in mathematical terms the behaviour of:

- industries, households and governments;
- domestic and foreign markets for commodities; and
- the domestic markets for labour and capital.

The key to generating realistic forecasts is to use detailed information available from expert groups specialising in the analysis of different aspects of the economy. MMRF forecasts incorporate a wide variety of information including:

- macro forecasts from the Commonwealth Treasury and Access Economics;
- export forecasts from ABARE and the Tourism Forecasting Council;
- published and unpublished data supplied by the Australian Bureau of Statistics;
- forecasts of changes in technology and consumer tastes derived from trends calculated at CoPS; and
- results from Dixon and Rimmer (1999) on the effects of the Government's *A New Tax System* package.[28]

The MONASH suite of models, including MMRF, has been applied in numerous forecasting and policy exercises. In forecasting, MMRF is used on a continuing basis by State and Commonwealth Government Departments to generate detailed employment projections. In policy analysis, these models have been used to examine:

[28] Dixon, P.B. and Rimmer, M.T.1999, 'The government's Tax Package: Further Analysis Based on the MONASH model', *Report Prepared for the Senate Select Committee on a Next Tax System,* mimeo, 1999, January 25.

- the impact of increased e-commerce across Australia (for NOIE);[29]
- the economic impact of the Sydney Olympic games (undertaken by CREA in collaboration with the NSW Treasury);[30]
- benefits resulting from changes in telecommunications services (for the Australian Communications Authority);
- changes in tariffs on motor vehicles and on textiles, clothing and footwear;
- the economy wide impact of investment in roads;[31]
- role of water in the Australian economy;
- reductions in waterfront costs;
- implications of a more open airline policy;
- implications of financing, by different types of taxes, a major project such as the undergrounding of electricity and communication cables;
- a reduction in the number of foreign students coming to Australia caused by the Asian economic slowdown; and
- the effects of the GST.

MONASH and MMRF fundamentals are fully documented[32] and documentation about the model and its application is regularly assessed in the refereeing processes of leading economic journals.

The complexity of the model is indicated by the fact that in total, the model contains over 27,500 equations relating to more than 50,000 variables.

C.2 Base case and state-wide case projections

In assessing the impact of a true broadband network throughout the Brisbane and Moreton regions, the MMRF model is used to produce a Base Case projection where the availability of telecommunications infrastructure, products and services remains reflects current projections.

A second projection is produced (called the limited competition scenario) to show the impact of constructing a true broadband network which would cover 50 per cent of the businesses and residential dwellings in the Brisbane and Moreton regions. This scenario assumes that the rollout of the network and the provision of services to end-users will be undertaken by a vertically integrated service provider and that there will be no third party access permitted. Hence, there will be only one new market entrant at both the retail and wholesale levels.

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29 NOIE 2000, *E-commerce Across Australia*, Department of Communications Information Technology and the Arts, Canberra.

30 NSW Treasury and Centre for Regional Economic Analysis 1997, *The Economic Impact of the Sydney Olympic Games*, TRP 97-10.

31 The Allen Consulting Group 1993, *Land Transport Infrastructure: Maximising the Contribution to Economic Growth*, Australian Automobile Association.

32 Dixon, P.B. and Rimmer, M.T. 2002, *Dynamic General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH*, North-Holland Publishing Company, (forthcoming).

The third projection is produced (called the open competition case) looks at what would happen if the true broadband network (as rolled out in the limited competition scenario) were subject to open third party access. Consequently, there will be several market entrants at the retail level of the market.

The effects of the true broadband network under the different competition assumptions are measured by the differences (deviations) between the base case and the scenario projections using MMRF.

C.3 Structure of MMRF

The basic theoretical assumptions of MMRF (and MONASH) are set out below.

Labour market

MMRF assumes that workers are concerned with the real after-tax wage rate, that is, the wage rate less income taxes, deflated by the CPI. If the labour market strengthens, then it is assumed that the real after-tax wage rate increases in response to greater worker negotiating strength. More technically, the deviation in the after-tax real wage rate from its base case forecast level increases in proportion to the deviation in employment from its base case forecast level. The coefficient of proportionality is chosen so that the employment effects of a shock to the economy are largely eliminated after 5 years.

In other words, after about 5 years the benefits or costs of a shock, such as additional productivity improvements (additional to those in the base case forecast) are realised almost entirely as an increase or decrease in real after-tax wage rates. The labour market assumption can be summarised as short-run real wage stickiness and long-run real wage flexibility. It is consistent with conventional macro-economic modelling in which the non-accelerating inflation rate of unemployment (NAIRU) is exogenous.

Public expenditure and taxes

MMRF assumes that the shocks considered make no difference to the path of real public consumption and that there are no adjustments in tax rates to compensate for changes in tax revenue and outlays associated with changes in the level of economic activity. As can be seen in the MMRF results for this study, the MMRF simulation shows an increase in economic activity. Thus, there is a movement in the government’s budget towards surplus.

Rates of return on capital

In simulations of the effects of changes in policy and other exogenous variables, MMRF allows for short-run divergences in after-tax rates of return on industry capital stocks from their levels in the base case forecasts. Short-run increases/decreases in rates of return cause increases/decreases in investment and capital stocks, thereby gradually eroding the initial divergences in after-tax rates of return.

Production technologies

The MMRF contains variables describing:

- primary-factor and intermediate-input-saving technical change in current production;
- input-saving technical change in capital creation; and
- input-saving technical change in the provision of margin services.

These variables are derived from measurement of technical change able to be observed in the run of ABS national accounts and input output data over recent decades.

In the simulation described in this report, such technical change is reflected in the base case. That is, a background rate of technological progress is already factored in to the study. Technological change assumptions incorporated in the model 'shocks' are viewed as being additional impacts.

The nature of markets

Markets are assumed to be perfectly competitive. Competition guarantees that a level of output is produced in each industry at a point where the producer's price equals marginal costs and where zero pure profits are earned. Demand is assumed to equal supply in all markets except in the market for labour where oversupply is allowed. The government intervenes in a market by imposing sales taxes on commodities. This puts a wedge between the price paid by the purchaser and price received by the producer. The model also recognises nine margin commodities (wholesale trade, retail trade, road transport, rail transport, water transport, air transport, transport services, insurance and restaurants) that are required for each transaction involving a commodity or service. The costs of the margins are included in the price paid by the purchaser.

Input demand for industry production

Two broad categories of inputs to the production process are recognised, intermediate inputs and primary factors (labour of various occupations, capital, agricultural land and working capital). Intermediate inputs are distinguished by commodity type and by source (domestically-produced and imported). Firms in each industry are assumed to choose a mix of inputs that minimises the costs of production for given input and output prices and for a given level of output. They are constrained in their choice of inputs by a production technology that combines intermediate and primary inputs to produce output.

Households demands

The household determines the composition of consumption by choosing commodities (distinguished by source) to maximise a utility function subject to an expenditure constraint. A consumption function determines the overall household expenditure as a function of household disposable income.

In MMRF, household preferences are described by a utility function leading to demand functions of the form:

$$X_i = f(T_i, P_i, C_i)$$

where:

X_i is consumption of good I per household;

P_i is a vector of commodity prices;

C_i is total consumption expenditure per household; and

T_i is a taste change variable.

Input demand for investment

Given a level of investment expenditure, an industry chooses inputs (distinguished by type and by source) to minimise the costs of capital creation. The input-demand functions to capital creation are analogous to the input-demand functions for current production, with the exception that there are no primary factor inputs to capital creation.

Government demands for current production

There is no explicit theory determining governments' consumption expenditures. These can be determined in one of three ways: (1) endogenously, by a rule such as moving government expenditures with household consumption expenditure or with overall domestic absorption; (2) endogenously, as a policy instrument which varies in order to accommodate an exogenously determined policy target such as a required outcome for the government's budget deficit; or (3) exogenously.

Foreign demand (international exports)

MMRF cannot explicitly model all of the determinants of foreign demand for Australian products. It handles export demand by imposing for each exported commodity a foreign demand schedule. These schedules, which relate the volume of exports to the foreign currency price of Australian products, are downward sloping. Hence, export volumes and foreign-currency prices can respond to changes in Australian supply conditions.

Capital stocks, investment and rates of return

MMRF allows for two broad treatments of capital and investment. The first, involving explicit assumptions about movements in rates of return and investment/capital ratios, is suitable for comparative-static simulations. In such simulations, the focus is upon the effects of a policy or other shock after considerable time, say seven years. In these circumstances, MMRF allows the user to assume that the shock under examination does not affect rates of return. Thus, industries favoured by the shock attract capital until their rates of return are driven down to their initial levels and that industries for which the shock is unfavourable lose capital until their rates of return increase to their initial levels. Having, in this way, tied down the long-run effect of the shock on capital stocks, the effect on investment by industry can then be determined by assuming no change in investment/capital ratios.

The treatment of capital and investment in MMRF (the treatment involved in this report) involves explicit capital supply functions, and is used in year-to-year simulations, i.e., simulations tracing out the paths of variables for years t, t+1, t+2, etc. While the assumption of no change in rates of return may be suitable for long-run analysis, it is unrealistic to assume that movements in an industry's rate of return are eliminated by year-to-year movements in the industry's capital stock. In each year of year-to-year simulations, industries' capital growth rates (and thus investment) are determined according to functions which specify that investors are willing to supply increased funds to industry j in response to increases in j's expected rate of return. However, investors are assumed to be cautious. In any year, the capital supply functions in MMRF limit the growth in industry j's capital stock so that disturbances in j's rate of return are eliminated only gradually.

Equations for facilitating dynamic policy simulations

There are a number of mechanisms in MMRF introduced to facilitate dynamic policy simulations. Probably the most important mechanisms relate to wage and employment adjustment in the labour market. In comparative static analysis, one of the following two assumptions is made about the operations of the labour market: (1) real wages adjust so that any policy shock has no effect on employment; or (2) real wages are unaffected by the shock and employment adjusts.

MMRF, however, allows an intermediate position for year-to-year policy simulations. In MMRF, real wages can be sticky in the short run but flexible in the long run and employment can be flexible in the short-run but sticky in the long run. More specifically, for year-to-year policy simulations it is assumed that the deviation in the real wage increases in proportion to the deviation in employment from its base case forecast level. The coefficient of adjustment is chosen so that the employment effects of a shock are largely eliminated after eight to ten years. This labour market is consistent with macroeconomic modelling in which the NAIRU is exogenous.

C.4 Evaluation of regional impact

The MMRF model adopts a tiered 'tops down' approach to regional analysis. Under this approach, national and regional (ie state) results are generated for each industry. The tops-down decomposition is undertaken in when assessing the impacts at the Statistical Division (SD) level within each region (or state). This is based on the industry mix of each statistical division's activity.

The MMRF model identifies 57 separate statistical divisions within Australia. These divisions are consistent with the ABS statistical division, which are outlined in Table C1.

Table C.1

MONASH Region	ABS SD	Main Centre	Other Selected Urban Centres
Brisbane	305	Brisbane	Beenleigh, Logan, Mount Gravatt, Redcliffe
Moreton	310	Coolangatta	Burleigh Heads, Caloundra, Ipswich, Noosa, Surfers Paradise
Wide Bay-Burnett	315	Maryborough	Bundaberg, Gympie, Hervey Bay, Mundubbera
Darling Downs	320	Toowoomba	Dalby, Goondiwindi, Stanthorpe, Warwick
South West	325	Charleville	Quilpie, Roma, St George
Fitzroy	330	Rockhampton	Emerald, Gladstone
Central West	335	Longreach	Barcaldine, Blackhall, Winton
Mackay	340	Mackay	Clermont, Proserpine
Northern	345	Townsville	Ayr, Bowen, Charters Towers, Ingham
Far North	350	Cairns	Atherton, Cooktown, Innisfail, Mareeba, Mosman, Weipa
North West	355	Mount Isa	Cloncurry, Hughenden, Normanton
Sydney	105	Sydney	Campbelltown, Gosford, Katoomba, Parramatta, Sutherland
Hunter	110	Newcastle	Cessnock, Maitland, Muswellbrook, Port Stephens, Singleton
Illawarra	115	Wollongong	Kiama, Mittagong, Moss Vale, Shellharbour, Shoalhaven
Richmond - Tweed	120	Lismore	Ballina, Byron Bay, Casino, Tweed Heads
Mid-North Coast	125	Coffs Harbour	Grafton, Kempsey, Port Macquarie, Taree
Northern	130	Tamworth	Armidale, Glenn Innes, Gunnedah, Inverell, Moree, Tenterfield
North Western	135	Dubbo	Bourke, Cobar, Coonabarabran, Gilgandra, Mudgee, Walgett
Central West	140	Orange	Bathurst, Blayney, Cowra, Forbes, Lithgow, Oberon, Parkes
South Eastern	145	Queanbeyan	Bega, Bombala, Cooma, Crookwell, Goulburn, Yass, Young
Murrumbidgee	150	Wagga Wagga	Cootamundra, Griffith, Gundagai, Hay, Narrandera, Tumut
Murray	155	Albury	Balranald, Deniliquin, Holbrook, Tumbarumba, Wentworth

MONASH Region	ABS SD	Main Centre	Other Selected Urban Centres
Far West	160	Broken Hill	Tibooburra, Wilcannia
Melbourne	205	Melbourne	Altona, Dandenong, Lilydale, Mornington Peninsula, Sunbury
Barwon	210	Geelong	Apollo Bay, Colac, Lorne, Queenscliffe
Western District	215	Warrnambool	Camperdown, Hamilton, Portland
Central Highlands	220	Ballarat	Ararat, Bacchus Marsh, Daylesford
Wimmera	225	Horsham	Dimboola, St Arnaud, Stawell
Mallee	230	Swan Hill	Kerang, Mildura, Ouyen
Loddon	235	Bendigo	Castlemaine, Maryborough
Goulburn	240	Shepparton	Bennalla, Echuca, Kyabram, Rochester
Ovens-Murray	245	Wodonga	Beechworth, Bright, Mount Beauty, Rutherglen, Wangaratta
East Gippsland	250	Sale	Bairnsdale, Omeo, Orbost
Gippsland	255	Traralgon	Moe, Morwell, Wonthaggi
Adelaide	405	Adelaide	Glenelg, Henley, Hindmarsh, Marion, Salisbury
Outer Adelaide	410	Mount Barker	Barossa Valley, Kangaroo Island. Onkaparinga
Yorke & Lower North	415	Yorketown	Bute, Riverton, Wallaroo
Murray Lands	420	Renmark	Murray Bridge, Pinnaroo
South East	425	Mount Gambier	Bordertown, Kingston, Naracoorte
Eyre	430	Port Lincoln	Ceduna
Northern	435	Whyalla	Cooper Pedy, Port Augusta, Port Pirie, Woomera
Perth	505	Perth	Armidale, Fremantle, Joondalup, Stirling, Wanneroo
Peel	510(p)	Rockingham	Kwinana, Mandurah
South West	510(p)	Bunbury	Busselton, Collie, Manjimup, Margaret River, Pemberton
Great Southern	515	Albany	Denmark, Katanning
Wheatbelt	520/525	Northam	Merridin, Moora, Narrogin

MONASH Region	ABS SD	Main Centre	Other Selected Urban Centres
Goldfields – Esperance	530	Kalgoorlie	Boulder, Coolgardie, Esperance
Mid West	535(p)	Geraldton	Meekatharra, Mount Magnet
Gascoyne	535(p)	Carnarvon	Exmouth
Pilbara	540	Port Hedland	Karratha, Newman, Tom Price
Kimberley	545	Broome	Derby, Kununurra, Wyndham
Greater Hobart	605	Hobart	Clarence, Glenorchy, Sorell
Southern	610	Greeveston	Bicheno, Huonville, Triabunna
Northern	615	Launceston	Deloraine, Georgetown, St Helens
Mersey-Lyell	620	Burnie	Devonport, Queenstown, Smithton, Ulverstone, Zeehan
Northern Territory	7	Darwin	Alice Springs
Australian Capital Territory	8	Canberra	

MRES: Monash regional economic system; ABS SD: Australian Bureau of Statistics statistical division. metropolitan regions are shaded.
Source: MONASH — RR database; ABS 1995 (Australian Standard Geographic Classification, Catalogue Number 1216.0) and Productivity Commission (1999, p 297).

Appendix D

Glossary

Asymmetric Digital Subscriber Line	ADSL	A technology for the delivery of digital data over existing twisted pair copper subscriber lines. The data rate is asymmetric, with downstream rates (to the user) up to a maximum of about six megabits per second (Mbps). The upstream data rate would be less than 512 kilobits per second (kbps). In practical applications, ADSL downstream data rates are limited to around 1.5 Mbps or lower.
Bandwidth		In analogue systems bandwidth is a measure of the amount of occupied spectrum and is measured in Hertz (Hz). In digital systems bandwidth is a measure of the data throughout capacity of a given communications network. Bandwidth is measured in bits per second (bps).
Bits per second	bps	A common measure of data speed for transmission carriers. The speed in bps is equal to the number of bits transmitted or received each second.
	kbps	Kilobits per second — the transmission of one thousand binary bits per second.
	Mbps	Mega bits per second — the transmission of one million binary bits per second.
	Gbps	Giga bits per second — the transmission of one thousand million binary bits per second.
Broadband		A generic term for high bandwidth capacity, with no commonly agreed specific definition. Any system with the ability to deliver digital data at hundreds of thousands of bits per second would be currently considered broadband.
Carrier		The holder of a telecommunications carrier licence in force under the Telecommunications Act 1997.
Carriage Service Provider	CSP	A party which uses its own or someone else's network facilities to provide basic or value-added telecommunications services.
Dial-up		In the context of Internet use, it refers to using the telephone network to 'dial-up' a link to an Internet Service Provider (ISP). The link to the ISP is only maintained for the duration of the connection.
Digital Subscriber Line	DSL	Digital Subscriber Line using copper 'twisted pair' lines. Exploits unused frequencies on copper telephone lines to transmit traffic: typically at multi-megabit speeds. DSL allows voice and high-speed data to be sent simultaneously over the same line. Normally 'asymmetric' (meaning greater download rates and lower upload rates).
Exchange		Network node where various numbers and types of communication lines are switched by the telecommunications user or network operator. Exchanges operate at local, trunk and international levels.
Fibre Optic		Fibre Optic cables consist of glass threads which transmit messages modulated onto lightwaves. Less susceptible to interference than legacy analogue technologies, fibre optic cables allow data to be transmitted digitally at very fast speeds. Easily outperforms other technologies in terms of speed and reliability.
Fibre To The Home	FTTH	A broadband network solution where fibre optical cable runs from the telephone exchange to the customer premises in a point-to-point configuration.
Hybrid Fibre Coaxial Cable Network	HFC Network	Consist of fibre optic cable supplement by coaxial cable for the connection to customers' premises.
Internet Service Provider	ISP	A commercial organisation which provides the link between an end user and the Internet, usually by means of a dial-up service. An ISP may also provide help desk, web hosting and email services to the end user.
Modem		A device that converts digital data into analogue signals for transmission on analogue networks and analogue signals back into digital data.
Narrowband		Narrowband is a generic term. It is commonly used to describe the data speed that can be achieved through the public switched telephone network when using a dial-up modem (e.g. 33kbps).

National Office for the Information Economy	NOIE	The Commonwealth agency responsible for information economy issues.
True Broadband		A broadband infrastructure capable of supporting at a minimum video, voice and data services and applications simultaneously — with various requirements for interactivity and bandwidth — over a single physical infrastructure.
Video on Demand	VoD	An umbrella term for a wide set of technologies which enables individuals to select videos from a central server for viewing on a television or computer screen. VoD can be used for entertainment (ordering movies transmitted digitally), education (viewing training videos), and videoconferencing (enhancing presentations with video clips).
Voice over Internet Protocol	VoIP	Enables voice communication to be to be transmitted and received via a network using the Internet protocol.