

Economic drivers and contribution of mobile communications in Australia

Prepared for

Telstra Corporation Ltd

Authorship

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Executive Summary

Key findings:

- Across many key measures, including uptake of technology, investment in network coverage and capacity, and value for money, the Australian mobiles market is performing at a very high level and delivering significant economic benefits.
- New technologies are being adopted. Competing providers have brought increasingly advanced mobile network technologies into Australia and these investments have allowed other sectors to develop – e.g. consumer and business devices, content and applications.
- A major factor in the consumer benefits derived from the mobiles sector is network investment and competition between networks. The state of competition is such that each provider has both the ability and the incentive to upgrade their networks.
- Australia has benefited from a relatively light-handed approach to mobile regulation (e.g. limited retail or wholesale price intervention, no regulation of domestic roaming) and this stance deserves some of the credit for the benefits Australians have enjoyed from the mobiles sector.
- The benefits of the mobiles market extend to residents of regional and remote regions as they too get the benefit from competition in urban areas because network providers do not price discriminate on a geographic basis.

Benefits of mobile communications

Technological advances in mobile communications have delivered significant economic benefits to the Australian population. A recent study put the total value added by the mobile industry at \$14.1 billion per annum. Further gains are set to continue through 4G networks which are still being installed and utilisation of the 700 MHz and 2.5 GHz bands of spectrum that have been acquired by network operators.

Mobile broadband already enables a very wide range of uses, while also creating opportunities for further innovation. Empirical analysis using cross-country data suggests that mobile broadband usage has a significant positive effect on GDP.

It is now difficult to remember and comprehend how we lived without mobile phones. It is timely to pause briefly and reflect, not just on the economic value that is being created, but more particularly on the economic drivers of that value. That is the aim of this report, which was commissioned by Telstra but reflects the independent opinions of the authors.

We have identified two broad sets of factors that can be credited with the benefits Australians have received and are continuing to gain from mobile communications services: 1) adoption of technology; and 2) network investment.

Adoption of technology

First and most obviously, new technologies are being adopted. Competing network providers have installed increasingly advanced technologies with 4G being the most recent and new technologies on the horizon (e.g. utilising the 700 MHz spectrum band and LTE-Broadcast). These network investments have allowed other sectors to develop and they in turn help to improve consumer benefits: devices are becoming more powerful and the range/variety is expanding; and applications are also being enhanced and new uses are being found.

The economic benefits of mobile technology derive jointly from all of these technological advances, and Australian consumers are clearly demonstrating the value they are receiving. In just a few years, Australia has moved from the bottom third of the OECD to the top position for mobile broadband connection with 117 wireless broadband subscriptions per 100 inhabitants.

Network investment

The second major driver of these benefits is network investment in Australia. Whereas much of the innovation in devices and applications is imported to Australia, the growing capability of mobile networks is needed to take advantage of that innovation. Mobile carriers have recently been committing billions of dollars to expand and upgrade their networks, including installing 4G technology that delivers much faster data speeds and opens up new possibilities for mobile communications and applications. The carriers have also committed almost \$2 billion in acquiring new spectrum in the 700Mhz and 2.5 GHz bands and have indicated they plan to utilise this spectrum in their mobile networks.

While the crucial role of network investment is very clear, the motivation for firms to commit such large sums to sunk assets is perhaps less obvious. We therefore consider that competition between networks deserves recognition as a distinct driver of the economic benefits of mobile communications in Australia. The pursuit of competitive advantage is what drives investment by mobile networks in Australia. Strong firms know they are being chased by hard-working rivals, and all players are looking for a competitive advantage. This environment fundamentally drives competitive investment.

Competing networks have a strong incentive to attract extra demand onto these new high capacity networks, which leads them to offer better deals to consumers, such as more usage for the same price. The evidence shows that Australian consumer prices for telecommunications, in nominal terms, have been almost unchanged since 1997. Over the same time period the general basket of consumption goods has increased in price by almost 60%.

Regulatory settings

Commercial investment in mobile networks is influenced by public policy, and for telecommunications that occurs primarily through regulatory policy. Australia has benefited from a relatively light-handed approach to mobile sector regulation and this stance deserves some of the credit for the benefits Australians have enjoyed from the mobile sector.

In particular, we note that the Australian Competition and Consumer Commission (ACCC) has twice (1998, 2004) considered regulating mobile roaming, rather than leaving this as a service that may be negotiated commercially. In each case the ACCC decided against regulating.

We explore the consequences of regulated roaming in those parts of Australia where the population density is such that only one network can be sustained. Our conclusions, which support the ACCC's stance of regulatory forbearance in this area, are as follows.

- Residents of these regions are already benefiting from competition in urban areas because there is no geographic price discrimination, and this situation is likely to persist into the future. Regulating roaming in such regions could only be justified on the basis of efficient use of or investment in infrastructure. We see no apparent case for it, and note that such an initiative would face formidable problems in separating regulated from non-regulated infrastructure.
- Importantly, heavy-handed roaming regulation would interfere with the competitive process and, at worst, eliminate the incentive that firms have to invest in the new technologies to build and protect their competitive advantages. This would certainly disadvantage customers who expect mobile network operators to bring the latest in network, application and handset technologies into Australia.

1 Introduction

Mobile communications have already revolutionised the way we conduct our personal and business lives. It is now difficult to remember and comprehend how we lived without mobile phones. But there is no time to look back because technological advances are accelerating. 4G networks are delivering exponentially greater data speeds. The variety, capacity and power of devices is ramping up. And an ever growing industry of app developers is helping us put these new facilities to new and valued uses.

It is timely to pause briefly and reflect, not just on the economic value that is being created, but also on the fundamental drivers of that value. That is the aim of this report, which was commissioned by Telstra but reflects the independent opinions of the authors.

We identify two broad sets of factors that can be credited with the benefits Australians have received and are continuing to gain from mobile communications services:

- Adoption of new technologies, which requires
 - Risky capital investment by mobile networks, which is stimulated by
 - Competition between mobile networks; and
- Accommodating policy settings, which has included
 - No regulation of retail rates, and
 - No regulation of domestic mobile roaming.

These factors are discussed further in sections 2 and 3 below, which draw on a range of relevant data and facts.

2 Economic Contribution of Mobiles

The use of mobile communications technology creates economic value in several ways. Perhaps the most obvious is the “value added” from market transactions for mobile hardware and services. The amount of value added to an economy by an industry or firm can be estimated by subtracting production costs from sales revenue.

This approach can be applied to a narrow set of activities (e.g. sales of mobile devices and services) or the scope of analysis can be extended to include ripple or spillover effects in sectors that supply the mobile industry (e.g. purchases by resellers, the sale of maintenance services to networks and other trade that is caused by mobile network activity).

In recent work on the Australian mobile industry using 2011-12 data, DAE estimated that the direct (narrow definition) value added was \$7.6 billion, and the ripple effects generated a further \$6.5 billion of value added. These are significant fractions of the \$22 billion of total industry revenue for that period.

These value-added estimates should be thought of as the industry level equivalent of GDP. As such, they omit some other important types of economic contribution, including:

- Consumer surplus, which is the extra revenue consumers would have been willing to pay over and above market prices; and
- Dynamic contributions that occur when users develop innovative uses that sustainably enhance productivity.

As competition reduces real mobile prices over time, two opposing effects occur. Consumer surplus and the dynamic contribution of mobiles both increase, and the “value added” by the industry declines (*ceteris paribus*). It is therefore important when thinking about the economic contribution of mobiles to retain a broad view. The consumer surplus and dynamic contributions, while not readily measurable, are highly relevant to the overall economic contribution of the mobile sector.

In this section, we investigate the sources and drivers of the economic contribution of mobiles. Our analysis focuses on three inter-related factors that seem to collectively account for most of the changes in the economic contribution of the mobile industry:

- **Technology** upgrades which allow new uses and make old uses cheaper;
- **Investment** needed to bring upgraded technologies to market; and
- **Competition** which drives investment and passes benefits to consumers.

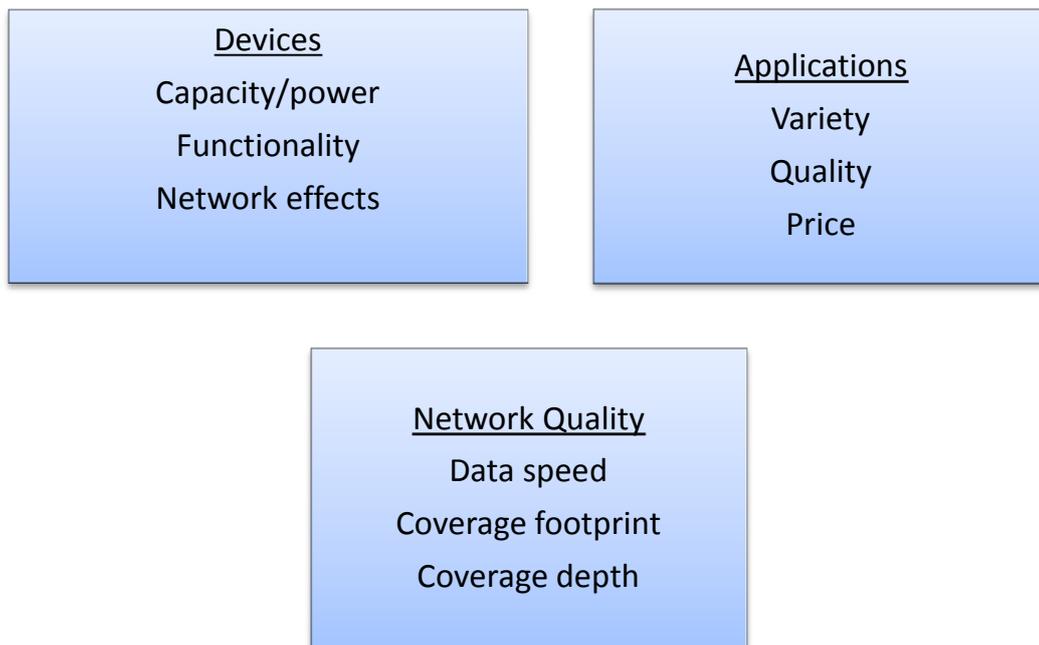
In what follows, we consider these factors separately and draw inferences in a summary section.

2.1 Mobile technology upgrades are critical

Some of the early contributions of mobile technology have been well documented in the economic development literature. The impact of basic voice services on market efficiency and labour productivity has been documented in Africa.¹In Kerala, the introduction of mobile voice services had a dramatic and positive effect on the fishing industry.² The developing world continues to enjoy major economic benefits from mobiles such as in Latin America where the sector was recently estimated as generating 3.7% of the region's GDP.³

Increasingly though, the economic benefits of mobiles are arising from technological advances that create the opportunity for new uses, while also driving down the cost of existing uses. These technological advances are occurring in three different fields, all of which are relevant to the user experience, and therefore to the economic benefits users receive.

Figure 1: Sources of mobile technology value



Network quality is a fundamental driver of the user experience and higher data speeds are the most obvious manifestation of technological advance in this area. Whereas the original 2G services offered a download speed of around 14.4k bits/second, speeds of

¹Aker, Jenny C., and Isaac M. Mbiti, 2010, "Mobile Phones and Economic Development in Africa." *Journal of Economic Perspectives*, 24(3): 207-32.

² Robert Jensen, 2007, "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector", *The Quarterly Journal of Economics*, 122 (3): 879-924.

³ GSM Association, 2013, Mobile Economy Latin America Report.

4M bits/second are realistically achievable with 4G technology. Moreover, over the last three upgrade cycles (2G – 2.5G – 3G – 4G) the rate of speed increase has accelerated, so that for example 4G is around 10 times faster than 3G.

High data speeds are not the only dimension of network capability that affects users however. Network reach is also critical, and it has both an extensive aspect, relating to the size of the network’s coverage footprint, and an intensive aspect concerning in-building coverage for example.

As mobile traffic moves towards data and away from voice (see below), the attributes of devices and applications are becoming increasingly important. For devices, capacity is assessed with reference to processing power and memory. Functionality is also relevant to consumers and it varies across different form factors such as smart phone, tablets and dongles for laptops. A third important feature of devices is the strength of the network effects or network externalities associated with the operating system used (iOS, Android etc). These operating systems become more attractive as they gather users, because that also increases the number of experts (for problem solving) and application developers.

Applications are a third distinct source of value to users. The variety (ie range) of applications available affects the potential uses to which a device can be put, and the quality and price of these applications are also important.

With this background in mind, we now consider the evidence on technology upgrades and the value consumers receive from these.

2.1.1 4G is increasingly available

As at June 2013, most Australians were covered by a 4G network. In its 2012-13 report, the ACMA records the following for 4G coverage:⁴

- Telstra 66% of population (since increased to 85%)
- Optus Main capital cities
- VHA network exists but no coverage data

Further investment is still proceeding, and in December 2013 Telstra was reported as covering 85% of the population with 4G. Optus is investing in 4G networks in the major capital cities.^{5 6}

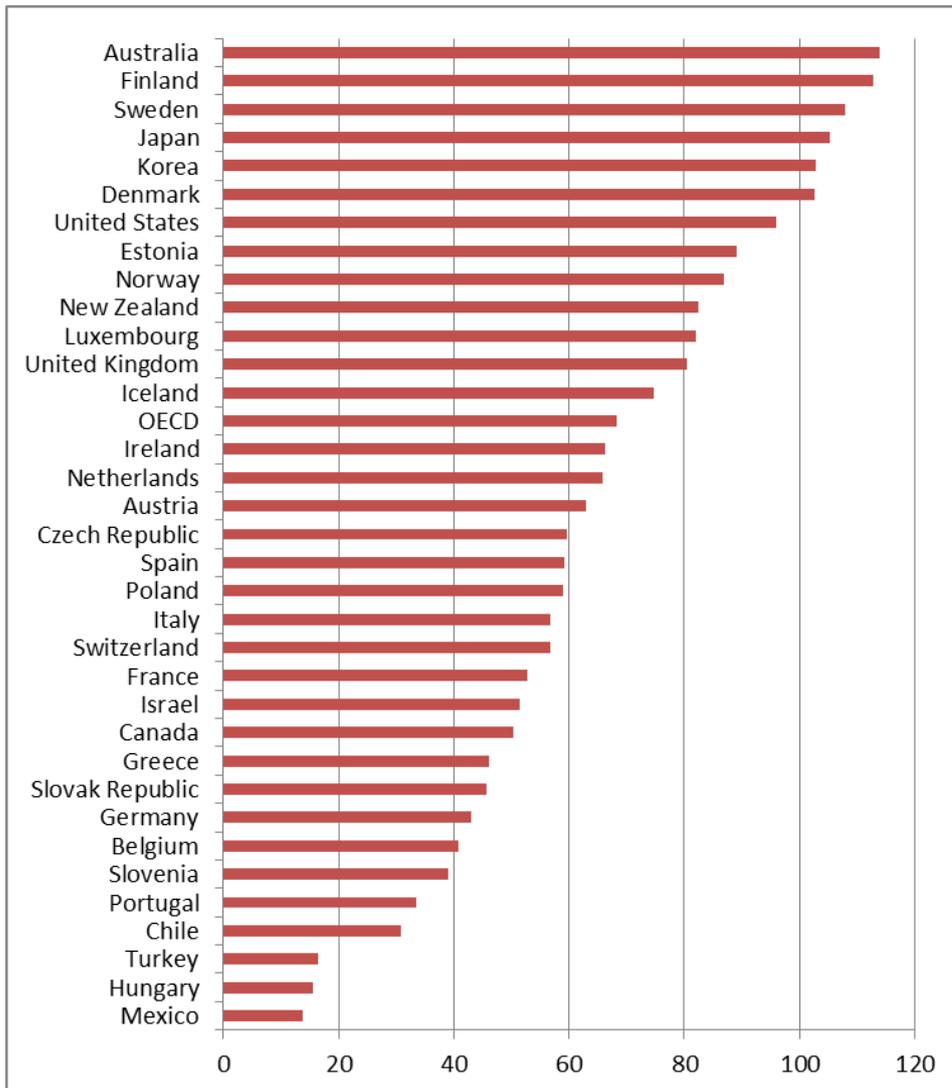
This availability, combined with other dimensions of consumer value, has propelled Australia to the top of the international rankings for mobile broadband penetration, based on OECD data to June 2013. These rankings are shown in Figure 2 below.

⁴ ACMA, Communications Report 2012-13, page 5

⁵ Using ABS data from 2012 suggests that the “greater” areas of these cities account for 65% of Australia’s total population; it is likely that not all of these areas are covered by 4G however.

⁶http://www.computerworld.com.au/article/433391/updated_4g_australia_state_nation/

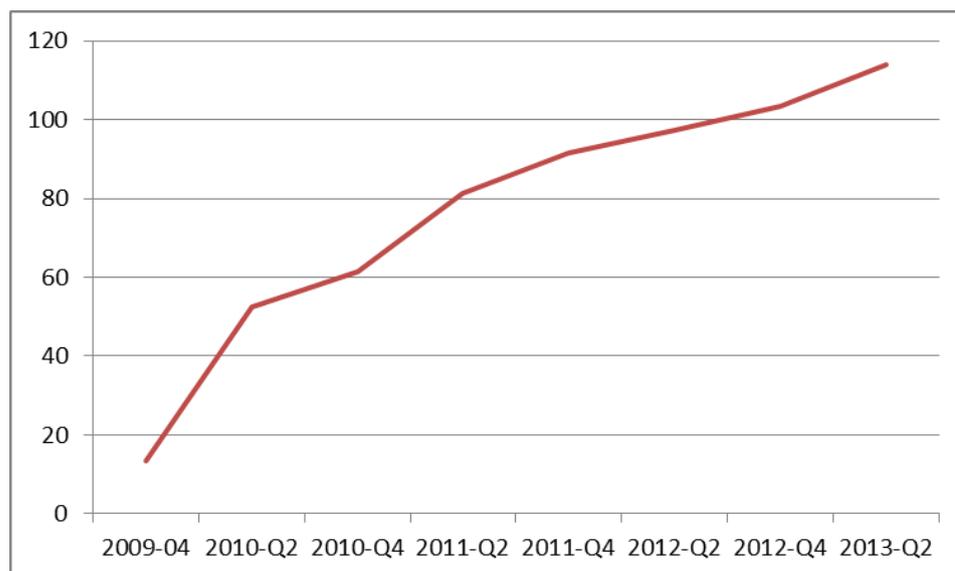
Figure 2: Mobile broadband penetration rates (%). Source: OECD



The OECD also reports historic penetration rates at six monthly frequencies, from which historic rankings can be derived. The increase in Australian mobile broadband over the last three and a half years is shown in Figure 3 below.

This growth was internationally unusual. In June 2009, Australia had 13.4% mobile broadband penetration which placed it about two-thirds of the way down the OECD rankings: 21 out of 34. To climb from that position to top rank with penetration 67% higher than the OECD average is a notable achievement.

Figure 3: Australian mobile broadband penetration over time (%). Source: OECD



2.1.2 Uptake creates economic value

Mobile broadband already enables a very wide range of uses, while also creating opportunities for further innovation. Empirical analysis using cross-country data suggests that mobile broadband usage has a significant positive effect on GDP.⁷ A similar effect has been cited on the rate of growth in GDP per capita, which has been estimated to increase by 0.5 percentage points for every doubling of mobile data usage.⁸ Clearly such estimates are subject to a degree of uncertainty, and results will vary across countries. Nevertheless, the effects are detectable.

At the level of consumers and households, it is apparent that both mobile network access and mobile broadband are viewed as substitutes for their fixed line equivalents to some extent.⁹ Again though, consumers in different situations react differently.

Moreover, substituting mobile services for fixed services still creates economic value for the consumer: that is the reason they switch. If we consider any given fixed broadband service, making it mobile adds a quality dimension which makes it more valuable to consumers, other things being equal. The price of the mobile service might be higher than the price of the corresponding fixed service, but any consumers who switch to the mobile service are signalling that they get more value (ie greater consumer surplus) from doing so, notwithstanding any price differential.

⁷ Thompson, H.G. and C. Gabacz, 2011, Economic impacts of mobile versus fixed broadband, *Telecommunications Policy*, 35(11) pp.999-1009.

⁸ Deloitte, 2012, What is the impact on mobile telephony on economic growth, Report for the GSM Association.

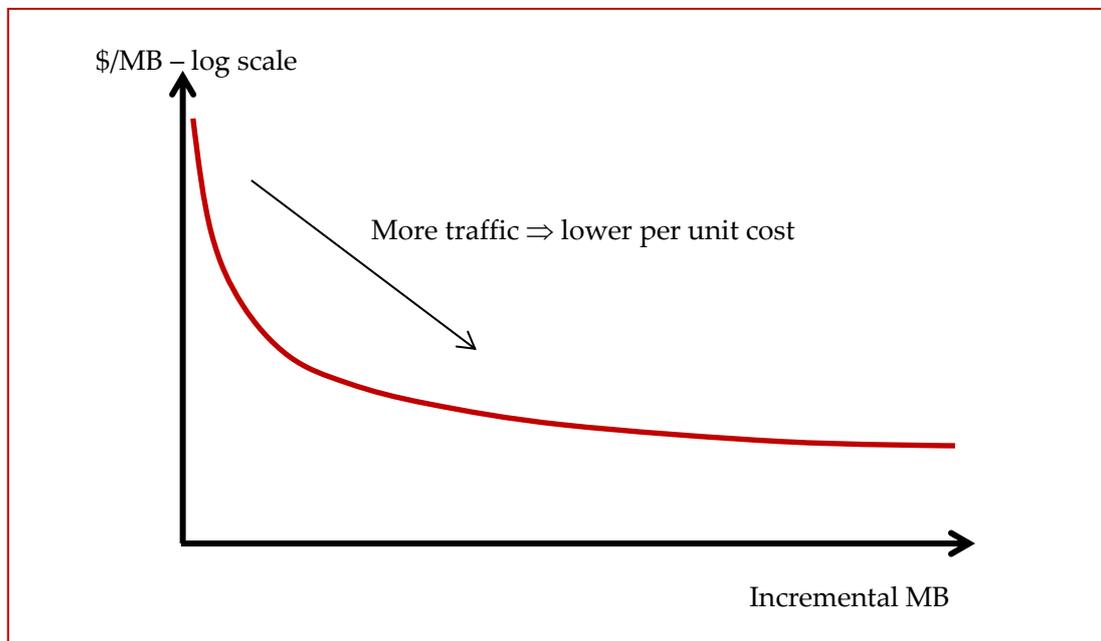
⁹ Grzybowski, L. and F. Verboven, 2013, Substitution and Complementarity between Fixed-Line and Mobile Access, NET Institute Working Paper No. 13-09.

2.1.3 Prices are falling for all services

New telecommunications services such as mobile broadband are not the only source of economic value that is attributable to technology upgrades. A key feature of 3G and especially 4G networks is that they have hugely enhanced capacity relative to previous versions of technology. Having invested in this capacity, mobile network operators then have a strong incentive to sell it, which drives down prices for all services. The average cost curve for mobile networks is the source of this incentive.

To understand this point, consider the June 2012 report that Optus plans to spend \$2 billion on 4G network capability.¹⁰ This is a fixed capital cost, which will be committed in the expectation of additional revenue. That revenue must be derived from use of the network. The following stylised cost curve illustrates the situation.

Figure 4: Stylised average cost curve for 4G network



The first few extra MB of traffic are very costly indeed, but average costs fall rapidly as usage grows. This is simply because the fixed cost is spread over more output.

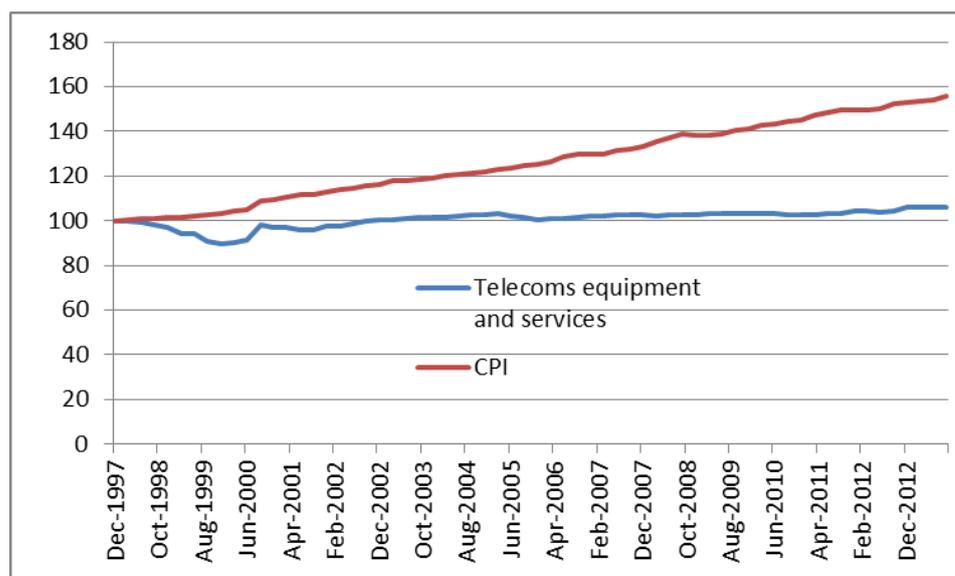
Once investment has occurred, competing networks have a strong incentive to attract extra demand onto these new high capacity networks and this leads them to offer better deals to consumers, such as more usage for the same price. The alternative strategy of keeping prices high allows rivals an opportunity to lock in a lower cost structure.

In summary, once capital is committed to higher capacity networks, everyone gains from lower prices. Network owners get a lower cost structure from the increased demand that lower prices induces, and this justifies the lower prices. Consumers also gain from better pricing and service quality.

¹⁰http://www.computerworld.com.au/article/428564/optus_shows_money_bid_overtake_telstra/

While we have discussed this in the context of 4G investment, the same process of technological progress has been operating for many years in the mobile sector, and also in fixed line telecommunications. Figure 5 illustrates the price consequences of this process for consumers. It shows that Australian consumer prices have, in nominal terms, been almost unchanged since 1997. Over the same time period the general basket of consumption goods has increased in price by almost 60%.

Figure 5: Price indices for telecommunications and general consumption 1997-2013. Source: ABS



The resulting consumer benefits are not solely attributable to the mobile sector, but technological upgrades have been more frequent and dramatic in this part of the industry.

2.2 Efficient and timely investment is needed

An important pre-condition for the availability and uptake of new mobile technology is that firms invest by installing the required equipment in an efficient and timely manner. This point needs some elaboration. In a purely static sense, investment is ex-ante socially efficient if the expected incremental static benefit to consumers of the last unit of investment in a single period equals the expected incremental static cost to firms of installing new capacity in that period. However, in capital intensive industries (of which the market for mobile services is a prime example) where rapid technological change can lead to significant quality improvements and lower costs over time, a broader concept of efficiency is more appropriate.

In such industries, a correct evaluation of the efficiency of investment balances the usual static or expected one-period net gains against the dynamic or expected future net benefits from improvements in quality of service that come from rapid technological advances. The concept of dynamic efficiency, which refers to this balance between static incremental net benefits and those that occur over time, is therefore more appropriate for judging the optimality of investment decisions.

Once these dynamic efficiency considerations are taken into account, the timing of investment becomes a crucial issue. What may appear today to be a socially efficient investment in a purely static sense may actually be suboptimal in a broader dynamic sense if the ultimate consequence of investment today (rather than tomorrow) is that consumers miss out on the development and adoption of better technologies and more valuable services at some point in the future. The question of when the timing of investment is efficient is therefore a question of weighing net social benefits if investment is brought forward, against the net social benefits that may accrue in the future if investment is instead delayed.

2.2.1 Australian mobile networks are investing heavily

Given the importance of dynamic efficiency, it is useful to review current mobile sector investment in Australia and to look ahead at the prospects for ongoing investment. This section reviews the data on rates of investment by mobile networks.

Recent company announcements and analyst reports suggest healthy rates of investment. For example:

- In 2012-2013 Telstra spent \$1.2 billion on its mobile network¹¹, and recently announced that it would double the number of mobile towers with 4G support by the end of 2013, taking their 4G coverage to 85 per cent of the population, up from 66 per cent at the end of June.¹² Bank of America/Merrill Lynch expects Telstra to make similar levels of capital expenditure in 2014 and 2015.¹³
- Over the next three years Optus plans to add nearly 1000 new greenfield sites into its network, and introduce 3G 900Mhz to a further 500 existing sites across metropolitan areas.¹⁴ Optus launched 4G services in mid-2012.
- VHA recently upgraded its entire network, replacing 2G and 3G equipment at all 8000 base stations in Australia.¹⁵ In early 2013 the company announced that it would make its largest ever single investment in its mobile network in 2013.¹⁶ VHA switched on 4G mobile broadband access in selected areas of major Australian cities in mid-2013.
- Telstra and Optus acquired \$1.96 billion worth of new spectrum licences in the Government's 'Digital Dividend' auction in 2013.¹⁷

¹¹<http://telstra.interactiveinvestorreports.com/annualreport2013/strategy-performance>

¹²<http://delimiter.com.au/2013/07/18/huge-4g-expansion-telstra-to-double-coverage/>

¹³Bank of America/Merrill Lynch, Global Wireless Matrix, January 2014, page 196.

¹⁴ Optus Sustainability Report 2013, page 11.

http://www.optus.com.au/dafiles/OCA/AboutOptus/StaticFiles/PDF/Sustainability_2013.pdf

¹⁵

http://www.arnnet.com.au/article/377521/vodafone_chooses_huawei_8000_network_base_station_upgrades/

¹⁶ <http://www.theaustralian.com.au/technology/vodafone-splurges-on-network-to-win-back-customers-and-restore-brand/story-fn4iyzsr-1226580662375>

¹⁷ <http://www.acma.gov.au/Industry/Spectrum/Digital-Dividend-700MHz-and-25Gz-Auction/Reallocation/digital-dividend-auction-results>

2.2.2 Ongoing investment is not guaranteed

The recent past is not necessarily a good guide to the future pattern of investment in any industry, but there are some particular issues that are currently relevant to the Australian mobile sector and may lead to a slow-down in investment over the medium to longer term. As several other researchers have noted, mobile sector business conditions are changing in several ways that could deter future investment.

- Subscriber growth has slowed to less than 3% per annum.¹⁸
 - As recently as 2010-11 growth was 13%
- In 2012, revenue fell in nominal terms, with some analysts expecting overall nominal service revenue growth to recover only slightly in 2013 and 2014.¹⁹
- OTT services (VoIP and Apple/Google) are challenging the structure of prices²⁰
 - Last year saw increases of 73% and 150% in the numbers of Australians using VoIP services over a mobile phone and a tablet respectively.

Investment always involves a forward-looking calculus, in which firms assess the likely extra revenues relative to a counterfactual of not investing. If revenues continue to decline or remain relatively stagnant, there is no extra income source to offset the cost of capital investment. Investment could still occur in such an environment, but it will be much more difficult to justify, and will require some combination of the following features:

- A need to replace existing equipment to maintain existing services; and/or
- Fear of losing competitive advantage or an opportunity to gain competitive advantage over a rival, resulting in customer churn to a rival that is continuing to invest.

2.2.3 Consumer benefit also depends on the timing of investment

The economic literature on investment in general – and investment in the telecommunications in particular - starts from several factual observations.²¹ On the one hand, technology in the market for mobile services is changing very rapidly. On the other hand, introducing new technology across an entire network may require many years of construction, and consumer take-up of new technology may (at least initially) be very slow. These commercial realities mean that firms seeking to introduce new technologies face highly uncertain returns with long lead times. Finally, the overall

¹⁸ ACMA Communications Report 2012-13, page 4.

¹⁹Bank of America/Merrill Lynch, Global Wireless Matrix, January 2014, page 210.

²⁰ ACMA Communications Report 2012-13, page 4.

²¹ We refer here to the modern investment literature, for which the classic reference is Dixit, A.K. and R.S. Pindyck, 1994, *Investment Under Uncertainty*, Princeton University Press.

market environment (including exit, entry and future regulatory developments) may be highly uncertain.

Analytically, investment in mobile networks tends to have three important characteristics.

First, investment returns (as in all industries) are uncertain. On the cost side, mobile networks face increasing costs for civil works in their radio networks and for spectrum, while the (quality adjusted) cost of electronics is declining. The balance between these opposing trends varies across technological upgrade cycles, depending for example on the extent to which existing cell sites can be re-used. On the demand side, there are two factors that are most relevant: uncertain overall willingness to pay by end-users as new applications develop, and the competitive rivalry for end-user business which determines the share of the total market that any given investor can reasonably expect.

Second, investment is often completely or partially irreversible or “sunk”, which means that possessing the ability to delay investment may be valuable. Investment tends to be firm specific, in the sense that once it is made it cannot be easily sold to another company or dismantled and used for a different economic purpose. This means that once the investment is undertaken firms cannot completely reverse the expenditure and disinvest if market conditions change for the worse. If firms’ expectations regarding future returns turn out to be incorrect, there will simply be no additional return on the investment. Suppose, for example, that a firm expects the market price or demand for its services to rise in the future. It may want to install additional network capacity (or upgrade existing capacity) today to take advantage of the expected improvement in market conditions. If the additional investment in capacity is completely reversible, then the firm can disinvest and recover its expenditure if market conditions do not improve. In that case there is no benefit to waiting or delaying the investment until tomorrow in order to observe market conditions, because any costs that are incurred before uncertainty is resolved can be fully recovered later on if required. If, on the other hand, the decision is not reversible, then there is a value to waiting until some or all uncertainty is resolved.

A third crucial characteristic is that firms actually possess the *ability* to delay investment, or to bring it forward. Investment in mobile networks is a voluntary activity and the timing, scale and location of investment are largely at the investors’ discretion. It is rare that today’s investment opportunities will completely disappear tomorrow. If delay is possible, then firms can hold off and wait until it observes future prices. By waiting instead of investing, firms can avoid the situation where they invest and then receive no return. Because delay allows firms to avoid some costs, the option of delaying must be valuable. By investing in additional capacity today, firms give up (or exercise) this option.

These characteristics mean that issues that arise in decisions to undertake mobile network investment are analytically similar to issues that arise in the study of financial call options. The ability to delay irreversible investment is of value to firms. As Dixit and Pindyck (1994) and others have shown, these real call options can be priced or valued using similar analytical methods that are used to price financial options.

For example, a general conclusion from the financial options literature is that all else being equal, an increase in the perceived volatility of the underlying asset will increase the value of the call option. Similarly, an increase in the uncertainty of net revenues will tend to increase the option value of waiting to invest. In other words, if net revenues become more volatile or uncertain, investment delay is more likely. As a result, consumer benefits, which are intimately linked to investment, are also likely to be delayed.

The decision regarding whether to invest at all is not the only real option facing firms in the mobile network industry. They also face decisions over their operating scale, how much to invest, when to invest, where to invest, whether to invest in stages now or later, whether to abandon projects, or whether to switch inputs or outputs or enter or exit a particular market segment. Many or all of these decisions can be delayed and are irreversible, and thus can be regarded as real options. At the same time, deciding to install additional network capacity can be seen as purchasing yet another real option over the ability to offer upgraded services over the newly installed part of the network at short notice, or purchasing the ability to compete more vigorously with current or future rivals.

Given the similarity between many (but not all) network investment decisions and financial call options, rational investors will pay close attention to the optimal timing of the adoption of new equipment, which is itself driven by two primary factors:

- anticipated rates of demand growth, and its volatility; and
- anticipated rates of cost change, and its volatility.

Both sources of uncertainty can affect the payoff to delay and the timing of investment. If, for example, demand and revenues turn out to be low, then a large and unprofitable sunk cost has been avoided, which is a gain to the firm. On the other hand, if it turns out that demand is actually high, then the investment can still go ahead, but the firm has only missed out on a single period of profits. This asymmetry in the payoffs from waiting means that investment effectively becomes a call option, which can be exercised once the expected benefit/cost calculus becomes more favourable, or which may never be exercised if the investment environment is too uncertain.

In addition to the usual firm-specific and industry-wide uncertainties that are faced in most commercial situations, changes in the likely future regulatory environment may introduce an additional source of industry-wide uncertainty, and is therefore crucial to the inter-temporal pattern of investment mobile networks. Unnecessary changes in the regulatory environment which add to the already considerable amount of firm-specific uncertainty or industry-wide (for example, an increase in the probability of future adverse regulatory changes) will affect the value of real options and will alter both the timing of firms' investment decisions and indeed the decision to invest at all. In turn, changes in the investment profile will affect the dynamic evolution of the industry and ultimately consumer wellbeing in the dynamic sense discussed earlier.

2.2.4 Competition drives investment

Workably competitive markets are a powerful mechanism for providing consumers with access to many products and services in Australia. In workably competitive markets there is no direct industry-specific regulation or control of commercial activity beyond the usual principles of common law (contract law, tort law, etc), standard trade practices law, consumer protection, and health and safety regulations. Rather, outcomes depend on the decisions of a large number of people acting independently.

Competition in the mobile industry occurs along a number of margins, with firms competing to gain a competitive advantage, protect a competitive advantage, or to reduce a competitive disadvantage relative to rivals. In the mobiles sector this usually involves upgrading the speed and capacity of services, as well as adding new capacity to existing networks more rapidly than their competitors. As discussed above, decisions to invest in mobile networks are critical to achieving ongoing consumer benefits from this sector.

3 Role of Regulatory Policy

In section 2 we explored the commercial drivers for the investments that have installed new technology and are continuing to do so. Competition was found to play an important role in stimulating investment.

All of this commercial activity takes place within a context defined by public policy however, and in the telecommunications industry it is regulatory policy that seems most important. We therefore turn now to look at the role of regulatory policy as a driver of mobile sector investment historically, and take a brief look into the future at how regulatory policy might evolve.

Australian law provides for telecommunication services to be regulated under certain circumstances. In such cases the service is said to be “declared” and certain obligations are then imposed on the provider(s) of the declared service. The relevant provisions are contained in Part XIC of the Competition and Consumer Act 2010 (‘the Act’), the objective of which (s152AB) is to

...promote the long-term interests of end-users of carriage services or of services provided by means of carriage services.

The Act further specifies this objective by identifying three objectives that promote the long term interests of end-users (s152AB(2)). They are:

- promoting competition in markets for listed services;
- achieving any-to-any connectivity; and
- encouraging the economically efficient use of, and the economically efficient investment in infrastructure.

Before a service can be declared the ACCC must hold a public inquiry in which interested parties have an opportunity to be heard. The key implication of declaration is that the ACCC is able to make an access determination for declared services (s152BC), the scope of which is very broad and includes price and non-price terms of supply.

3.1 Regulatory services and their history

At present, there are eleven service declarations in force, but only one (mobile terminating access service) imposes obligations directly on the mobile sector. The full list is as follows.²²

- Local bitstream access service
- Wholesale ADSL
- Digital Set-Top Unit Service (Foxtel)
- Domestic PSTN Originating Access
- Domestic PSTN Terminating Access

²²<http://registers.accc.gov.au/content/index.phtml/itemId/777921>

- Mobile terminating access service
- Line Sharing Service
- Local Carriage Service
- Unconditioned local loop service
- Wholesale Line Rental
- Domestic transmission capacity service 2010

The basic provisions of the telecommunications access regime have been in place since 1997, and since that time a further 31 service declarations have been made but are no longer in force.²³ Within this set of historic declarations, six related to mobiles:

- Domestic AMPS terminating access (revoked 7 February 2001)
- AMPS to GSM diversion service (revoked 7 February 2001)
- GSM service declaration technology - neutral [no longer in operation]
- Domestic GSM terminating access [no longer in operation]
- Domestic GSM originating access [no longer in operation]
- Domestic AMPS originating access (revoked 7 February 2001)

Mobile network operators are also subject to regulation that provides for open access to each other's facilities –sites, towers and electricity.

In addition, the ACCC has twice investigated the merits of declaring a national roaming service. Declaration would have allowed it to issue pricing determinations and arbitrate disputes regarding the wholesale supply of roaming services on mobile networks. However in each of these investigations (1998 and 2004) the ACCC concluded that declaration was not warranted.

It is interesting to briefly review the key arguments for and against declaration of national roaming from those investigations, focusing on the competition issues.

Market definition is the first task and the ACCC defined two national wholesale markets for roaming: one for GSM and another for CDMA. That technology split recognises that roaming cannot work unless the host and roaming networks use compatible technology. The ACCC rejected suggestions that other services such as site-sharing and MVNO access were effective substitutes for roaming, and considered that a nation-wide market definition was appropriate.

Turning to assess the extent of competition in those markets, the ACCC noted (in 2004) that for GSM there were two suppliers, Telstra and Vodafone, and that Optus could readily enter the market. That made the roaming market more concentrated than the retail mobile market, which had four network operators and which the ACCC had previously determined was not subject to effective competition. By extension, competition might therefore have been expected to be not effective in the roaming market.

²³<http://registers.accc.gov.au/content/index.phtml/itemId/777922>

That view was challenged however, by the fact that the buy side of the roaming market appeared quite satisfied with competition, even though there were only two suppliers. There were “few concerns, if any”.²⁴

Reconciliation was found through the arguments of Stephen King in the earlier (1998) investigation. King’s analysis pivots on the incentives that exist even in a two-player market.

An existing carrier will not simply weigh up the benefits of extra roaming revenue and greater use of their system compared with the increased competition in overlapping areas, due to a new mobile carrier rolling out a limited network which becomes more attractive to customers with roaming. In addition, when deciding whether or not to provide roaming to a new entrant, each existing carrier will weigh up the potential gain or loss in profit if they offer roaming to an entrant given that the other existing network owners are carrying out exactly the same calculation.

... So long as each existing carrier believes that NO OTHER carrier is going to offer roaming, then it will not offer roaming. However, as soon as any carrier believes that another existing carrier is likely to offer roaming, then it will also want to offer roaming — it is better to offer than not offer if SOMEONE is going to offer roaming.

In other words, there can be effective competition even in a two player roaming market because neither firm wants to miss out on roaming business, and neither firm can be confident its rival will resist the temptation to supply roaming.

Consequently, in its final determination, the ACCC reported that it was not satisfied that declaration would promote competition.

This experience is a stark reminder of a principle well known by competition economists. Simple indicators of market concentration can assist a competition analysis but they are not determinative of the intensity of competition or of economic welfare.²⁵ For example, Verouden (2004) describes the EU’s position as being that concentration measures provide

“...useful first information about the competitive situation in a market”

but cautions that

²⁴ ACCC, October 2004, Draft decision on whether or not the Commission, should declare a mobile domestic inter-carrier roaming service, p.27.

²⁵ For an early analysis of these issues, see Demsetz, H. (1973) *The Market Concentration Doctrine: An Examination of Evidence and a Discussion of Policy*, Washington DC: American Enterprise Institute. ,

“...it is important to keep in mind that market shares and concentration levels only provide part of the picture and that many other factors have to be considered in an in-depth assessment.”²⁶

The US Department of Justice is similarly circumspect. In its latest merger guidelines, referring to market share thresholds, it says²⁷

“The purpose of these thresholds is not to provide a rigid screen to separate competitively benign mergers from anticompetitive ones, although high levels of concentration do raise concerns. Rather, they provide one way to identify some mergers unlikely to raise competitive concerns and some others for which it is particularly important to examine whether other competitive factors confirm, reinforce, or counteract the potentially harmful effects of increased concentration.

Finally, the author of the leading graduate textbook on industrial organisation has written that:²⁸

“Concentration indices are useful in that they give an easily computable and interpretable indication of how competitive the industry is. However, they have no systematic relationship with economic variables of interest for assessing changes in cost, demand or policy. Furthermore, they are endogenous, so they do not allow simple observations of correlation to be interpreted in a causal way.”

With this in mind, we now consider a slightly different roaming issue that might be considered in the context of 4G technology.

3.2 Possible changes in regulation

Australia’s population density varies dramatically across the country and this has a correspondingly dramatic impact on the business case for mobile networks. While the densely populated urban centres can sustain several competing mobile networks, some rural and remote parts of the country may struggle to sustain one network. That raises a potential question as to whether some form of regulated access might be warranted in some parts of the country where there is only one network.

To analyse this issue, we start by defining two potential competition problems that might exist.

- Retail customers in one-network areas might miss out on the benefits of competition; and/or
- Competition in urban areas might be lessened if some networks have no coverage in more remote regions.

²⁶Verouden, V., 2004, The role of market shares and market concentration indices in the European Commission's Guidelines on the assessment of horizontal mergers under the EC Merger Regulation, <http://www.justice.gov/atr/public/workshops/docs/202601.htm>

²⁷ US Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, 19 August 2010, page 19.

²⁸Tirole, J. (1988) *Theory of Industrial Organization*, Cambridge: MIT Press, page 223.

In thinking through these issues, we need to recognise that this market structure (ie just one network in many locations) is a current reality. So if it does cause competition problems, such problems must already exist. Current market observations are therefore highly relevant to our assessment.

Retail customers in one-network areas

Current market observations suggest that retail customers in one-network areas are in fact getting exactly the same benefits of competition as all other customers. Telstra's advertised mobile pricing²⁹ is not location specific and Optus also appears to only offer the same options nation-wide.³⁰

This should not be surprising and is unlikely to change in the future. The underlying reason is that price discrimination cannot be sustained if customers can evade it.³¹ Mobile operators could not set higher prices for remote users purely on the basis of their residential or billing address, because it would be easy for consumers to arrange a different billing address. It is theoretically possible for mobile networks to set different call charges for calls originating from remote cell sites, but

- This would require a costly re-configuration of the billing system and
- Urban customers visiting remote areas would also be caught.

Competition in urban areas

The second possibility is that networks with less extensive coverage may be less attractive to consumers, even if they cover the places frequented by those customers. This is likely to be a driving force behind why the two largest mobile carriers have built networks covering approximately 2.3 million square kilometres and 1 million square kilometres respectively.

The key point here is that the option to retain service while moving around is highly valued by mobile customers. In fact, it is perhaps the main reason for having a mobile phone.

Moreover, it clearly is the case that networks compete on the basis of network reach. This is why mobile operators carry out marketing on the basis of their reach. Networks with coverage that is inferior to their rivals' are at a comparative disadvantage to the extent that customers value coverage. But comparative disadvantage exists in all workably competitive markets and escaping that position is the primary driving force of competition.

More importantly, differential coverage maps have always been present in the Australian mobile sector. All of the benefits of mobile competition in Australia, as

²⁹<http://www.telstra.com.au/mobile-phones/plans-and-rates/>

³⁰<https://www.optus.com.au/shop/mobile>

³¹ R. Preston McAfee, Price Discrimination, in *Issues in Competition Law and Policy* 465 (ABA Section of Antitrust Law 2008), available at <http://www.mcafee.cc/Papers/PDF/ABAPriceDiscrimination.pdf>

discussed in section 2 above, have been realised while networks have had different coverage. This fact alone should stimulate further thinking, because it tells us that effective competition can endure despite different coverage maps.

One explanation is that competition in the mobile sector occurs across several dimensions. This means that a disadvantage in coverage can be offset by lower pricing or by providing bigger bundles for the same price. Brand image, created by advertising, is also a factor.

In summary, we consider that:

- No new competition issues are raised by 4G technology;
- Australian mobile networks have always had different coverage maps; and
- Rural and remote customers are benefiting from urban competition and this situation seems likely to continue.

3.3 What if rural/remote access was more heavily regulated?

For the above reasons, we see no obvious need for regulated access in respect of those parts of Australia that can only sustain one network. Our view is based on three primary criteria– competition, connectivity and the efficiency of investment– and is the result of comparing two future scenarios against those criteria: the world with and without regulation. To make this comparison we briefly consider what would happen if a mobile access service was regulated in these one-network areas of Australia.

For the reasons described in section 3.2 we think there would be no real beneficial change in respect of the first criterion: competition. A detriment is possible though because there is not an enduring bright line separating one-network areas from other areas. Instead, it is likely that there will always be some locations that currently have one network but are under consideration for competitive investment by a rival operator. Regulated access would be an attractive substitute for such investment.

The second criterion is connectivity. In a world where interconnection and cross-network calling is widespread we see no such benefit from declaration.

There are, however, some serious questions over the third criterion, concerning the efficiency of investment in infrastructure. In analysing this question we need to consider two important facts:

1. Some of the (quite modest) demand in rural/remote Australia originates in densely populated urban areas (eg business representatives travelling to remote clients, or customers travelling on holiday). At the margin, visitor traffic can make it worthwhile to install remote mobile infrastructure.
2. Customers attach value to the option of using mobiles in places they might never actually visit.

These two facts lead mobile networks to establish sites that are uneconomic if viewed on a stand-alone basis. All networks have such sites, but they do not remove them because their perspective is at the whole-of-network level. When looked at from this perspective, the existence of rural/remote sites is a source of competitive advantage relative to rivals.

The heavy handed regulation of these sites would be inefficient, because it converts a source of competitive advantage for one mobile network over its rivals into a quasi-public good available to all rivals. That is, the very thing that warrants an operator's investment in what may otherwise be uneconomic on a standalone basis, is taken away. That would risk reducing future investment in those areas. This could delay the next iterations of technology yet to reach those areas – 4G, 5G and further, depriving rural/remote Australians of the devices, content and applications that will continue to drive the economic benefits to their peers in other areas of Australia and in other countries.

It therefore seems unlikely that roaming regulation at the urban/rural boundary could lead to improvements on any of the three main criteria, and would most likely lead to considerable detriment.

3.4 Summary

Australia has maintained a relatively light-handed approach to regulatory policy for the mobile sector and this has contributed to the economic benefits enjoyed by consumers. There is no apparent reason why further technological advances in the form of 4G should change this stance in regulatory policy, even in single network areas. Indeed we conclude that regulatory intervention will have a detrimental impact on competition and investment.