

# Realising the full socio-economic promise of the National Broadband Network in preparing all regions of Australia for participation in the Digital Economy

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## Executive Summary

*In the 21st century, affordable broadband access to the Internet is becoming as vital to social and economic development as networks like transport, water and power.* (Dr Hamadoun Touré, ITU Secretary-General, cited in International Telecommunications Union [ITU], 2010a, p.1)

*Broadband is becoming a prerequisite to economic opportunity for individuals, small businesses and communities. Those without broadband and the skills to use broadband-enabled technologies are becoming more isolated from the modern American economy. This is due to the rapidly changing nature of work in the digital age.* (US Federal Communications Commission [US FCC] 2010, p.265)

### Purpose

This paper provides a point-in-time analysis of the National Broadband Network (NBN) initiative in Australia. Conducted against a backdrop of escalating hype and media coverage, analysis shows Industrial Age thinking is encumbering debate and influencing the NBN's construction plans to the extent that the significant opportunity and long-term promise the network holds for the universal ability of all Australians to participate in the global Digital Economy, irrespective of their physical location, may be limited.

### Findings and significance

The NBN, which is a significant investment by the Australian Government, is intended to provide new, universally accessible digital infrastructure that will immediately boost Australia's position in the race by nations to compete in the Digital Economy. Domestically, the success of this investment will be measured based on the NBN's social and economic contribution to communities, businesses and industries across all regions and locations. This paper will show that, based on international research, the success of the NBN as an investment is contingent upon advancing beyond Industrial Age thinking and short-term imperatives.

Discussion has been overly focussed on high speeds without considering fundamental requirements for both global and domestic opportunities. As a result, the economic cost to Australia could be as much as AUD\$12.76 billion per annum to the nation's GDP for every 10 per cent of Australians that do not connect to the new high-speed broadband network (Gyarmati et al., 2010, pp.17-18; Kim, Kelly, and Raja, 2010, p.2). Importantly, however, policy makers need to appreciate that the economic benefits are intertwined with social factors that extend beyond construction of the NBN and include how to better prepare Australians to adopt and use the network.

This interdependent relationship between the economic and social promises of the NBN in preparing Australia for the future is most evident in the role that quality high-speed broadband plays in liberating regional Australians from physical and geographic restraints. It is here that the vast distances and small population bases have traditionally been a disadvantage for competing in the physical goods and markets associated with the Industrial Age. If plans for the NBN are constrained to converting existing subscribers to faster connections without regard to quality, then non-metropolitan consumers' access could be relegated to non-fixed-line connections, which are significantly inferior to xDSL or fibre. Such an approach represents a failure of current modes of thinking and an inability to appreciate the role that digital infrastructure must play in raising the

universal level of Australia's preparedness for the future (Broadband Quality Score [BQS], 2010, p.16).

### Structure

Following the introduction, the paper looks at the global race to compete in the Digital Economy and defines the imperatives that led to the Australian Labour Government's significant investment in the NBN. The subsequent sections lay out the two overriding national promises behind the NBN and the opportunities associated with these promises, which can be realised if dominant modes of current thinking are transformed as follows.

National promise 1: The NBN stimulates economic growth

Opportunity 1: Extending the 'physical infrastructure' construction paradigm to encompass ICT development

Opportunity 2: Looking beyond a narrow discipline-based skilling paradigm to consider ICT skills for work and life (e-skills)

National promise 2: The NBN as a high-speed, universally accessible network

Opportunity 3: Evolving beyond the access to infrastructure paradigm to consumer readiness to adopt

Opportunity 4: Beyond the paradigm of improved speed being the sole driver of adoption and quality

Finally, the paper reiterates that increasing the preparedness of Australia to compete in the Digital Economy is not only possible but can be more fully realised if both metropolitan and non-metropolitan Australians can access high-quality broadband for work and life and possess the skills required to use Internet-enabled information and communication technologies (ICTs). As such, the NBN infrastructure construction plans for fibre-to-the-home (FTTH) to be available only in high-density population centres may achieve short-term economic gains but at the expense of long-term social benefits and economic advantage. Further, those plans will truncate Australia's ability to harness latent capacity and grow its economy.

### Key words:

national broadband network; broadband; nodes; networks; bandwidth; rural, regional and remote Australia; metropolitan and non-metropolitan; ICT development; digital divide; Digital Economy; Industrial Age; Digital Age; latency; mobile; satellite; wireless; fibre-to-the-home.

## Introduction

The current debate about the construction of a national broadband network (NBN) in Australia is characterised by hype and obsolete paradigms that serve to limit consideration of the network's full potential. Considerations have been confined to technical issues relating to ICT infrastructure and the skills required to build and maintain the network. In addition, the discussion over construction of an NBN as an affordable, high-quality and universally accessible network has assumed that speed drives quality, without fully addressing user requirements.

As a result, a dichotomy has been created between social and economic policy agendas. On one side the short-term economic imperative to build the physical fibre-optic infrastructure is seen as an essential stimulus investment that will ensure that at least nine out of ten Australians have access to

the 'optimal future-proof technology', fibre-optic broadband (Senator Conroy, cited in Bingemann and Massola, 2010). On the other side there is domestic and international uncertainty about whether those privy to the cost and planning processes for the entire NBN network are fully cognisant of the potential such a network offers for improved social and long-term economic benefits (Organisation for Economic Cooperation and Development [OECD], 2010b, p.17; Riley, 2010, p.1).

The crux of the dichotomy is the risk that the policy and infrastructure planning imperative to connect 4000 premises per day over eight years is overly focussed on construction in high-density population centres (Department of Broadband, Communications and the Digital Economy [DBCDE], 2010b, p.10). In this context the exclusion of some regional users from the fibre network is seen as a necessary trade-off between quality, cost and time and does not contravene the Australian Government's promise to ensure that 'every Australian, no matter where they live, has access to affordable high-speed broadband' (Senator Conroy, cited in Hansard, 2010, p.19). However, not connecting one in ten users has serious implications that include limiting the NBN's promise for economic inclusion and social advantage, which is implicit in the desire to achieve universal coverage and access.

This article will examine how the current debate on NBN's potential has been truncated by thinking and actions that hark back to Industrial Age paradigms. It is not so much that there are mutually exclusive choices, but rather there is a failure to see information and communication technology (ICT) as intrinsic to both social and economic outcomes in the Digital or Information Age. To ensure that the NBN does not exacerbate socio-economic issues instead of addressing them, we need to overcome outmoded paradigms.

This article will highlight how we can best readdress four Industrial Age paradigms that cut across economic and social dimensions of the NBN. Through appreciation of the paradigms, it will be argued a focus on ICT industry development will give a systems-level orientation that can ensure that the NBN stimulates opportunities that include promoting the readiness of all users to adopt and use broadband. In conclusion, the article will show that, in striving for social benefits, the NBN can provide an affordable, reliable, low latency, high-speed Internet connection that expands the opportunities for long-term national economic growth while harnessing the latent capacity resident in non-metropolitan Australia.

## **The Global Race to compete in the Digital Economy**

The use of ICT and conducting social and economic activities via digital networks form the basis of the Digital Economy (DBCDE, 2009a, p.2). This means technology, rather than residing on the periphery, is now omnipresent in how we work and live, in the conduct of business and in how a nation competes (Australian Communications and Media Authority [ACMA], 2010a, p.13; Bradley, 2010, p.183).

The important role networks play in supporting social wellbeing and economic growth is not without precedence. Network infrastructures such as roads and rail or utilities such as water, electricity and telecommunications, all support the movement of physical elements of production and consumption, services or goods throughout the economy. However, unlike the physical paradigms of the Industrial Age, the Digital Age economy is reliant on information flow (OECD, 2009, p.7) and, by extension, digital infrastructure. Instead of nations competing on geographically-rooted infrastructure and moving goods along physical transport networks at improved speeds and efficiency, nations now compete globally based on their ability to develop and control technology (Toffler, 1991).

Digital networks can facilitate individuals' access to information using digital media, for instance, the Internet. The more that information can be shared, typically, the more rapid the diffusion of knowledge regarding the innovation and its subsequent use. The more nodes (units within a network that may contain and pass on information), the more information is shared across the network. Since digital information can flow at any time to any number of nodes based on security or permission settings, delays or time constraints of a physical network can be mitigated.

In the Digital Age, speed depends on the size of the connection, or whether it is broadband. Broadband refers to the data transfer capacity or speed of a digital network. Bandwidth is the rate of data-carrying capacity of a network connection or communication channel. The faster the bit rate per second (bps), the more data can be transferred (Kbps—kilo or thousand bits of information per second, Mbps—mega or a million bits per second, or Gbps—thousand million bits per second). Broadband is any Internet connection with a higher bandwidth than a standard telephone line (56.6Kbps access to the Internet). Over the first decade of the twenty-first century any network operating faster than 256Kbps was typically considered effective broadband. Today, however, what we used to consider high-speed bandwidth—10Mbps or greater—is now more likely to be considered standard broadband. This is especially so for countries that have 2 to 10-year plans for establishing widespread, high-speed broadband access at 50Mbps to 1000Mbps (1Gbps) (Qiang, 2009; US FCC, 2010, p.3).

### **The imperative: Australia's position in the race to connect to high-speed broadband**

The call to arms for the Australian Government to implement a national broadband network strategy was spurred by the 2007 OECD and World Economic Forum figures that independently confirmed Australia's rapid loss of ground in the global race to seize advantage in the Digital Economy. The OECD ranked Australia as (DBCDE, 2009a, p.v):

- 16th in terms of broadband penetration
- 20th in terms of the average monthly subscription price for broadband
- 3rd most expensive for fixed-line services for SMEs

The World Economic Forum ranked Australia as:

- 14th for network readiness
- 16th for the total number of broadband Internet subscribers per 100 population
- 20th for monthly high-speed broadband subscription charges
- 25th for accessibility of digital content
- 35th for the quality of competition in the Internet service provider sector
- 29th for the lowest cost of broadband

It was not just evidence of Australia's shortcomings that spurred action. The relative underperformance had been known since early 2000 (Australian Industry Group [AiG], 2008, p.24; *Sydney Morning Herald*, 2006). The 2007 figures indicated an actual decline comparative with other nations in ICT development (Teltscher, Magpantay, Gray, Olaya, and Vallejo, 2009, p.38). The concern was not just about lagging behind South Korea, Norway, Japan, the UK and other predominantly European and Scandinavian countries. Economic multipliers showed that countries

advancing high-speed broadband infrastructure were also generating improved ICT skills. Together the ICT infrastructure and skills were directly stimulating economic growth, promoting productivity and improving performance in social indicators, such as digital literacy, and enrolments in ICT-related courses (Teltscher et al., 2009, pp.24-25).

By 2009, it seems apparent that the absence of a high-speed broadband infrastructure and any further delays in securing such a network would affect Australia's relative global competitiveness and long-term economic prosperity.

### **The National Broadband Network: Regaining competitiveness in the race**

In January 2009, the Australian Government confirmed an investment of up to \$43 billion over eight years to build and operate an NBN capable of delivering superfast broadband connectivity through high-speed, next generation broadband (DBCDE, 2009b). By April 2009, the Government announced it would establish a company (NBN Co) to build a wholesale-only, open access, universal national network to enable 100Mbps fibre-to-the-home (FTTH) connectivity to over 90 per cent of Australian homes (DCBDE, 2009c). The remaining 10 per cent of homes and workplaces, though not reached by the fibre-optic cables, were assured of access to high-speed fixed wireless and satellite services connecting at download speeds of not less than 12Mbps. The *NBN Implementation Study* suggested modifying the coverage objective as follows:

1. Optic Fibre Network to provide 93 per cent of premises with a 100Mbps FTTH service;
2. Wireless Network involving a commercially tendered service to cover 4 per cent of premises with at least 12Mbps download speeds; and
3. Satellite Network option whereby the body responsible for the construction (NBN Co) to provide a 12Mbps service for the remaining 3 per cent of premises and give the wireless subscribers the option of a satellite connection (DBCDE, 2010b, p.10; NBN Co, 2010d).

The *NBN Implementation Study* reinvestigated the likely investment required for the NBN and reported breakdown costs for achieving construction as \$26.6 billion for 90 per cent of premises, \$5.3 billion for the remaining 10 per cent, \$3.3 billion for backhaul costs, \$2.0 billion for overhead costs and \$5.6 billion for out-turning (a government costing adjustment): a total of \$42.8 billion for the NBN (DBCDE, 2010b, p.18). Final costs could be reduced through leveraging network design innovations (NBN Co, 2010a) and by taking advantage of an agreement with Telstra, the major telecommunications company and network operator, to use some of its infrastructure (NBN Co, 2010c).

The direct social impact of the investment in the NBN rollout was initially to be realised through employment, skills demand and universal access. In terms of its overall nature and scale, the NBN construction would:

1. Involve a direct construction workforce of between 15,000-20,000 full-time-equivalents at the peak of construction (Flannigan 2010: 24);
2. Involve construction plans expected to be completed in eight years (Flannigan, 2010, p.24; Rudd, 2009);
3. Roll out to an estimated 10 to 12.1 million points of connection, implying an average of at least 4000 to 4800 connections to a premise per day over the life of the project (Flannigan, 2010, p.24); and
4. Guarantee connections across all metropolitan, regional and remote locations of Australia (DBCDE, 2009b).

Given that context, it is imperative that the economic and social promise of the NBN be closely examined. The following section will look at the economic promise of the NBN in terms of its contribution to economic growth. After examining this first national promise, we will examine the second promise relating to the social dimension.

### **National promise 1: The NBN stimulates economic growth**

The availability of high-speed broadband for business and households is a well understood factor in any modern nation's efforts to stimulate economic growth (Broadband Stakeholder's Group, 2004; D'Costa and Kelly, 2008; European Commission [EC], 2010; ITU, 2010b; OECD, 2008b, 2010, p.37; Oh, Ahn, and Kim, 2003; US FCC, 2010). As global trade and economic activity move increasingly into what has been termed the Information or Digital Economy, enabling Internet activities by both business and households has increasingly become an accepted way for nations and regions to stimulate and maintain competitiveness, especially in a recessionary economy.

The Australian Government policy and plans for the NBN are intended to stimulate a significant 'leap forward' in terms of overall investment in ICT in comparison to other nations. An investment that commits the equivalent of 3.25 per cent of GDP (OECD, 2010b, p.17) is intended to move Australia into the top ten nations in terms of broadband infrastructure and competitiveness (AiG, 2008, p.24), and leverage the resulting world-leading levels of ICT penetration, especially by young people and business (Australian Bureau of Statistics [ABS] 2009a; Bowles and Wilson, 2009c, pp.36-38; Teltscher et al., 2009, pp.48-49), to accelerate volume use.

The NBN is the largest investment by one nation in the race to improve its capacity to compete in the Digital Economy (See Appendix 1). This is despite the recent US announcement of an ambitious Broadband Plan that will connect 100 million homes to a network with speeds of at least 1Gbps (US FCC, 2010) and the European Commission's announcement that 30Mbps broadband would be available to all European citizens by 2020 (including at least 50 per cent of these subscriptions at or above 100Mbps) (EC, 2010).

The importance of this 'race' has only recently been more accurately quantified. International evidence confirms that improvements to Gross Domestic Product (GDP) and resultant social wellbeing are both triggered by stimulating investment in high-speed broadband infrastructure and the skills relating to adoption and use (ITU, 2010a, p.1). As a macro-level indicator the World Bank and United Nations Educational, Scientific and Cultural Organization (UNESCO) independently confirmed that for every 10 per cent increase in the penetration of broadband across the population 1.2 per cent or 1.38 per cent respectively will be added to the annual GDP of an industrialised country such as Australia (Gyarmati et al., 2010, pp.17-18; Kim et al., 2010, p.2).

The importance of this indicator needs to be emphasised. In the second quarter of 2010, Australia's GDP was expanding at an annual rate of 0.50 per cent. As the current World Bank estimate of Australia's GDP is AUD\$925 billion (Trading Economics, 2010), the indicators predict every 10 per cent growth could be equivalent to between \$11.1 or \$12.76 billion per annum.

However, the attainment of the economic promise of the NBN is being hampered by Industrial Age thinking that restricts the opportunities available to Australia in the Digital Economy. Two opportunities that challenge outmoded thinking relating to the 'build it and they will come' mentality and the failure to appreciate the impact on ICT development or full scope of the skills development task at hand, need to be investigated, in particular.

### Opportunity 1: Extending the ‘physical infrastructure’ construction paradigm to encompass ICT development

Given the urgency and the importance of generating the predicted 25,000 jobs per annum during construction (DBCDE, 2009c), it is no wonder the early focus for the NBN rollout has been on the telecommunication, technology and electrical skills required to construct the network. However, the focus on construction has overwhelmed discussion about the importance of developing an extensive, integrated model that can ‘make sense’ of the many complex components within the NBN initiative and their interrelationships. We need to determine the NBN impact in ICT activities and the full scope of the skills planning requirements (Bowles and Wilson 2010; European Centre for the Development of Vocational Training [CEDEFOP], 2010).

By way of response the national skills council, Innovation and Business Skills Australia, posited an Anticipatory Skills Demand Model. This is intended to place the NBN into a context and permit national planning for short to medium-term ICT skills demand (Bowles and Wilson, 2010, p.16). The model was designed to isolate interrelated components and provide indicators that can measure how the NBN, as an instance of the shift towards a Digital Economy, may cause discontinuities in the labour market between demand and supply of people with ICT skills (Bowles and Wilson, 2010, p.18, see Figure 1).

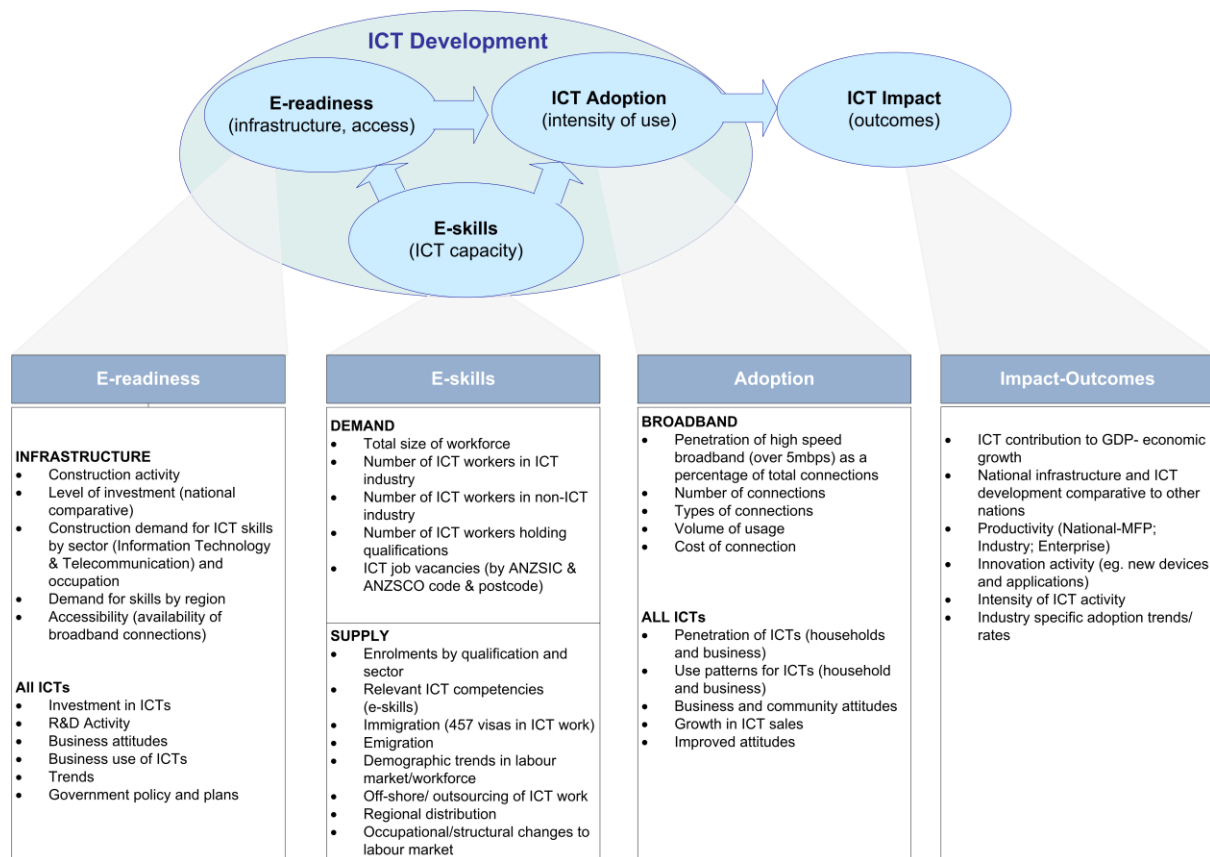


FIGURE 1: ANTICIPATORY SKILLS DEVELOPMENT MODEL FOR DETERMINING THE IMPACT OF ICT IN THE DIGITAL ECONOMY

The resulting model presented above is primarily based on the ITU’s ICT Development Model with the three components of development that shape movement towards an Information Society (ITU, 2007, 2010a, 2010b; Teltscher et al., 2009, p.14). The model recognised that Australia’s readiness to compete in the Digital Economy necessitated consideration of constructing the NBN within an ICT

development context. The model also recognised how short-term skill imbalances caused by infrastructure development affect all industries and the attainment of the desired ICT impact.

The model extends previous ‘e-skills’ or ‘e-competencies’ work in Australia (Blake and Pease, 2005; Bowles and Wilson, 2001; Mitchell, 2000) while leveraging the more recent research and work in Europe (Campbell et al., 2001; Cattaneo, Kilding, Lifonti, Husing, and Korte, 2009; CEDEFOP, 2008, 2010; Didero, Husing, and Korte, 2009; Dutta and Mia, 2010; Kolding, Robinson, and Ahorlu 2009). Fundamentally, the approach places the investment in NBN infrastructure into a context of increasing Australia’s readiness by adding capacity and access to the ICT required to achieve the outcomes. However, it is the level of e-skills that determines the readiness of a business, region and thence a nation to adopt ICTs (ITU, 2007, 2010a), such as broadband infrastructure, as well as the speed of adoption.

### **Opportunity 2: Looking beyond a narrow discipline-based skilling paradigm to consider ICT skills for work and life (e-skills)**

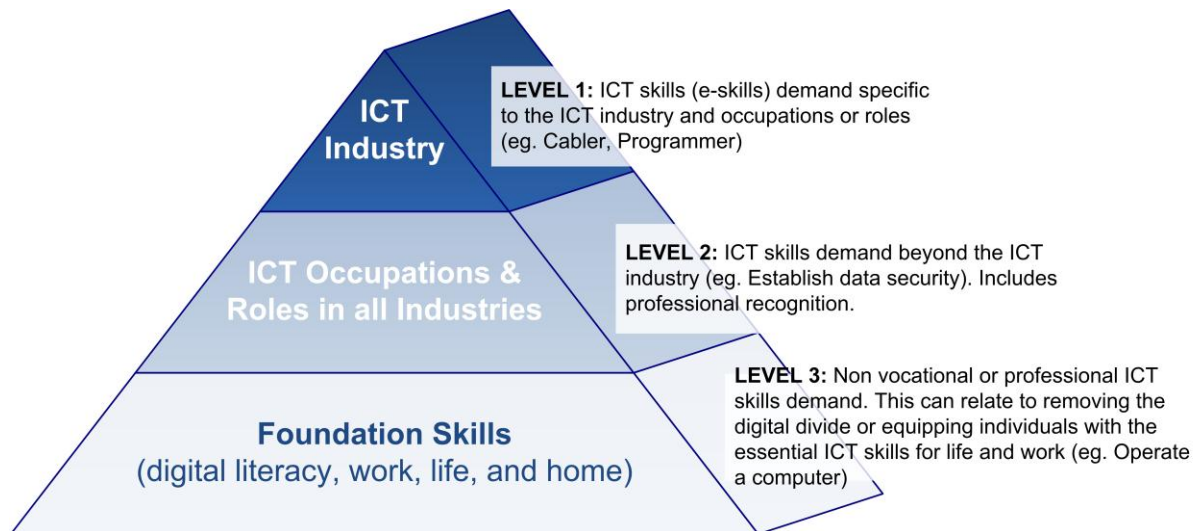
The ICT development approach provides a model that isolates two important points:

- readiness in ICT development terms is reliant not just on developing the ICT skills to assure preparedness for building infrastructure, but also on accelerating adoption; and
- an ICT development approach suggests capacity will not be limited to one industry or occupational cluster.

When identifying labour market supply and demand or defining skill needs that can inform supply-side educational responses, we may be deluded by the Industrial Age belief that skills relate to activities residing in occupations within neatly defined industries. This paradigm has reinforced consideration of the impact that the NBN has on labour supply and demand within the telecommunications and electro-technology sectors. However, if we recognise the promise of an investment in digital infrastructure construction affecting ICT development, then we need to appreciate that a focus on just the telecommunications industry and the occupations relating to construction is both overly simplistic and unhelpful.

While not devaluing the importance of ensuring skills supply during the construction of the NBN (Bowles 2010; Bowles and Wilson, 2009b; Clarius Group 2010; Foo and Foreshew, 2010; Hepworth and Bingemann, 2010), planning has to ensure the parallel consideration of skilling business and households to be prepared to connect and use the network. To overcome similar problems with skilling businesses and the community across discipline boundaries, the European Union adopted an e-skills approach (Fonstad and Lanvin, 2010). An e-skills strategy and approach acknowledges that for individuals, businesses and regions to use technology to the levels required in a modern society, an understanding of the correlation between levels of skills and preparedness to adopt the technology is required (Kolding et al., 2009, p.5).

As illustrated by the Anticipatory Skills Demand Model (Figure 1), e-skills are considered to encompass all ICT competencies, whether specific to an occupation or generic to any user of communication and information technologies. As with the presence of ICT, the competencies required to use ICT span across the workforce at different levels of deployment. This includes essential or foundation skills for everyone to use ICT, ICT skills common to many occupations and roles across all industries, and skills specifically for those in the ICT industry, as depicted in Figure 2 below. Each dimension is interdependent. A flow of e-skills can be expected between dimensions, as once specialist ICT skills mature and are assimilated into everyday work or life they become less visible.



**FIGURE 2: DIMENSIONS TO E-SKILLS**

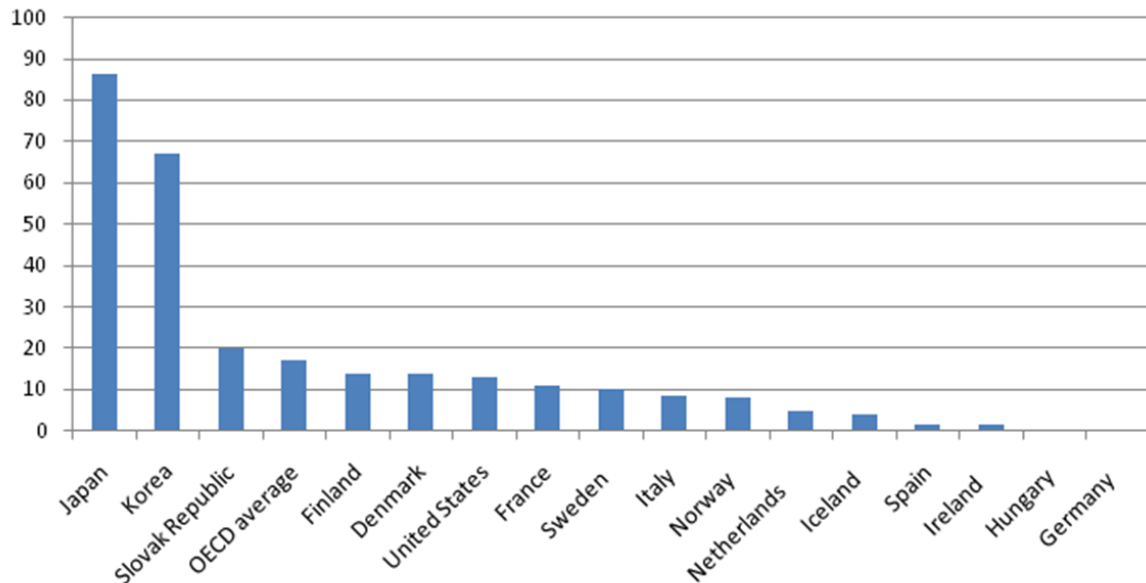
Notwithstanding that the e-skills perspective suggests a very large skills development agenda (Bowles, 2010, p.8) and challenges defining the ICT industry and boundaries between occupations (Australian Computer Society [ACS], 2009, 2010; Bowles, 2009; Bowles and Wilson, 2010, pp.60-65; Innovation and Business Skills Australia [IBSA], 2009a, 2009b), the NBN promises to have a massive impact on the Australian workforce.

Consistent with the critical importance of high-speed broadband to the modern economy, the impact will affect all industries. As such, the debate on the benefits derived from preparing the workforce with the skills (capacity) to implement an NBN should not be limited to just the 88,900 workers in occupations within the telecommunications industry. The debate should at least consider the three levels of e-skills within the ICT workforce: Level 1 has 230,100 workers in the ICT industry, Level 2 has 196,000 ICT workers in other industries, and Level 3 has all workers, including those seeking to be more employable or those not in work who seek to use ICT (ABS, 2010c; Skillsinfo, 2010) (see Appendix 2 for a breakdown of total employment as it relates to the Australian ICT workers).

This section illustrates how the promise of the NBN infrastructure can be usefully studied as part of an ICT development model. Such a study has highlighted the importance of skilling workers and consumers on the adoption and use of high-speed broadband. Given these findings, it is important to move beyond the promise of the NBN to Australia's economic growth to examine the promise for social advantage generated through the provision of universal access.

### **National promise 2: The NBN as a high-speed, universally accessible network**

Australia may have deep penetration in terms of broadband, but the connections are not at the same level of universal quality or bandwidth as those countries leading the race to roll out high-speed broadband.



**FIGURE 3: GLOBAL FTTH HOUSEHOLD AVAILABILITY (PER CENT), DECEMBER 2009**  
(OECD, Broadband Statistics)<sup>1</sup>

According to the Global *Broadband Quality Score Report* for 2009 and 2010, to be competitive with the top ten ranked nations in the world, Australia would need to not only increase the penetration of broadband, but also have a significant improvement in performance against the three broadband quality score (BQS) benchmarks (averages):

- Downloading speeds over 4.75Mbps
- Uploading speed over 1.3Mbps
- Reduced latency below 170 milliseconds (Vicente, Fu, and Jain, 2009, p.1)

With nearly 60 per cent of all broadband connections based on Asymmetric Digital Subscriber Line (ADSL) services connecting at an average speed under 1.5Mbps (ABS, 2010a), Australia lags well behind the OECD average advertised broadband speed for xDSL (any form of Digital Subscriber Line) of over 14Mbps (OECD, 2009)<sup>2</sup>. With over 20 per cent of other connections being a dial-up or satellite connection at or below 1.2Mbps (download speed), the high subscription levels in Australia have not achieved average connection speeds comparable with other OECD countries or those with a high BQS.

<sup>1</sup> Compiled from latest data from OECD Broadband Portal [oecd.org/sti/ict/broadband] 9 September 2010. Note: Coverage data are measured using different indicators and have different reference dates and thus may not be fully comparable.

<sup>2</sup> Sourced from OECD Broadband Portal 9 September 2010 at [http://www.oecd.org/document/54/0,3343,en\\_2649\\_34225\\_38690102\\_1\\_1\\_1\\_1.00.html#Services\\_and\\_speeds](http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1.00.html#Services_and_speeds).



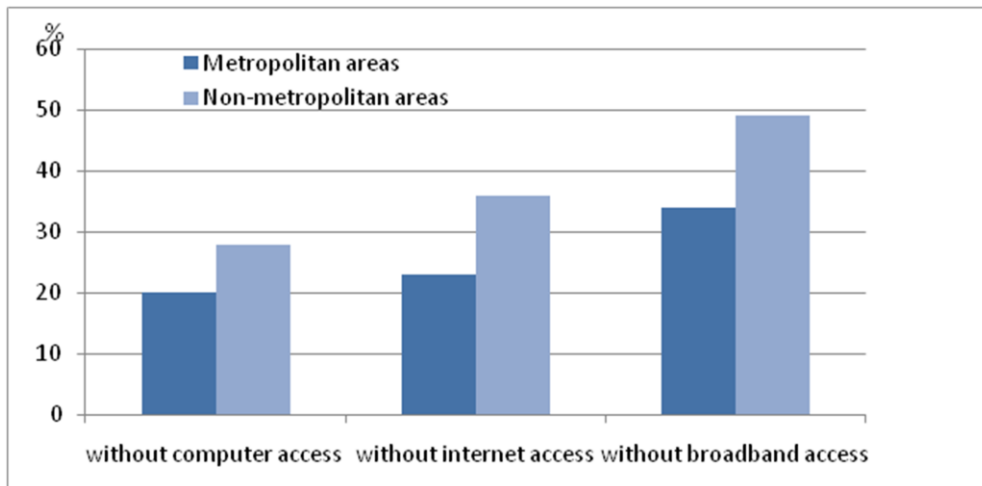
**FIGURE 4: BROADBAND LEADERSHIP TOP 20, 2009**  
(BQS, 2010, p.10, with permission)

Improving the BQS is in Australia's interest as countries with higher scores have not only been achieving greater socio-economic benefit, but they have been innovating faster and using newer infrastructure to position themselves for tomorrow's opportunities (Vicente, et al. 2009, p.1).

#### **Universal access**

At present, while access to and use of high-speed broadband with speeds over 10Mbps have increased, broadband is by no means universally available across Australia. The NBN, therefore, promises a significant investment in bridging the digital divide through 'universal' access to broadband at speeds faster than 12Mbps.

The concept of 'universal' access does suggest a consideration of both the capacity and readiness to adopt. Despite household access to the Internet more than quadrupling between 1998 to 2008-09, from 16 per cent to 72 per cent, and access to computers increasing from 44 per cent to 78 per cent (ABS, 2009c), as many as half of all Australians not only cannot access broadband, but also have no access to the Internet or no personal access to a computer. In addition, despite lower population densities, the percentage of users without access or use is consistently higher in non-metropolitan areas (ABS, 2009c, p.3).



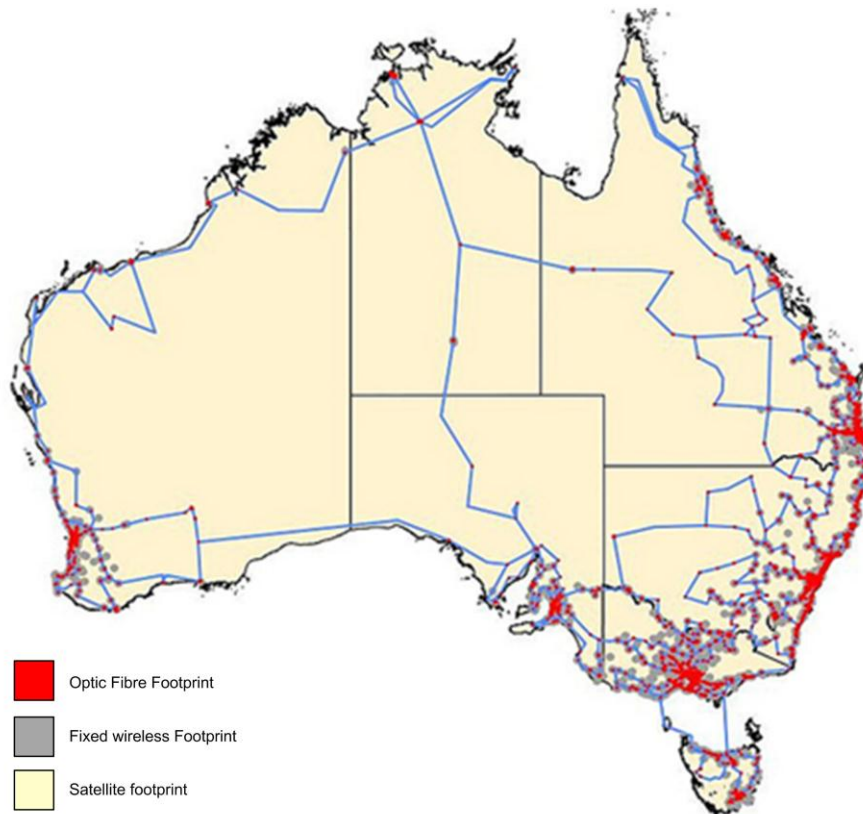
**FIGURE 5: HOUSEHOLDS WITHOUT ACCESS TO COMPUTER, INTERNET OR BROADBAND, BY GEOGRAPHIC LOCATION, 2008-2009**

The above Figures 4 and 5 suggest that the NBN requires both an e-skills strategy and an awareness that a digital divide exists between subscribers and those consumers unable to afford access to computers or the Internet. To address the divide, access has to be coupled with strategies to address both e-skills and attitudes that resist computer or Internet use (Nielsen, 2010, p.19).

One significant social promise is NBN's ability to bridge the digital divide between metropolitan and non-metropolitan areas. Currently, where an Australian lives—in a capital city, regional centre or rural and remote location—heavily influences the quality and type of their access to the Internet (ABS, 2008a, 2009a, 2009b, 2009c, p.3). While over 94 per cent of all businesses in Australia use broadband as their main Internet connection (>256Kbps), and some 25 per cent of these can connect to the Internet at speeds of over 5Mbps (ABS 2009a), at best 66 per cent of farms across Australia are connected to the Internet. Of these farms, 17 per cent still use dial-up connections (56.6Kbps) and an estimated less than 2 per cent can access connections with download speeds over 2Mbps (ABS, 2009b).

With less than 25 per cent of the landmass covered and access available to 91 per cent of the population, Australia has one of the lowest penetrations of xDSL (fixed-line) broadband networks comparative to landmass (OECD Broadband Portal, Table 3b October 2009). The cost to connect those living outside high-density populations exacerbates two existing factors that will weaken broadband availability in non-metropolitan Australia: telecommunication companies invest in infrastructure where they earn the highest returns and regional and remote users' adoption is heavily contingent on the quality and utility of the services relative to the overall cost (Stenberg et al., 2009, p.15). The first point reinforces the assumption that, other things being equal, it should be less costly on a per-connection basis to deploy broadband to an area that is highly populated than one that is sparsely populated (Turner, 2006, p.10). The latter point confirms that the cost of access must reflect value in terms of connection quality and the range of services provided to non-technical users.

Alongside the cost issues (DBCDE, 2010, pp.252, 279), replacing broadband delivery by the existing copper cable telephony lines with fibre seems to be one of the prime reasons the *NBN Implementation Study* in May 2010 recommended that fibre fixed-line coverage extend from 90 per cent to 93 per cent of the 12.1 million premises to be connected (DBCDE, 2010b, p.269). As represented in the image below, the promise of universal coverage seems to suggest the remaining 7 to 10 per cent of Australians not already accessing xDSL services will have access to broadband using either a fixed wireless or a satellite connection at a guaranteed 12Mbps.



**FIGURE 6: NBN FOOTPRINT AND COVERAGE AREA FOR FINAL 10 PER CENT**  
(Source NBN Co; DBCDE, 2010b, p.11)

Achieving universal coverage holds significance beyond closing the digital divide. Availability of high-speed broadband in non-metropolitan Australia can have a positive impact on regional employment growth (Crandall, Lehr, and Litan, 2007). Broadband applications lend advantage to rural and regional locations seeking to compete for low and high-end service jobs, from call centres to emerging ICT services, such as web and interactive media development, third-party logistics and network and virtual service providers (SaaS and cloud computing). Broadband can also enable transient populations (e.g. agricultural and mining operations) to stay in regional centres where services, especially in education and health, can be enhanced through access to digital infrastructure.

### **Opportunity 3: Evolving beyond the access to infrastructure paradigm to consumer readiness to adopt**

The Australian Government's management of the NBN construction has been vested in the NBN Co, but the recent *NBN Implementation Study's* Recommendation 2 states that the NBN Co's role as a wholesale service provider does not include connecting premises (DBCDE, 2010b, p.65).

The NBN Co charter is to construct the wholesale broadband network, not connect users to a service. Connecting a premise is the role of retailer service providers (RSPs).

Government investment, in making high-speed broadband infrastructure more accessible, can stimulate economic activity and innovation (OECD, 2009, pp.4-5). As with Industrial Age infrastructure, digital infrastructure will become ubiquitous in everyday life. But unlike physical infrastructure such as road, rail, water or electricity, a physical high-speed broadband network must connect as many premises and people as possible to anywhere in the world, on demand. The paradigm shift from the physical to the virtual ensures that those connected are no longer bound to an Industrial Age physical context where the transportation of goods or services must occur across a physical

‘point-to-point’ (OECD, 2009, p.7). The elegance of digital networks is that with the connections to the Internet, geographic limitations become less relevant as goods and services flow on a virtual, world wide web. Once more subscribers are able to *connect* to broadband networks and *use* the Internet, greater economic growth will follow and sustainable improvement to GDP can result with more immediacy.

As revealed by Metcalfe’s Law, the value of a telecommunications network is synonymous with connectivity, in the sense that ‘... as more people join a network, they add to the value of the network non-linearly, i.e. the value of the network is proportional to the square of the number of users’ (Tongia and Wilson, 2007, p.5). Even if the value diminishes as only those with major need join early, the network still benefits from not excluding potential users. Significant later costs may be avoided and advantage gained for increasing penetration by connecting households during the initial fixed-line infrastructure rollout (DBCDE, 2010b, pp.13-14; Stenburg et al., 2009, pp.iii, 15).

For governments at all levels and stakeholders seeking to build the NBN as a universally accessible digital network, the cost of exclusion at the point of construction is a vital consideration. The cost is not a consideration only at the point of construction, as exclusion limits later adoption by those not initially connected in the fixed-line rollout. Tongia and Wilson (2007, p.18) warned:

*Several practical implications flow from our analytic framework for network exclusion. First, public officials should apply a more favorable discount rate to government support for inclusionary policies than they might otherwise consider without using this framework. Social costs that seem modest in the short term explode exponentially over time. Second, because the costs are borne by all – network-included and as well as the excluded – they should expect future burdens to grow for their entire electorate. Total economic costs could be reduced on all citizens/taxpayers/voters by timely and early interventions at the front end of any network design and build out... Third, there are also political implications as these digital, ubiquitous networks grow. The rules and regulations of the network are most likely to be set by the more privileged included, who will have different perspectives and priorities than the excluded.*

Governments are major beneficiaries of the NBN through the network’s ability to streamline service delivery and reduce costs (especially in health, educational and billing services). But there is little evidence that all levels of government appreciate disadvantages resulting from (and the long-term implications of) excluding non-metropolitan households and businesses from the FTTH network.

Investigating the investment required by governments seeking to build digital infrastructure, the OECD research indicated cost recovery over ten years could be achieved by improving the capacity of and realising direct benefits from just four priority industries of the economy—electricity, health, education and transport (OECD, 2009, pp.39-40). Relatively modest costs savings in any or all of these sectors, and especially government provision of services across these sectors, can offset government stimulus spending on broadband infrastructure. This analysis, when considered with the guiding assumptions, argue overall cost savings in each of the sectors would need to be over 1.5 per cent to justify building a national FTTH network such as Australia’s that falls into the ‘upper range’ of capital cost of connecting each premise (DBCDE, 2010b, p.14; OECD, 2009, pp.42-43).

While a salutary guide, research into the contribution ICT makes to productivity in Australia suggests the priority industries may differ from those in Europe or the US (Catteneo et al., 2009, p.4; CEDEFOP 2010; Dutta and Mia, 2010, p.5; Telstra, 2009, 2010a, 2010b). By comparing communication-intensity and multi-factor productivity growth over the decade to 2008-2009 it is suggested rather than the four OECD priority industries, the investment by the Australian Government in the NBN can be recouped by prioritising commercial use by industries such as retail, transport, finance, wholesale and recreation and accommodation (notably tourism related) (Telstra, 2010b, p.6).

However, this observation should not divert from investment in the low communication-intensity industries, in particular agriculture, which benefit through indirect use of or access to ICTs (e.g. improved supply chains through enhanced prices, improved cycle times or reduced waste from producer through to the end consumer).

#### **Opportunity 4: Beyond the paradigm of improved speed being the sole driver of adoption and quality**

The bandwidth of a broadband network connection available to a subscriber will influence the types of services available. Government, RSPs and technology vendors, to avoid technical issues and simplify the message to consumers, have tended to focus on higher 'speed' generating better, more affordable services. This focus has skewed public understanding of the NBN rollout, as the implication has been that higher speed alone equates with higher quality.

When analysing the economic and social benefits from this investment in high-speed broadband, it is essential that the debate on the quality of the connection extends beyond download speed to also consider upload speed, latency, affordability and ubiquitousness. This is vital, as relative to other countries Australia's ranking has stagnated or declined when two quality dimensions are assessed: (a) 'readiness' to introduce new applications was considered decidedly average and behind over fifty other countries (BQS, 2010, p.13) and (b) its overall closing of the digital divide in terms of BQS and 'gap between quality in the "main cities" and "outside main cities" placed Australia in the lowest ten nations' (BQS, 2010, p.15).

In the Digital Age, economic advantage and growth in GDP are functions of quality of the available broadband connection, not just a faster speed. As a result, the number people subscribing to quality connections is a more critical indicator of socio-economic advantage than broadband penetration or number of subscriptions without regard to the type of connection.

#### **Qualifying quality: Pull services and upload speed**

Readiness in terms of skills and the ability of the broadband infrastructure requires consideration of future user needs. In the emerging third generation of the Web—Web 3.0, the 'pull' or demand side drives Internet use. The focus of Web 1.0 was on the initial effort to 'push' content and electronic business solutions to the consumer. As the focus was on supply, download speeds were critical. Web 2.0 saw a shift to open architecture, collaboration, social networking and data exchanges. While download speed remained important, upload speed increased in importance. Web 3.0 empowers the consumer to personalise how the web delivers applications and services. Unlike earlier generations, web content is richer; communication is more interactive and synchronous (two-way) rather than just asynchronous (one-way, one at a time); applications can process and understand (semantic web) (Ray, 2010); content creation is increasingly vested with consumers (e.g. Facebook® updates, posting YouTube™ videos or blogs); and businesses can access virtual services and applications (Software-as-a-Service and cloud computing). Coupled with the drive to personalise the virtualisation of business, Web 3.0 marks the shift to 'pull' systems where upload is every bit as important as download speeds (BQS, 2010). Capacity, instead of being centred on a location or a business or a person, is shared.

Broadband quality is no longer just about downloading speed or the capacity to push products and services down a one-way channel to a consumer. It is about the capacity to make connections, to collaboratively create content and ideas, to share applications, to synchronise real-time data transmission to businesses across a global supply chain, to diffuse innovations and to stimulate two-way exchanges between multiple nodes in a network anytime.

### **Qualifying quality: Latency and reliability**

Residents in outer suburban and regional centres with existing xDSL services may fall into the final 7 to 10 per cent and receive wireless or satellite services. If the Australian Government's deals with major telecommunications companies accelerate the decommissioning of the copper cable network, those premises with existing—admittedly slower—xDSL services fear they may face the unpalatable reality of losing a cable connection and having to rely on lower quality and reliability non-terrestrial solutions from the NBN to secure voice and data connections (Booth, 2010; Martin, 2010).

One of the key problems with satellite and wireless when compared with fibre connections is latency. Latency refers to the time it takes for data to be transmitted from one point to another (NBN Co, 2010b). It represents a time delay between the moment something is initiated and the moment when its effects begin or become detectable' (O3b Networks, 2008, p.4). Latency issues are critical to the quality and reliability of broadband connections. In practical terms, network latency affects the types of services and activities that can be carried out via a network (Berkman Center, 2010, p.54).

Therefore, while satellite broadband may be appropriate for enhancing such activities as downloading videos on demand, latency issues will render it unsuitable for interactive activities requiring synchronous exchanges such as data synchronisations or massive multiplayer, online games (OECD, 2004, p.46). Low latency bandwidth is also crucial for real-time applications. For instance, levels of latency on broadband satellite and wireless connections will affect high-bandwidth activities such as Internet Protocol telephony, telepresence, work in 3D environments, video streaming and high definition IP TV (Pepper, 2009, p.16). Network latency can make impossible even low-bandwidth applications and services, such as those commonly required by government services (i.e. data transfer, secure e-commerce activities, telemedicine).

Reliability is a secondary but closely related problem. The lack of reliability becomes an issue where services are unable to be supplied to the much promoted always on' advantage of fibre-optic cables. For fixed wireless users, this is an issue, as line-of-sight configurations operate much as cellular networks do. Black spots can emerge and no connection to, or drop outs' in, the signal will occur. For regional Australians who experience problems with the cellular phone network coverage or reception of analogue TV signals, wireless NBN is a far inferior option to a fibre or cable connection.

### **Qualifying quality: Affordability**

Affordability is a major factor in adoption rates and volume of traffic. As many parents of children who exchange media files and download movies or music will attest, the speed of connection is not the sole determinant for a broadband subscription cost. In Australia, the cost of data has been the major factor influencing affordability and broadband penetration.

Australia's overall average per person volume of data carried on digital networks is lagging well behind nations with established high-speed networks. While the average volume of data continues to grow in Australia, the possible benefit derived from increased numbers of mobile Internet subscribers has had only marginal effect as over 91 per cent of data traffic still remains on fixed-line networks (ACMA, 2010a, p.33). Australians' transmission of data over the Internet on a per-capita basis in 2008 has been estimated to be as much as twenty-four times lower than that of Korea and only a fifth of regional competitors such as Japan (OECD, 2007, p.12)<sup>3</sup>.

Broadband subscriptions in Australia (unlike many other nations) will often include a data cap' on data usage per month (DBCDE, 2010b, p.34). For those with slower broadband (<1.5Mbps), it is the

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<sup>3</sup> The Australian Communication and Media Authority reported this rate had risen in 2008-2009 to 3.5Gb data downloaded per month, per subscriber on average (ACMA, 2010a, p.176)

cost of data that shapes monthly plans and variations across different Internet Service Providers (ISP). Currently Australia's cost of data per Mbit/s is higher than the OECD average and all countries with comparably high broadband penetration rates. At USD\$11.82 Australia was ranked 15th in a comparative study of average price per advertised Mbit/s (OECD, Broadband Statistics<sup>4</sup> as at October 2009), far higher than the lowest price of USD\$1.76 (Korea) and, with the exception of Sweden, way behind all the countries ranked in the top ten BQS nations that had averages below USD\$5.56 per Mbit/s (Vicente et al., 2009, p.9; BQS, 2010). Equally, countries enjoying lower costs and top ranking in terms of BQS have demonstrated that as access to quality connections improved so adoption and levels of broadband penetration increased across all regions (BQS, 2010, p.15; Gyarmati et al., 2010, pp.48-52).

There is currently no evidence that the cost of data per Mbit/s for those offered subscriptions that connect to the NBN will be competitive with OECD averages. As such, the cost of data may remain an encumbrance on the volume use of the network.

Early analysis of the Tasmanian NBN rollout suggests that while 13-18 per cent of those offered connections signed up for \$29.95 one-month trials with one of the retailers, less than 5 per cent of the 6000 homes in Stage 1 have subsequently subscribed (Paine, 2010). As with other pilot sites (Willunga in SA and Armidale in NSW), the vast majority of the Tasmanian subscriptions seem to be for plans with speeds less than 20Mbps and priced according to data costs as 5Gb for \$49.95, 60Gb of data for \$129.95 or 90Gb of data for \$159.95 per month<sup>5</sup>. None of the standard plans initially offered any connection speed of more than 300Gb, well short of the 2000Gb of data per month suggested by the NBN Co (Quigley, 2010, p.12). If speed was not the sole motivator, then it is questionable that the utility to cost differential is sufficiently compelling in terms of affordability to convince existing consumers to switch from their lower cost standard xDSL plans that contain more data (e.g. the most popular is ADSL2 with 1.2Mbps download, 256Kbps upload and 50Gb of data at a monthly cost of around \$79.95).

#### **Qualifying quality: Mobility and ubiquitous access**

The NBN has been designed to be an open, 'ubiquitous' network. To achieve this 'universality', connections will not be solely dependent on FTTH. Instead, the NBN will include fixed wireless and satellite options for the 7 to 10 per cent of Australians not provided with fibre. But is this truly a ubiquitous or universal solution?

For the last two years, Australia's Internet subscriptions remained fairly stable with some 84 per cent of Australians being connected (ABS, 2008a, 2008b; Nielsen, 2010, p.4). However, the shift towards mobile and satellite connectivity seems to be expanding in line with global trends where over 30 per cent of subscriptions to the Internet use connections other than terrestrial, fixed lines (OECD, 2008b, p.249). In Australia, while fixed, terrestrial broadband connections in the form of Digital Subscriber Line (DSL) dominate types of connections (51 per cent of non-dial-up connections), there has been a significant acceleration away from cable-type connections to mobile Internet connections (increasing to 2.8 million in December 2009) and satellite (40 per cent increase in subscriptions 2007-2009) (ABS, 2010a).

The shift in subscriptions does suggest that many city dwellers are replacing (ACMA, 2010b, p.21) or augmenting their existing fixed telephone line Internet connections with a variety of mobile and wireless connections (ACMA, 2010b). However, in rural and remote Australia the growth in satellite

<sup>4</sup> Compiled from latest data from OECD Broadband Portal [oecd.org/sti/ict/broadband] 9 September 2010.

<sup>5</sup> Based on iiNet subscription plan prices for Tasmanian NBN connections in Midway Point, Smithton and Scottsdale, sourced September 2010 at <http://www.itnews.com.au/News/169592.iiNet-leads-the-way-on-nbn-fibre-pricing.aspx>. Price excludes hardware, connection or set-up costs.

broadband subscriptions appears to be due in large part to the absence of affordable, reliable terrestrial and cellular network coverage<sup>6</sup>, in spite of claims by mobile phone carriers that coverage extends to 99 per cent of the Australian population (ACMA, 2010b, p.25). Current data indicate that of the 107,000 Australian Internet subscribers with satellite connections in December 2009, over 40 per cent were new connections since 2007 and the vast majority were to remote households, farms and businesses (ABS, 2009b, 2010a).

The growth in non-fixed-line broadband connections is a critical consideration in any national approach to promoting ICT adoption (Dwivedi, Lal, and Williams 2009). The trend in Australia towards mobile and satellite Internet connections is unlikely to slow if it follows global developments in use of broadband (ACMA, 2010b, pp.3, 8; Teltscher et al., 2009, p.3). Without factoring in the effect of the NBN, one in three new connections to broadband in Australia is expected to be to a mobile service (Teltscher et al., 2009, p.5). This reflects the fact that, while remote users opt for satellite in the absence of DSL or cellular coverage, subscriptions to the copper cable network in the city will plateau as consumers increasingly use mobile wireless Internet and Internet-connected phones (ABS, 2010a; Battersby, 2010).

As of late 2010, the design of the proposed fixed wireless and satellite solutions within the NBN and how they would integrate with the fibre network remained unclear. Many, varied options are being considered, including non-cellular networks, such as the analogue television radiofrequency spectrum available, since the switch to digital TV, or more advanced technologies such as remote mesh networks (DBCDE, 2010a; Lohman, 2010). Nevertheless, if the fixed wireless solution fails to match consumer quality preferences and speeds, subscriptions to 3G and other forms of mobile broadband or alternate satellite services may continue. This is an important consideration as the penetration of broadband through wireless and satellite is not restricted to urban populations choosing connections that reflect their lifestyle or business choices or the prevalence of mobile phone ownership (Gyarmati et al., 2010, p.43). Satellite is not a choice of convenience; rather it is one made to fill a void due to the absence of a quality, affordable fixed-line, mobile or wireless connection. However, the mobile broadband adoption rates suggest that ubiquitousness is not just a function of not being able to access a fixed connection; it is a choice made to ensure access to broadband on the move, using a range of devices that can connect to the Internet anytime, anywhere.

## Conclusion

The NBN is Australia's investment in the attainment of quality, affordable, universally accessible high-speed broadband. The investment's promise involves serious risks if limited to the thinking that constructing the NBN is considered the end goal. Rather, the NBN should be considered the means of enhancing Australia's readiness to compete in the Digital Economy.

If the primary economic rationale driving the building of the NBN is based exclusively on the density of population and cost per connection (DBCDE, 2010b, p.10), then the promise of the NBN is eroded. Such a decision may achieve short-term policy and economic imperatives, but this may well be at the cost of entrenching social and long-term economic disadvantage. Maps showing which areas of Australia will not receive FTTH (see Figure 6 above) should not become a predictive model for a digital divide, where one in ten people will not have universal access to increased economic opportunity, employment, reliable connections with friends and family, enhanced e-business capacity, or improved government services in areas such as health and education (US FCC, 2010, p.129).

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<sup>6</sup> While the suggestion is 99% of Australians can access mobile or fixed telephony services the reality is the terrestrial telephony networks cover less than 18% of the landmass and cellular network coverage exists only in approximately 27% of the landmass. Subject to weather and local variables, satellites can cover 100% of the landmass. See [http://www.dbcde.gov.au/mobile\\_services/mobile\\_phones](http://www.dbcde.gov.au/mobile_services/mobile_phones).

The readiness and capacity necessary to participate in the Digital Economy means government, community and business have to collaborate in order to plan investment in building broadband infrastructure while, in parallel, developing the e-skills required to drive both construction and adoption. A virtuous relationship can exist between all elements: infrastructure, e-skills and adoption. The race by nations to compete is not just about planning for one element in isolation from the other. For instance, the ultimate aim of improved national competitiveness requires improved levels of broadband penetration. This implies access, skills and a subscription. Therefore, governments at all levels need to ensure that thinking and planning extends beyond building infrastructure to consider:

- the availability of the skills that prepare individuals and businesses to set up and use the network; and
- adoption and issues extending beyond a focus on speed, to include affordability of data, quality and universal accessibility (irrespective of an individual's location or connecting technology).

If the aim is to ensure that all Australians can participate in the Digital Economy, then e-skills have to be developed beyond telecommunication occupations to raise the ICT readiness of workers and the digital literacy of the general population (Bowles and Wilson, 2009a, pp.70-72; Smith and Anderson, 2010, pp.6-10). It is equally vital that any consideration of universal access accept that speed is not the sole determinant of quality in the Digital Age. Nor can countries rely on any type of 'high-speed' connection when seeking to secure advantage in the race to be competitive in the Digital Economy. Evidence confirms a nation's competitiveness and consumer decisions to subscribe will be guided by interrelated considerations that include:

- **Download bandwidth speed** as it relates to consumption activities such as accessing websites, watching videos, listening to music, downloading files
- **Upload bandwidth speed** as it relates to sharing and sending activities such as information and content production and advanced interactive service activities (e.g. telehealth, telecommuting, real-time collaboration, video-communication and services, SaaS and cloud computing)
- **Latency** as it affects consumer satisfaction with the Internet experience and the performance of specific interactive communication and data exchanges, or real-time consumption and production activities
- **Reliability** as it relates to consumer satisfaction or the risk of error when low reliability prevents or adversely affects exchanges with others across different types of networks, connections or platforms
- **Mobile access** as more than wireless Internet, but anywhere anytime connection that is not fixed and can follow the consumer in a range of work and life contexts
- **Data costs** as a critical consumer consideration when assessing cost against utility factors such as types of services and applications able to be used, and volumes of data able to be uploaded and downloaded

The important relationship between quality and adoption was also evidenced through a study of non-metropolitan consumers unable to access the NBN's fibre network. Regional and rural subscribers adopting broadband can place a heavier emphasis on social factors such as the quality of the utility of services comparative with overall cost (Stenberg et al., 2009, pp.23, 29). Lack of a connection of comparable quality to optic-fibre will therefore affect adoption patterns. The lack of 'future proof', quality connections can affect government services and relationships across supply chains and between regions. For instance, latency will affect the connection and relationship between those on the FTTH network and those excluded from it. With different connection speeds, highly valued

services to the regional and rural consumer (e.g. telehealth, telework, on-farm services, distance education) can be provided only at the optimal quality and speed of a user's connection (Stenberg et al., 2009, pp.24-6). Even if two networks have the same bandwidth, for example 100Mbps, different levels of latency between fibre and satellite will impact quality. For instance, when compared with FTTH, latency on fixed wireless will occur at high levels while for satellite latency will be around ten times that of a fibre network (Zhang, De Lucia, Ryu, and Dao, 2007).

If we take into account the socio-economic cost of digital exclusion for those in non-metropolitan areas, an argument has been made for alternative strategies to recoup the higher cost per connection. Research suggests that both national competitiveness and recouping the investment in the NBN across all regions can be attained by placing a priority on improvement to government services (e.g. health and utilities) and activities in industries where ICT intensity and multi-factor productivity growth verify existing e-readiness. These industries include retail, transport, agriculture, and accommodation and tourism, all of which hold significant importance across all regions of Australia.

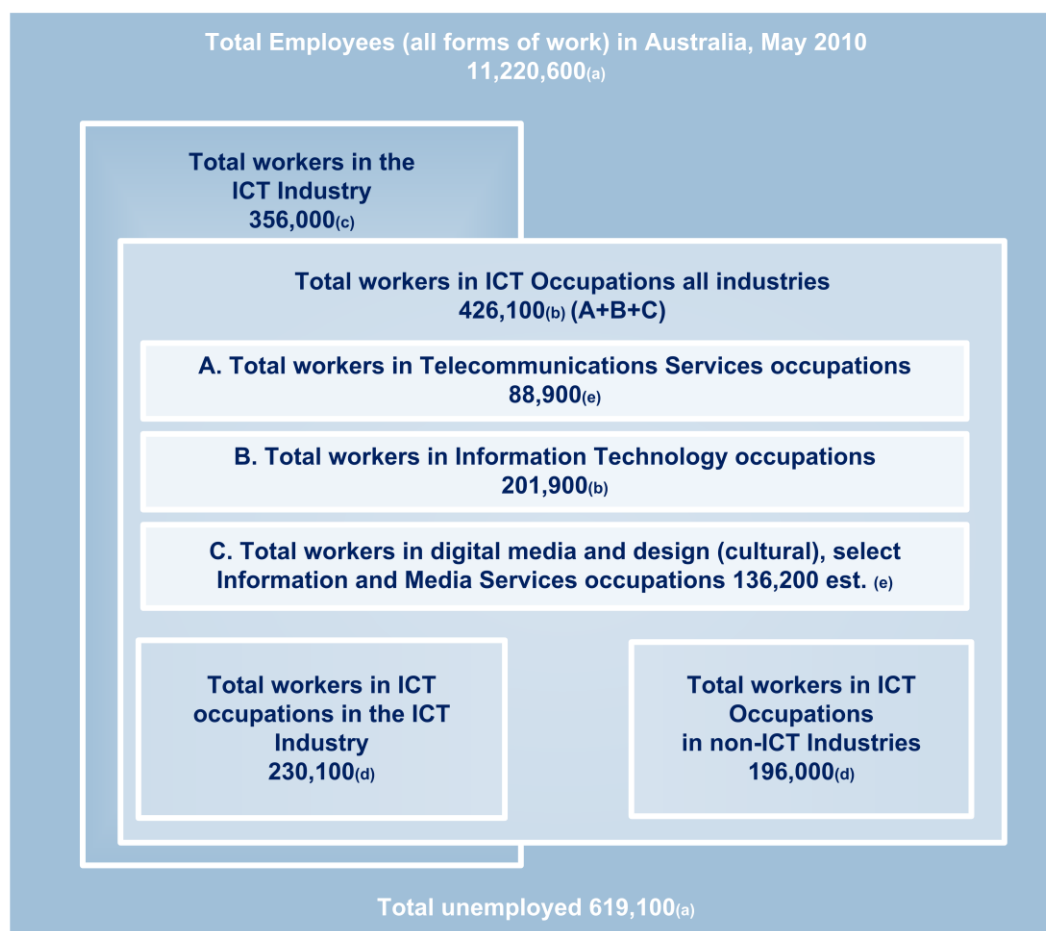
We will be able to overcome Industrial Age thinking and realise the promise of the NBN when future preparedness and participation in the Digital Economy is possible across metropolitan and non-metropolitan Australia. This achievement will be based on two important functions that prepare all Australians for the future: nationally developing the skills to build, maintain, access and use high-speed broadband and subscribers being satisfied that high-speed is associated with an affordable service that incorporates utility and quality.

## Appendix 1 National Broadband infrastructure initiatives

Country	Time Frame	Broadband Goals
Germany	2019 10 years from 2009	Provide broadband access at 50Mbps to 75% of households by 2014.
Australia	2018 8 years from 2010	With less than 1% of connections on fibre at speeds over 100Mbps the intention is to build a fibre network able to deliver broadband speed of 100Mbps to 93% of homes, schools and businesses. Remaining 10% to be guaranteed wireless or satellite connection at or over 12Mbps. Estimated investment of USD\$36b.
Malaysia	2018 8 years from 2010	35% Internet penetration. Investment of USD\$680m.
Finland	2016 7 years from 2009	Provide broadband to every household, with download speeds of at least 1Mbps by 2010 and 100Mbps by 2016.
USA	2014 4 years from 2010 to 2014	Already have 4% of homes connected to 100Mbps fibre or higher. Connecting America plan to have 100 million homes connected to wireless and fixed fibre to give access to broadband speeds not less than 1Gbps (1000Mbps). Estimated investment of USD\$15.5 billion.
South Korea	2014 5 years from 2009	Over 35% of premises already connected to FTTH of over 100Mbps. Started expansion in 2004 and plans to upgrade broadband already reaching 94% of homes to ensure all homes and businesses can access up to 1Gbps. Investment of USD\$700m.
Hong Kong	2014 4 years from 2010	Already have 28% of premises connected to fibre. Increase broadband subscriptions to 1Gbps by 2014.
Stockholm, Sweden	2014 2 years from 2010	Already have 7% of premises connected to fibre. Establishing city strategy to have 100% of Stockholm homes and businesses able to access fibre with speeds not less than 100Mbps and up to 1Gbps. Estimated investment of USD\$300m.
Italy	2013 4 years from 2009	Already have 3% of premises connected to fibre network with minimum speeds of 100Mbps. Aim to have 100% of homes passed with fibre to give access to broadband speeds not less than 20Mbps. Estimated investment of USD\$1.25 billion.
Singapore	2013 5 years from 2008	Existing penetration of 3% of premises accessing fibre considered too low. Aim to now have 100% of homes passed with (Universal Next Generation) fibre with speeds of up to 1Gbps by 2013. Investment of USD\$670m.
Canada	2013 4 years from 2009	Extend broadband coverage to all currently underserved communities. Estimated investment of over USD\$330m.
France	2013 5 years from 2008	Provide universal access to broadband at affordable prices by the end of 2010.
Spain	2013 4 years from 2009	Extend existing, estimated USD\$320m broadband to rural areas.
Japan	2011 2 years from 2009	Already have 24% of homes connected to fibre. Now seeking to extend existing 95% fibre network to cover all rural homes and businesses.
Ireland	2011 2 years from 2009	Provide broadband to 100% of homes and premises at a minimum speed of 1.2Mbps.
Portugal	2011 2 years from 2009	Extend broadband to 50% of homes by 2010.

Sources include Qiang 2009; US FCC 2010:3; McKinsey and Company analysis cited in Beardsley et al. 2010, p.68; current connections data from FTTH Council 2008-2009, <http://www.ftthcouncil.eu>

## Appendix 2 Estimated profile of ICT workforce in Australia as at July 2010



(a) ABS (August 2010). 6202.0 - Labour Force, Australia, July 2010. ABS: Canberra. Sourced September 2010 at <http://www.abs.gov.au/ausstats/abs@.nsf/mf/6202.0>.

(b) DEEWR (July 2010). ICT Industry: ICT employment and trends, *SkillsInfo*. Available online at <http://www.skillsinfo.gov.au/skills/SkillsIssues/ICTSkills/>.

(c) Latest available is ABS (7 October 2008) 8126.0 *ICT, Australia, 2007-2008*.

(d) Estimates extrapolated for 2010 based on total number of people employed in ICT occupations reported in 2007-2008 (ABS, 2008 as above and 2010 below)

(e) ABS, 6291.0.55.003 *Labour Force Survey, Detailed May Quarter 2010*. Source September 2010 at <http://www.abs.gov.au/ausstats/abs@.nsf/mf/6291.0.55.003>

(Bowles and Wilson, 2010, p. 64)

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