

The critical role of e-skills in raising NBN adoption and Australia's competitiveness in the global Digital Economy

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Abstract

This paper reports initial findings from two of the latest research projects commissioned by Innovation and Business Skills Australia. Studies into digital literacy and adoption of information technology and broadband services at three of the earliest NBN release sites, Armidale (NSW), Brunswick (Vic) and Scottsdale (Tas), show that the readiness of small businesses and regions to compete in the Digital Economy is affected by their ability to acquire specific ICT skills. Whilst the study results are not unexpected, and although priority skill sets are identified, the backdrop to these studies is likely to be of most interest. It is argued that while national effort to address affordable access is being advanced, efforts to raise the skills necessary to effectively utilise the opportunities on offer are not always keeping pace with demand. This has important implications for the National Digital Economy Strategy, as effective competition in the Digital Economy is primarily a function of two factors: affordable access to ICT, and, critically, the skills to effectively use the technology and services.

Introduction

Australia has undertaken an aggressive national agenda to place it at the forefront of the race to be competitive in the global Digital Economy. The agenda has generated enormous hyperbole and commentary by political parties, business and social groups, focussed predominantly on the efficacy of investing more than AUD\$43 billion on the construction of a National Broadband Network (NBN) to provide high-speed broadband to all Australians, with optical fibre to the premises for a large majority (93%).

The hype has tended to obfuscate the fact that the NBN is one part, albeit the most significant part, of the Australian Government's National Digital Economy Strategy (NDS) ([NDS 2011](#) [5]). The NDS outlines eight 'Digital Economy Goals' that the NBN will enable:

1. increased number of Australian households connected to broadband
2. increased percentage of Australian businesses and not-for-profit organisations using online business opportunities
3. smart management of Australia's environment and infrastructure
4. more effective and efficient delivery of health care
5. expanded online education
6. increased teleworking
7. improved uptake of online government service delivery and engagement
8. greater digital engagement in regional Australia ([NDS 2011](#) [5]:2).

Attaining the Digital Economy Goals has significant potential economic benefits. In economic terms, the NDS is anticipated to generate an additional \$4 billion per annum and some one trillion dollars in revenue from ICT industries by 2050 ([IBIS World 2012](#) [6]:8),¹ [7] and add \$12.76 billion per annum to Gross Domestic Product for every 10% of the population gaining access to high-speed broadband for the first time ([Bowles 2011](#) [8]).² [9]

In conjunction with the economic outcomes, leveraging the NBN is intended to deliver substantial social benefit. The high-order outcome of universal access to the NBN promises an equitable capacity to participate in the Digital Economy for all people, urban and regional, as well as enterprises. In this manner, effort can be made to eliminate the digital divide adversely affecting groups with traditionally low access to high-

speed broadband infrastructure and low digital literacy. These groups include Australians who:

- have low incomes
- lack tertiary level education
- are older, aged over 55
- live in rural and remote areas
- have Aboriginal or Torres Strait Islander heritage
- have a disability
- have non-English speaking backgrounds (based on [AISR 2006](#) [10]:6).

Research from 2009 to 2012 suggests small businesses might belong to this list of groups. Research from Sensis' eBusiness Reports ([Sensis 2011](#) [11] & [2012](#) [12]) shows that only about one in five small businesses have a formal digital business strategy. This is reinforced by research commissioned by Innovation and Business Skills Australia (IBSA) that consistently shows fewer than 15% of businesses employing fewer than 20 people have any plans to leverage the NBN ([Bowles & Wilson 2010](#) [13]; [Bowles 2012a](#) [14]; [Bowles 2012b](#) [15]). However if, as the Executive Director of the Council of Small Businesses of Australia (COSBOA) believes, the NBN will 'create a level playing field?', then small businesses will have the opportunity to more effectively compete in the Digital Economy ([Strong 2012](#) [16]). Given the fact that these businesses contribute more than half of industry employment and more than one third of Australia's GDP ([Clark et al 2011](#) [17]:3-4), closing the digital divide for smaller businesses holds enormous social and economic advantage.

This paper presents early insights, which suggest the desired socio-economic benefits that the NBN and attainment of the Digital Economy Goals can produce for end users and businesses are under threat. The threat lies in providing access without the ICT skills required to use or derive benefit and opportunity from information technology and high-speed broadband.

An ICT Development model and E-skills

As part of its national responsibility to provide advice to governments and other stakeholders on skills needs and workforce development priorities, IBSA completes an annual industry environmental scan (eScan). To more accurately anticipate ICT workforce development needs, a systematic approach has been developed. This model accommodates variations in the business cycle, new technologies and applications and the Australian Government's Digital Economy strategy, including the rollout of the NBN and prevalence of other high-speed broadband platforms.

□ [18]

(click image to enlarge)

Figure 1 – ICT Development Model for determining the impact of ICT in the Digital Economy

The ICT Development Model (Figure 1) was derived from comprehensive analysis and research into global practices ([Bowles & Wilson 2009a](#) [19]:17), in particular by the European Commission and International Telecommunications Union ([Teltscher et al 2009](#) [20]: 14; [ITU 2010](#) [21]) and work in Europe that extended beyond the Australian research into business readiness and ability to adopt e-commerce (e.g. by the Australian Electronic Commerce Centre) ([Catteneo et al 2009](#) [22]; [CEDEFOP 2008](#) [23] & [2010](#) [24]; [Kolding et al 2009](#) [25]). The Model has provided insights into how ICT maturity and e-readiness (existing intensity of use and capacity) can be increased by targeting skills that provide the capacity to more rapidly adopt ICT. As developmental maturity increases so does the positive impact achieved through ICT adoption, deployment and, subsequently, innovation (e.g. through gains in productivity, economic growth, market share, reduced costs, employment, social wellbeing, closing the digital divide, speed of technology and diffusion).

The early insights presented in this paper are possible because, for the first time since investigative research was commissioned by IBSA in 2009, an ICT Development Model has been employed. This Model can trace anticipated readiness and ICT skills demand. As a consequence, the latest research has moved beyond prediction to an evaluation of the impact on enterprises and regions that have had access to the NBN for more than a year. Thus it has been possible to determine that early signs indicate that the effort to address digital literacy of users, and the essential ICT skills, or so-called e-skills, for enterprises, is failing to keep pace with demand. Moreover, skilling strategies intended to support NBN adoption are, apparently, failing to adequately address the demand for the required ICT skill sets and competencies that businesses and experts have validated.

E-readiness

E-readiness is ultimately determined by examining access coupled with the physical capacity to use ICT and the desire to adopt ICT. As part of the ICT Development Model, an E-readiness Audit was developed to provide a common framework for the identification of current levels of ICT access and adoption comparative to those required to effectively participate in the Digital Economy. This enabled primary users – households and businesses, and groups of users they may belong to, such as organisations, regions, professions and industries – to rank themselves and produce a scorecard benchmarking comparative maturity across **access** and capacity to **use** or **adopt** ICT. Overall ICT maturity and progress is then reported and mapped onto a matrix. This permitted comparison with other scorecards and more accurate prioritisation of strategies to address immediate needs (the e-readiness tool is accessible at <http://ereadiness.com.au> [26], or for an example of a completed industry E-readiness Audit tool see [Bowles 2012a](#) [14]).

E-skills

The ICT Development Model requires e-skills be applied more broadly, as any study of digital literacy for people, enterprises and regions is not just about the foundation skills required to use information technology and the Internet (so-called end-user skills, [Bowles 2009a](#) [27]; [Bowles & Wilson 2010](#) [13]; [Smith & Anderson 2010](#) [28]). Study of e-skill must also address adoption and use of technology by people competent in an

existing role who are seeking to enhance their productivity or to plan and manage business adoption or innovation at a strategic level. Skills at all levels deliver the digital literacy necessary to ensure that people across all industries, occupations, sectors of the economy and locations can equitably participate in the Digital Economy (digital inclusion).

□ [29]

Figure 2 – Types of e-skills

Figure 2 depicts the three types or levels of e-skills: **foundation** or entry level tied to foundation digital literacy; **extension** where existing ICT skills extend occupational skills or further enhance digital literacy; and **strategic** where the user may seek to manage ICT adoption for a group or deploy high-end ICT skills to the advantage of an organisation, community or industry. The descriptions for the e-skill levels are provided in Table 1 together with the corresponding levels in the Australian Qualification Framework (AQF).

E-Skill Levels*	Description
Foundation E-skills 1 (AQF 1; Certificate 1)	ICT skill sets at this level will be required by people wanting to gain the essential digital literacy skills in the routine use of a personal computer, software applications, the Internet and digital devices.
Foundation E-skills 2 (AQF 2; Certificate 2)	ICT skill sets at this level will be required by people wanting to advance on their foundation user competencies to gain digital literacy skills sufficient to understand appropriate methods, tools and applications and perform a range of routine activities using communication technologies, the Internet and software as well as the basic range of applications and functions associated with standard digital devices.
Foundation E-skills 3 (AQF 3; Certificate 3)	ICT skill sets at this level will be required by people wanting to advance their foundation user competencies to gain digital literacy skills sufficient to apply a methodical approach and understanding, and to perform a broad range of work, sometimes complex and non-routine, in a variety of environments.
Extension E-skills (AQF 4-5; Certificate 4 & Diploma)	ICT skill sets at this level will be required by people wanting to extend existing occupational competency to include advanced digital literacy skills required to improve productivity, or to review and deploy information and communication technologies consistent with standard methods, tools and applications within a specific context.
Strategic E-skills (AQF 6+; Advanced Diploma and above)	ICT skill sets at this level will be required by people wanting to extend digital literacy skills required to review requirements, assess resource requirements, build vendor relationships and deploy information and communication technologies to enhance capabilities that meet the strategic requirements of a business or community.

Table 1 – Levels of e-skills supporting digital literacy

* While aligning to AQF the levels are respectively consistent with Skills Framework for the Information Age levels 1, 2, 3, 4 and 5-7 (www.sfia.org.uk [30]).

Insights, Observations and Principles for enhancing e-skills and ICT adoption

The ICT Development Model has instilled a strong realisation that raising digital literacy and targeting priority e-skills can positively influence e-readiness and the capacity of enterprises and regions to adopt ICT. Once adoption is accelerated, a virtuous cycle is encouraged whereby outcomes and innovation ensue, which positively influence maturity. Having outlined this broader development milieu the following section moves on to outline findings from two investigative projects completed at the end of 2012: an investigation into digital literacy and e-skills (Bowles 2012c [31]) and an investigation of e-skills in demand by small- to medium-sized enterprises (SMEs) in three of the earliest NBN release sites?Armidale (NSW), Scottsdale (Tas) and Brunswick (Vic) (Bowles 2012b [15]). This latter study also included reference to the Willunga site in South Australia.

As findings have not been presented to the IBSA Board for approval, this paper will present findings as a series of insights, observations and principles:

1. Insights into digital literacy and e-skills in demand
2. Observations on post-NBN impact on business skills
3. Principles for e-skills training and education interventions

A. Insights into digital literacy and e-skills in demand

The following insights are based on a consultative process that reached more than 100 people with 35 nominated experts and stakeholders completing a feedback questionnaire and another 40 individual experts and business owners or their employees directly involved in consultative forums. When using the questionnaire, experts were asked to rank demand for e-skills; competencies 'bundled' into 16 skill sets that have been validated by previous research. The option also existed to report new or modified skill sets or competencies. Figure 3 shows the overall ratings received from those providing formal responses.

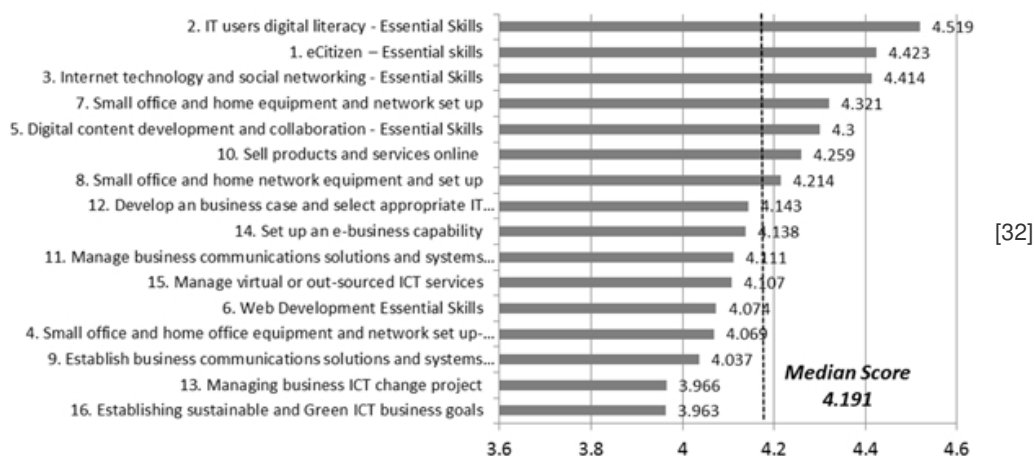


Figure 3 – ICT skill set priority needs ranked by median response

The first thing to note is that the statistical significance of the variance between skill sets is low. While statistically the sample size is small ($n = >35$), the overall median response of 4.191 indicates expert respondents agree somewhat or strongly that all skill sets require development. This is much higher than any of the three previous national e-skills surveys in which median scores did not exceed 3.581 (Bowles & Wilson 2009 [19] & 2010 [13]; Bowles 2012a [14]).

Furthermore, in statistical terms, analysis of data for reliability yields Chronbach's Alfa coefficient of 0.895, indicating a very high reliability level of the data set. Further analysis using a hypothesis test was conducted to examine if the mean feedback for each question is significantly larger than the 'neutral' value of 3. All p-values are far less than 1%. This strongly supports the conclusion that the surveyed population strongly agreed with the proposed skill needs.

The findings show a continued trend that, irrespective of region, industry, business type, size or other variable studied, indicates:

1. The identified skill sets and units of competency previously identified as essential in promoting adoption and use of ICT remain valid and reliable indicators for assessing and addressing e-skills and related digital literacy needs (see Attachment 1).
2. The e-readiness and capacity of small business to adopt and use the NBN, particularly in regional locations, is not advancing even after 12 months of access. This is indicated by the continued high demand for the validated skill sets even where training in two of the early-release sites being studied had been available for more than 20 months.
3. The preconditions for potentially widening the digital divide are present. Indications suggest a direct correlation exists between digital literacy and e-skills. Feedback from experts and business participants show that regional small businesses and groups with traditional low digital literacy (e.g. indigenous communities, low income, people with a disability, older Australians, and those from non-English speaking backgrounds) are less likely to adopt the NBN and related technologies as rapidly as urban Australians who have had prior access to high-speed broadband and who have the requisite skills to use it. With indications that at least one third and, in some cases, more than half of the population in some regional NBN early-release sites have never had a high-speed broadband connection (Bowles 2012c:33) digital literacy levels will form a greater hurdle to adoption in some locations and with some groups than is currently anticipated.
4. Demand for digital literacy spans all three levels (foundation, extension and strategic e-skill). However it is noted that potential exists to extend skill sets and units of competency at the Extension Level (AQF 4-5) to cover new digital media and content businesses and at the Strategic Level (AQF 6+) to cover gaps resulting from emerging demand from those planning regional and business Digital Economy strategies, those with new digital business models, and entrepreneurs and innovators taking digital media and products to market. The new skill sets initially validated include:
 - Digital information literacy
 - Commercialising a digital technology product, design or idea
 - Promoting virtual access to 3D digitised cultural and community assets
 - Promoting digital literacy skills in the local community/group
 - Developing online sales, service and marketing strategies
 - Serving and interacting with customers online in real time
 - Developing online sales, service and marketing strategies
 - Managing telework
 - Working with others in a virtual/off-site/telework team

The two new qualifications initially validated included:

- Diploma in Innovation and Commercialisation (digital technology products, designs or ideas)
 - Graduate Certificate in Management (digital technology product, design or idea commercialisation)
1. There was additional concern that momentum behind existing language, literacy and numeracy programs and related digital literacy educational imperatives may be at risk. 'Coalface' ICT educators in the public system indicated funding may be severely reduced from 2013 in the three most populous states. This reduction in funding is apparently occurring in foundation digital literacy qualifications and

skill sets from Certificates I and II in information technology. This could place disadvantaged groups – in particular people from non-English speaking backgrounds and people with a disability – at increased risk of exclusion from participation in the Digital Economy.

B. Observations on Post-NBN Impact on Business Skills

The following observations are derived from interviews with businesses owners, operators and employees. While these largely anecdotal and qualitative issues fall outside the parameters set for the study, they do inform the need for a more systematic approach to ICT development and support for NBN adoption by small businesses.

1. A vacuum exists with regard to a single entity coordinating consumer adoption of the NBN.

Beyond the skilling issue and an enormous optimism and desire to leverage the NBN, most people interviewed expressed severe dissatisfaction with the level of support relating to implementation and installation of the NBN service. Most prominent is the apparent fragmentation of government support for implementation of the NBN in a region. While an alphabet soup of Australian Government agencies (not least of all ACMA, DCBDE, DIISRTE, DEEWR, AWPAs)³ [33] and State or Territory agencies play a primary role in skills strategies, there seems to be an absence of coordination, particularly at enterprise level implementation.

Secondly, individual householders and business users are apparently having difficulty identifying who is responsible for specific activities after the subscription is available (e.g. consumer support, faults, advice and training). Consistent feedback suggested some Retail Service Providers (RSPs) were providing very poor customer support and thus many business owners in regional Australia believe NBNCo or Telstra will remain the main source of help when they experience poor service performance. This is unrealistic given that the NBNCo has been legislatively restricted to a wholesale-only role and Telstra's responsibility for end user problems does not reach beyond its own retail customers. It is also not apparent whether the industry regulator (ACMA) or the co-regulator (CommsAlliance) has developed adequate guidelines by which end users can resolve service disputes in a multi-provider service delivery situation (Gerrand 2011 [34]).

2. There is an absence of access to meaningful, culturally appropriate learning and content that increases the capacity of people to effectively use ICT in a contemporary business context.

The feedback indicates that while programs funded to specifically support local NBN adoption and skilling across households and businesses – Digital Enterprise⁴ and Digital Hub⁵ [35] – are generally doing some things well, the relevance and quality is highly variable. An examination of the three targeted early-release sites directly and three others indirectly indicates duplicate investment in content development and curriculum design that all too often lacks contextual relevance (e.g. rural, small business, or to an indigenous culture). This may well be less to do with what the courses offer than those accessing their services lacking the means to tie individual needs with what is being offered.

This matter is related to the funding being directed towards recreating training content or learning delivery solutions and platforms (e.g. learning management systems) that already exist. Worse still, this duplication has a great propensity to generate solutions inferior to those already developed and which are known to work well. To avoid duplication of effort and investment and to accommodate the huge diversity of learners, their context and possible future 'business' models, a core set of online, open learning content and an learning management platform that can offer a high-quality learning experience on the NBN 'backbone' are recommended (e.g. the DE Hub located at Armidale, <http://dehub.edu.au> [36]).

3. Infrastructure is required to enhance the capacity of regional participants and business groups to form communities.

Communities play a vital role in the Digital Economy. Nevertheless those interviewed in NBN early-release sites consistently requested easier access to open source tools, collaborative applications, file sharing or shared services that could assist businesses and community groups form and participate in social networks or collaborate within and across NBN rollout site.

The sense of community was central to why many users who lacked high levels of digital literacy adopted the NBN. As Prime Minister Julia Gillard stated, the investment in high-speed broadband and the Australian Government's overall Digital Economy strategy "...is about people and keeping it personal because technology, I have realised, is just a tool and what it really does is strengthen relationships" (Gillard 2012 [37]:7). This was particularly the case in rural regions (Armidale, Scottsdale and Willunga) and was supported by feedback from experts working in remote indigenous communities (Bowles 2012c [31]:30-32).

The sense of sharing and communicating seems to be core to engaging people, particularly those with historically low literacy skills. For instance, some businesses owners felt a greater affinity to similar businesses in other regions than to dissimilar businesses in their own region. In such cases the drive was to share knowledge and enable people to learn from each other using short audio-visual case studies explaining how they successfully leveraged the NBN. In one indigenous community, early adoption was spurred by sharing media files covering cultural events and festivals with family members located in another community.

4. Shift the marketing that targets businesses in newly connected NBN sites from an emphasis on speed to an emphasis on utility.

The promise of speed is appealing and certainly attracting massive attention. However, the 'appeal' of such marketing to many early adopters was less important than reliability, quality and affordability. Having faster email or browsing seems to have limited enduring appeal. In particular, review of Twitter accounts and blogs from subscribers recently connected to services using the NBN show the 'promise' often fails to justify the additional cost for those users satisfied with standard ADSL2+ or standalone home telephony services. Many of the interviewees and, given the tweets, other NBN subscribers, found many of the services commonly used for file sharing or entertainment were on much slower networks (e.g. iTunes, iCloud, iView, Google Apps, Flickr, Dropbox).

5. There is a growing gap between the new business models, innovation and commercialisation activities fostered by the NBN and available high-level qualifications.

It was apparent some enterprises that had moved to or were already located in an early-release site invested in new businesses models or innovative products and services. While multiple business types, technical and financial needs and a range of products were reported, the common need expressed was for more education and support to assist in undertaking high-level commercial activities such as patenting and

licensing, IP protection, marketing and sourcing capital. But there is a growing lag between the emerging models for leading and doing business in the Digital Economy and current strategic level education programs (AQF 6+, particularly postgraduate level) (AIIA 2012 [38]; Shorten 2012 [39]; Koppi et al 2012 [40]).

6. Without a Digital Economy strategy many regions have few or no formal mechanisms for either coordinating business activity or measuring progress.

From a top-down planning perspective, participants in some rural locations expressed a disconnect between Councils and regional decision makers and the needs and priorities of the business community. This was not only about an individual business; it was more concerned with promoting the NBN rollout to better support a coordinated approach to industry development strategies in sectors such as tourism, health, retail, agriculture and creative industries. Only one of the regions studied had a formal regional Digital Economy strategy or development plan; however, it is evident where such plans and strategies have been developed the foundations exist for prioritising development, coordinating state and Australian Government initiatives, targeting skills development strategies and preparing the region to leverage the NBN (RTIRC 2012 [41]; Gregg & Wilson 2011 [42]).

7. Given that ubiquity of access is one of the main NBN policy imperatives it is essential for consumers to be able to access a third-party, independent guide or branding regime (e.g. ?NBN tested and approved?) that spells out what hardware and software will function on different NBN connections.

Throughout the consultations, 'trust' and 'risk' emerged as ongoing, related issues. Interviewees frequently expressed concerns about the additional cost incurred by having to invest in new hardware and update software to optimise their new NBN connection. They also cited frustration that such investment often resulted in something incompatible with the NBN or unreliable to the point of affecting business continuity. Anecdotal evidence was reported from numerous sources on this matter including RSPs supplying modems or drivers that were incompatible with the NBN connection; vendors selling incompatible hardware or software updates; and subscriptions to services that were incorrectly configured or unavailable on the NBN. In addition local IT service companies or the businesses themselves complained about the onus falling on them to undertake a range of testing and configuration activities to assure that standard devices or software updates were compatible with the NBN.

C. Principles for E-skills Training and Education Interventions

Throughout the consultation and investigation, the feedback from digital literacy experts and educational and businesses users located in early-release NBN sites strongly emphasised the need to improve ICT skills development interventions. One of the main problems was perceived to be the use of unaccredited providers. This eroded the control over quality standards and any ability to tie learning to the skill sets being validated and recognition of competency standards and qualifications. The following principles appear to be the five most important learning design principles:

1. Training for adoption of the NBN has to be less about the technology and more about what it can do for a defined user.

Overwhelming feedback was received that 'training' supporting ICT adoption was more about knowledge than skills. While those with lower levels of digital literacy openly acknowledged their weaknesses they were unhappy available training was more often about the technology or software, rather than how it could be applied to outcomes they found meaningful.

2. Training interventions in a region must be consistent and systematically target all e-skills levels.

The smaller the size of the community, the less effective narrow-skilling strategies (promoted by discrete, funded programs) proved to be. For instance, Digital Hub initiatives have a huge task of advancing digital literacy (Foundation Level e-skills) for older Australians, and underprivileged and disadvantaged groups. But the learning offered through such programs typically excluded business owners and/or members of Council. In small communities, that overlooked citizens engaged in work-related activities. Yet many business owners and Councillors reported that the Digital Enterprise or digital-ready programs targeting Strategic Level e-skills were too esoteric and technically specific. Hence, enterprise participants strongly reinforce their demand for Extension Level e-skills and work-based approaches to delivery that allowed them to selectively engage in acquiring lower or higher level e-skills contingent upon need.

3. One size does not fit all and customisation to individual levels of readiness must be encouraged.

There is a huge diversity of business typologies and levels of ICT capacity in any community. A standardised, supply-driven approach that offers generic ICT qualifications will not improve the situated capacity of a business to adopt ICT. Any skills strategy therefore has to first establish a baseline whereby the community's or the regional, enterprise or individual business participants' current e-skill levels and access to ICT are established. A training plan and course offering should be customised to fit the level of ICT maturity and resulting priority needs.

4. Learning and assessment has to be based on vocational, business-related outcomes.

Small business owners are typically time-poor and operating on thin margins. Face-to-face courses in business hours or courses longer than 90 minutes in one day neither encourage engagement nor are likely to achieve learning. Despite extensive research on training design for SMEs, publicly funded 'business courses' supporting NBN adoption still failed to adhere to simple design principles: one course required business owners to spend up to six hours in two three-hour sessions morning and evening on the same day; another two-day course purporting to be about 'attracting online customers' actually taught participants how to use a software package to build a website!

5. Learning strategy and delivery has to create a meaningful, enriching and relevant learning experience.

There is significant evidence that highly variable learning design is occurring. For many of the providers there is no imperative to ensure that newly developed content is based on solid research, national guidelines, business input or reference to institutions with a successful track record in the field (e.g. Australian Communications and Media Authority resources site, <http://www.acma.gov.au> [43]; ForwardIT, <http://www.forwardit.sa.gov.au> [44]; Tasmanian Electronic Commerce Centre, <http://www.tecc.com.au> [45]).

Moreover, national funding is promoting the development of this new content and ignoring the significant public investment in existing

solutions. As a minimum requirement emphasis in small business-related ICT learning design must return to effective, quality educational practices that encourage learning from others, peer mentoring and coaching, use of multimedia more than text-based content, flexible and distance learning, learning by doing, and attainment of competency outcomes that tangibly enhance an individual's adoption and use of ICT.

Conclusion

Early indications suggest that demand for the skill sets and competencies considered essential for increasing the capacity of enterprises and regions to adopt the NBN and compete in the Digital Economy is not being met. The ICT Development Model has been examined to show that a systematic approach to research anticipated and now reinforces the wider importance of this conclusion. Without enhancing specific e-skills, it can be expected digital literacy will not be improved, thus jeopardising any effort to further develop the capacity of individuals and businesses to adopt ICT and achieve beneficial outcomes.

It is not unexpected that different regions, enterprises and individuals would move at a different pace to adopt the NBN, or other high-speed broadband technologies. Building the NBN infrastructure was a deliberate 'step change' intended to enhance Australia's ICT capacity. Such changes have a disruptive impact. However the early insights and resulting observations and principles reported herein can inform national decision making. In particular, consideration must be given to:

1. Broaden the NBN marketing emphasis away from speed to focus on case studies of consumers using high-speed broadband in ways that deliver benefit;
2. The need for a single entity to coordinate end-user adoption of the NBN and provide guidelines by which standards and procedures are established for resolving service problems and disputes;
3. Systematically integrating NDS with an ICT development approach that not only sets regional and business Digital Economy priorities, opportunities and outcomes, but is based on an accurate assessment of current ICT maturity;
4. Improving access to tools, content and learning platforms that can promote ICT adoption and use by consumers or enterprises across all e-skill levels; and
5. Tying investment in digital literacy and ICT training to competency and educational outcomes that are nationally recognised and assessable in terms of the learner's attainment of e-skills in either an end-user or business context.

The surprise is not that demand for ICT skills outstrips supply; rather it is the lack of coordination and precision surrounding training interventions and strategies intended to support NBN adoption. At best, such efforts are targeting general citizens with foundation-level digital literacy skills or businesses with existing, high levels of ICT maturity. This study indicates two important issues:

1. more effort is required to target the validated e-skills at all levels, and
2. higher-quality learning must be provided to those with low levels of digital literacy.

These actions are essential if small businesses and regional Australia are to transition to the point where they have equity of access to the NBN and the skills required to gain the socio-economic outcomes that participation in the Digital Economy can produce.

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Endnotes

1. The Australian Dollar is the value reported unless otherwise stated. The 2050 target IBIS World anticipate enhanced ICT and high-speed broadband and online information capabilities industries will deliver the Australian economy.
2. World Bank research suggests this is the gain Australia can expect from connecting every additional 10 per cent of the population to high-speed broadband.
3. Australian Communications and Media Authority, Department of Broadband, Communications and the Digital Economy, Department of Industry, Innovation, Science, Research and Tertiary Education, Department of Education, Employment and Workplace Relations, Australian Workforce and Productivity Agency.

4. For sites where this has been made available see http://www.dbcde.gov.au/digital_economy/programs_and_initiatives/digital_enterprise_program [66].

5. For sites where this has been made available see http://www.dbcde.gov.au/digital_economy/programs_and_initiatives/digital_hubs_program [67]

Attachment 1 Validated ICT skill sets

Existing ICT Skill Sets

National competencies forming the e-skill set

1. eCitizen – Essential skills

ICAICT101A Operate a personal computer
ICAICT102A Operate word-processing applications
ICAICT103A Use, communicate and search securely on the Internet
BSBOHS201A Participate in OHS processes

2. IT users digital literacy – Essential skills

ICAICT101A Operate a personal computer
ICAICT102A Operate word-processing applications
ICAICT103A Use, communicate and search securely on the Internet
ICAICT105A Operate spreadsheet applications
ICAICT106A Operate presentation packages

3. Internet technology and social networking – Essential Skills

ICAICT104A Use digital devices
ICAICT108A Use digital literacy skills to access the Internet
ICAICT103A Use, communicate and search securely on the Internet
ICAU1213B Conduct online transactions
ICAS2243B Detect and protect from spam and destructive software
ICAWEB201A Use social media tools for collaboration and engagement
ICASAS202A Apply problem-solving techniques to routine IT malfunctions

4. Small office and home office equipment and network set-up – Essential skills

ICASAS203A Connect hardware peripherals
ICASAS205A Maintain IT system integrity
ICASAS206A Detect and protect from spam and destructive software
ICASAS207A Protect and secure information assets
ICASAS208A Maintain IT equipment and consumables
ICASAS209A Connect and use a home-based local wireless network
ICAWEB201A Use social media tools for collaboration and engagement
ICAICT204A Operate a digital media technology package

5. Digital content development and collaboration – Essential skills

CUFDIG301A Prepare video assets
CUFDIG302A Author interactive sequences
CUFDIG304A Create visual design components
ICAWEB303A Produce digital images for the web
ICAGAM302A Design and apply simple textures to digital art
ICAWEB302A Build simple websites using commercial programs

6. Web development Essential Skills

ICAWEB303A Produce digital images for the web
BSBEBU401A Review and maintain a website
ICAWEB403A Transfer content to a website using commercial packages
ICASAS303A Care for computer hardware

7. Small office and home equipment and network set-up

ICASAS304A Provide basic system administration
ICASAS306A Maintain equipment and software
ICASAS307A Install, configure and secure a small office home office network
ICANWK401A Install and manage a server

8. Small office and home network equipment and set-up

ICANWK405A Build a small wireless local area network
ICANWK406A Install, configure and test network security
ICANWK407A Install and configure client-server applications and services
ICANWK410A Install hardware to a network

9. Establish business communications solutions and systems security

ICANWK416A Build security into virtual private networks
ICANWK406A Install, configure and test network security
ICANWK403A Manage network and data integrity

10. Sell products and services online

BSBITU305A Conduct online transactions
BSBEBU401A Review and maintain a website
BSBCUS402B Address customer needs
BSBMKG413A Promote products and services
BSBMKG416A Market goods and services internationally

11. Manage business communications solutions and systems security

ICANWK501A Plan, implement and test enterprise communication solutions
ICANWK510A Develop, implement and evaluate system and application security
ICANWK511A Manage network security

	ICANWK513A Manage system security ICAICT509A Gather data to identify business requirements
12. Develop a business case and select appropriate IT strategies and solutions	ICAICT510A Determine appropriate IT strategies and solutions ICAICT511A Match IT needs with the strategic direction of the enterprise ICAICT507A Select new technology models for business ICAICT508A Evaluate vendor products and equipment ICAICT512A Plan process re-engineering strategies for business
13. Manage business ICT change project	ICAPMG501A Manage IT projects ICAICT601A Develop IT strategic and action plans ICAPMG608A Manage IT project systems implementation
14. Set up an e-business capability	BSBEBU501A Investigate and design e-business solutions BSBEBU502A Implement e-business solutions BSBMKG513A Promote products and services to international markets
15. Manage virtual or out-sourced ICT services	ICAICT602A Develop contracts and manage contracted performance ICAPRG603A Create cloud computing services ICAICT706A Direct outsourced ICT services ICAICT713A Manage IT services
16. Establish sustainable and Green ICT business goals	ICASUS701A Plan and manage virtualisation for IT sustainability ICASUS702A Conduct a business case study for integrating sustainability in IT planning and design projects
Digital information literacy	CULINS401A [68] Assist customers to access information CULINS403A [69] Search library and information databases CULINS501A [70] Research and analyse information to meet customer needs CULINL601A [71] Extend own information literacy skills to locate information
Additional	Suggested new inclusions
BSB07 Intellectual Property Strategic Management Skill Set	Existing endorsed skill set BSBIPR501A Manage intellectual property to protect and grow business [72] BSBIPR601A Develop and implement strategies for intellectual property management [73]
Promote virtual access to 3D digitised cultural and community assets	Capture, manipulate and store 3D images of cultural and community assets (NEW) Prepare catalogues and inventories for digitised cultural and community assets (NEW) Create a virtual community or cultural exhibit (museum or gallery) (NEW) Curate an online community or cultural exhibit (NEW) Print digital assets in three dimensions (NEW)
Develop online sales, service and marketing strategies	Develop an online sales and service strategy (NEW) Develop a multi-channel marketing and communications plan (NEW) Manage brands online (NEW)
Serve and interact with customers online in real time	Engage, interact and transact with customers online (NEW) BSBRKG404A [74] Monitor and maintain records in an online environment
Develop online sales, service and marketing strategies	Develop a multi-channel marketing and communications plan (NEW) Develop an online sales and service strategy (NEW) Manage brands online (NEW) BSBMGT404A [75] Lead and facilitate off-site staff (IMPROVE TO FOCUS ON LEADING VIRTUAL STAFF - really too big and needs to build into the new Diploma level competencies recommended below)
Manage telework	BSBEBUS508A [76] Build a virtual community (NEW) Lead a remote/virtual/telework team (NEW) Prepare job profiles for off-site/remote work (NEW)
Work with others in a virtual/off-site/telework team	BSBOHS603B [77] Analyse and evaluate OHS risk BSBOHS601B [78] Develop a systematic approach to managing OHS ICAW2011B [79] Work individually or as a team member to achieve organisational goals (NEW) Complete work duties from a remote location using digital technology
Training Skill set	Noted
Promote digital literacy skills in the local community/group	TAEDEL301A Provide work skill instruction [80] (Coach others) TAEDEL402A Plan, organise and facilitate learning in the workplace [81] TAEDEL404A Mentor in the workplace [82]

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