THE NBN AND ITS EFFECT ON PRODUCTIVITY AND GROWTH OF REGIONAL SMALL TO MEDIUM ENTERPRISE

ROBERT ESTHERBY
Honours Student, University of Wollongong
Supervisor — William Tibben

Abstract

Australia is currently embarking on a unique infrastructure project that may change the nature of the Last Mile access to Australian telecommunications forever. The National Broadband Network is designed to bring ‘Internet’ access to 98% of the Australian population by a mixture of fibre wireless and satellite technologies. The primary argument in favour of this project has been that it will increase productivity. With over 90% of Australian businesses classified as small or medium, many of which are located in regional areas, it is important to understand the impact that the NBN will have on regional SMEs. This paper provides an examination of current literature surrounding this question and explains a method by which an expert consensus can be gathered surrounding these issues. In addition, this paper will provide the preliminary findings of this research.

Introduction

Australia is currently embarking on a unique infrastructure project that may change the nature of ‘Last Mile’ access to Australian telecommunications forever. The Australian geographical context is unique and encourages a greater reliance on telecommunications infrastructure. Australia is isolated from the rest of the world, but also isolated from itself, with small concentrated pockets of population surrounded by much larger areas of sparse population. This distribution of population coupled with the harsh natural landscapes has caused a digital divide to grow between metropolitan and non-metropolitan areas of Australia and the National Broadband Network’s goal to close this gap is ambitious.

Much of the argument for building this ‘super fast’ broadband network has been based on the premise that increased internet bandwidth will increase Australia’s productivity and growth. There is however very little evidence which links increases in bandwidth to increases in productivity and growth.

As over 90 per cent of Australian Businesses are classified as small to medium enterprise (SME) many of which are located in the regional areas, much of this increase in productivity and growth would take place in these businesses. The question is, ‘Will access to last mile fibre increase productivity and growth, especially in regional SMEs?’

This paper will seek to answer this question by first identifying the key literature surrounding this question, and examine the extent to which the current literature can be applied to the National Broadband Network. The paper will then outline our use of the Delphi Method to answer this question in the Australian context and present some of the preliminary results that have been found to date. Finally this paper will highlight several important points identified from the preliminary results that we believe are central to understanding the NBN’s effect on productivity, as well as central to debate on this issue within the public and political arenas.

A brief background for the NBN

Australian academics have had access to the Internet since the mid 1970’s. However it was not until the early nineties that the first commercial Internet Service Provider (ISP) offered public access to the world wide web by reselling bandwidth from the Australian Academic & Research Network
Since that time, the Internet Services industry had grown remarkably with over 200 Internet services active in the market place today (Whirlpool 2010). These ISPs offer services over a diverse range of technologies including fibre, wireless, dialup and xDSL.

However it has been plain since 1995 that there is an ever-increasing demand for bandwidth from the consumers. In 1995 the Telstra Research laboratories conducted trials of various customer access network (CAN) technologies including Fibre Optics and xDSL, which concluded that:

> Fully integrated services demand broadband network capability and the long-term adoption of optical fibre to replace the copper medium (Hawkins, Muirhead et al. 1994).

However, despite successful trials of fibre technology in Cordeaux Heights, New South Wales (Hsieh RC, Lampard G et al. 1995), Telstra chose not to invest in a new CAN, but instead capitalised on their existing infrastructure to great effect, while extending their mobile networks in parallel.

The Federal Government’s decision in 1997 to privatise and introduce competition into the Telecommunications market, is a subject that causes controversy even today. The sale of Telstra as a fully integrated telecommunication company placed them in a position of market dominance, despite the newly introduced competition. This has resulted in, on at least one occasion anticompetitive behavior, which has led the ACCC’s successful prosecution of Telstra (ACCC 2010).

The National Broadband Network was first proposed by the Labor Party as part of their 2007 election campaign. It promised a Fibre-to-the-Node broadband network delivering a minimum of 12 Mbps. This policy was implemented when the ALP formed government in November 2010, with the Communications Minster issuing a request for tenders. However, in the wake of the Global Financial Crisis, the Federal Government changed direction by establishing a government-controlled company to build a $43 billion wholesale fibre network (Rudd 2009) designed to provide speeds of up to 100Mbps to 93% of Australia with the rest being covered by wireless or satellite connectivity of at least 12Mbps.

As part of the negotiations between the independent MPs in the aftermath of the 2010 Federal Election, the roll out pattern for the NBN was changed to prioritise regional areas.

**Definitions**

Broadband is a somewhat liquid term, with a broad range of definitions. The standard OECD and ABS definition being ‘an always on internet connection with access speeds of equal to or greater than 256 Kbps’. However as the OECD noted ‘broadband today may be considered narrowband in a couple of years’ (Collins, Day et al. 2007).

This paper will use the term ‘broadband’ to refer to the current ADSL technologies readily available in the Australian market achieving speeds up to 24 Mbps. In addition we will use the term *Next Generation High Speed Broadband* (NGHSB) to refer to a network that provides homogenous speeds of between 24Mbps and 100Mbps.

In addition this paper will seek to disassociate the term *National Broadband Network* (*NBN*) from the political concept and define it as an open access, layer two wholesale, Fibre to the Home (FTTH) customer access and backhaul network.

Possibly the hardest concept in this research to define is the term *Regional*, as this has term is often used in varying contexts with varying meaning. In 2001 the Australian Parliament’s Joint Sitting on Migration was unable to find a satisfactory definition of regions, calling it an ‘elastic term’ which could be applied based on a number of factors from resources to lifestyle (Australia. Parliament. Joint Standing Committee on Migration. and May 2001).
The NBN and its effect on productivity and growth of regional small to medium enterprise

While there are inner and outer regional classifications in the ABS’s Australian Standard Geographical Classifications, they do not map easily to the geographical areas that would be described as regions. In addition the ABS definitions are based on ARIA+ measurements for individual Census Collection Districts (CCDs), which is not necessarily appropriate for the classification of regions for telecommunications.

The ARIA measurement takes into account how far it is necessary to drive to access services such as Education and Health (of varying levels) as well as Police, Financial, Postal, Waste Disposal, Government, Retail, Wholesale, Manufacturing, Accommodation, Religious, Entertainment and Recreation Services (Australian Bureau of Statistics 2001). It does not measure how ‘technologically’ isolated an area is, especially as the Internet can now provide access to many of these services in some form.

As such its use in the context of this research is limited. However due to the need for a specific definition in this research the following definition was ‘a regional area is any Statistical Division not containing a capital city and 40% of it component CCDs are classified as Inner Regional using the ASGC Remoteness Structure’. This may be generally understood to be a region that is neither metropolitan nor rural.

Finally Small to Medium Enterprises (SMEs) are defined as an Australian business employing between 1 and 200 fulltime employees.

Broadband and productivity

Broadband has been a feature of international telecommunications markets since the mid 1990’s. Over this 15 year period a wealth of information of varying quality that has been published by Governments, Consultants and Research Centres around the world. Much of this research examines the benefits of broadband but does not distinguish between High Speed Broadband and Broadband. Further, much of the economic research fails to separate broadband from other Information Communications Technologies, or else to examine some of the social factors in the work place that may reduce productivity gains.

The claim that Broadband increases productivity is quite prevalent throughout academic literature and the political rhetoric of the government.

… the productivity gains associated with this investment, the full benefits will continue to flow for decades beyond the completion of the project (Rudd 2009).

… broadband also enhances the productivity of many existing processes, leading to better wages and better returns on investment. Governments at all levels have recognised the impact that broadband may have on everyday lives and are committed to ensuring that its benefits are made available to all (Commission of the European Communities 2006).

Increased broadband usage is delivering greater efficiency and productivity and is opening up new markets for regional and metropolitan businesses. (National Broadband Strategy Implementation Group 2005).

Despite the political dogma that ‘Broadband increases Productivity’ there is in fact surprisingly little reliable evidence to prove or disprove this theory. The relationship between productivity and broadband may not be as straight forward and technologically determinist as these authors would suggest.

The first issue that must be examined when assessing the previous literature in the area of broadband and productivity is the Unit of Analysis. The term ICT (Information Communication Technology) along with GPT (General Purpose Technology) are two collective terms that are often used in the literature relating to Broadband Productivity (Collins, Day et al. 2007). Statistics based on these units of analysis are misleading in the context of this study as they do not apply exclusively to broadband, but rather to Office Computers, Telephone Systems, Fax Machines,
Internal Networks, e-Commerce and as well as broadband or any other ‘internet access technology’. Therefore measures based on these terms also dilute statistics, as not all the productivity gain can be associated to the Internet.

While ICT may be a more significant unit of analysis in the context of an overall economy, this aggregation of technologies into a single statistic may be inappropriate for determining the effect that broadband has upon the economy. Despite this, claims about the productivity of broadband have been made in several government reports based on such statistics (Broadband Advisory Group 2003; National Broadband Strategy Implementation Group 2005; Commission of the European Communities 2006; Australian Labour Party 2007; Productivity Commission 2009).

**Broadband not the Internet**

A second issue we find in literature is there is an abundance of information regarding how the Internet improves productivity. It should be noted however that the Internet is different to broadband, as Internet access, along with VoIP and IPTV, are simply broadband applications.

**The international experience**

Following the Lisbon summit in 2005, the European Commission’s Director General Information Society and Media, commissioned MICUS Management Consulting GmbH to conduct in depth research into ‘the impact of Broadband on Growth and Productivity’ (Fornefeld, Delaunay et al. 2008). Unlike other research conducted in the field, which tended to focus on macro or micro economic statistical analysis this study used a two-step methodology.

The first step uses a mixture of qualitative case studies and previous datasets to analyse the productivity effects at the company level. This information is then used to evaluate the productivity impact of broadband by multiplying the general company level case across the European economy (Fornefeld, Delaunay et al. 2008).

While objections to the second step of this method could be raised as it does not take into account the heterogeneous nature of broadband development within the European Union (José Luis Gómez-Barroso and Claudio Feijóo 2010), the first step of the methodology appears sound.

Despite these uncertainties the report does find a correlation between the introduction of broadband and productivity and subsequent growth (Fornefeld, Delaunay et al. 2008).

This correlative link between broadband and productivity has been further established in a 2009 paper published by the Motu Economic and Public Policy Research Centre in New Zealand. Using statistical analysis on data collected by Statistics New Zealand over a four year period, they were able to identify a 10% increase in productivity moving from no broadband to the slowest rate of broadband access (Grimes, Ren et al. 2009).

They found no distinguishable increase in productivity from those moving from a slow broadband connection to a faster one (Grimes, Ren et al. 2009). The implication of this is that the NBN, which will take us from a slower (ADSL) broadband to a Next Generation High Speed Broadband Network (Fibre Optics), may not necessarily increase productivity in relation to increased bandwidth in the short term.

However Grimes, Ren et al. warn that this must be interpreted with care as four key factors may have an effect on this result. Firstly there may have been confusion as to the definition of fast and slow broadband. Secondly, there may have been a lack of technical understanding amongst the respondents. Additionally, Firms that have recently introduced cable Internet may be suffering from ‘productivity lag’. Finally the benefit gained from a faster internet connection may only be applicable to a small number of firms (Grimes, Ren et al. 2009).

It could be argued that their first finding of a 10% increase in productivity moving from no broadband to the slowest rate of broadband access (Grimes, Ren et al. 2009) included dial-up. It
would then follow that because broadband has greater bandwidth than dial-up that there is a correlative link between broadband and productivity. This argument is underpinned by technologically determinist assumptions which possibly limit the complex interaction of technical, social and economic factors.

While some increase in productivity could be attributed to the speed increase, it could equally be attributed to other factors, such as ‘always on connectivity’ (enabling the user to talk on the phone and work on the internet), reduced times for establishing connections, or lower cost. These factors would not be seen in a move from slow broadband to fast broadband. It then follows that, should there be a correlation between bandwidth and productivity, it is necessarily not one to one.

**The productivity paradox**

Why then do we have such difficulty in trying to evaluate the productivity benefits of broadband technologies? Nobel laureate economist Robert Sloan once said ‘we see computers everywhere except in the productivity statistics’. This could equally be said of broadband. Erick Brynjolfsson in his seminal work ‘The Productivity Paradox’ (1993) identified four possible explanations for the paradox in relation to ICTs. They were mismeasurement, mismanagement, lag and redistribution. These same explanations can be equally applied to broadband, which is a subset of ICTs generally.

**Mismeasurement**

The effects on productivity of Broadband in particular are hard to quantify. The traditional measure of productivity is:

\[
\text{Productivity} = \frac{\text{Output}}{\text{Input}}
\]

Source: Equation 1: Productivity (Flamm, Friedlander et al. 2006)

However, the measure of these inputs and outputs is hard to quantify due to the intangible nature of Broadband (Brynjolfsson 1993). This problem is exacerbated in Australia due to our predominantly service based economy. Due to the interchangeable nature of the work conducted by the service sector, measuring outputs is harder. In the service sector increased quality, speed and responsiveness have been attributed to Broadband but these factors are poorly accounted for in productivity statistics (Brynjolfsson 1993).

Government statistics have traditionally used Multi Factor Productivity: see Source: Equation 2.

\[
MFP = \frac{\text{Output}}{\text{Weighted - Average (Capital, Labour, Energy, Materials, Services)}}
\]

Source: Equation 2: Multifactor Productivity (Flamm, Friedlander et al. 2006)

Within the multifactor productivity equation, broadband is combined with other services as an input to the equation. As broadband itself is not a dependent variable it is very hard to attribute the specific growth in productivity to broadband unless all other variables remained static. This has led to discussions within Australian government departments as to how better to measure broadband’s contribution to productivity:

The contribution that ICTs have made to productivity growth has been somewhat of a conundrum for researchers over recent years. Many have thought that the contribution of ICTs has appeared lower than expected, especially given the widespread use of ICTs. Recent research by internationally renowned experts in productivity measurement has suggested that a major cause of the conundrum is the inadequacy of sector data to support this type of measurement for ICTs. (Collins, Day et al. 2007)

**Lag**

Lag, is the gap between the implementation of a technology, such as broadband, and a measureable increase in productivity. This lag has been suggested to be anywhere up to a decade (Brynjolfsson
A range of social and technological factors can explain this lag. Technologies can take several years to fully mature, especially if they are developed in-house. Furthermore, in the case of some solutions, the improvements in technology are catalysts for innovation. In some cases, one of these innovative solutions, when combined with the increase in Internet speed, may enable a further increase in productivity.

Therefore, quantitate productivity studies into broadband should be conducted over a long period of time, as short-term studies may not reflect the long-term effects of broadband on productivity.

**Redistribution**

Redistribution occurs when a technology such as next-generation high-speed broadband is introduced in one company or department and the expected productivity benefits are displaced making an other partner company or department more productive. The result is that the productivity in the original implementing department may remain stationary or increase slightly while the partner department or company has an increase in productivity that is not related to their own infrastructure. This results in increases in productivity in some firms, a reduction in productivity in others and no change to the aggregate productivity statistics of the industry (Brynjolfsson 1993).

It is possible that broadband could affect the economy, especially small to medium enterprises in this way. By increasing the capacity of the communication channels it is possible that some companies will experience productivity growth at the expense of their ‘information suppliers’. As a result the outcomes of such redistribution are both complex and unpredictable. It is therefore impossible to predict the outcomes of implementing the NBN as many of the outcomes may be unintended and unpredictable.

**Mismanagement**

This is where decision makers may not make the decisions that are in the best interests of the company.

According to Brynjolfsson (1993), this can be accounted for in three ways.

1. Decision-makers are building an inefficient system as a result of technical incompetence or the digitising of inefficient work practices.
2. Decision-makers are making decisions based on industrial-age management techniques as opposed to information-age techniques.
3. Management are utilising increased productivity to increase ‘slack’ (leading to no new growth).

**Australian studies**

While there are some studies which ‘provide evidence that ICTs have contributed significantly to productivity growth, none address the issue of the contribution of broadband directly. None provide any evidence of the quantum of the contribution that broadband has made to the contribution that ICTs have made to productivity growth’ (Collins, Day et al. 2007).

The 2005–06 *State of the Regions* report suggests that the regions with high-quality broadband are more economically successful than others (Australian Labor Party 2007). This however could be equally attributed to a number of other factors such as proximity to major cites, and services.

Further, the National Broadband Strategy report suggests that, based on a Nielsen study, there is a perception amongst users that broadband technology increases their productivity (National Broadband Strategy Implementation Group 2005). More interestingly, this report suggests that SME productivity is enhanced through the use of broadband.

In 2007, the then Department of Communications, Information Technology and the Arts compiled a report to be presented to an OECD conference in London called ‘The economic effects of Broadband and Australian perspective’. It suggested that we must be careful when speculating about
the economic effects of broadband, so as not to create ‘economic dogma’ (Collins, Day et al. 2007). It suggests that although Broadband greatly contributes to the area of ‘ICTs’, it does not follow that the ‘ICT’ productivity gains can be used to suggest that increases in Broadband speed are going to improve productivity. They made the recommendation that before any definitive statement about the productivity benefits of broadband could be made, more research was necessary (Collins, Day et al. 2007).

Further research was undertaken by Access Economics on behalf of the Telstra Corporation in 2009. This research was the first Australian research to examine the economic benefits of a high-speed broadband network. However, this research concluded that although there would probably be economic benefits, these were subject to a high degree of uncertainty (Access Economics Pty Ltd 2009).

**Regions, small to medium enterprise and broadband**

Several themes have emerged from the research relating to the regional areas and SMEs. The first is that SMEs are not aware of the potential benefits of Broadband to their business (Fornefeld, Delaunay et al. 2008). This may not be the case in Australia with 95% of SMEs using broadband connections (Australian Communication and Media Authority 2009). This, however, does not mean that they are fully realising the potential of these connections.

The second theme was that there are mixed messages from SMEs about their need for speed. The ACMA reports that of 1800 SMEs surveyed none felt that ‘speedier internet’ was necessary for the business in the coming year. This is in contrast to businesses interviews in Cornwall, UK who said they are ‘... convinced of the necessity of a higher speed (fibre-optic) broadband connection’ (Fornefeld, Delaunay et al. 2008).

**The question**

The existing literature paints a complex picture, in which we have multiple contradictions. The literature does not provide a clear answer to the question ‘does bandwidth effect productivity’. In addition there is debate on how to measure the suspected productivity gains, and which factors effect the measurement of such gains.

The NBN is fundamentally unique. There is not another network that has been built on such a scale. To cover 98% of Australia’s population is a huge task. There are two attributes that make the NBN different to all the networks that have been examined so far in the literature, they are speed and ubiquity.

Currently the literature uses mainly statistical analysis of pre-existing government or industry statistics on broadband. With the broadband definition of the OECD still ‘an “always on” Internet connection with an access speed equal to or greater than 256 Kilobits per second (Kbps)’, this provides the researcher with very little information as to what speed is being referred to when the term broadband is used. Within the literature the highest speeds were approximately 20Mbps based on current ADSL and Cable technologies (Fornefeld, Delaunay et al. 2008). The National Broadband Network however will be running at 100Mbps (Rudd 2009), five times faster than current networks. Therefore it may not be appropriate to base the productivity of this network on research based on much slower networks.

The second difference is ubiquity. The NBN designed to reach 98% of the Australian population. Unlike other networks examined in the literature, this will have a network externality factor that could also have an enormous impact on productivity, especially to SMEs in regional areas.

So what we are left with is a set of complex uncertainties, which in themselves cannot be quantifiably verified while the NBN remains incomplete. Australia is about to spend $43 Billion on a new Fibre Optic, Customer Access and Backhaul Network because it will increase productivity. It
would therefore make sense to test this premise before proceeding. Given this complex list of uncertainties which must be predicted, what better way to address them than through a Delphi Study.

The Method

The Delphi Method is ‘intended for use in judgment and forecasting situations in which pure model-based statistical methods are not practical or possible because of the lack of appropriate historical/economic/technical data, and thus where some form of human judgment is necessary’ (Rowe and Wright 1999).

The technique has four distinguishing features:

1. **Anonymity of Participants:** This anonymity places each expert in a situation where they feel that they can express their opinion without pressure of fear of humiliation (Rowe and Wright 1999).
2. **Multiple Rounds:** Multiple rounds allow participants to refine their views in the light of the group’s work from round to round (Skulmoski, Hartman et al. 2007).
3. **Feedback to Participants:** After each round participants are provided feedback based on the responses of the other participants (Skulmoski, Hartman et al. 2007).
4. **Opportunity for Participants to Change their View:** Giving the experts the opportunity to change their view, allow experts who have been persuaded by the evidence presented in each round to change their position (Rowe and Wright 1999).

**Why Delphi?**

The Delphi Method is ideal for research that:

- **Is predictive** (Linstone and Turoff 1975; Rowe and Wright 1999)
  The National Broadband Network was proposed in 2007 (Australian Labor Party 2007), announced in 2009 and is due to be built between 2010 and 2018 (Rudd 2009). As it is impossible to measure the effects of a network that has yet to be completed, research into the NBN is necessarily predictive.

- **Requires broad heterogeneous input** (Linstone and Turoff 1975)
  The cross-disciplinary nature of this research requires expert opinion to be gathered from an economic, social, political and technological standpoint. This requires the gathering of information from a wide range of inherently heterogeneous sources.

- **Is not suited to precise analytical techniques** (Linstone and Turoff 1975; Skulmoski, Hartman et al. 2007)
  NBN is a unique network, in respect to its speed, ubiquity and distribution area and consequently, previous literature may not be applicable. Further, there is currently no study that investigates the effect of high-speed fibre optic broadband networks on the productivity of Australian Regional SMEs. This is further reinforced by the lack of reliable measurements available for the measuring of broadband productivity, either from Government or Industry sources. This renders this study unsuited to analytical techniques.

This is therefore the natural method to use for this research.

**Research approach**

In order to attempt to answer the questions raised by the literature review, this study will conduct a two-round Delphi Study, with an optional third round.

The first round will consist of a semi-structured interview with thirteen experts in order to determine what, if any, effect the NBN will have on the productivity and growth of regional small to
medium enterprise. In addition the expert participants will be asked to define the factors that they believe influence it and they will also be asked to respond to factors found in the literature.

The second (and optional third rounds) will take the form of a short online survey. During the second round experts will be given feedback on the factors that were identified during the first round, and then asked to rank the these factors in order of significance.

In the event of no clear consensus being reached during the second round, a third round will be conducted, which will follow the format of the second round. The results of this final round (whether second or third) will be collected, analysed and compared with the literature in order to draw conclusions regarding the effect of broadband on the productivity of regional SMEs.

**Selection of experts**

The purpose of this Delphi Study is to make a prediction about the productivity effects of the NBN. Experts are used as a central part of the Delphi Method because they are assumed to have greater insight and practical experience in their area of expertise. This enables them to make more accurate predictions regarding their area of expertise (Rowe and Wright 1999). This requirement renders the standard probabilistic sampling inappropriate for this study.

While the majority of Delphi Studies to date have contained between 15 and 20 participants (Ludwig 1997), this study will contain only 13. This is not unprecedented, as the original Delphi Study conducted by RAND, had only 7 participants, and still provided a reliable prediction (Dalkey and Helmer 1963). In addition, while research into the Delphi method shows that there is a correlation between the number of participants and reliability, it also shows that ‘correlation coefficient approaching .9, was found with a group size of 13’ (Ludwig 1997).

Experts were selected from the telecommunication, small to medium enterprise and information communication & technology sectors as well as regional development organisations, academia and government bodies.

To be considered an expert the participant must be:

- A prominent analyst from one of the sectors mentioned above,
- A representative of an Australian Telecommunication Company,
- A representative of a leading Small to Medium Enterprise,
- A representative of a respected industry body,
- A regional development officer or
- An academic actively researching in this area.

Figure 15 below, shows the distribution of experts from each of the areas listed above. However, it should not be inferred from this graph that there was a bias in the distributions of experts, as this is not a statistical sample. Rather the choice of experts was done based on their knowledge and experience with the subject matter rather than their ability to provide a representative view for a particular industry. In addition Figure 15 reports the experts primary area of expertise however in all cases the experts had a broad expertise covering multiple areas.
Research timeline

The political uncertainty surrounding the 2010 Federal Election, and the subsequent stand-off between both major political parties and independent members of Parliament created a situation in which many of the experts approached for this study wished to know the outcome of the election prior to conducting their interview. Waiting for this certainty has increased the reliability of their predictions, but it has also delayed the research.

This research is to be completed by the 25th October, however at the time of submission the research was partially through the round one interviews. It is expected that the round one interviews will be completed by the 1st October with round two being completed by the 15th October. This should allow for the major findings to be reported during the presentation of this paper.

Preliminary results

As a result of the Federal Election, at the deadline for submission of papers, for this conference, only four expert interviews had been completed. However, this paper will give some initial indications about the nature of the current results. It should be stressed that these results are based on only four experts. These experts’ opinions have not been subjected to peer review in the second stage of the Delphi process, and these experts do not represent the diversity of the full sample. It is highly likely that within the remainder of experts to be interviewed, there will be at least one dissenting opinion.

However based on the current data, it is clear that there are four important points that can be identified.

Firstly all four experts agree that the NBN would have a positive effect on productivity for small to medium enterprise in regional Australia. If this trend is to continue within the rest of the interviews it will fill a gap in the Australian research surrounding this topic. While it will not provide highly quantitative data, it will provide possible factors that can be used to explain the phenomena.

Secondly all experts agree that the ubiquitous nature of the NBN will be a major driver of productivity gains especially in regional areas where equality of access will help to reduce the digital divide.
Another important point raised by the experts was that the NBN’s productivity will not be derived from bandwidth but rather the applications that can utilise this bandwidth. This suggests that ICTs and GPTs may in fact be a more appropriate unit of analysis when examining broadband productivity. However, a conclusive position on this point will depend upon the final results of the study.

The final important point we have identified relates to the measuring of the expected productivity gains. All participants believe that the expected productivity will be affected by a mixture of Lag, mismeasurement, mismanagement and redistribution. The experts agree that productivity will have to be measured over an extended economic cycle with productivity benefits not being easily visible for at least a decade.

It is expected that these results will be reviewed during the presentation, in light of the final findings.

**Conclusion**

In examining the literature and conducting this Delphi study, this research seeks to understand how the NBN will affect productivity and growth of regional SMEs. In order to do this, this paper has attempted to clarify the relationship between broadband and productivity. The literature has shown that much of this area uses units of analysis that are not appropriate to answering this question in an Australian context. In addition the literature provides possible reasons as to the difficulty in capturing productivity gains based on a specific technology. The use of the Delphi study technique is already providing useful insights into the question of broadband productivity in relation to regional SMEs. We believe that this technique will be capable of answering the fundamental question and provide a detailed, prioritised and peer-reviewed list of factors and conditions that will be necessary to ensure that the NBN achieves its goal of increasing productivity especially within regional small to medium enterprises.

**REFERENCES**


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