

Towards the Socio-Economic Patterns of the National Broadband Network Rollout in Australia

Tooran Alizadeh (t.alizadeh@griffith.edu.au)
Griffith University

Abstract: Since the formation of the National Broadband Network Company (NBN Co.) in April 2009, the NBN rollout has been gradually announced following a range of engineering and logistic criteria. However, the early rollout gives the release sites a regional competitive advantage against other localities that might have to wait up to a decade to receive the same infrastructure. This leads to an important question about the socio-economic status of the release sites, and the potential impact of the NBN on the social discrepancy across the nation. The answer to this question then leads to a second question about the degree to which the NBN should be incorporated in planning and policy development for spatial justice. In an attempt to explore these questions, this paper examines the ranking of the sixty earlier NBN release sites in the Socio-Economic Indexes for Area, and Accessibility/Remoteness Index of Australia. Findings are in line with the recent research that emphasizes the role of infrastructure in intensifying social divisions.

Keywords: National Broadband Network, Australia, socio-economic status, rollout plan, telecommunication infrastructure, social justice

Introduction: The NBN Rollout Plan

In response to the increasing concerns that Australia's broadband and telecommunication infrastructure had not been well developed in comparison to other countries (Barr, 2008; Given, 2008; Middleton & Chang, 2008), the Australian Federal Government, in 2009, approved the construction of Australia's first National Broadband Network (NBN)(NBN Co. Ltd., 2010a). The Australian Government on several occasions has declared that the NBN will lead to a major structural reform of telecommunication industry across the nation, and provide reliable, high speed broadband access to all Australians (DBCDE, 2010). Furthermore, underpinning the rollout of the NBN throughout Australia has been the acknowledgement that the infrastructure will provide regional and rural communities with better broadband access, thus closing the gap between the services available in these communities and those available in Australia's major metropolitan centres (NBN Co. Ltd., 2012b, 2012c). Following the approval for the construction of the NBN, the Federal Government announced the formation of the National Broadband Network Company (NBN Co.) in April 2009 (NBN Co. Ltd., 2010a). The NBN Co. is responsible for the design, construction and operation of the NBN. The company is also tasked with the subsequent rollout of the NBN infrastructure and technology which includes optic fibre, fixed wireless and next generation satellites (NBN Co. Ltd., 2009). Furthermore, it is expected that by the completion of the ten year rollout plan, by the end of 2020, 93% of Australian premises will be connected through the optic fibre infrastructure while the remaining 7% will have access to the NBN through the fixed wireless and satellite technologies (DBCDE, 2010).

The rollout began with the announcement that Tasmania was the launch state for the NBN (Minister's Media Release, 2009). A three-stage rollout was planned for Tasmania with Smithton, Scottsdale and Midway Point being the first localities to receive the NBN services. The rollout of the NBN on mainland Australia started one year later in March 2010 when the NBN Co. announced the first five release sites as part of live trials of the network design and construction (NBN Co. Ltd., 2010b). These sites included Armidale, Coffs Harbour, Kiama, Townsville, and Willunga. The second stage of the mainland rollout, announced in July 2010, included fourteen new locations and five sites adjacent to the existing first release sites (NBN Co. Ltd., 2011b). This was followed by the release of a twelve month national rollout schedule plan, announced by NBN Co. in October 2011, which would connect half a million premises (NBN Co. Ltd., 2011a). This schedule listed 60 locations in all Australian states and territories where the rollout would begin prior to September 2012 (Table 1). Additionally, in March 2012, NBN Co. announced that the NBN fibre rollout will be completed or underway in a third of the country over the next three years (NBN Co. Ltd., 2012c). This involves connecting 3.5 million premises in 1500 communities in every state and territory to the fibre optic component of the network. It is envisioned that the localities included in this updated schedule will be connected to the fibre-optic component before mid-2015, representing the first stage of the large-scale rollout of the NBN. The release of the NBN Co. corporate plan for 2012-2015 confirmed this by highlighting that as of June 2012 construction had already commenced or was complete for approximately 305,000 premises

across Australia. Furthermore, it was predicted that this figure would rise to approximately 785,000 premises by December 2012, in line with the three-year rollout plan announced in March.

Up to now, the rollout of the NBN has been mostly based on a series of operational modules that each covers approximately 3000 premises (NBN Co. Ltd., 2012a). The plan is to continue the rollout by extending from the modules developed in the earlier release sites, as well as adding other sites as rollout progresses (NBN Co. Ltd., 2011b). There has been some speculations about the political agenda behind the release site selection (King, 2011). However, the NBN Co. and the Australian Federal Government on different occasions presented a range of engineering and logistic criteria including the availability of existing core infrastructure to connect the access network to, and also access to the transit network and fibre access nodes (DBCDE, 2011; NBN Co. Ltd., 2012a). It has also been said that the earlier release sites were selected because they represented the diversity of situations that the NBN Co. will encounter across Australia in the volume rollout, and allowed the company to test and document different design and construction techniques (NBN Co. Ltd., 2010b).

Table 1: 60 earlier NBN release sites in Australian states and territories

Location		
<i>South Australia</i>	<i>New South Wales</i>	<i>Tasmania</i>
Aldinga Beach*	Armidale	Deloraine
Modbury	Blacktown	George Town
Port Augusta*	Coffs Harbour	South Hobart
Port Elliot*	Dapto	Kingston Beach
Prospect	Gosford	Launceston*
Seaford / McLaren Vale	Jamberoo	Midway Point
Stirling*	Kiama	Scottsdale
Strathalbyn*	Lidcombe	Smithton
Yankalilla*	Long Jetty	Somerset*
Willunga	Penrith	Sorell
	Richmond	St Helens
	Riverstone	Triabunna
	Sawtell	
	Strathfield (Homebush)	
	Wollongong	
Location		
<i>Queensland</i>	<i>Western Australia</i>	<i>Victoria</i>
Aspley	Applecross*	Bacchus Marsh
Goodna	Geraldton	Ballarat Central*
Nudgee	Mandurah	Brunswick
Toowoomba	Meadow Springs	Melbourne City*
Townsville	Pinjarra*	Melton*
Townsville City	South Perth*	South Morang
	Victoria Park	Tullamarine*
Location		
<i>Australian Capital Territory</i>	<i>Northern Territory</i>	
Gungahlin	Casuarina	
	Darwin	

This paper does not make any comment on the genuinity of the engineering selection criteria announced, as it is more interested to understand the socio-economic pattern underpinned for the rollout plan so far. It is obvious that early rollout gives the release sites a regional competitive advantage against other localities that might have to wait up to a decade – to the end of the rollout in 2020 - to receive the same infrastructure. This leads to an important question about the socio-economic status of the selected sites, and whether they fairly represent the diversity included in the Australian society. The answer to this question closely relates to recent urban debates that emphasize the socio-economic justice side of infrastructure formations, and then leads to a second question about the degree to which the NBN is presently, or should be, incorporated in planning and policy development for social equity and spatial justice. The paper does not seek a comprehensive resolution of the above questions; rather it proffers the more modest objective of throwing new light on the link between telecommunication infrastructure provision and socio-economic equity debates in Australia, and expanding the methodological possibility to investigate this line of inquiry. The present paper supports the advancement of socially sensitive NBN research, and articulates its methodology

through examining the 60 earlier NBN release sites (Table 1) to understand their relative position across the socio-economic spectrum.

Socio-Economic Dimension of the NBN Rollout

Socio-economic research argues that public infrastructure is a powerful driver of business productivity, economic growth and social prosperity (Aschauer, 1989; Button, et al., 1995; Gramlich, 1994; Seitz, 1995). More recently, planning literature has shown growing interest in broadband technology as the key telecommunication infrastructure, and also as the backbone of the emerging knowledge economy (Eskelinena, et al., 2008; Ford & Koutsky, 2005). Over the last decade, several countries including the UK (Galloway, 2007), Korea (Kelly, et al., 2003; Speta, 2004), Germany (Katz, et al., 2010), and Spain (Gerrand, 2006) have undertaken substantial direct government investment in broadband infrastructure, often treating it like other areas of public infrastructure. A few others such as the US (Ford & Koutsky, 2005) and Finland (Eskelinena, et al., 2008) have established a number of support and subsidy plans, and taken regulatory actions, including universal service programs, to increase the speed and the coverage area of their otherwise market-based broadband plans. Different governments' direct and indirect involvement with broadband infrastructure is often justified by reference to social equity grounds (Faulhaber & Hogendorn, 2000; McMahon & Salant, 2001); and is based on assumptions that the new technology-based infrastructure will facilitate their long-term economic development (Alizadeh, et al., 2011; Martin, 1999; Willson, et al., 2009). These assumptions are founded in part on the literature generated over the last 10 to 15 years, describing the potential economic and social benefits of such infrastructure including increases in gross output, employment, and aggregate consumption at national, regional and local levels (Ford & Koutsky, 2005; Lee, et al., 2005; Martin & Rogers, 1995). For example, in a recent study Katz et al. (2010) examined the impact of currently undergoing broadband infrastructure investments (The German National Broadband Strategy) on the German economy, in particular on employment and output. The study estimated that a total investment of close to 36 billion Euros would generate a total of 968,000 incremental jobs, and results in 170.9 billion Euros of additional GDP (0.60% GDP growth). Their findings, based on the huge economic returns, represented broadband as a high priority stimulus programme that the German government needs to rely on to improve the current economic outlook and create a solid foundation for future growth.

The present paper acknowledges that it is extremely complex to establish beyond doubt that the telecommunication infrastructure per se results in a change in an economic indicator (Lee, et al., 2005; Strategic Networks Group, 2003). Although the research findings in this area should be qualified as 'preliminary evidence', broadband deployment is already considered as an important policy issue for many governments seeking to address social divisions. For example, in August 2011, the Standing Committee on Infrastructure and Communications on behalf of the Parliament of Australia tabled its report on the potential of the National Broadband Network to enhance economic and regional development and social and community activity (Parliament of Australia, 2011). The report sets forward a number of recommendations for the Australian Government including developing targeted programs for those currently disadvantaged by the digital divide. Moreover, throughout the report there is a great emphasis on the significant role of the NBN to ensure greater equity across Australia's communities in regard to access to government services through e-government, e-health, and e-education particularly in regional and rural areas, and for people who are geographically isolated.

In order to understand the ways in which the NBN rollout plan so far is going to affect the current socio-economic divisions across the nation, the following uses two well-established sets of indexes and assigns a socio-economic index score and a remoteness index score to each of the 60 earlier NBN release sites. This will hopefully develop a basic understanding of the socio-economic patterns of the NBN rollout so far, and set forward a socio-economically sensitive methodology that has the potential of investigating the upcoming stages of large-scale rollout as they are being gradually announced over the next few years.

Socio-Economic Index for Areas

The Australian Bureau of Statistics Census-based Socio-Economic Index for Areas (SEIFA) scores are the most widely used general measure of socio-economic status nationwide. This paper uses the 2006 SEIFA as its main analytical dataset to critically examine the selection process and criteria of the early NBN rollout sites (2011 SEIFA was not yet released at the time that decisions were made for the selection of the early release sites). The 2006 SEIFA is a suite of four summary measures that have been created from 2006 Census information. The indexes can be used to explore different aspects of socio-economic conditions by geographic areas. For each index, every geographic area in Australia is

given a SEIFA score which shows how that area is compared with other areas in Australia (ABS, 2006a, 2006b). The four indexes in SEIFA 2006 are:

- Index of Relative Socio-economic Disadvantage: uses a broad definition of relative socio-economic disadvantage in terms of people's access to material and social resources, and is derived from Census variables like low income, low educational attainment, unemployment, and dwellings without motor vehicles.
- Index of Relative Socio-economic Advantage and Disadvantage: encompasses the entire socio-economic spectrum, a continuum of advantage (high values) to disadvantage (low values), and is derived from Census variables related to both advantage and disadvantage.
- Index of Economic Resources: focuses on financial aspects of advantage and disadvantage, using Census variables relating to residents' incomes, housing expenditure and assets.
- Index of Education and Occupation: includes Census variables exclusively relating to the educational attainment, employment and vocational skills. A low score indicates that an area has a high proportion of people without qualifications, without jobs, and/or with low skilled jobs.

While there has been some criticism of the SEIFA indexes in the past, they have proved over time to be a good overall measure of socio-economic status and the only nation-wide measure available at a small area level (Kennedy & Firman, 2004). However, in many areas there are likely to be small sub-groups of populations which have characteristics that may be quite different from the overall population they live among. Thus the concept of the ecological fallacy, that is making assumptions about individuals or minority populations from the characteristics of the overall population of an area is a common problem (Baker & Adhikari, 2007). Having said this, a number of studies over the last few years have shown that there are important theoretical and practical lessons to be gained in the field of spatially sensitive social scientific research. For example, Dodson et. al (2003; 2007) combining the SEIFA indexes with transport data-sets examined the links between social status and infrastructure provision with a focus on transport disadvantage. Their main empirical finding was the identification of a strong socio-spatial pattern for those vulnerable to transport disadvantage in terms of both their location within the urban structure and also their spatial and temporal access to public transport services.

Following a similar line of investigation and in order to further promote policy relevant empirical social inquiry, this paper attempts to understand the social dimensions of telecommunication infrastructure provision with a focus on the earlier NBN rollout plans. To do so, the distribution of SEIFA across the NBN release sites in the Australian states and territories was examined. Postal Areas (POAs) were used as the primary geographical entity for analysis because the NBN Co. has been releasing rollout plans according to suburbs names and postcodes. Moreover, following the Australian Bureau of Statistics' recommendation (ABS, 2006b), the SEIFA indexes have been used to group areas into quartiles, and then these quartiles been used as the basis for analysis, using boxplots as a simple method of visually comparing distributions. Boxplots present the median, upper and lower quartiles, and also the range of the distribution.

Figure 1 represents and compares the distribution of relative socio-economic advantage and disadvantage across all areas in the Australian states and territories vs. the NBN release sites in each state and territory, using the Index of Relative Advantage and Disadvantage at the POA level. Looking at the NBN release sites across Australian states and territories shows that, with the exception of Tasmania, their median scores are higher than the median scores for all areas in each state and territory. The NBN release sites also have narrower ranges of scores in comparison to all areas in each state and territory. Moreover, their minimum scores are equivalent or more than the lower quartile scores for all areas in each state and territory but Tasmania and South Australia. A very similar pattern is observed when the upper quartile values are compared between the release sites and all areas in each state and territory (with the exception of New South Wales and Tasmania). Putting these points together, it is evident that the release sites are very different from the most disadvantaged areas in vast majority of Australian states and territories. Having said that, it is also important to understand that the maximum scores for the release sites in the majority of states and territories (with the exception of Australian Capital Territory, Northern Territory and South Australia) are well below that for all areas which suggests that the utmost advantaged areas are not necessarily among those that get the NBN sooner than others.

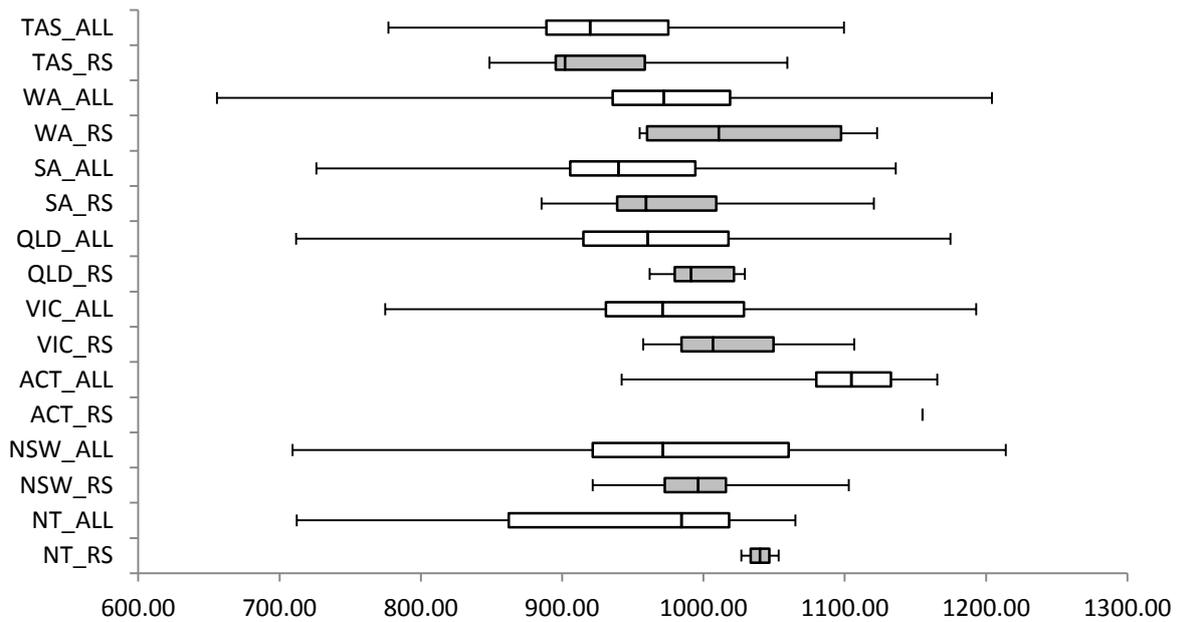


Figure 1: Index of Relative Socio-economic Advantage and Disadvantage, distribution by state/territory for all areas (ALL) vs. release sites (RS)

The underrepresentation of the most disadvantaged areas in the earlier NBN rollout plans is better illustrated in Figure 2 that represents and compares the distribution of relative socio-economic disadvantage across all areas in the Australian states and territories vs. the NBN release sites in each state and territory, using the Index of Relative Disadvantage. It is evident that the minimum scores for the NBN release sites across all states and territories are much higher than that in all areas. The trend is more obvious with Western Australia, Queensland, Victoria, Australian Capital Territory and Northern Territory in which the minimum scores for the NBN release sites are equivalent or higher than the lower quartile scores for all areas. This basically suggests that the most disadvantaged areas have not benefited from the earlier provision of the telecommunication infrastructure so far and could potentially lag further behind because of the late rollout.

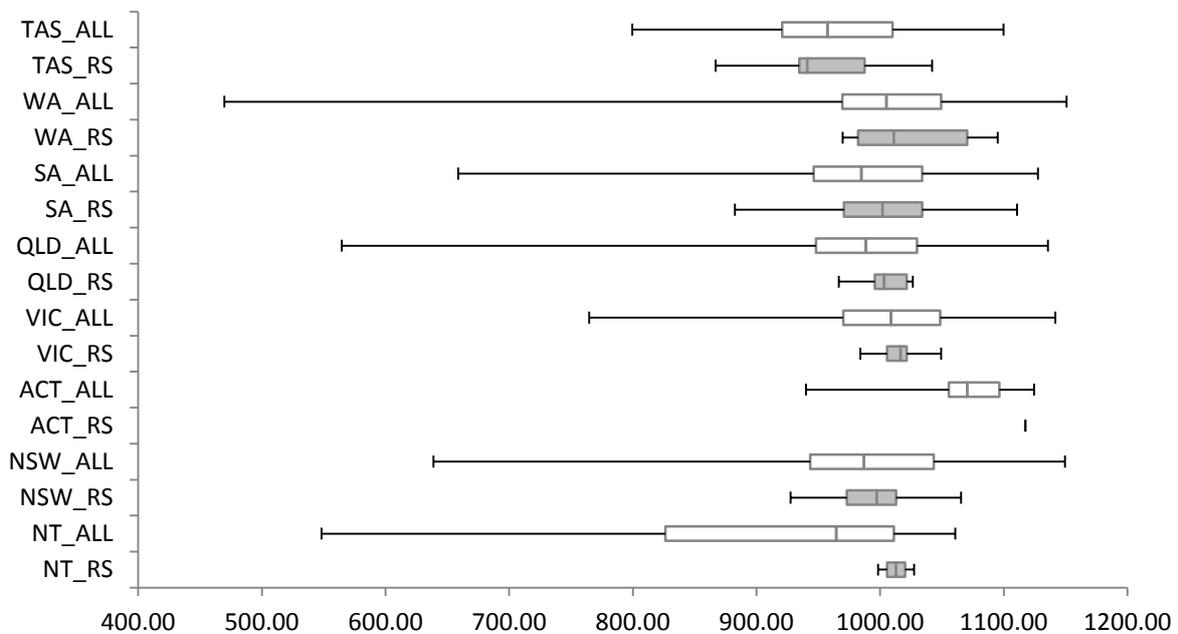


Figure 2: Index of Relative Socio-economic Disadvantage, distribution by state/territory for all areas (ALL) vs. release sites (RS)

A combination of Figure 1 and Figure 2 suggests that the NBN rollout so far has provided some opportunities for a number of communities mostly at the middle range of socio-economic spectrum to

take advantage of early provision of the upcoming infrastructure. Yet, closer examination warns that the most disadvantaged communities have not been among the winners. The case of Northern Territory, for example, shows that in both earlier discussed indexes the median scores of the NBN release sites are even higher than the upper quartile scores of all areas. This suggests that in a territory that contains some of the most disadvantage communities of the nation, the ones that have enjoyed the early rollout so far are amongst the better-off ones.

In order to have a better understanding of the socio-economic patterns of the earlier NBN rollout, Figure 3 and Figure 4 represent and compare the distribution of Economic Resources, and Education and Occupation across all areas in the Australian states and territories vs. the NBN release sites in each state and territory, using the Index of Economic Resources, and the Index of Education and Occupation. These two indexes are specifically important as they focus on peoples' access to economic resources, and skills and qualifications. Figure 3 shows a narrower range of access to economic resources among the NBN release sites mostly focused around the middle of the range for all areas. This basically means that in the majority of states and territories the earlier release sites include local communities that are quite similar in their average (with a tendency towards high) access to the economic sources.

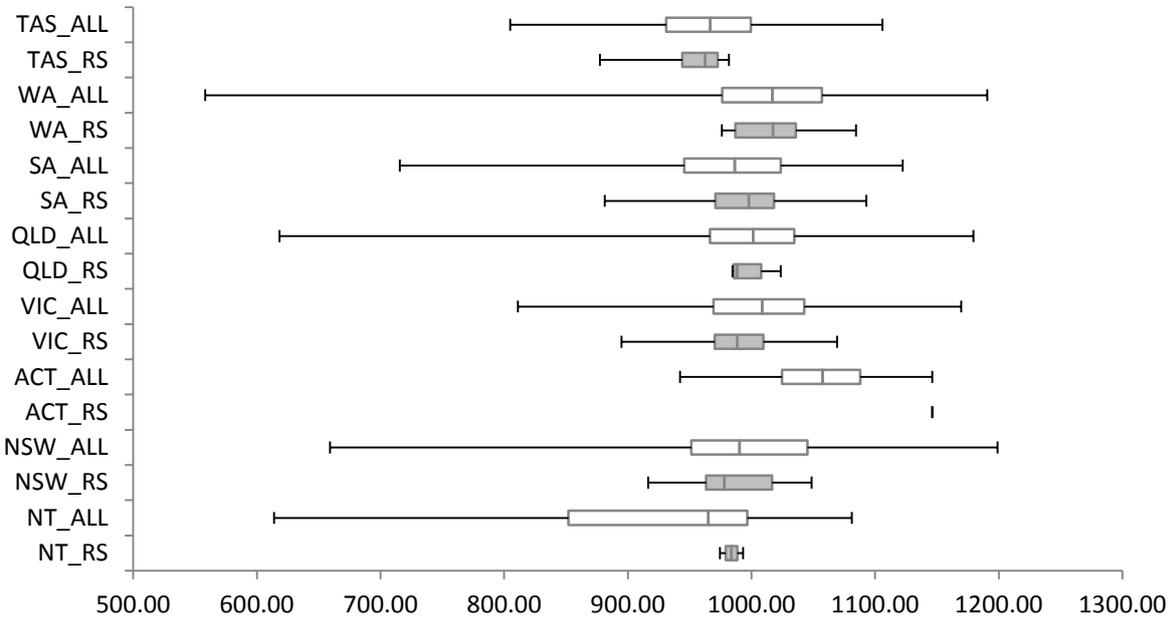


Figure 3: Index of Economic Resources, distribution by state/territory for all areas (ALL) vs. release sites (RS)

Figure 4, on the other hand shows that the earlier NBN release sites are not so similar when it comes to education and occupation as the distribution ranges are quite wide with the exception of Northern Territory and Queensland. Tasmania and then South Australia and Victoria have the widest range of scores which shows that they all contain some areas with highly qualified and skilled people as well as some with mostly underqualified and low-skill population. Nevertheless, a comparison between the distributions of all areas vs. the release sites across the Index of Education and Occupation shows that the minimum scores for the release sites across all states and territories are higher than those for all areas. Such a trend is observed far stronger in Northern Territory in which the two NBN release sites sit at the very high end of the distribution line for all areas. This once again suggests that while some less advantaged communities in regard to education and occupation might benefit from the earlier provision of the infrastructure and become more competitive through e-education opportunities, the utmost lowest-SEIFA communities have not yet been offered the same chance.

This translates to the scary truth that the most distressed localities at the bottom of the SEIFA indexes could fall behind even further – in both short-term and mid-term - as a result of a later NBN rollout, if the same pattern was to be followed in the large scale rollout phases. This means that the NBN rollout plan without accounting for the socio-economic status of the release sites could potentially intensify the existing social divisions in the Australian context at least in the short-term and mid-term.

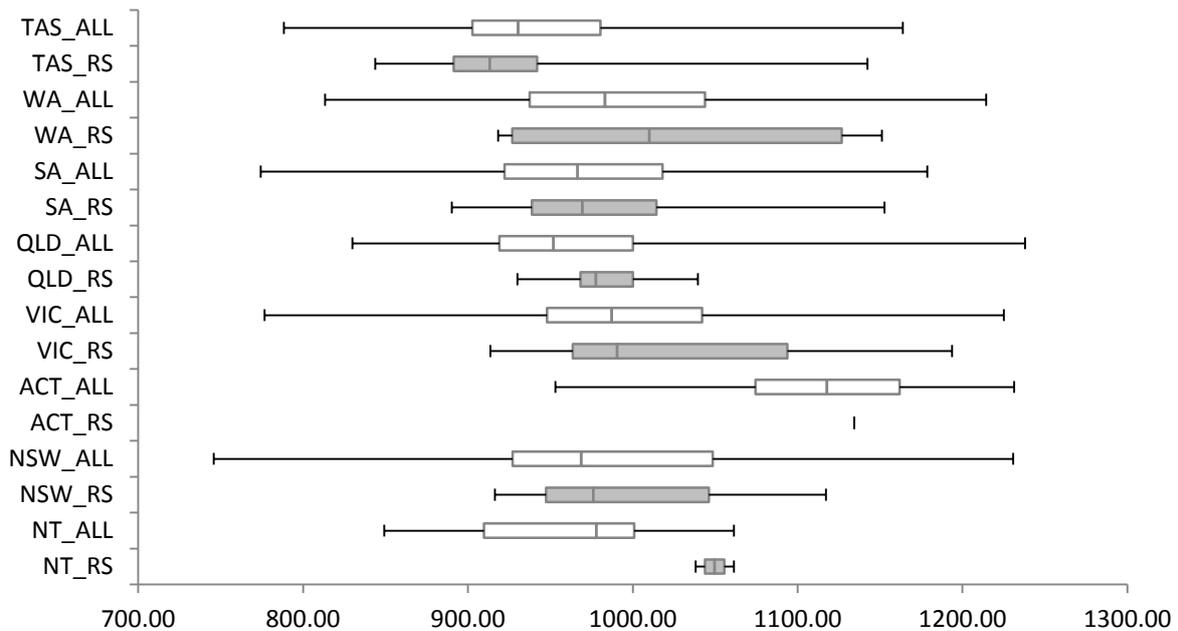


Figure 4: Index of Education and Occupation, distribution by state/territory for all areas (ALL) vs. release sites (RS)

Accessibility/Remoteness Index of Australia

There have been increasing concerns over a number of years about the difficulties faced by Australians living in rural and remote areas in accessing health, welfare and other services that most Australians take for granted. More recently, telecommunications infrastructure is perceived as the lynchpin for achieving socio-economic development (Bandias & Vemuri, 2005). It has been suggested that without appropriate development of telecommunication infrastructure, the disparities already experienced by rural and remote communities will be further exacerbated as the reliance of services over computer-mediated networks increases. This line of thinking has been also supported by the Australian Federal Government. For example, in August 2011, the Standing Committee on Infrastructure and Communications on behalf of the Parliament of Australia put a great emphasis on the significant role of the NBN to ensure greater equity across Australia's communities particularly in regional and rural areas, and for people who are geographically isolated (Parliament of Australia, 2011). Australian Government has been interested in finding out about the concept of remoteness as an important dimension of policy development across the nation, long before the NBN was introduced. In 1997, the Commonwealth Department of Health & Aged Care (DH&AC) commissioned a project designed to measure and classify remoteness in a physical, geographic way. The outcome of that project was the Accessibility/Remoteness Index of Australia (ARIA), developed by the National Key Centre for Social Applications of GIS (GISCA) (ABS, 2001a). The ARIA is an index of remoteness derived from measures of road distance between populated localities and service centres. These road network distance measures are then used to generate a remoteness score for any location in Australia (Raicu, et al., 2011). Since its development, ARIA is increasingly being used by government agencies as a definition of remoteness and is emerging as a defacto standard. More recently, the Australian Bureau of Statistics (ABS) addressed the concept of remoteness, with a view to including it in its classification of areas. The ABS work, also undertaken with GISCA, used ARIA as the underlying methodology for the determination of remoteness. The new classification, described by the ABS as a 'Remoteness Structure', is referred to as ARIA+, and is an update and refinement of the original ARIA (Glover & Tennant, 2003). The purpose of the Remoteness Structure is to provide a classification for the release of statistics that inform policy development by classifying Australia into large regional categories that share common characteristics of remoteness. The categories are (ABS, 2001b):

- □ Major Cities of Australia: with an average Accessibility/Remoteness Index of Australia (ARIA) index value of 0 to 0.2
- Inner Regional Australia: with an average ARIA index value greater than 0.2 and less than or equal to 2.4
- Outer Regional Australia: with an average ARIA index value greater than 2.4 and less than or equal to 5.92

- Remote Australia: with an average ARIA index value greater than 5.92 and less than or equal to 10.53
- Very Remote Australia: with an average ARIA index value greater than 10.53
- Migratory: composed of off-shore, shipping and migratory areas

Department of Health and Aged Care (DHAC, 2001) indicates that, as an index of remoteness that covers the whole of Australia, ARIA+ provides a measure of remoteness (or accessibility to services) that is suitable for a broad range of applications including community service planning, demographic analysis and resource allocation. Following a similar line of thinking, in addition to the spatial-socio-economic analysis already offered in the present paper, the distribution of ARIA scores across the NBN release sites in the Australian states and territories has been examined. The results are presented in Figure 5, and show that so far remote Australia, and very remote Australia has not had any share of the early rollout. However, early rollout is likely to provide some opportunities for a number of localities in inner regional Australia, and outer regional Australia to benefit from the provision of the telecommunication infrastructure, be more competitive in the new economy, and perhaps use it as a driver of growth to address some of the difficulties that Australian regions located outside the major cities have experienced over the years. The fact that a similar opportunity has not been so far offered to remote and very remote localities could potentially intensify the existing concerns about the limitations linked to remoteness in Australia.

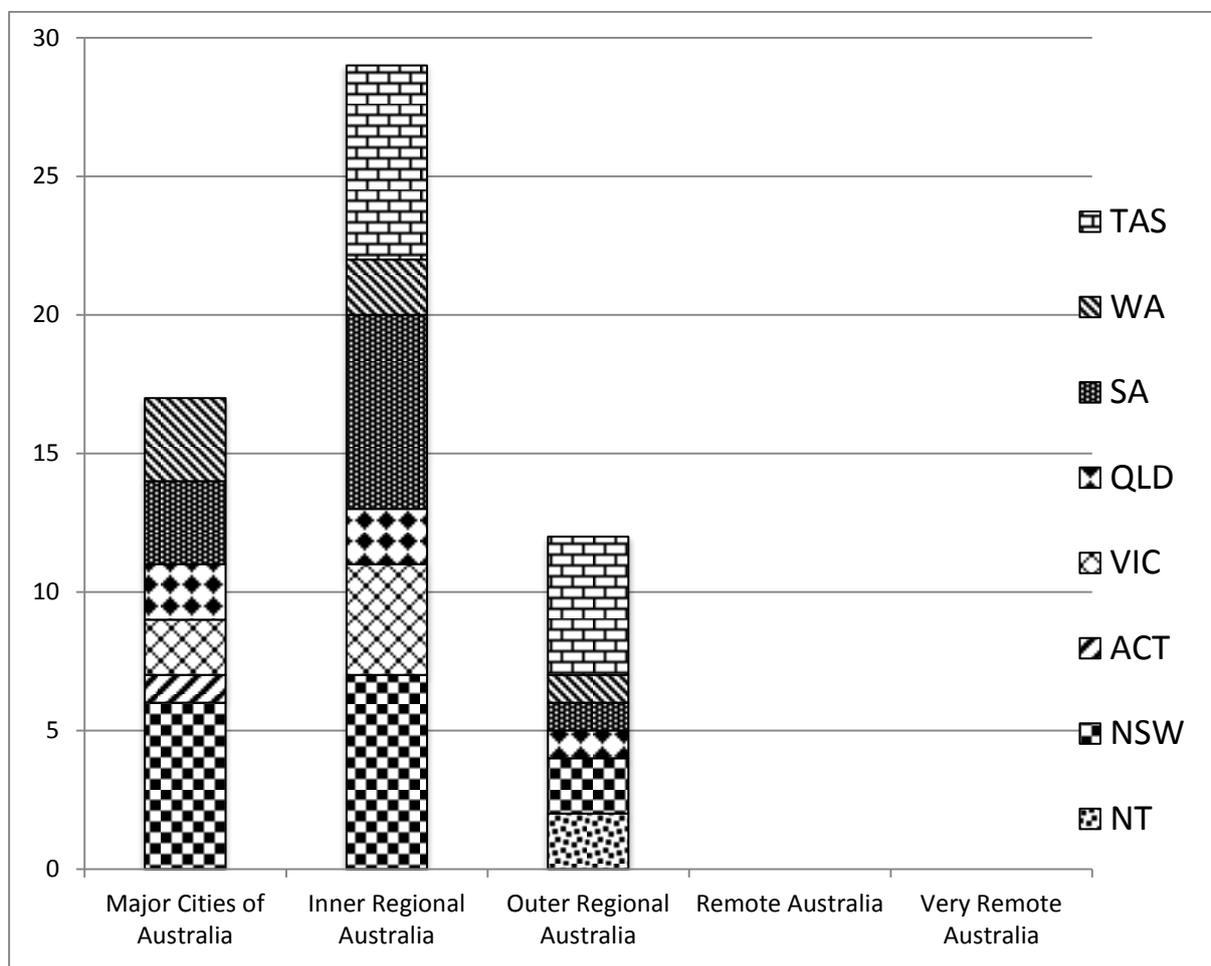


Figure 5: Accessibility/Remoteness Index of Australia, distribution by state/territory for the NBN release sites

Conclusion

The present paper, refers to the international literature investigating the link between telecommunication infrastructure and socio-economic development indicators; and argues that, in the Australian context, early rollout gives the NBN release sites a regional competitive advantage against other localities that might have to wait up to a decade – to the end of the rollout in 2020 - to receive the same infrastructure. In order to understand the ways in which the NBN rollout plan so far is going to affect the current socio-economic divisions across the nation, the paper examines the ranking of the

sixty earlier NBN release sites in the Socio-Economic Indexes for Area (SEIFA), and Accessibility/Remoteness Index of Australia (ARIA). This develops a basic understanding of the socio-economic patterns of the NBN rollout so far, and sets forward a socio-economically sensitive methodology that has the potential of investigating the upcoming stages of large-scale rollout as they are being gradually announced over the next few years. The findings show that early rollout is likely to provide some opportunities for a number of localities in inner regional Australia, and outer regional Australia mostly within the mid range of SEIFA to benefit from the provision of the telecommunication infrastructure, be more competitive in the new economy, and perhaps use it as a driver of growth to address some of the difficulties that Australian regions located outside the major cities have experienced over the years. Nevertheless, the results translates to the scary truth that the most distressed and mostly isolated localities at the bottom of the SEIFA indexes could fall behind even further as a result of a later NBN rollout, if the same pattern was to be followed in the large scale rollout phases. This means that the NBN rollout plan without accounting for the socio-economic status of the release sites could potentially intensify the existing social divisions in the Australian context at least in the short-term and mid-term.

The paper has started with two very important questions about the socio-economic status of the selected sites. The first question was whether they fairly represent the diversity included in the Australian society. The second one closely related to recent urban debates that emphasize the socio-economic justice side of infrastructure formations, and questioned about the degree to which the NBN is presently, or should be, incorporated in planning and policy development for social equity and spatial justice. On the first question, while the analysis of the earlier rollout sites is not comprehensive and broad enough to offer a conclusive answer, the findings are in line with the recent research and emphasizes the role of infrastructure in intensifying social divisions. In other words, the answer for the second question is a resounding yes. The NBN has the potential to have a major impact on the social divisions and it needs to be seriously taken into consideration when it comes to planning for spatial justice.

While the present paper supports the advancement of socially sensitive NBN research, it is cognisant of the critique that has been made of social analyses that are overly reliant on the use of ABS statistics, particularly Census categories (Gibson, et al., 1996). Clearly there is substantial room for methodological refinement and support of better scholarly connections between social systems and telecommunication infrastructure analysis. The inclusion of data on the quality of current telecommunication services (other than NBN) might help to illustrate a more sophisticated understanding of the conceptual concerns outlined above. Perhaps an interesting (and a logical) extension is also to use 2011 SEIFA to test whether the socio-economic status of the early rollout sites have changed since the rollout of the NBN (though change is unlikely due to the NBN given the early stage of the construction). However, the major advancement needed here is that further research should account for the large-scale rollout plans, including but not limited to the recently announced first stage of the large-scale rollout, in order to be able to offer conclusive results. Such investigation will then need to be incorporated in planning and policy development for social equity and spatial justice. It is only then that all Australian communities will get a fair chance of benefiting from the socio-economic opportunities embedded with the telecommunication infrastructure.

References

- ABS, (2001a), "Abs views on remoteness", Canberra: Australian Bureau of Statistics
- ABS, (2001b), "Statistical geography volume 1: Australian standard geographical classification (asgc)", Canberra: Australian Bureau of Statistic
- ABS, (2006a), "An introduction to socio-economic indexes for areas (SEIFA)", Canberra: Australian Bureau of Statistic
- ABS, (2006b), "Socio-economic indexes for areas (SEIFA) - technical paper", Canberra: Australian Bureau of Statistic
- Alizadeh, T., Dodson, J., & Sipe, N., (2011), "Metropolitan planning and NBN: A comparative policy analysis, Sydney vs. Brisbane", Paper presented at the State of Australian Cities National Conference, Melbourne, from: http://www98.griffith.edu.au/dspace/bitstream/handle/10072/43549/74563_1.pdf?sequence=1
- Aschauer, D. A., (1989), "Is public expenditure productive?". *Journal of Monetary Economics* 23, 177-200
- Baker, J., & Adhikari, P., (2007), "Socio-economic indexes for individuals and families", Canberra: Australian Bureau of Statistics

- Bandias, S., & Vemuri, S. R., (2005), "Telecommunications infrastructure facilitating sustainable development of rural and remote communities in northern Australia ". *Telecommunications Policy* 29(2-3), 237-249
- Barr, T., (2008), "Broadband bottleneck: History revisited". *Media International Australia*, 129, 129-139
- Button, K. J., Leitham, S., McQuaid, R. W., & Nelson, J. D., (1995), "Transport and industrial and commercial location.". *Annals of Regional Science*, 29, 189-206
- DBCDE, (2010), "National broadband network, overview", Canberra: Australian Government, Department of Broadband, Communications and the Digital Economy
- DBCDE,(2011), "How were the sites in the 12-month rollout schedule chosen?", Canberra: Department of Broadband, Communications, and Digital Economy, Retrieved 12 Feb, 2012, from <http://www.nbn.gov.au/frequently-asked-questions/nbn-fibre-network-rollout/how-were-the-sites-in-the-12-month-rollout-schedule-chosen/>
- DHAC, (2001), "Measuring remoteness: Accessibility/remoteness index of Australia (aria)", Canberra: Department of Health and Aged Care
- Dodson, J., Gleeson, B., Evans, R., & Sipe, N., (2003), "Transport disadvantage in the Australian metropolis: Towards new concepts and methods". *Infrastructure*, 03, 2-23
- Dodson, J., Gleeson, B., Evans, R., & Sipe, N., (2007), "Investigating the social dimensions of transport disadvantage ii: From concepts to methods through an empirical case study". *Urban Policy and Research*, 25(1), 63-89
- Eskelinena, H., Frankb, L., & Hirvonena, T., (2008), "Does strategy matter? A comparison of broadband rollout policies in finland and sweden". *Telecommunications Policy*, 32(6), 412-421
- Faulhaber, G. R., & Hogendorn, C., (2000), "The market structure of broadband telecommunications". *The Journal of Industrial Economics*, 48, 305-329
- Ford, G. S., & Koutsky, T. M., (2005), "Broadband and economic development: A municipal case study from Florida ". *Review of Urban & Regional Development Studies*, 17(3), 216-229
- Galloway, L., (2007), "Can broadband access rescue the rural economy?". *Journal of Small Business and Enterprise Development*, 14(4), 641-653
- Gerrand, P., (2006), "Accelerating broadband rollout - initiatives in regional spain". *Telecommunications Journal of Australia*, 56(3/4), 84-89
- Gibson, K., Huxley, M., Cameron, J., Costello, L., Fincher, R., Jacobs, J., et al., (1996), "Restructuring difference: Social polarisation and the city", Melbourne: Australian Housing and Urban Research Institute
- Given, J., (2008), "Australia's broadband: How big is the problem?". *Media International Australia*, 127, 6-10
- Glover, J. D., & Tennant, S. K., (2003), "Remote areas statistical geography in Australia: Notes on the accessibility/remoteness index for Australia", Adelaide: Public Health Information Development Unit, the University of Adelaide
- Gramlich, E., (1994), " Infrastructure investment: A review essay". *Journal of Economic Literature*, 32, 1176-1196
- Katz, R. L., Vaterlaus, S., Zenhäusern, P., & Suter, S., (2010), "The impact of broadband on jobs and the german economy". *Intereconomics*, 45(1), 26-34
- Kelly, T., Gray, V., & Minges, M., (2003),"Broadband Korea: Internet case study"(Seoul: International Telecommunications Union
- Kennedy, B., & Firman, D., (2004), "Indigenous SEIFA – revealing the ecological fallacy", Paper presented at the 12th Biennial Conference of Population and Society: Issues, Research and Policy, Canberra, Australia Retrieved: 21 Feb 2013, from: http://www.apa.org.au/upload/2004-4E_Kennedy.pdf
- King, C.,(2011), "Politics or not, no easy answers on NBN rollout", Mildura - Swan Hill, Vic: ABC, Retrieved 9 Feb, 2012, from <http://www.abc.net.au/local/stories/2011/11/22/3373407.htm>
- Lee, H., Oh, S., & Shim, Y., (2005), "Do we need broadband? Impacts of broadband in Korea". *info*, 7(4), 47-56
- Martin, P., (1999), "Public policies, regional inequalities and growth". *Journal of Public Economics*, 73, 85-97
- Martin, P., & Rogers, C. A., (1995), "Industrial location and public infrastructure". *Journal of International Economics*, 39(3-4), 335-362
- McMahon, K., & Salant, P., (2001), "Strategic planning for telecommunications in rural communities". *Rural Development Perspectives*, 14(3)
- Middleton, C., & Chang, S., (2008),"The adoption of broadband internet in Australia and Canada"(In Y. K. Dwivedi, A. Papazafeiropoulou & J. Choudrie (Eds.), *Handbook of research on global diffusion of broadband data transmission* (pp. 820-842), Harrisburg, PA: IGI Global
- Minister's Media Release,(2009), "Tasmania NBN Co limited established", Canberra: Senator the Hon Stephen Conroy, Minister for Broadband, Communications and the Digital Economy,

- Retrieved 8 Feb, 2012, from http://www.minister.dbcde.gov.au/media/media_releases/2009/075
- NBN Co. Ltd., (2009), "National broadband network, information pack", Melbourne
- NBN Co. Ltd.,(2010a), "History of NBN Co", Melbourne: NBN Co. Ltd., Retrieved 12 Feb, 2012, from <http://www.nbnco.com.au/about-us/index.html?icid=pub:hme:about:bod:txt>
- NBN Co. Ltd.,(2010b), "NBN Co announces "first release" sites for high-speed network", Melbourne: NBN Co. Ltd., Retrieved 12 Feb, 2012, from <http://www.nbnco.com.au/news-and-events/news/nbn-co-announces-first-release-sites-for-high-speed-network.html>
- NBN Co. Ltd.,(2011a), "NBN Co releases 12-month national rollout plan", Melbourne: NBN Co. Ltd., Retrieved 12 Feb, 2012, from <http://www.nbnco.com.au/news-and-events/news/nbn-co-releases-12-month-national-rollout-plan.html>
- NBN Co. Ltd.,(2011b), "Start dates announced for NBN second release sites in NSW, Qld, ACT", Melbourne: NBN Co. Ltd., Retrieved 12 Feb, 2012, from <http://www.nbnco.com.au/news-and-events/news/second-release-schedule-3-aug-11.html>
- NBN Co. Ltd.,(2012a), "NBN Co announces next rollout locations", Melbourne: NBN Co. Ltd., Retrieved 12 Feb, 2012, from <http://www.nbnco.com.au/news-and-events/news/nbn-co-announces-next-rollout-locations.html>
- NBN Co. Ltd.,(2012b), "NBN satellite network extends to the outback", Melbourne: NBN Co. Ltd., Retrieved 25 Sept, 2012, from <http://www.nbnco.com.au/news-and-events/news/bourke-satellite-ground-station.html>
- NBN Co. Ltd.,(2012c), "Three year rollout plan for NBN announced", Melbourne: NBN Co. Ltd., Retrieved 12 Dec, 2012, from <http://www.nbnco.com.au/news-and-events/news/nbn-co-announces-three-year-rollout-plan.html>
- Parliament of Australia, (2011), "Broadening the debate : Inquiry into the role and potential of the national broadband network ", Canberra: House of Representatives, Standing Committee on Infrastructure and Communications
- Raicu, R., Taylor, M. A., Meng, L., & Currie, G., (2011), "Scoping study on regional transport in desert Australia", Alice Springs: Ninti One Limited
- Seitz, H., (1995), "The productivity and supply of urban infrastructures". *Annals of Regional Science*, 29, 121-141
- Speta, J. B., (2004), "Commentary: Policy levers and demand drivers in Korea broadband penetration". *Journal of Korean Law*, 4, 1-18
- Strategic Networks Group, (2003), "Economic impact study of the south dundas township fibre network", London: Department of Trade and Industry (DTI). Retrieved 15 April, 2011 from www.berr.gov.uk/files/file13262.pdf
- Willson, P., Marshall, P., & McCann, J., (2009), "Evaluating the economic and social impact of NBN", Paper presented at the 20th Australasian Conference on Information Systems, Melbourne