RMIT University

School of Engineering

GPO Box 2476V
Melbourne VIC 3001
Australia

Joint Parliamentary Committee on the National Broadband Network

Statement

NBN Co and construction partners

Staff are completing a difficult task and their roles have put them in the middle of a political debate. I strong support the people building the NBN, however, in my view there has been considerable grounds to criticise the performance of the NBN Co senior management team.

NBN Co statements to the committee

Statements by NBN Co yesterday regarding multi-technology mix versus FTTP were nonsense and at the end of every statement, Mr Morrow needed to add a qualification that NBN Co is building what the government asked them to build.

Other statements by Mr Morrow beyond his remit attempting to justify FTTN were hyperbole and nonsense. FTTN is obsolete and should not have been used in Australia.

The statements have been shown to be nonsense when a business case looking at infrastructure cost benefit over 30-50 years is taken into account.

If you build FTTP from 2010 to 2020 then the savings to the nation over the next 50 years are many tens of billions. By building MTM there will be a cost to the nation of $10-12 billion to upgrade to FTTP.

The economics of MTM do not hold up to scrutiny and this is why so many countries are building gigabit capable networks today – see notes.

NBN Co's forward projections are overly optimistic and the discrepancy for FY21-FY25 should be explained.

When will FTTC to FTTP be offered? What is the cost of upgrading from FTTN to FTTC? – no answer, no plans, no costing, etc. wishy washy answers highlighting the underlying problems at NBN Co with regards to transparency and waiting for political direction.

The committee should ask NBN Co to respond on notice and provide answers to when FTTC to FTTP will be offered and costings for FTTN to FTTC and FTTC to FTTP.

FTTC to FTTP about $700-$800 average – with qualification.

Also, the committee should ask NBN Co on notice if it would connect a FTTC to FTTP upgrade if the work is completed by a private contractor or a service provider.

Unique opportunity to lift the lid

Department of Communications and the Arts report recently highlighted that 49 Mbps is all that is needed by about 2025 – The committee should request that the Department provide the models and underlying data to the committee – this would permit public scrutiny

This report conveniently supports the earlier 2013/2014 reviews and audits and the government position

This is a unique opportunity to get access to the governments underlying model and data.

The work carried out in 2013/14 that a resulted in about 7 NBN reviews and reports is heavily dependent on flawed data and assumptions. There is a public imperative to get this information into the public domain.

Government

The government's statements that FTTP would cost $30 billion more and take 6-8 years longer are nonsense, blatantly false and deliberately misleading the Australian public. This is one of the reasons why there is a growing call for a Royal Commission into this debacle. see notes.

Business

International

UK and Germany have identified the investment needed to move to FTTC and FTTP – In the background we're seeing moves for government to intervene similar to what happened here

Viability

1. Hansard. FTTP rollout should have sped up over time – NBN Co CEO Bill Morrow last year agreed that it is possible to have rolled FTTP out faster – 30000 per week – and when asked he would have taken up this challenge – see notes.
2. The cost of FTTP is reported by NBN Co as $4400. Historical cost – cost not including Telstra component added to FTTP and reduction due to technology improvements about $3200 and likely to be less than this over time - see notes.
3. 5G – likely to reduce NBN Co connections by 10-15 per cent due to a continual reduction in mobile costs and increased capacity on offer. TPG Networks entering mobile data market now. Argument by NBN Co business case that it expects no change in market share for the next 22 years cannot be justified.
4. Telstra smart modem advertising - https://www.telstra.com.au/broadband/extras/modem
5. AVC / CVC mix should be shifted to a fixed AVC based charge similar to NZ – this would provide pricing certainty, the network to be built and dimensioned accurately and ensure that the consumers experience is significantly improved.

Regional and Remote

Skymuster approx. 427, 000 now - increasing

Vital that a new satellite is ordered now to boost capacity - it would come online in 2024

The reliability of the satellite service is not as good as it should be. A focus needs to be put on improving the consumer experience.

Fixed Wireless network is underperforming and there should be an independent audit of NBN Co's network design and plan to increase coverage and capacity. NBN Co's 100 Mbps product should not be cancelled until such time that the independent audit is completed and in as many areas as possible, the 100 Mbps product should be retained.

Fixed Wireless network is not future proof and the move to cancel the 100 Mbps product highlights the negativity coming from NBN Co related to supporting or offering more than the bare minimum to regional and remote areas.

Number of customers in regional and remote areas expected to grow over time and this will place additional pressure on the service capacity.

The mobile blackspot programs implemented by government over the past couple of decades has been flawed as the result has been government funding to build infrastructure that becomes the property of the funding recipient. NBN Co should be the recipient of the funding to provide transit links and towers for the four mobile cellular providers.

Wireless Internet Service Providers – reallocation should not affect cost, reach and consumer experience

USO – NBN Satellites not designed for voice - two hop for voice, not suitable for voice. A new satellite should provide one hop voice.

Technical

HFC – Optus written off $800 million – the timing on the announcement was convenient – Telstra installation cable bending angle is an ongoing problem

Growth in FTTC is significant now and hopefully this trend will continue.

Chorus video on 100 Mbps - https://blog.chorus.co.nz/the-case-for-100mbps-or-more/

Average bit rate + peak bit rate need to consider both, not just the average bit rate for an application

There is a need for improved broadband monitoring across the different technologies.

Point Topic – example report provided. A copy of the quarterly reports over the past two years would provide valuable information for the committee and I recommend the committee source this information. Note the FTTH figures for new connections, etc.

SIP – wholesale product service standards are defined and met.

NBN Co. 5 dropouts per day of indeterminate length – this is not acceptable for consumers and highlights poor reliability that has become "acceptable".

Connection speed provided by service provider may not ever reach the speed tier now that the new ACCC marketing guidance has been implemented – there was a requirement that this connection speed be met for a

short period each day – likely to occur in off peak times. Both approaches unacceptable as they promote a outcome that is not in the best interests of end users.

Notes

Cost Evolution:

Original 2013 Cost Per Premise Connected (CPPC) was comprised of $1,500 for Local distribution Network (LNDN) and $1,100 for Connection Costs (CC) to give a total of $2,600.

To get to the $4,400 that NBN Co was quoting as the "real" costs NBN Co added in the following:

For LNDN, $100 of project management costs and $131 of OPEX that NBN Co capitalised – pre-2014 had both these numbers in the business case but not in the CPPC.

For CC, $39 of internal labour and $236 of extra costs because NBN Co did very little aerial deployment from to Oct 2014.

So the $2,600 goes to $1,731 + $1,375 = **$3,106**. This is the real like for like comparison.

NBN Co then added $349 for LNDN and $177 for CC agreed variations with the construction contractors in 2014. These are the extra amounts requested by the contractors and the Government agreed in 2014 to pay this to the contractors. Total $526.

NBN Co then added the lease costs of $755 which was in the 2013 business case but in another bucket.

This brings the total to $4,387 or $4,400 as used by Turnbull.

If we use the number of $4,387 and take out the $526 which NBN Co should not have agreed to pay then using NBN Co's accounting method (which is equally valid) and including the lease costs the CPPC would be $3,861.

The 2013 draft NBN Co corporate plan indicated projected cost reductions would take the $3,861 at July 2013 down to $3,415 by July 2018 and then retained this cost for the rest of the rollout. This is not a very aggressive cost reduction profile when you consider the cost reduction achieved by Chorus in New Zealand has been about 40 per cent over five years. This is also consistent with the cost reduction achieved by Verizon in their FTTP rollout.

The $3861 may have reduced to about $2500 based on published overseas experience.

For another analysis of the Government and NBN Co figures see - http://www.abc.net.au/cm/lb/6905096/data/exploding-malcolm-turnbull%25E2%2580%2599s-myths-to-pm-data.pdf

NATIONAL BROADBAND NETWORK - SENATE ESTIMATES

Page 53 Thursday, 23 November 2017

Senator REYNOLDS: Between the FTTP and FTTC, which you were just talking about, does the FTTC deliver similar speeds to the FTTP, and is it cheaper?

Mr Morrow: It is definitely cheaper to build FTTC historically, and I'll explain that, because I don't want to misrepresent this. Historically, our cost for fibre to the premises was $4,400. That would be cheaper today—Senator O'Neill, I want you to know that.

Senator O'NEILL: How much cheaper, Mr Morrow?

Mr Morrow: Probably in the neighbourhood of $500 cheaper, so think of $3,900. If we applied the same tactics that Mr Ryan has applied to bringing fibre out to that neighbourhood entry point, we'd probably be looking somewhere around that $3,900. Fibre to the curb, Senator Reynolds, is less than $3,000, and the speeds will be initially, on our rollout, in the hundreds of megabits per second. With technologies such as G.fast and others that are on the horizon, that will get up to the gigabit-per-second speeds as well. Again, you can see where that fibre to the curb is going to be faster and cheaper than fibre to the premises and offer comparable speeds.

Senator O'NEILL: How much less than $3,000 for FTTC, Mr Morrow?

Mr Morrow: $2,900.

NATIONAL BROADBAND NETWORK - SENATE ESTIMATES

Page 118 Thursday, 24 May 2018

Senator O'NEILL: Mr Morrow, you said on 27 November that NBN could deploy fibre to the premises for $3,900 per premises. That was your evidence. Is that correct?

Mr Morrow: That would be if you took a lot of averages, so I'm being careful with that number. It's kind of the high-level analysis like what I did for the minister before. Yes, that would be roughly it.

Mr Rue: It's an approximation, I suggest.

Senator O'NEILL: That means the underlying construction cost of fibre to the premises would be $3,200. Is

that correct?

Mr Rue: If you take out the Telstra lease and you assume that $3,900 is correct, that would be correct.

Senator O'NEILL: That's the $700 we have been talking about today?

Mr Rue: Correct.

NATIONAL BROADBAND NETWORK - JOINT STANDING - Senate Tuesday, 1 August 2017

Page 66:

Mr Morrow: Because fibre-to-the premises brownfields is largely complete, we are not doing a whole lot of it. I see a lot of questions like, 'Does NBN think this price can come down?' Yes, sure, a little bit, but we are not building anymore. It was $4,400 for the last few that we did—that's the historical cost, and we are

leaving it there. Could we be rolling out at 30,000 FTTP per week? I would hope that we have the capability to do that. It is a process-improvement machine, and we are already seeing improvements with FTTC to be able to reduce that build time and speed up the volume that can run through that. So I would say, yes, we would've been a lot better.

Page 67:

CHAIR: If you had to guarantee how many premises you could make ready for service on fibre to the curb in 12 months, where would you land?

Mr Morrow: I don't know. I'd have to do more analysis to give you that answer. When we first started looking at involving fibre and the experience that we had with fibre to the premises and looking at fibre to the curb, which uses a slightly different approach to putting fibre down in a neighbourhood, the estimate was about 50 weeks. Through this process of improvement and this obsession with, 'What can we do today to make tomorrow better than yesterday?' and the challenge of saying, 'How many FTCs can we get in place to stay within the SOE requirements and the basic three measures that we often talk about?' we were able to reduce that 50 weeks down to 30 weeks, and we are pushing for even quicker than that. We want to get it done even sooner. That helps on cost. If you can pump more out during the same period of time, you can reduce that cost. That is how we have been able to get this price per premises down into the $2,900 range. It is because we are driving a change in the way in which we deploy fibre. We are driving a change in how long it takes. Then, of course, not having to do that lead-in, which was the most painful process of FTTP, saves us $1,100. That's why fibre to the curb is appealing to us. But it's still going to take longer than FTTN as it is today. Maybe that will change in the future, but right now that's where it is.

Page 68:

Senator URQUHART: Mr Morrow, can I just clarify: did you say that you could hit 30,000 per week with FTTP?

Mr Morrow: It's not beyond unthinkable. We didn't analyse it. We stopped building FTTP, so we don't know. If somebody said that's a challenge they'd throw down in front of me, I'd take that challenge.

Mr JOSH WILSON: Going back to the strategic review, the strategic review NBN Co produced at the end of 2013 put different scenarios to government and they were kind of analysed, and it was the MTM one that went forward. Scenario 2, which was subtitled, 'Radically Redesigned FTTP', said:

In this scenario, NBN Co continues to roll out fibre to all premises within the fixed line footprint and makes radical changes to improve its productivity, architecture, materials and construction techniques to increase rollout speed and decrease costs;

Presumably, NBN Co reached an informed view at that point—there would be some analysis in your archives in your keeping that would constitute the detail of that informed view—that the FTTP rollout could have been proceeded with at lower cost and higher speed. That's what the review itself says. Is it possible for NBN Co to consult its archives or the material behind those scenarios and provide some advice to the committee about the detail of that proposed or contemplated radical redesign? It would be very interesting for us to know. Clearly, that was four years ago, and it backs what you were just saying—that the rollout speed would have continued. It would be very interesting to know, based on that scenario, how much quicker and how much cheaper FTTP could have been rolled out.

Mr Morrow: I do recall in the discussions—as Mr Rue pointed out, he and I both came on board after that was completed and issued—that that was taken into account in the scenarios you're looking at there. Fibre to

the premises assumed a certain improvement in time and in cost to be able to calculate what the total peak funding level would be and the rates of returns. But because I was not there, and nor was Mr Rue, we're happy to take that on notice and give you that answer.

If you have any further queries please contact me.

Regards,
Dr Mark A Gregory FIEAust, SMIEEE
Associate Professor

4 June 2018

Attachments follow.

Telstra Smart Modem™

Plug in and connect in minutes. Smart.

Get a more reliable home broadband connection with the Telstra Smart Modem™. It switches from our home network to our mobile network if needed, all while still using your home data allowance.

4G coverage needed. Mobile speeds are limited to 6/1 Mbps and will vary.

Sales: Live Chat

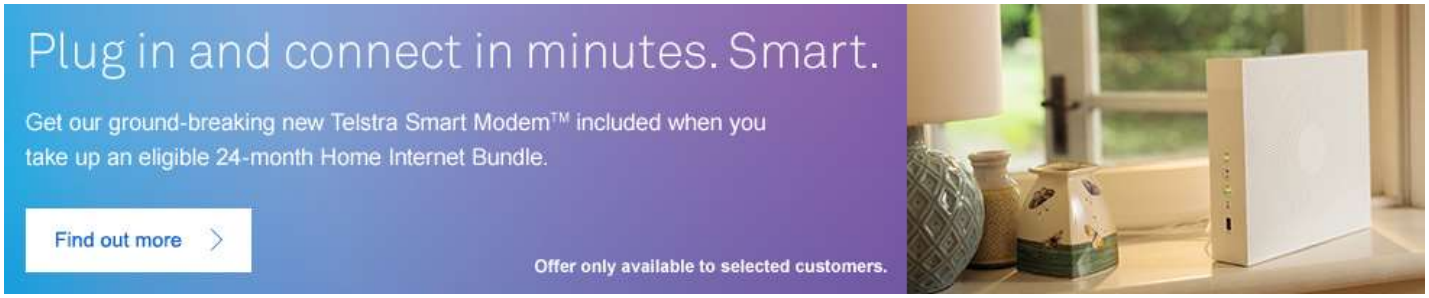
Telstra Smart Modem™

The Telstra Smart Modem™ brings the latest hybrid technology to your home broadband which allows you to:

- Connect sooner: Get online even before your home network is activated with Telstra Smart Modem™. Its inbuilt, pre-activated SIM can connect to our mobile network right out of the box.
- Have a built-in backup plan: No home broadband due to network upgrades or bad weather? Your Telstra Smart Modem™ will automatically switch to our mobile network if required, so you'll be back online in minutes.

What you can do with the Telstra Smart Modem™:

- Access our 4G service on the Telstra Mobile Network using the inbuilt SIM card, as well as your home broadband connection via ADSL2+ or VDSL2
- Enjoy the fastest ratified Wi-Fi standard of 4x4 802.11ac
- Easily pair wireless devices using the WPA push-button connection
- Connect multiple devices to its four gigabit Ethernet ports
- Make fast transfers using the 3.0 USB port
- One DSL Port for ADSL2+ and VDSL2
- Set up a flexible home network with dual band capability (2.4GHz and 5GHz)



Things you need to know

The value of 100Mbp broadband markets

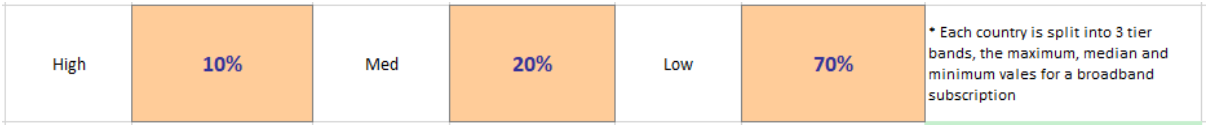
Being able to understand how much revenue can be generated from an area is an important input for anyone's business plans. As operators across the globe are increasingly focusing on deploying superfast broadband with download speeds of 100Mbps and higher, Point Topic has developed a model that allows to assess potential 100Mbps+ broadband subscription revenues that can be generated in a country – the so called revenue headroom.

The EU countries in particular are pursuing the Digital Agenda (DA) targets which focus on making 100Mbps broadband access available to the majority of population by 2020. Hence this version of the model is centred on the potential revenue that can be generated from 100Mbps+ broadband services, once the DA targets are achieved, in selected EU countries. In this instance we are focusing on residential broadband services. The model can be extended to the pan-European and global scale as well as adapted to other services (for example, business broadband, TV etc) and different time scales.

The model combines data from two of our services - Global Broadband Statistics and Broadband Operators and Tariffs - as well as other inputs such as the DA targets related to 100Mbps+ broadband and the estimated total households in 2020 in each country. The model is based on the split of broadband subscribers by tiers of tariffs they subscribe to (monthly subscriptions). It is assumed that the countries will achieve their broadband coverage targets on time and that the monthly subscriptions (tariffs) will remain at levels similar to the current ones. The calculations are based on Point Topic's tariff and subscriber data as of mid-2017. All tariffs used in this model are at USD$ PPP rates.

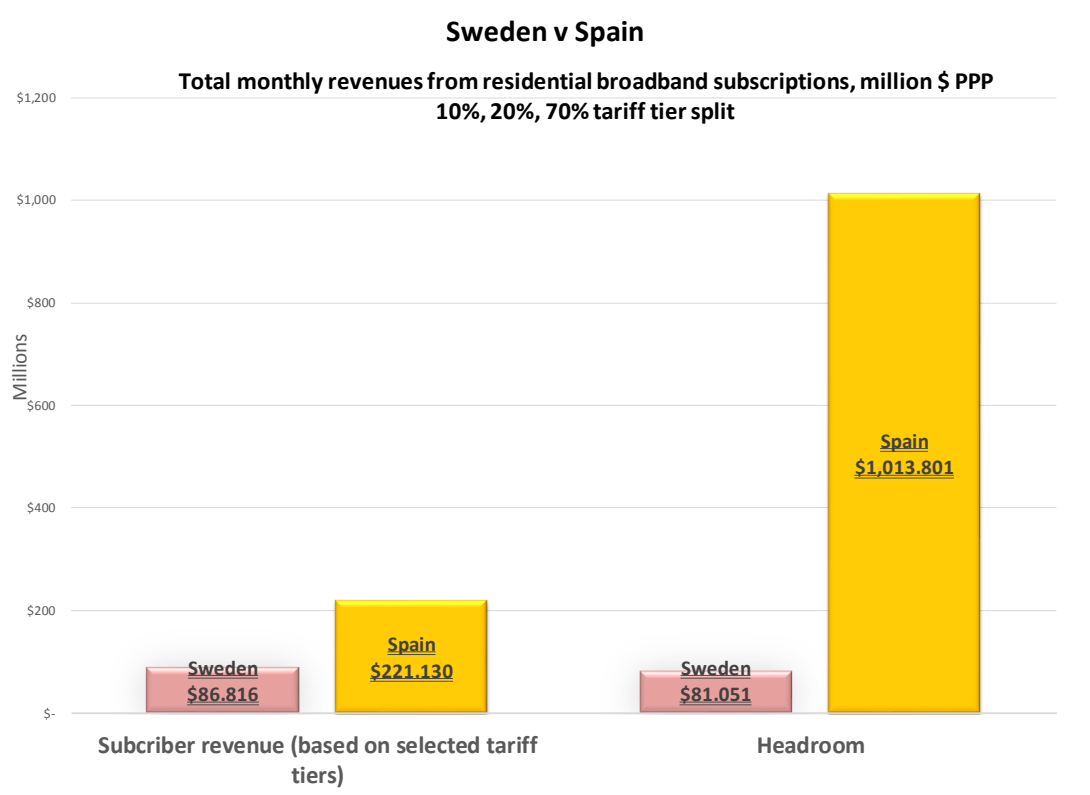
Tariff tier assumptions and the resulting revenue headroom

In this first example we set the tariff tier split as follows:



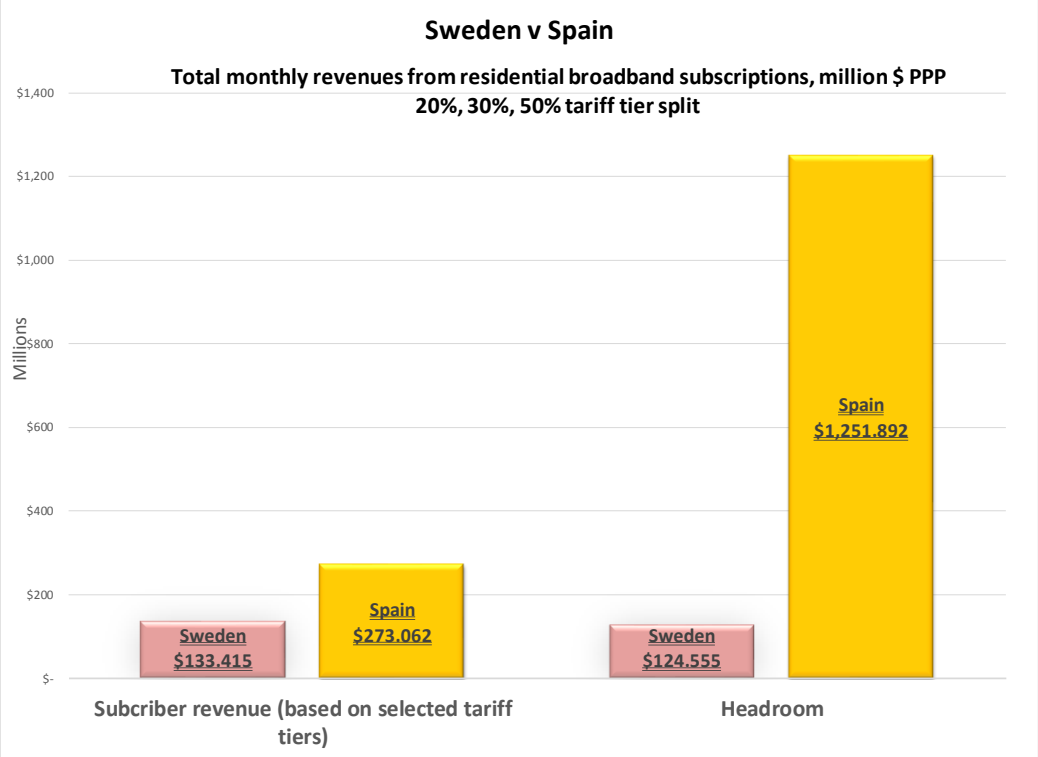
So, we assume that 10% of residential broadband subscribers take the most expensive 100Mbps+ services with 20% taking the mid-price ones and 70% go for the lowest monthly subscriptions.

In this example we compare two selected countries – Sweden and Spain.



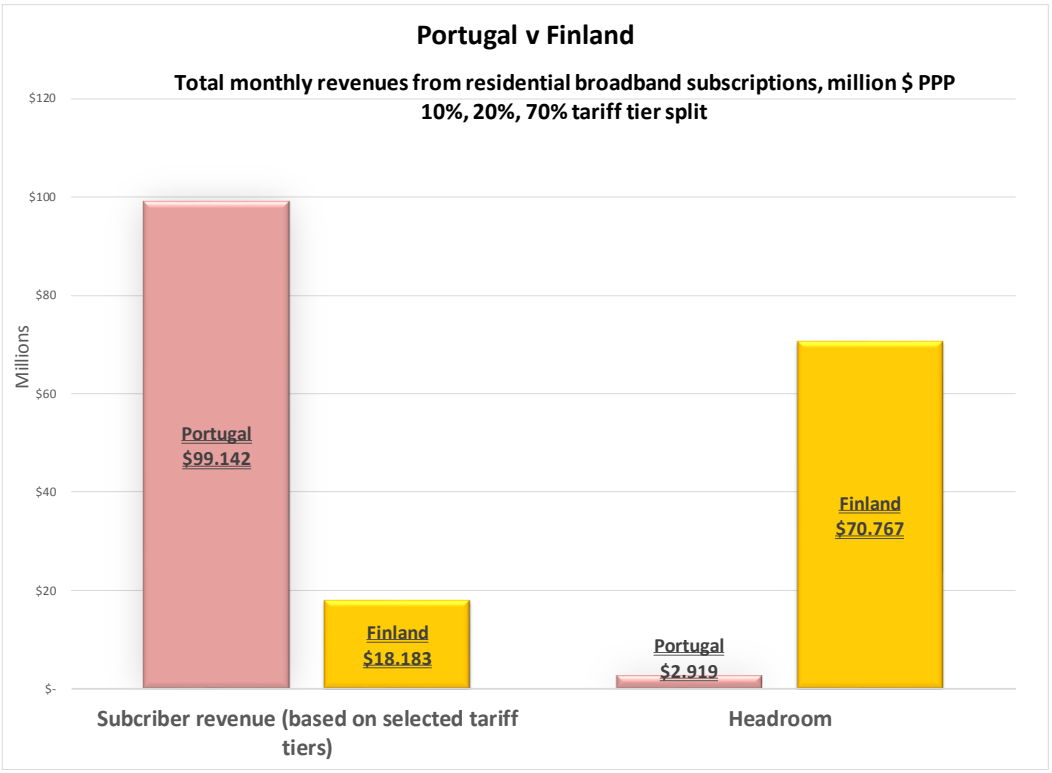
With the tariff tiers set as above, Spanish operators are generating nearly three times more revenue from 100Mbps+ residential broadband services compared to Sweden - $221m and $87m (PPP) respectively. Also, potential additional revenue that could be generated from such services once the DA targets are achieved is dramatically higher in Spain - $1.014bn compared to Sweden's $81m (PPP). The difference is caused by the much larger addressable market in Spain as well as the fact that only 18% of the total Spanish households targeted with 100Mbps+ services (100% by 2020 according to DA targets) were signed up to such services as of the end of Q2 2017. In Sweden, which aims to cover 95% of households with 100Mbps+ services by 2020, as many as 52% of households were already using such services as of Q2 2017. Hence the potential for additional revenue there is much lower.

If we adjust the tariff tiers to 20%, 30%, 50% for example, we get the following results.



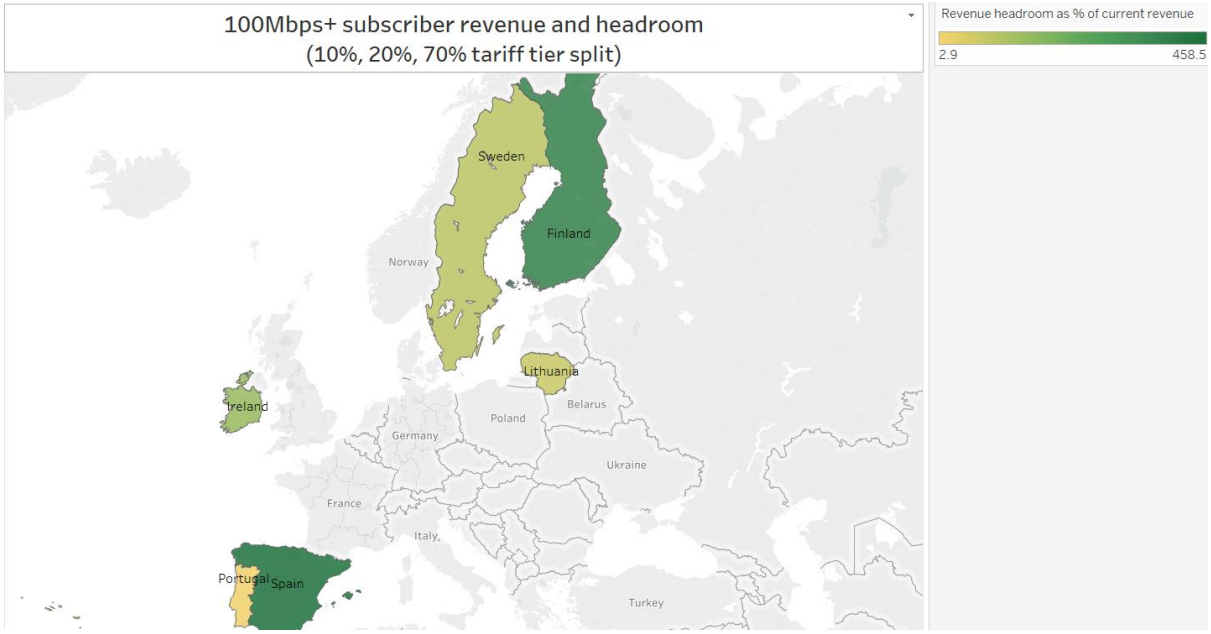
If Swedish operators were able to persuade 100Mbps+ subscribers to move up the subscription tier ladder they would increase their revenue relatively more - by 54% compared to 23% in Spain.

We also noticed some seemingly unexpected results.



With the tier splits set at 10%, 20% and 70% we can see that Finland has much more revenue headroom than Portugal, although current revenue in Portugal is much higher than in Finland. This is the case because Portugal's 100Mbps+ coverage target by 2020 is only 50% while Finland targets 99% of households, so there is more room for growth there. At the same time, 97% of targeted households in Portugal are already subscribing to 100Mbps+ services. In Finland, this figure is only 20% (Q2 2017).

The complete picture of the selected countries is shown in the map below.



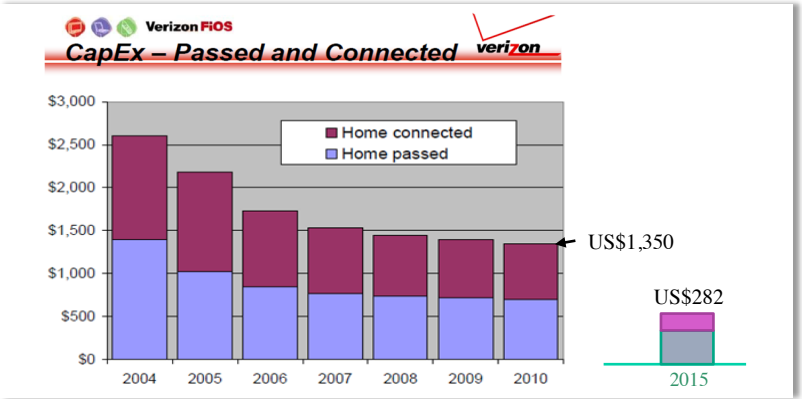
The interactive version of the map can be accessed here.

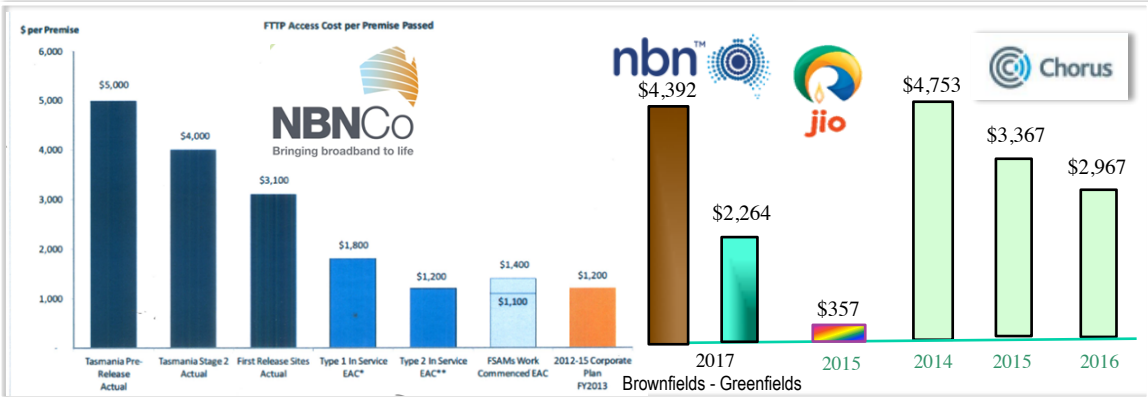
Of course, some countries will exceed or miss their DA targets which means the revenue headroom will increase or decrease. The model will be updated as new data becomes available. Another caveat is that the actual take-up of 100Mbps+ broadband services will likely be lower than the maximum households possible, at least by 2020. This model estimates the maximum revenue headroom possible. It is down to the operators to convince all eligible consumers to migrate to the superfast plans.

We have made this model available publicly to demonstrate how data from different Point Topic's services can be combined to produce interesting insights. Other countries and tariff tiers can be compared using the attached spreadsheet. We would welcome feedback on info@point-topic.com

An extended version of this model will be made available to Point Topic subscribers. It will provide more depth, ability to compare more countries and operators, updated coverage estimates and access to our estimates of addressable audience.

Comparisons of Cost per Premises Passed





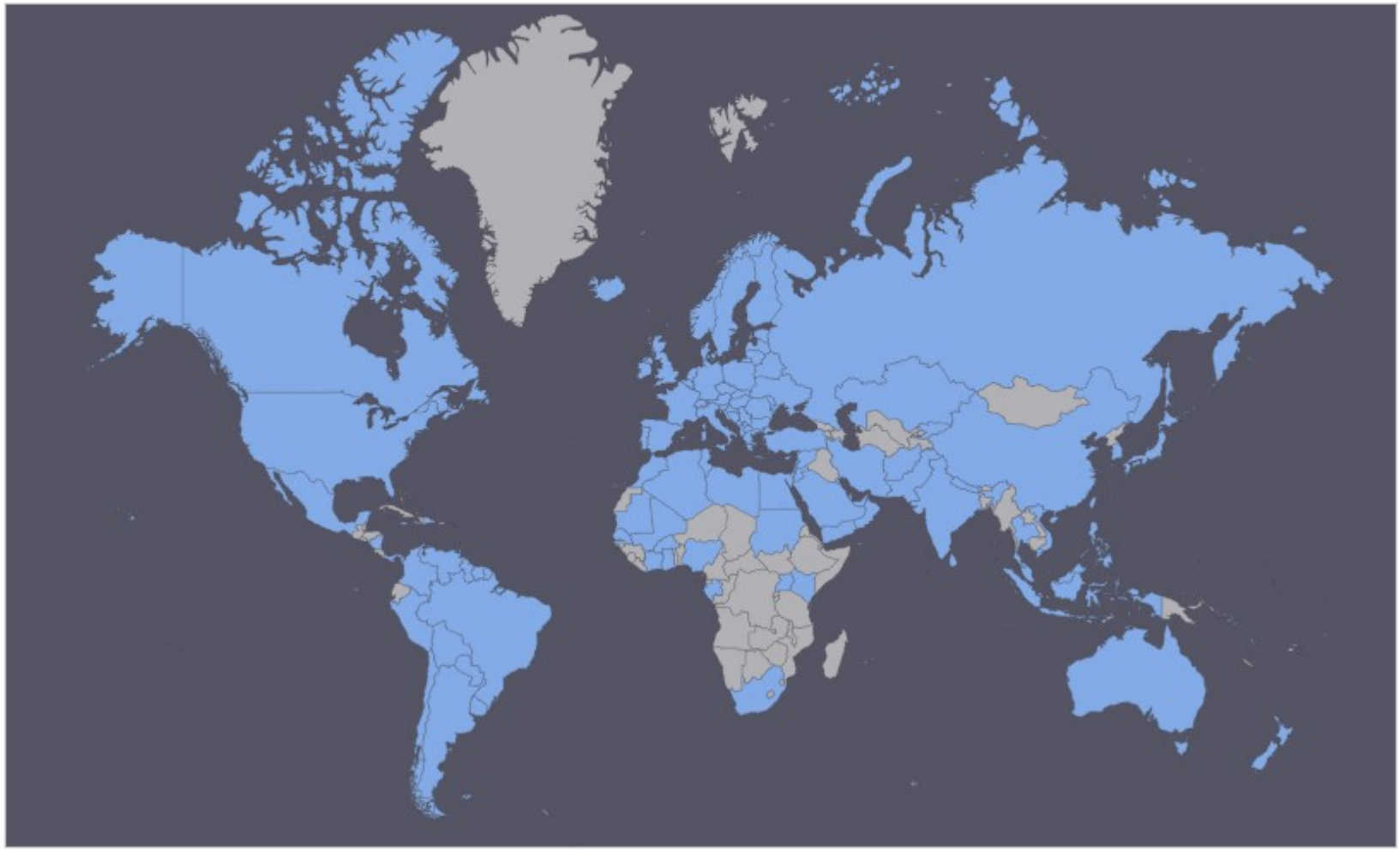
PJF

point-topic.com/our-services/point-topics-triple-play-package-three-products-one-price/

The **Double Play** option, combining any of the two services, is also available.

What countries Point Topic data covers?

We cover most of the world (marked blue in the map below), with new countries added regularly.



Geography of PT data coverage

point-topic.com/wp-content/uploads/2017/11/tableau.png

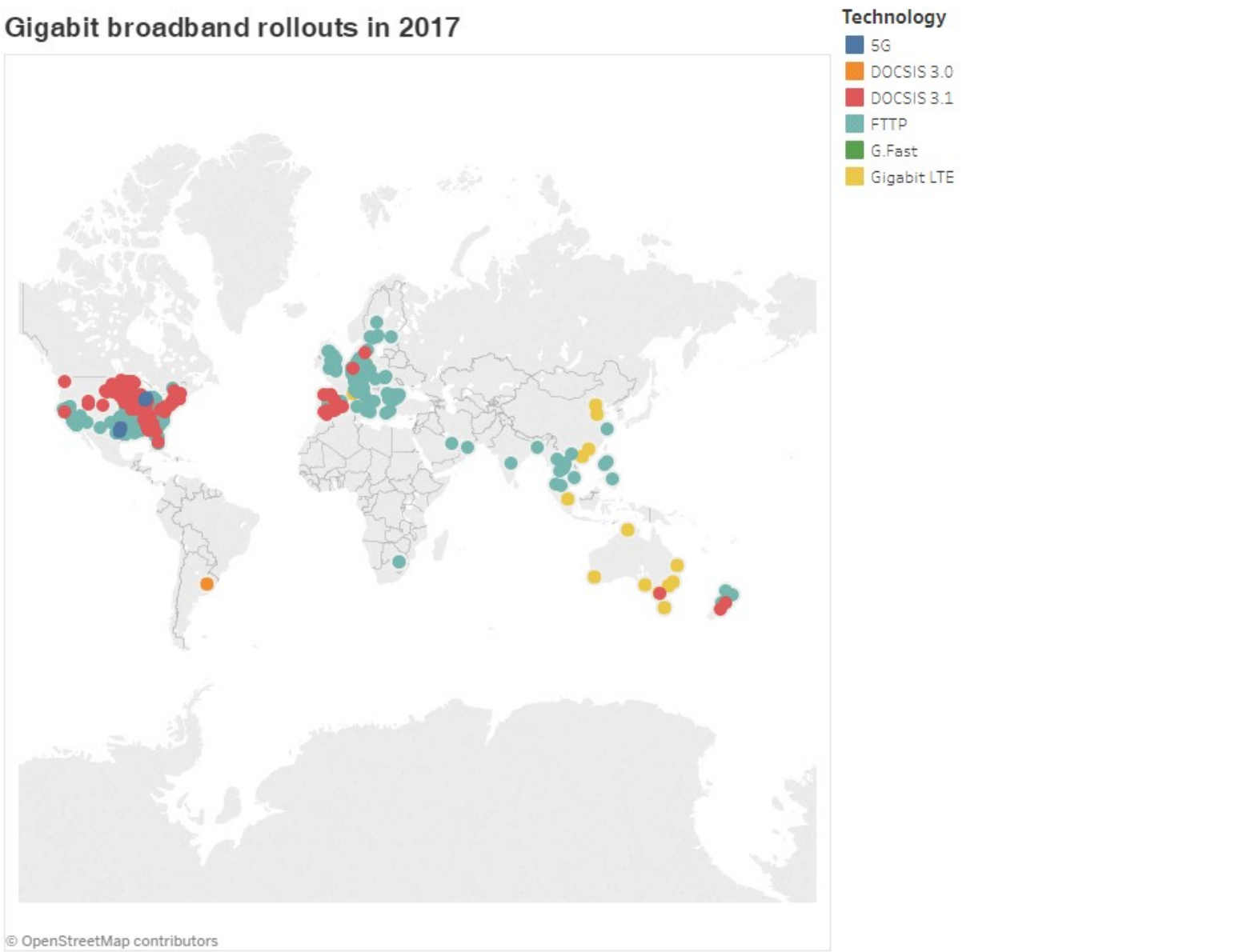
point-topic.com/our-services/point-topics-triple-play-packages-base-products-one-price/

Point Topic – Valuing 100Mbps market

Back to top

Gigabit broadband rollouts in 2017

A map showing 1Gbps broadband coverage by location, operator and technology around the world. The map was last updated in November 2017.



Australian Journal of Telecommunications and the Digital Economy

Australian Wholesale Telecommunications Reforms

Mark A. Gregory
RMIT University

Abstract: The Australian telecommunications market has been reshaped with the introduction of the National Broadband Network (NBN), arguably a short-term renationalisation of the fixed-access telecommunications infrastructure. The NBN rollout commenced in 2009 and is expected to be completed by 2021. The telecommunications market has evolved rapidly as the NBN has taken shape and it is anticipated that the telecommunications industry will seek a period of certainty following the NBN's completion. This paper considers what the government of the day should do with the NBN after the NBN is built and fully operational in 2022. It discusses four options for the ownership of NBN Co beyond 2022 and describes arguments for and against each option. Telecommunications provides an essential service, is central to the nation's participation in the global digital economy, and the management of telecommunications infrastructure is a national priority.

Keywords: Telecommunications, Wholesale, National Broadband Network, Policy, Regulation

Introduction

This paper investigates whether there is a need for further telecommunications market reforms to coincide with the completion of the Australian Government initiative to roll out a National Broadband Network (NBN) (DCA, 2018b).

There are a range of options for how the telecommunications market reforms might occur and the potential benefits vary depending on the weight given to various factors, including what's best for the nation, long-term interest of end users, infrastructure security, market value and future competition.

Telecommunications market reforms should provide an opportunity to remove impediments to a fair, open and competitive telecommunications market whilst providing outcomes that are in the long-term interests of end users.

A fair, open and competitive telecommunications market can be elusive and hard to achieve depending on a range of factors including the political, social and economic circumstances at the time that a nation embarks on a process of telecommunications market reform.

http://doi.org/10.18080/ajtde.v6n2.155

Telecommunications is an essential service, and telecommunications infrastructure is a national asset that fulfils a vital role, providing telecommunications services that underpin the economy, emergency response, government, business, industry and national security.

The Australian telecommunications market has been subjected to specific policies that are highly contentious and grounded in neo-liberalism, resulting in widely discredited conceptual policy frameworks (Gregory, 2014b). The chaotic telecommunications legislative and regulatory environment is a result of ideology-driven political intervention, the result of which has been a lack of certainty for the telecommunications industry and consumers (ABC, 2014; Durie, 2017; Penn, 2017; Biddington, 2018).

Telecommunications Deregulation

For many nations the telecommunications deregulation process commenced 25 years or more ago, when government-owned telecommunications providers were wholly or partially sold off and privatised telecommunications markets were created. This process was not uniform and the result was a global mix of privatised telecommunications markets struggling with aspects of their unique formulation (Kautsarina, 2017; Hansen, 2017; Middleton, 2017; McLaren, 2017; Saenz De Miera, 2017; McDonough, 2017).

Governments introduced legislation and regulation to support the formation of new telecommunications markets that were intended to provide a fair, open and competitive landscape into which new and existing companies could invest, build networks and grow market share.

To support the new relationship between the government, telecommunications industry and consumers, key regulatory, dispute-resolution and industry bodies were either put in place or enhanced to provide the necessary glue and balance between the parties in this new telecommunications environment.

The government department responsible for telecommunications interacts with the regulatory bodies, state and local government and other organisations, including consumer groups, to formulate legislation and regulations (DCA, 2018a).

Two independent statutory bodies in Australia provide an umbrella under which the telecommunications industry operates. The Australian Competition and Consumer Commission (ACCC) is responsible for competition and consumer protection (ACCC, 2018a) and the Australian Communications and Media Authority (ACMA) is responsible for the technical operations, including technical standards, codes of practice, spectrum management, industry operations levies, rules and public-interest activities (ACMA, 2018).

http://doi.org/10.18080/ajtde.v6n2.155

Key points of interaction with the telecommunications industry are provided by two bodies. The first is an independent telecommunications industry ombudsman formed as a public company that is funded by its industry members to handle consumer complaints categorised in its charter, with powers to impose fines on members and compensate consumers under the enabling legislation (TIO, 2018).

The second is an industry body formed to provide a point of contact, forum, codes of practice and self-regulatory initiatives (CA, 2018). The Australian telecommunications industry body, Communications Alliance, "was formed to provide a unified voice for the Australian communications industry and to lead it into the next generation of converging networks, technologies and services" (CA, 2018).

Due to the membership, financial contribution and voting rules, industry bodies may fragment at times when there is a perceived need to highlight issues or industry segments. Over the past decade, additional Australian telecommunications industry bodies and lobby groups have been formed, including the Competitive Carriers Coalition (CCC) (CCC, 2018) and the Australian Mobile Telecommunications Association (AMTA, 2018).

The CCC states on its website that "communications competition in Australia appears to be stagnating, leaving consumers with internationally uncompetitive prices and services. This requires the Federal Government to review the adequacy of policy in a post NBN, post convergence world, and the ACCC to take a strong line in addressing prices that remain out of line with international benchmarks" (CCC, 2018).

The AMTA states that it "is the peak industry body representing Australia's mobile telecommunications industry. AMTA members include mobile Carriage Service Providers (CSPs), handset manufacturers, retail outlets, network equipment suppliers and other suppliers to the industry" (AMTA, 2018).

The telecommunications deregulation process is ongoing and the interaction between government, the industry and consumers can be dynamic, as governments introduce, amend and repeal legislation and regulation depending on their ideology, feedback from the industry and consumers and as a result of input from expert panels, committees and reviews (TLADB, 2014).

Telecommunications deregulation has provided a fertile area for research and opinion that provides a valuable insight into the understanding of the process at the time (McCormick, 1996) and the outcomes, including how deregulation affects the labour market (Batt, 1998).

Argument that deregulation is a panacea for reducing costs and increasing competition is ongoing, substantial and can, at times, be undermined by the industry that is supposed to

http://doi.org/10.18080/ajtde.v6n2.155

benefit from the deregulation process due to the non-homogeneity of direction taken by companies that make up the industry.

The conclusions put forward by Hausman and Taylor (Hausman, 2012), in their analysis of Kahn's seminal works on regulation and deregulation, including *The Economics of Regulation* (Kahn, 1988), *Lessons from Deregulation* (Kahn, 2004), *Network Neutrality* (Kahn, 2007), include:

- "prices must be informed by costs; costs are actual incremental costs; costs and prices are an outcome of a Schumpeterian competitive process, not the starting point; excluding incumbents from markets is fundamentally anticompetitive.
- a regulatory transition to deregulation entails propensities to micromanage the process to generate preferred outcomes, visible competitors and expedient price reductions.
- where effective competition takes place among platforms characterized by sunk investment—land-line telephony, cable and wireless—traditional regulation is unnecessary and likely to be anticompetitive."

Kahn reached a conclusion that different industries require different mixes of institutional arrangements that cannot be decided on the basis of ideology (Kahn, 1988). Kahn's body of work and the conclusions reached by Hausman and Taylor reflect much of the economic argument regarding deregulation put forward over the past thirty years, and is applicable to most industries. As pointed out by Kahn, where effective competition does not take place among platforms characterized by sunk investment, regulation is necessary.

The regulator may regulate telecommunication products and services because of the prohibitive cost of infrastructure, competitive access to infrastructure, providing products and services into areas of low customer density, new technologies, a dominant market participant and other factors.

As an example, the Australian NBN partially originated because of Telstra's refusal to upgrade the fixed-line network (Gregory, 2017) after putting a complex and expensive plan to government that resulted in a Government demand that potential support would be contingent upon Telstra agreeing to horizontal structural separation.

Telstra, the incumbent telecommunications company, argued that fixed-line infrastructure investment would benefit its competitors and undermine Telstra's position due to the potential for the new infrastructure to be regulated in terms of price and access (Hogan, 2006; AAP, 2007; Dodson, 2005; Bartholomeusz, 2006).

http://doi.org/10.18080/ajtde.v6n2.155

Telstra's assessment was correct, but it was in the position it found itself due to a Government failure early in the deregulation process to identify the future problems associated with a single company owning most of the fixed-line infrastructure and facilities.

After the Howard Government had failed to resolve the impasse with Telstra, the Rudd Government decided to create a government business enterprise (GBE) to build a new wholesale fixed-line access network, effectively renationalising fixed-line telecommunications to residential and small business premises.

Australia's telecommunications deregulation journey has taken more than 25 years. It is arguable that, until the NBN is built and fully operational, the telecommunications deregulation process will be ongoing. Telecommunications, as an essential service, will always remain a regulated market because of its nature and market structure, although the nature and intensity of regulation will inevitably change in future, as it has in the past 25 years.

As the deregulation process occurs there is a need to constantly review how a fair, open and competitive telecommunications market will be achieved whilst providing outcomes that are in the long-term interests of the nation and end users.

The Australian telecommunications Universal Service Obligation (USO) (USO, 2018) is one example of government intervention related to fairness and equality of access. Government intervention programs related to fairness and the national interest have evolved to meet new circumstances such as the current and ongoing need to provide universal access to telecommunications and digital services (Gregory, 2015a).

NBN Completion Date

NBN Co updates its rollout planned availability dates in response to a range of factors associated with the multi-technology mix approach adopted after the September 2013 Federal election. Key amongst the factors has been the remediation cost of the Hybrid Fibre Coax (HFC) networks purchased by NBN Co from Telstra and Optus and the remediation cost of the copper to be used in the Fibre-to-the-Node (FTTN) networks. The decision to add Fibre to the Curb (FTTC) to the multi-technology mix solution has meant that some areas previously zoned to receive HFC and FTTN have been rezoned as FTTC. NBN Co rollout and planned availability of service now extends into mid-2020.

The Migration Assurance Framework – Telecommunications Industry Guide (MAF, 2017) states that "once nbn declares an area to be Ready For Service (RFS), customers, whether households or businesses generally have 18 months to migrate their voice, broadband and over the top services to the NBN or alternative telecommunications network. This 18 month period is known as the migration window".

http://doi.org/10.18080/ajtde.v6n2.155

The migration window was originally linked to the Subscriber Agreement section of the binding definitive agreement between NBN Co and Telstra signed on 23 June 2011 (NBNCO, 2011). A summary stated:

> "In broad terms, the disconnection [of the legacy access network excluding Pay TV services] must be completed within 18 months of NBN Co declaring that rollout region to be ready for service (which cannot happen until at least 90% of the premises in that rollout region are passed by NBN Co fibre). A separate regime (with a different time frame for disconnection) applies to disconnection of special services provided over the copper Customer Access Network. Disconnection protocols have been agreed to govern this."

A key change in the revised Definitive Agreements signed by NBN Co and Telstra on 14 December 2014 (Turnbull, 2014a) was to the section affecting the copper and HFC networks: (Telstra, 2014)

> "Original DAs (June 2011) - Disconnected 18 months after an area is declared Ready for Service by NBN Co.
>
> Revised DAs (Dec 2014) – Rollout regions with FTTP, FTTN and/or HFC deployment:
>
> > Disconnected 18 months after an area is declared Ready for Service by NBN Co.
> >
> > Ownership of relevant copper and HFC assets progressively transferred to NBN Co such that it owns them as at the Ready for Service date."

Under the revised Definitive Agreements, Telstra and Optus would progressively transfer ownership and maintenance of the copper and HFC networks to NBN Co as the NBN rollout occurs in each area.

The Migration Assurance Framework statement that "households or businesses generally have 18 months to migrate their voice, broadband and over the top services to the NBN or alternative telecommunications network" appears to uphold the original principle that customers would have a window of opportunity to transition to the NBN.

The NBN will not be built and fully operational until early 2022 based on the latest rollout planned availability and migration window. To argue that the NBN is built and fully operational when the last rollout area is deemed "ready for service" (or using NBN Co's most recent variation "ready to connect") before the end of the migration window in all rollout areas and before the legacy network disconnection has occurred, is not justifiable. The NBN build, including customer premises broadband connections, legacy equipment connections and remediation associated with connection problems identified when customers move to the NBN, that would be expected to occur as a result of the NBN rollout and first use of a

http://doi.org/10.18080/ajtde.v6n2.155

connection during the migration window, may not have been completed. Also, the VDSL2 equipment used for the FTTN connections cannot be switched over to vectoring mode until the legacy network disconnection has occurred. The NBN is therefore not fully operational until the migration window is closed.

NBN Sale Requirements

According to the *National Broadband Network Companies Act 2011*, the NBN can be sold when (NBN, 2011; DCA, 2018b):

- "the Minister for Communications declares that the nbn is built and fully operational;
- the Productivity Commission has an inquiry into regulatory, budgetary, consumer and competition matters relating to the nbn;
- a Parliamentary Joint Committee considers the findings of that report;
- the Minister for Finance makes a disallowable declaration that conditions are suitable to sell nbn; and
- Parliament doesn't disallow that declaration."

The NBN sale requirements include the requirement for a Productivity Commission inquiry that would be anticipated to take 12 months based on the similarly scoped Productivity Commission Inquiry into the Telecommunications Universal Service Obligation (PC, 2017).

A consideration for the NBN sale is the "off budget" Government peak funding of $48.7 billion that is broken into two components: equity funding of $29.5 billion; and debt funding of $19.2 billion (NBNCO, 2017). It is possible that one or more of the options discussed in this paper might require that the Government's contribution to NBN Co be brought "on-budget" or partially or wholly written off.

The final NBN sale requirement indicates that, for the NBN sale to proceed, approval from both Houses of Parliament is required, potentially slowing or halting a Government-initiated sale process.

Customer Connections

In response to a question with notice (number 175) (SECEC, 2017a) at the Senate Estimates Committee on the Environment and Communications, NBN Co stated on 12 January 2018 that the "estimated proportion (%) of premises who can access layer 2 speed of 100 Mbps or more by rollout completion" was:

- FTTP – 100%

http://doi.org/10.18080/ajtde.v6n2.155

- FTTN – 24%
- FTTB (Fibre to the Building) – 100%
- FTTC – 100%
- HFC – 100%
- Fixed Wireless – 50%
- Satellite – 0%

On 24 May 2018, at a Senate Estimates Committee hearing, NBN Co CEO Bill Morrow indicated that the fixed wireless 100 Mbps speed product was withdrawn (SECEC, 2018).

The NBN Co Corporate Plan 2018-2021 (NBNCO, 2017) states that, in FY21 (1 July 2020—30 June 2021), 11.7 million premises will be ready for service with:

- FTTP Brownfields – 1.2 million;
- FTTP Greenfields – 0.8 million;
- FTTN/B – 4.6 million;
- FTTC – 1.0 million;
- HFC – 3.1 million;
- Fixed Wireless – 0.6 million;
- Satellite – 0.4 million.

On 10 April 2018, NBN Co announced (NBNCO, 2018a) that the FTTC footprint would increase by an additional 440,000 premises. The media release stated that "these premises are inside or adjacent to existing Telstra HFC network coverage but are not able to connect to the Telstra HFC network". NBN Co CEO Bill Morrow stated that "we are also excited to announce we will be expanding FTTC to cover an additional 440,000 in areas where some long-copper FTTN and new HFC lead-ins were previously planned."

Telstra

NBN Co and Telstra are inextricably linked because of NBN Co's genesis and the annual, leasing payments that NBN Co makes to Telstra to utilise Telstra's infrastructure and facilities. Mr Morrow and NBN Co Chief Financial Officer, Stephen Rue, revealed the leasing arrangement cost of $15 per customer per month at a Senate estimates hearing on 24 October 2017 (SECEC, 2017b).

http://doi.org/10.18080/ajtde.v6n2.155

In 2016, ratings agency Moody's indicated that Telstra would struggle to fill a $2-3 billion earnings gap when the NBN is built and fully operational. Moody's estimated that Telstra's ongoing loss of revenue from its wholesale business would be about $700 million per annum. Telstra would also have to pay NBN Co for wholesale access to customers, further eroding pre-tax profits (ABC, 2016a).

In 2012, Telecom NZ split into Spark (retail) and Chorus (wholesale). Spark and Chorus have found their feet since the split and are performing well. Spark and Chorus have a focus and, as smaller businesses, they have become more agile and able to compete in New Zealand's rapidly changing telecommunications market.

Spark's share price today (June 2018) is $3.25 after falling to $1.50 in late 2011 when Chorus was split off. In late 2011, Chorus was at $2.53 and, after a period of consolidation, investment and growth, it is now at $3.76.

Over the same period, Telstra's share price has risen from $3.12 in late 2011 to $6.59 in February 2015 and fallen back to $2.87 on 15 May 2018.

On 28 May 2018, Telstra's long-term rating was downgraded by Standard and Poor's from A to A-, with the short-term rating falling from A-1 to A-2 (ABC, 2018).

A 2012 decision by the Australian Competition and Consumer Commission (ACCC) (ACCC, 2018) to increase the number of Points of Interconnect (PoI) to the NBN to 121, from NBN Co's proposed 14, meant that the existing transit networks, including Telstra's extensive transit network, became a factor in the overall cost of access to consumers.

To alleviate this situation the Government rolled out additional transit links in areas where Telstra was the only transit link provider and the ACCC carried out a domestic transmission capacity service declaration inquiry that resulted in some of the transit links being price regulated (ACCC, 2014a). The current declaration extends to 31 March 2019. It is not anticipated that there would be a major change to the status quo resulting from the 2019 review.

For Telstra, the decision by the Abbott Government in September 2013 to adopt the multi-technology mix NBN plan has made the future more complicated because the homogenous reliable, high speed and high capacity all-fibre NBN is not available as a platform upon which Telstra can provide new and innovative digital products and services (Gregory, 2012).

Telstra's foreign ownership restrictions are likely to come under scrutiny as part of any sale of the NBN. By 2022, the NBN will be built and fully operational and, if the Turnbull Government wins the next Federal election (due by May 2019), there is likely to be a replacement program for the Universal Service Obligation (USO, 2018; PC, 2017), removing the concept that Telstra

http://doi.org/10.18080/ajtde.v6n2.155

is the "service provider of last resort". The foreign ownership restrictions that apply to Telstra state that "no more than 35% of its shares may be held by foreign entities and no more than 5% by any single foreign entity" (Lattey, 2017, p. 14).

Telstra resisted upgrading its access network infrastructure for more than a decade between 1996 and 2007 and has continued until recently (see Endnote) to resist splitting the company into two companies, one retail and one wholesale (Gerrand, 2004; Gerrand, 2017; Gregory, 2014a; Gregory, 2014b; Gregory, 2018a).

Wholesale Reform

The future of the NBN after it is built and fully operational is central to the formation of an Australian wholesale telecommunications reform package designed to provide the telecommunications industry with certainty in the decades to come.

With the advent of the NBN, there has been increased competition (about 180 service providers (Duke, 2017)) and disruption in the retail telecommunications market that has motivated the retail service providers, led by Telstra (Smith, 2017b), to begin the process to move beyond handsets and bitstream.

A key shift has occurred in the telecommunications market, the advent of "unlimited" broadband plans. The increased competition in the fixed and mobile retail broadband markets has increased the pace at which service providers have had to decrease margins and increase monthly data usage allowances.

The disruption caused by the NBN should not be underestimated. Telstra's market size has been reduced and it is having to transform to reposition itself, to retain market share and to offer new products and services.

Australia needs a telecommunications market where we do not see a repeat of the missteps that occurred during earlier telecommunications deregulation. Foremost, we do not need a telecommunications industry that relies on handsets and bitstream for survival. The future should be based on over-the-top products and services, and we need the telecommunications industry to be focused on providing Australians with access to new and innovative products and services.

Arguably, by 2022, for the first time, every Australian will enjoy reasonable access to broadband, albeit with differing levels of reliability and performance, but the end of the NBN rollout may see the momentum for continued investment and innovation falter.

Telecommunications is an essential service and, therefore, telecommunications infrastructure is not something that should be allowed to become obsolete (Gregory, 2017b).

http://doi.org/10.18080/ajtde.v6n2.155

The nation's future in the global digital economy must be secure. Australia was ranked 60 in the world for broadband speed in 2016 (ABC, 2016b), a drop from position 25 a decade earlier. For an industrialised country that likes to think that it is an early adopter of new technologies, Australia has struggled to retain a reasonable position in the world broadband rankings, due to the delay to move beyond ADSL during the 2000s and the decision to adopt the multi-technology mix in 2013 (Gregory, 2016a; Gregory, 2017).

NBN Co is a wholesale telecommunications products and services provider. Absent effective regulation, NBN Co could unreasonably use its market position to set unfair and exorbitant prices and adopt unfair and restrictive practices. Effective regulation, in this context, relies upon the government and the ACCC to work in concert to ensure that NBN Co is subject to fair and open infrastructure competition, that competitors are required to offer wholesale access to infrastructure, that uniform national wholesale pricing is maintained by wholesalers, with each wholesaler permitted to set different uniform national wholesale pricing, and removal of barriers to becoming an infrastructure wholesaler.

It is possible that the ACCC's position on some aspect of NBN Co's operation may not be in concert with the position of the service providers and, as seen with NBN Co's pricing model changes, there can be a need for re-evaluation of decisions taken by NBN Co or the ACCC. For example, NBN Co product pricing that undermines the principle of uniform national wholesale pricing should be opposed by the ACCC or, if necessary, enforced through regulation by the government.

Uniform national wholesale pricing is a principle that should be enforced to ensure that regional and remote consumers are not disadvantaged. Wholesalers can still compete effectively, if wholesalers offering products in regional and remote areas can receive funds for each connection from the regional and remote broadband levy.

As a wholesale telecommunications product and services provider, NBN Co's potentially dominant position can be tempered by removing existing legislative restrictions on wholesale telecommunications product and services competition and by reducing the administrative cost and red tape for wholesale providers to install infrastructure. In other words, its legislated position of market power could be reconsidered.

The effect of wholesale infrastructure installation "cherry picking" by NBN Co's competitors is difficult to measure or prevent without price and access regulation. If NBN Co is sold off as a single entity or disaggregated before sale, the bounds for "cherry picking" will be difficult to set, as one would expect NBN Co's sale to open up wholesale infrastructure competition.

New legislation and regulations (TLACC, 2018; TRBSCB, 2018) have reduced the barriers to infrastructure sharing, restrictive trade practices related to infrastructure access and pricing,

http://doi.org/10.18080/ajtde.v6n2.155

and provided a mechanism to ensure that the telecommunications industry contribution to the provision of fixed wireless and satellite infrastructure is broadly based.

The Australian government carries out a review of telecommunications services in regional, rural and remote parts of Australia every three years (RTR, 2018). The regional telecommunications review has attracted considerable public interest over the years and provides government with valuable information.

It is reasonable, based on the success of the regional telecommunications reviews, to have periodic urban telecommunications reviews that focus separately on the wholesale and retail markets. The rationale is that government would be better informed by periodic public reviews and better placed to ensure that future problems are tackled early.

Options for NBN Co Ownership after 2022

When the NBN is built and fully operational in 2022, the future ownership of NBN Co should be addressed. There are four broad options that could be adopted, as described below.

It is unlikely that there will be political consensus about the future of NBN Co, and even within the political parties there is likely to be a range of viewpoints due to hardened ideology that often leads to detrimental outcomes for the nation.

How can a consensus be found on what to do with NBN Co after 2022? Possibly there will not be a consensus so it is vital that there be a broad review of the options.

This section aims to introduce the potential options for NBN Co after 2022, and is not an exhaustive analysis of the factors affecting NBN Co's future, but a starting point. Interestingly, each factor can be seen to affect all of the options, so discussion of a factor is not duplicated unless necessary to differentiate the effect on a particular option.

Option A. Not sold off

If NBN Co were retained as a government business enterprise for a period of not less than 10 years, there would be several benefits to government:

1. Maintaining the disruption momentum;
2. Uniform national wholesale pricing;
3. Reducing the digital divide through a focus on regional and remote telecommunications;
4. Revenue growth over time;
5. A single entity that can upgrade FTTN, FTTC and HFC to FTTP over the next five years;

http://doi.org/10.18080/ajtde.v6n2.155

6. Implementing telecommunications infrastructure security.

Disruption needs time to work its magic and the next decade will be critical to the future of the telecommunications market. A rushed sale of NBN Co puts the beneficial outcomes expected from a period of positive disruption at risk.

A key disruptive event linked to the NBN occurred on 31 March 2015 when Netflix commenced its operation in Australia.

Selected quotes from NBN Co's Corporate Plan 2018-21 highlight how the NBN is changing broadband access and usage (NBNCO, 2017):

> "At the end of FY17, 46 RSPs [Retail Service Providers] have wholesale broadband agreements in place with nbn [NBN Co] and others are on-selling services to consumers through aggregation.
>
> "End-user demand for data has grown, and will continue to grow substantially. Connectivity is playing an ever-increasing role in everyday life with the average Australian household now accessing the internet over 14 fixed and mobile devices, and forecast to have 31 internet connected devices in the home by 2021.
>
> "nbn expects consumption to continue to grow substantially over the next 10 years, driven by an explosion of video-streaming, use of multiple connected devices simultaneously and new data-intensive applications both in Australia and globally. Average monthly data usage has increased nearly ten-fold over the past five years, and is forecast to grow by 20–30 per cent CAGR [compound annual growth rate] to 2025.
>
> "94 per cent of households participate in eCommerce, including online shopping.
>
> "More than 1 million premises previously underserved or without internet now have access to fast broadband.
>
> "400,000 Australians work from home today, doubling by 2025 … Nearly 70 per cent of regional premises use retail services on the nbn™ network to work from home."

By maintaining NBN Co as a GBE, the uniform national wholesale pricing regime can be bedded down over the decade to 2030. Maintaining a uniform national wholesale pricing regime for the next decade should be a key goal of any decision about NBN Co's future ownership. The telecommunications industry needs a period of price certainty and this option is the best approach to achieve this goal. Uniform national wholesale pricing and an improving quality of service from NBN Co provides service providers with a level playing field upon which competition can thrive.

http://doi.org/10.18080/ajtde.v6n2.155

There will be pressure from large telecommunications companies to relax the uniform wholesale pricing regime and to provide discounts to the large telecommunications companies. Every step along this path reduces the effectiveness of the disruption caused by the NBN, reduces the smaller service provider competitiveness and ultimately reduces the opportunity to provide Australia with an open, fair and competitive telecommunications market.

The advent of the NBN has provided an opportunity to reduce the digital divide through a focus on regional and remote telecommunications. As a national wholesale provider, NBN Co would have the expertise and growing experience to tackle the challenge of providing new solutions to regional and remote telecommunications.

There is a need for an ongoing program to increase the spread of fibre into regional areas and to put a new satellite into service every six years to meet increased demand in remote areas and to replace the existing satellites, which have a 15-year lifetime.

Australians living in regional and remote areas have long suffered because commercial telecommunications providers have not been able to service the demand for reliable and low-cost telecommunications products and services. NBN Co has facilitated effective competition in regional and remote areas for the first time. It would be unwise to unwind this competitive environment before it has a chance to become the norm.

The telecommunications levy for regional and remote areas should be periodically reviewed and consider customer satisfaction, demand, growth, retail competition, availability of funds for infrastructure upgrades and OPEX (operational expenditure).

The revenue that would be generated by 8.1 million premises paying $52 per month for a broadband connection (NBNCO, 2017) plus business connections will, over time, become a sizeable amount, particularly as debt is paid and the company becomes more profitable. After OPEX and future CAPEX (capital expenditure) are taken into account, the return on investment should make ownership of NBN Co advantageous to government as the years go by. Government could then look to sell off NBN Co at a time of its choosing, rather than as a rushed move to get NBN Co off its books in 2022-24.

By 2022, Australia will have a broadband network that consists of a mix of technologies including copper-based technologies and the future-proof FTTP. The cost to upgrade about 6 million premises from FTTN/B, FTTC and HFC to FTTP is about $10-12 billion. By retaining ownership of NBN Co, government could manage the upgrade pathway to the future-proof FTTP (Gregory, 2015b; Gregory, 2016b; Gregory, 2017b; Gregory, 2017d).

The next decade will be a period of national security uncertainty. Increasingly, digital infrastructure and systems are becoming a target for state actors, criminals and terrorists. As

http://doi.org/10.18080/ajtde.v6n2.155

a GBE, NBN Co is optimally placed to act on government national security policy and regulations (Gregory, 2018c; Gregory, 2017c; Gregory, 2013).

Option B. Sold off as a single entity

If NBN Co is sold off as a single entity, this option immediately satisfies the "small government" ideology where GBEs are, supposedly, not needed and a government enterprise is assumed not to be able to compete with private enterprise when it comes to providing low-cost products and services with a reasonable return on investment (Melleuish, 2000; Van Onselen, 2015; Young Liberals NSW Division, 2018).

For the NBN to be sold off as a single entity consideration should be given to:

1. Viability;
2. Wholesale competition;
3. Foreign ownership restrictions;
4. Price control.

Viability

The NBN Co corporate plan indicates that, for NBN Co to be viable, it would need an Average Revenue Per User (ARPU) of $52 per month. On 10 May 2018, NBN Co reported that ARPU had risen to $44 per month (NBNCO, 2018b) and was expected to grow to $52 per month in FY21 (NBNCO, 2017).

However, there is doubt that the ARPU will reach $52 per month in FY21, especially given the limitations in predictable performance inherent with FTTN technology. ARPU has risen from $40 per month in 2010 to $44 in Q3 2018, yet NBN Co expects this figure to suddenly rise to $52 per month in a little over two years. To do so would require an increment of significant additional value that NBN Co cannot provide and is not planning to provide. NBN Co's projections (NBNCO, 2017) indicate that, by the end of FY20, it will have 8.1 million premises connected to the NBN and, by the end of FY21, 8.6 million premises will be connected out of a total 11.7 million premises. This means that NBN Co anticipates about 73-75 per cent of premises will connect to the NBN.

The Australian Bureau of Statistics (ABS) (ABS, 2018) reports that there were 14.2 million broadband Internet subscribers in Australia at the end of December 2017. Of these, there were 6,286,000 mobile wireless subscribers (datacard, dongle, USB modem or tablet SIM card and other wireless broadband, excluding mobile handsets). This means that there were 7,914,000 premises connected using DSL, Cable, Fibre, Satellite, or Fixed Wireless.

http://doi.org/10.18080/ajtde.v6n2.155

Mobile cellular providers know that, to take market share away from the NBN, providing access to more data is vital, and we are seeing evidence of this recently with the advent of "unlimited" data plans. TPG Networks recently announced that it intends to offer "unlimited" mobile data for customers on its "Brand New Australian Mobile Network" (TPG, 2018). The "unlimited" plan means that customers would get the "first 1 GB of data every day supplied at 4G LTE speeds, after which speed will be capped at 1 Mbps for the remainder of the day". The plan would be free for the first six months and customers would pay $9.99 per month after this.

NBN Co does not adequately address the threat of mobile cellular 4G/5G in its projections and it is possible that NBN Co could have a 10-15 per cent reduction in connections due to mobile cellular. There are a number of reasons why mobile phones make sense for some people: they are likely to have mobile phones; they rent; they are not prepared to endure the poor, slow and unreliable performance provided by FTTN; and, by utilising only 5G, they reduce the administrative overhead of having multiple Internet connections (Gregory, 2018b). By FY21, 5G is likely to be cost comparative with NBN Co's 50/10 Mbps product, to provide higher connection speeds than what is available via the NBN and should also provide "unlimited" data access.

It is anticipated that, by the end of 2018, the ACCC will have defined what "unlimited" means in response to a recent Federal Court decision that Telstra's use of the word "unlimited" in some advertising was misleading consumers. Telstra's "unlimited" data plans limit the connection speed to 1.5 Mbps after the 40 GB quota is exceeded on its $69 per month mobile plan (Adhikari, 2018).

NBN Co has an opportunity to increase its viability by offering products and services to government, business and industry. Over time, it is anticipated that, if NBN Co builds momentum as a wholesale provider linking government, business and industry with retail service providers, this will improve NBN Co's overall viability. NBN Co has commenced offering products and services to business, government and industry, but this direction is likely to remain a secondary focus until the NBN is built and fully operational (Viasat, 2017).

Wholesale Competition

Government legislation has introduced limited wholesale competition; however, there remains an opportunity to look at the impediments to open, fair and competitive wholesale competition, including administrative costs and red tape.

Wholesale competition is likely to motivate the privatised NBN Co to complete the all fibre access network to 93 per cent of premises. Consumers should benefit from wholesale competition (Whigham, 2018).

http://doi.org/10.18080/ajtde.v6n2.155

Another motivation for wholesale competition would be to reduce legislative intervention, the need for the ACCC to declare services and implement price controls.

Effective wholesale competition may not occur in regional and remote Australia due to customer density and the cost of infrastructure. Before NBN Co's SkyMuster satellites were launched, the cost of broadband in remote areas was prohibitive, available capacity was limited and efforts to enter the private satellite provider market were difficult (Baker, 2017).

A privatised NBN Co would rely on the industry wide wholesale levy for the provision of wholesale broadband services to regional and remote areas. This levy is flawed because it does not have a broad base – exclusions include small business, mobile broadband services, fixed-wireless broadband services, satellite broadband services, exchange-based xDSL broadband services and inactive super-fast carriage services (Gregory, 2017e).

The question of whether other wholesale providers should be able to access the regional and remote broadband industry levy is problematic, because it would be assumed that NBN Co is already receiving the proceeds of the levy to cover regional and remote areas and the telecommunications industry is not likely to support two companies receiving funds to support the provision of broadband in the same regional and remote areas. However, NBN Co should not gain the proceeds of the industry levy if the competing wholesale provider offers service providers an improved wholesale product at the same or lower price than what NBN Co is offering.

An example of this scenario is the recent decision by NBN Co to withdraw the Fixed Wireless 100 Mbps product (Gothe-Snape, 2018). This decision, whilst in keeping with the Government's statement of expectations (DCA, 2014) for the NBN, does not adequately address the technical issues related to lower average speed connections.

The New Zealand wholesale broadband provider, Chorus, published a blog post titled "The case for 100 Mbps (or more…)" in 2016 that highlights some of the issues (Chorus, 2016) related to why the Government's statement of expectations was inadequate.

After 2022, if the privatised NBN Co is not offering a 100 Mbps Fixed Wireless product, then a competing wholesale provider that is offering a 100 Mbps product (technology agnostic) should be able to replace NBN Co as the recipient of the industry levy for areas where the competing wholesale provider is offering an improved wholesale product at the same or lower price than what NBN Co is offering.

Foreign Ownership Restrictions

Government will need to consider foreign ownership restrictions for a privatised NBN Co. If NBN Co is sold off as a single entity, then it is more likely to attract a foreign buyer or a

http://doi.org/10.18080/ajtde.v6n2.155

consortium dominated by foreign partners. Would this, however, be in the nation's best interest?

Legislation for foreign ownership restrictions of a privatised NBN Co should occur. Telecommunications is an essential service and NBN Co would largely remain a dominant company owning most of the nation's vital telecommunications infrastructure under this option.

Foreign ownership restrictions are likely to significantly reduce the potential pool of purchasers with the capital necessary to purchase NBN Co and this is likely to have a negative effect on the sale price (McCarthy, 2018; Gregory, 2014b; Lattey, 2017).

Price control

The privatisation of other utilities (e.g. electricity and gas) in Australia has demonstrated that lower prices for consumers is not always an outcome. It may be necessary for the ACCC to be given power to declare wholesale infrastructure, in areas where there are less than three wholesale infrastructure providers, for the purpose of price control.

Discussion

The 2013 NBN Strategic Review included a FY25 valuation of the NBN using an EBITDA multiple of 6.0 resulting in a valuation of $27 billion (NBNCO, 2013). It achieved this figure by using the Government's Panel of Experts review EBITDA projection of $4.5 billion in FY25 (Turnbull, 2013; DCA, 2013; DCA, 2018b). The Government's Panel of Experts utilised inputs and assumptions that have been questioned. Also, the underlying models used have not been released for scrutiny (Gregory, 2014c).

NBN Co's Corporate Plan 2018-21 states that annual revenue is forecast to increase to $5.4 billion and EBITDA to $2.2 billion in FY21, providing a valuation of $13.2 billion (NBNCO, 2017). In FY21, free cash flow is projected to be $100 million.

Of interest here is the question of how NBN Co will raise the EBITDA from the projected $2.2 billion in FY21 to the Government's Panel of Experts review EBITDA projection of $4.5 billion in FY25. One approach would be to minimise CAPEX and OPEX between FY21 and FY25. Reducing the CAPEX spend could be achieved by freezing the NBN as it is when it is built and fully operational – this would mean no new satellites and no technology upgrades unless the customer pays. However, this approach is not guaranteed to bridge the $2.3 billion EBITDA gap, especially if debt is to be reduced and customer demands for better broadband are to be met.

In FY21, NBN Co peak funding is expected to be $48.7 billion broken into two components: equity funding of $29.5 billion; and debt funding of $19.2 billion (NBNCO, 2017).

http://doi.org/10.18080/ajtde.v6n2.155

A 2015 Fairfax media report quoted unidentified industry sources that said "the final sale figure is likely to be as low as $20 billion" (Clark, 2015).

By FY21 NBN Co will be the third largest Australian telecommunications company, with only Telstra (2018 EBITDA projected $10.2 billion) and Optus (FY18 EBITDA $5.089 billion) being larger.

The sale of NBN Co as a single entity will be difficult due to the financial commitment required to purchase NBN Co. A government write-off of as much as $30 billion may be necessary for NBN Co to be sold off, either as a single entity or disaggregated entities. In 2017, the Turnbull Government rejected calls for the Government's NBN investment to be written off; however, this has not stopped debate on this matter (Smith, 2017a; Duke, 2018).

The alternative is for the Government to delay the sale or to put NBN Co up for sale hoping for market interest.

On 19 April 2018, a NAB Trade analysis (Rickard, 2018) stated:

> "Telstra's challenges are essentially two-fold. Firstly, there's the impact of the NBN, which is estimated to leave an earnings hole of $3.0bn pa when fully implemented. If Telstra took no action, EBITDA would fall from around $10.5bn to $7.5bn.
>
> "Telstra has a high level plan to address this, which includes productivity, capex and revenue goals. It says that it has so far delivered around $870m of benefits, mainly from productivity and cost initiatives. However, details on how it aims to address the balance are sketchy. In particular, it has yet to articulate the 'new' revenue sources."

As discussed earlier, if Telstra was to split into two companies, the wholesale company could absorb NBN Co and, with an appropriate government debt repayment plan, the new wholesale company could be positioned to gain broader industry support. [While this article was going to press, Telstra made an announcement that it would split some network and wholesale assets into an organization separate from its retail activities. See the Endnote.[i]]

This should occur for three reasons: (1) Telstra shareholders would gain a share in each entity for one share currently held in Telstra; (2) the resulting size of the retail company would make it comparable to Optus, further enhancing competitive activity in the retail telecommunications market; and (3) the Government could shift existing foreign ownership restrictions from Telstra to the new wholesale company.

http://doi.org/10.18080/ajtde.v6n2.155

Option C. Disaggregated technology footprints sold off separately

The sale of the disaggregated NBN technology footprints has been recommended by the Government's Panel of Experts and the Australian Competition and Consumer Commission Chairman, Rod Sims (DCA, 2013; Duckett, 2016; ACCC, 2014a).

In a preliminary response to the Government's Panel of Experts report, the then Minister for Communications, Malcolm Turnbull, stated: "while disaggregation of NBN Co's business units (as the panel recommends) after the network is complete cannot be ruled out, now is not the time. Breaking up NBN Co would distract its management and delay the provision of high-speed broadband to all Australians" (Turnbull, 2014b).

In the Communications sector market study final report, the ACCC (ACCC, 2018b) stated that "this form of infrastructure-based competition would encourage ongoing investment in network upgrades and deliver price benefits and improved services to consumers over time".

The rationale behind the ACCC's plan for the future of the NBN appears to be based on the Government's Panel of Experts review reports.

The ACCC has recommended that:

> "The Government should continue planning for the future disaggregation of the NBN and ensure that measures are in place to enable the NBN to be split into competing networks, to provide a market structure that will facilitate greater infrastructure-based competition. The form of any disaggregation and privatisation should also be part of the terms of reference for the Productivity Commission's future inquiry into regulatory, budgetary, consumer and competition matters relating to the NBN."

This recommendation is based on the ACCC's submission to the Government's Panel of Experts review:

> "...while natural monopoly characteristics [in telecommunications] may be present in many circumstances, there may be other instances in which it will be economically efficient for there to be multiple operators of particular network infrastructure. In particular, areas with lower cost of deployment and relatively dense customer distributions may be more efficiently served by competing infrastructure" (ACCC, 2014b).

And:

> "We understand that NBN Co has introduced separate accounts for the different lines of its business, which it provides to the Government. In addition, we understand a

http://doi.org/10.18080/ajtde.v6n2.155

> report was commissioned by NBN Co on OSS and BSS separation and provided to the Government, but neither the report itself nor its findings have been released publicly.
>
> "We consider that privatisation of the NBN following completion of the network rollout should not be undertaken in a way that limits competition in order to maximise the sale proceeds. Rather, privatisation of the NBN will provide a unique opportunity to put in place a market structure with the potential to deliver effective infrastructure-based competition, such as through the horizontal disaggregation of NBN Co by different network technologies or areas of coverage. To achieve the competition objectives, the disaggregated parts would need to be able to contest each other's customer base. In our view, this form of infrastructure-based competition would encourage ongoing investment in network upgrades and deliver price benefits and improved services to consumers over time.
>
> "We note that the Government does have a policy objective of disaggregation of the NBN once the rollout is complete. In our view, it is imperative that actions be taken to provide further detail and planning for this. We are concerned that if measures to help facilitate separation are not put in place at an early stage, such as separate OSS and BSS, it will become more costly to implement later on, which could be used as a basis for not proceeding with the separation of NBN Co. We acknowledge that it is current Government policy for the form of disaggregation to be part of the Productivity Commission's remit in examining the NBN prior to privatisation. We are keen to see that this remains the case, but also consider that anticipatory actions should continue to be taken prior to this inquiry commencing" (ACCC, 2014b).

The ACCC does not fully expand on why it is "keen to see that this remains the case", beyond the comments quoted above. A full reasoning for the ACCC's position should become evident when the ACCC makes a submission to a future Productivity Commission inquiry.

The argument put for disaggregation has several fundamental problems that are difficult to overcome.

If the NBN is disaggregated and sold off as four, five or six entities (FTTN/B/C, HFC, FTTP, Fixed Wireless, Satellite, Transit and Business wholesale), the result could be simply that one or more telecommunications companies would purchase the entities and seek to optimise a financial return from the new asset without consideration to upgrading or increasing the infrastructure footprint.

The telecommunications company that purchased the FTTP areas would be in a prime position to optimise revenue and to begin rolling out FTTP into high-value areas currently covered by FTTN/B/C. This cherry picking would have a detrimental impact on the value of the

http://doi.org/10.18080/ajtde.v6n2.155

FTTN/B/C assets and this would be anticipated during the sale process. If the telecommunications companies that purchased the FTTN/C/B technologies tried to counter this situation by rolling out FTTP outside the FTTN/C/B footprint to maintain market share, then a consumer backlash should be anticipated. It is for this reason that the FTTP footprint is likely to sell at a premium, even though many of the FTTP areas are outside major urban centres.

A disaggregated sale of NBN Co assets would require careful planning to ensure that infrastructure-based competition was able to evolve.

If Telstra purchases one or more of the technology footprint areas, then it would benefit by not having to pay itself to lease facilities and infrastructure; however, other telecommunications companies that purchase fixed-line assets should be required to pay Telstra $15 per connection per month, as NBN Co is now paying. We would then have a partial return to the market scenario between 2000-2009.

Removal of the principle of uniform national wholesale pricing will immediately unbalance retail price competition and there is a discrepancy associated with the different infrastructure lifetimes and the higher OPEX cost for copper-based technologies.

Fixed Wireless and Satellite fall into a different category and the industry levy would be needed to make the operation of Fixed Wireless and Satellite viable.

The worst-case scenario, as a result of this option, would be for none of the telecommunication companies that purchased NBN Co assets to upgrade or to expand their infrastructure footprints. Whilst this is not anticipated, the result could be a very slow upgrade pathway to competitive, all-fibre networks and a short-term adoption of 5G as an alternative infrastructure that offers headline connection speeds that can be marketed as being "better than FTTN/B/C".

Option D. Disaggregated technology footprints (excluding satellite and fixed wireless) sold off separately

Option D follows from Option C with the exception that NBN Co's Fixed Wireless and Satellite assets would be retained and continue to be funded partially through an industry levy.

NBN Co's two satellites have an approximate 15-year lifetime before they need to be replaced and it takes 4-6 years from contract signing to when a satellite can become operational.

An increase in the number of Fixed Wireless and Satellite residential and business connections and an increase in demand for improved connection speeds and capacity mean that the

http://doi.org/10.18080/ajtde.v6n2.155

industry levy to support the provision of regional and remote broadband products and services may need to be adjusted.

Direct government control and management of every aspect of providing telecommunications services to regional and remote areas will help to bridge the digital divide and to ensure that new products and services are provided to regional and remote areas. It is a government responsibility to ensure that people living in regional and remote areas have access to eGovernment digital services, education and health. The next decade will see significant change in how eGovernment digital services are provided and what is on offer. With digital transformation a national priority, it is vital that government continue to focus on building telecommunications capability and capacity in regional and remote areas.

The provision of telecommunications to regional and remote areas is vital for this nation's future role in the global digital economy and to ensure that everyone, irrespective of where they live or work, is able to access digital services at reasonable cost.

There is no reason for people living in regional and remote areas to be part of an ideological lottery associated with the sale of NBN Co.

Government retention of the Fixed Wireless and Satellite assets does not prevent the assets being sold in the future. Retention would provide the government with the time necessary to ensure that the competitive and pricing outcomes from the sale of the rest of NBN Co have been successful and, if not, that remedial action has been taken before privatisation of Fixed Wireless and Satellite occurs.

Conclusions

By 2022, when the NBN is expected to be built and fully operational, the NBN will provide Australia with vital telecommunications infrastructure and for the first time every Australian should reasonably expect to be able to get access to broadband, irrespective of where they live and work, at reasonable cost.

The NBN has been a disruptive influence on the telecommunications market, particularly impacting Telstra's market share and revenues.

Disruption should not be confused with chaos and the period after the sale of NBN Co as a disaggregated entity could be chaotic if legislation and regulations do not adequately provide for access, pricing and competition. There is nothing to be gained by the government setting out on a chaotic path due to ideology and it is for this reason that the telecommunications industry should consider carefully what happens next.

http://doi.org/10.18080/ajtde.v6n2.155

Disaggregation of NBN Co could reduce or remove the positive disruption that the NBN is having on the telecommunications industry. Telecommunications companies are looking beyond handsets and bitstream in an effort to become technology companies and to build additional revenue streams. A rush to sell off NBN Co could remove or significantly reduce the positive disruptive effects that the NBN is having on the industry, and the telecommunications industry could revert to circa 2005.

Options A, B, D and C, in that order, are preferred based on the discussion and analysis presented.

Option A provides the nation with the greatest opportunity to benefit from the disruptive nature of the NBN whilst focusing on providing a ubiquitous future-proof fibre access network and reducing the digital divide in regional and remote regions.

The breadth of topics, perspectives and factors that must be taken into account before a decision is made as to what should be done with NBN Co, after the NBN is built and fully operational, is considerable.

For this reason, the government should commission public inquiries by the ACCC, the Australian Communications Consumer Action Network, the Australian Communications and Media Authority (infrastructure technologies, standards and security) and Infrastructure Australia prior to the legislated public inquiry by the Productivity Commission into the sale of NBN Co.

Telecommunications is an essential service and, in the next phase of the deregulation process (possibly the last phase?), the government should put in place legislation and regulations that ensure that the nation gains an open, fair and competitive telecommunications market whilst providing outcomes that are in the long-term interests of the nation and end users.

Acknowledgements

The author would like to acknowledge the feedback received and contributions made by Emeritus Professor Trevor Barr, Mr Paul Budde, Emeritus Professor Reg Coutts, Professor Peter Gerrand, Dr Jim Holmes, Dr Murray Milner, and Emeritus Professor Rod Tucker.

References

AAP. (2007). “Sol resumes broadband hostilities”. AAP. The Age. Fairfax Media. 14 May 2007. Retrieved from https://www.theage.com.au/news/business/sol-resumes-broadband-hostilities/2007/05/14/1178995053432.html

ABC. (2014). “Telstra boss David Thodey calls for budget certainty”. ABC PM. 14 August 2014. Retrieved from http://www.abc.net.au/pm/content/2014/s4067290.htm

ABC. (2016a). "Telstra dividends threatened by $2-3 billion post-NBN earnings gap: Moody's". ABC News Online. 28 July 2016. Retrieved from http://www.abc.net.au/news/2016-07-28/telstra-faces-2-3-billion-dollar-earnings-gap/7668454

ABC. (2016b). "Fact check: Has Australia's internet speed dropped from 30th to 60th in the world under the Coalition?" ABC Fact Check. 22 June 2016. Retrieved from http://www.abc.net.au/news/2016-06-21/fact-check-australias-internet-speed-rank/7509352

ABC. (2018). "Telstra hit with ratings downgrade over 'weak profitability' as competitors win market share". ABC News Online. 28 May 2018. Retrieved from http://www.abc.net.au/news/2018-05-28/telstra-s&p-ratings-downgrade/9807476

ABS. (2018). "8153.0 Internet Activity, Australia December 2017". Australian Bureau of Statistics. 3 April 2018. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/mf/8153.0

ACCC. (2014a). "Domestic transmission capacity service declaration 2013-2014". Australian Competition and Consumer Commission. Australian Government. 28 March 2014. Retrieved from https://www.accc.gov.au/regulated-infrastructure/communications/transmission-services-facilities-access/domestic-transmission-capacity-service-declaration-2013-2014/final-decision

ACCC. (2014b) "ACCC submission to the Independent Cost Benefit Analysis Review of Regulation first issues framing paper", 14 March 2014, p. 4.

ACCC. (2017). "Solving the multi-technology puzzle: The ACCC's perspective". Australian Competition and Consumer Commission. Australian Government. 17 November 2014. Retrieved from https://www.accc.gov.au/speech/solving-the-multi-technology-puzzle-the-accc%E2%80%99s-perspective

ACCC. (2018a). "Australian Competition and Consumer Commission". Australian Government. 5 May 2018. Retrieved from https://www.accc.gov.au/

ACCC. (2018b). "Communications sector market study final report". Australian Competition and Consumer Commission. Australian Government. 5 April 2018. Retrieved from https://www.accc.gov.au/publications/communications-sector-market-study-final-report

ACMA. (2018). "Australian Communications and Media Authority". Australian Government. 5 May 2018. Retrieved from https://www.acma.gov.au/

Adhikari, S. (2018). "Telstra ordered to take down misleading 'Unlimited' ad". *The Australian*. News Limited. 23 May 2018. Retrieved from https://www.theaustralian.com.au/business/technology/telstra-ordered-to-take-down-misleading-unlimited-ad/news-story/0e58e0227off7b44f4cf3c39edfe89e9

http://doi.org/10.18080/ajtde.v6n2.155

AMTA. (2018). "Australian Mobile Telecommunications Association". 5 May 2018. Retrieved from http://www.amta.org.au/

Baker, R., McKenzie, N. (2017) "First criminal charges in NewSat scandal". *Sydney Morning Herald.* Fairfax. 19 December 2017. Retrieved from https://www.smh.com.au/business/first-criminal-charges-in-newsat-scandal-20171219-h072e2.html

Bartholomeusz, S. (2006). "Sol and Samuel point fingers while broadband falls behind". *Sydney Morning Herald.* Fairfax Media. 1 December 2006. Retrieved from https://www.smh.com.au/news/business/sol-and-samuel-point-fingers-while-broadband-falls-behind/2006/11/30/1164777720863.html?page=fullpage#contentSwap1

Batt, R., Strausser, M. (1998). "Labor Market Outcomes of Deregulation in Telecommunications Services". *Proceedings of the 50th annual meeting of the Industrial Relations Research Association*. pp. 126-134. Madison, WI: Industrial Relations Research Association.

Biddington, M. (2018). "Changes to broadband arrangements to be considered by Parliament". Parliament of Australia. 26 March 2018. Retrieved from https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/FlagPost/2018/March/Telecommunications_Legislation_to_pass_through_the_Parliament

CA. (2018). "Communications Alliance". 5 May 2018. Retrieved from http://www.commsalliance.com.au/

CCC. (2018). "Competitive Carriers Coalition". 5 May 2018. Retrieved from http://www.ccc.asn.au/

Chorus. (2016). "The Case for 100 Mbps (or more...)". Chorus. 20 June 2016. Retrieved from https://blog.chorus.co.nz/the-case-for-100mbps-or-more/

Clark, A. (2015). "Malcolm Turnbull in talks to sell NBN to large telcos". *Financial Review.* Fairfax Media. 4 December 2015. Retrieved from http://www.afr.com/business/telecommunications/turnbull-in-talks-to-sell-nbn-to-large-telcos-20151204-glfy5d

DCA. (2013). "Terms of Reference for the NBN Panel of Experts". Department of Communications and the Arts. Government of Australia. 12 December 2013. Retrieved from https://www.communications.gov.au/departmental-news/terms-reference-nbn-panel-experts

DCA. (2014). "Statement of Expectations". Department of Communications and the Arts. Government of Australia. 24 August 2016. Retrieved from https://www.communications.gov.au/publications/nbnstatementofexpectations

http://doi.org/10.18080/ajtde.v6n2.155

DCA. (2018a). "Department of Communications and the Arts". Government of Australia. 5 May 2018. Retrieved from https://www.communications.gov.au/

DCA. (2018b). "National Broadband Network". Department of Communications and the Arts. Government of Australia. 5 May 2018. Retrieved from https://www.communications.gov.au/what-we-do/internet/national-broadband-network

Dodson, L. (2005). "Competitors to get a slice in Telstra privatisation". *Sydney Morning Herald*. Fairfax Media. 12 August 2005. Retrieved from https://www.smh.com.au/news/business/rivals-to-get-a-slice-in-telstra-selloff/2005/08/11/1123353442607.html

Duckett, C. (2016). "Infrastructure Australia calls for full benefits of NBN but skirts technology choices". ZDNet. 17 February 2016. Retrieved from https://www.zdnet.com/article/infrastructure-australia-calls-for-full-benefits-of-nbn-but-skirts-technology-choices/

Duke, J. (2017). "'We're not the police': NBN chief Bill Morrow reluctant to share data about speeds". *Sydney Morning Herald*. Fairfax Media. 23 November 2017. Retrieved from https://www.smh.com.au/business/companies/were-not-the-police-nbn-chief-bill-morrow-reluctant-to-share-data-about-speeds-20171123-gzr7lb.html

Duke, J. (2018). "NBN admits three in four FTTN customers won't get top speeds". *Canberra Times*. Fairfax Media. 17 January 2018. Retrieved from https://www.canberratimes.com.au/business/nbn-admits-three-in-four-fttn-customers-wont-get-top-speeds-20180117-hojeo0.html

Durie, J. (2017). "Bill Morrow shrugs off retailers' calls for NBN pricing certainty". *The Australian*. News Limited. 10 October 2017. Retrieved from https://www.theaustralian.com.au/business/opinion/john-durie/bill-morrow-shrugs-off-retailers-calls-for-nbn-pricing-certainty/news-story/1f123b8d0144bb1b26524f452ac38b70

Gerrand, P. (2004). "Revisiting the Structural Separation of Telstra", *Telecommunications Journal of Australia*, Vol 54, Spring issue, 2004, pp. 15-28.

Gerrand, P. (2017). "2004 Structural Separation". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 4, Article 5. http://doi.org/10.18080/ajtde.v5n4.5

Gothe-Snape, J. (2018). "NBN fixed wireless blowing out bush broadband bill as Government pins hopes on fixed-line levy". ABC News Online. 1 June 2018. Retrieved from http://www.abc.net.au/news/2018-06-01/nbn-fixed-wireless-congestion-upgrade-delay/9770802

Gregory, M.A. (2012). "Telstra's post-NBN future". *The Australian*. News Limited. 18 October 2012. Retrieved from https://www.theaustralian.com.au/business/business-spectator/telstras-postnbn-future/news-story/4396363c06f1834ad2e5ff5a5ffccf87

Gregory, M.A. (2013). "Will the NBN be 'affordable' without Huawei?" *The Australian*, News Limited. 2 October 2013. Retrieved from https://www.theaustralian.com.au/business/business-spectator/will-the-nbn--be-affordable-without-huawei/news-story/3d37fc94774d84e0d001eeecbc672352

Gregory, M.A. (2014a). "Can Telstra save the NBN?" *The Australian*. News Limited. 20 March 2014. Retrieved from https://www.theaustralian.com.au/business/business-spectator/can-telstra-save-the-nbn-/news-story/1d2fa0ff7d3a5828b8bf28229f223379

Gregory, M.A. (2014b). "NBN – ageing copper network and structural separation". John Menadue – Pearls and Irritations. 11 February 2014. Retrieved from https://johnmenadue.com/mark-gregory-nbn-ageing-copper-network-and-structural-separation/

Gregory, M.A. (2014c). "Why the NBN's cost-benefit analysis is flawed on arrival". *The Australian*. News Limited. 18 September 2014. Retrieved from https://www.theaustralian.com.au/business/business-spectator/why-the-nbns-costbenefit-analysis-is-flawed-on-arrival/news-story/dbc280971aec94ceb18ac44e211d18be

Gregory, M.A. (2015a). "The Rationale for Universal Access to Digital Services". *Australian Journal of Telecommunications and the Digital Economy*. Vol. 3 No. 4. pp. 166-184. DOI https://doi.org/10.18080/ajtde.v3n4.45

Gregory, M.A. (2015b). "Why the NBN can do without fibre-to-the-node". *The Australian*. News Limited. 10 April 2015. Retrieved from https://www.theaustralian.com.au/business/business-spectator/why-the-nbn-can-do-without-fibretothenode--/news-story/29215a9c2b4c2d0cb904326283887f64

Gregory, M.A. (2016a). "What the government doesn't want you to know about the NBN". John Menadue – Pearls and Irritations. 19 April 2016. Retrieved from https://johnmenadue.com/mark-gregory-what-the-government-doesnt-want-you-to-know-about-the-nbn/

Gregory, M.A. (2016b). "Labor's NBN silence". *The Australian*. News Corporation. 10 June 2016. Retrieved from https://www.theaustralian.com.au/business/technology/opinion/labors-nbn-silence/news-story/4c4c8f774c2322654b264089c3c34e9e

Gregory, M.A. (2017a). "Stuck in the NBN slow lane". *The Australian*. News Corporation. 25 July 2017. Retrieved from https://www.theaustralian.com.au/news/inquirer/stuck-in-the-nbn-slow-lane/news-story/540ff6a0d059cb318ad025f5d856f30c

Gregory, M.A. (2017b). "High long-term cost of NBN". InnovationAus. 17 July 2017. Retrieved from https://www.innovationaus.com/2017/07/High-long-term-cost-of-NBN

Gregory, M.A. (2017c). "Telco security is the new frontier." InnovationAus. 22 August 2017. Retrieved from https://www.innovationaus.com/2017/08/Telco-security-is-the-new-frontier

Gregory, M.A. (2017d). "Is it time for NBN Co to make fibre-to-the-curb the default option?" *The Australian*. News Limited. 15 February 2017. Retrieved from https://www.theaustralian.com.au/business/technology/opinion/is-it-time-for-nbn-co-to-make-fibretothecurb-the-default-option/news-story/6c1938a6a48da2c74743ee939b5e226c

Gregory, M.A. (2017e). "A new broadband levy in another NBN bungle". John Menadue – Pearls and Irritations. 23 May 2017. Retrieved from https://johnmenadue.com/mark-gregory-a-new-broadband-levy-in-another-nbn-bungle/

Gregory, M.A. (2018a). "Telstra pain linked to NBN". InnovationAus. 21 May 2018. Retrieved from https://www.innovationaus.com/2018/05/Telstra-pain-linked-to-NBN

Gregory, M.A. (2018b). "NBN's astounding results fail". InnovationAus. 14 February 2018. Retrieved from https://www.innovationaus.com/2018/02/NBNs-astounding-results-fail

Gregory, M.A. (2018c). "Spooks form a view on TelcoLand". InnovationAus. 4 May 2018. Retrieved from https://www.innovationaus.com/2018/05/Spooks-form-a-view-on-TelcoLand

Hansen, S., & Jones, N. (2017). "New Zealand Telecommunications: The actual situation – legislation and regulations". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 3, pp. 83-88. DOI https://doi.org/10.18080/ajtde.v5n3.111

Hausman, J. A., & Taylor, W. E. (2012). "Telecommunications Deregulation." *American Economic Review*, Vol. 102, No. 3, pp. 386-390. DOI: 10.1257/aer.102.3.386

Hogan, J. (2006). "Trujillo gives Murdoch broad support". *The Age*. Fairfax Media. 30 November 2006. Retrieved from https://www.theage.com.au/news/business/trujillo-gives-murdoch-broad-support/2006/11/29/1164777656709.html

Irving, W. (2018). "Establishing a standalone infrastructure business". Telstra Exchange. Telstra. 20 June 2018. Retrieved from https://exchange.telstra.com.au/establishing-standalone-infrastructure-business/

Kahn, A.E. (1988). *The economics of regulation: principles and institutions*. MIT Press. Cambridge, USA. ISBN 9780262111294

Kahn, A. E. (2004). *Lessons from Deregulation*. AEI-Brookings Joint Centre for Regulatory Studies. 2004.

Kahn, A. E. (2007). *Network Neutrality*. AEI-Brookings Joint Centre for Regulatory Studies. March 2007

Kautsarina, K., Rafizan, O., Setiawan, A., & Sastrosubroto, A. (2017). "Information and Communication Technology Service Industry Development in Indonesia". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 3, pp. 50-82. https://doi.org/10.18080/ajtde.v5n3.96

Lattey, R. (2017). "Australia". King & Wood Mallesons. *The International Comparative Legal Guide to: Telecoms, Media & Internet Laws & Regulations 2017*. 10th Edition. Publisher Global Legal Group. ISBN 978-1-911367-15-4. Retrieved from http://www.kwm.com/~/media/library/Files/Knowledge/Insights/au/2016/10/12/iclg-telecoms-media-internet-2017-australia.ashx?la=en

MAF. (2017). "Migration Assurance Framework". Department of Communications and the Arts. Australian Government. 21 August 2017. Retrieved from https://www.communications.gov.au/have-your-say/migration-assurance-framework

McCarthy, M. (2018). "'Arrogant' Australia risks scaring-off foreign investors wanting farmland as new reforms favour local bidders". ABC News Rural. 3 February 2018. Retrieved from http://www.abc.net.au/news/rural/2018-02-03/australian-real-estate-agents-concern-foreign-investment-reform/9391394

McCormick, J. (1996). "Telecommunications deregulation: an Australian perspective". *Information Management & Computer Security*. Vol. 4 Issue 3. pp. 39-41. https://doi.org/10.1108/09685229610126986

McDonough, C. (2017). "U.S. Telco Industry History as a Prologue to its Future". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 2, pp. 98-112. https://doi.org/https://doi.org/10.18080/ajtde.v5n2.108

McLaren, G. (2017). "Hong Kong's Fibre Broadband Market - Busting the Myth of Residential Fibre Broadband always being a Natural Monopoly". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 3, pp. 36-49. https://doi.org/10.18080/ajtde.v5n3.117

Melleuish, G. (2000). "A Short History of Australian Liberalism". Centre for Independent Studies. 16 March 2000. Retrieved from http://www.cis.org.au/publications/occasional-papers/a-short-history-of-australian-liberalism/

Middleton, C. (2017). "An Introduction to Telecommunications Policy in Canada". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 4, pp. 97-124. https://doi.org/10.18080/ajtde.v5n4.129

NBN. (2011). National Broadband Network Companies Act 2011. Australian Government. 29 April 2016. Retrieved from https://www.legislation.gov.au/Details/C2016C00381

NBNCO. (2011). "NBN Co and Telstra Sign Binding Definitive Agreements". NBN Co. 23 June 2011. Retrieved from https://www.nbnco.com.au/corporate-information/media-centre/media-statements/nbn-co-and-telstra-sign-binding-definitive-agreements.html

NBNCO. (2013). "Strategic Review Report". NBN Co. 12 December 2013. Retrieved from https://www.nbnco.com.au/corporate-information/media-centre/media-statements/strategic-review.html

NBNCO. (2017). "Corporate Plan 2018-21". NBN Co. August 2017. Retrieved from https://www.nbnco.com.au/corporate-information/about-nbn-co/corporate-plan/corporate-plan.html

NBNCO. (2018a). "NBN Co pushes fibre further and relaunches HFC services". Media release. NBN Co. 10 April 2018. Retrieved from https://www.nbnco.com.au/corporate-information/media-centre/media-statements/HFC-relaunch-FTTC-expansion.html

NBNCO. (2018b). "NBN Co Q3 2018 results. Financial Reports". NBN Co. 10 May 2018. Retrieved from https://www.nbnco.com.au/corporate-information/about-nbn-co/corporate-plan/financial-reports.html

PC. (2017). "Inquiry into Telecommunications Universal Service Obligation". Productivity Commission. 19 June 2017. Retrieved from https://www.pc.gov.au/inquiries/completed/telecommunications#report

Penn, A. (2017). "Time to end uncertainty over regional investment". Telstra Corporation. 5 May 2017. Retrieved from https://exchange.telstra.com.au/time-to-end-uncertainty-over-regional-investment/

Rickard, P. (2018). "When will Telstra be a bargain?" NABTrade. National Australia Bank. 19 April 2018. Retrieved from https://www.nabtrade.com.au/investor/insights/latest-news/news/2018/04/when_will_telstrabe

RTR. (2018). "Regional Telecommunications Review". Department of Communications and the Arts. Australian Government. Retrieved from https://www.communications.gov.au/who-we-are/department/regional-telecommunications-review

Saenz De Miera, O., Rovalo, A., & Morales, R. (2017). "Review of the Mexican Telecommunications Market". *Australian Journal of Telecommunications and the Digital Economy*, Vol. 5, No. 1, pp. 70-91. https://doi.org/10.18080/ajtde.v5n1.84

SECEC. (2017a). Question 175. Senate Estimates Committee on Environment and Communications. Australian Parliament. October 2017. Retrieved from https://www.aph.gov.au/Parliamentary_Business/Senate_Estimates/eqon

SECEC. (2017b). Evidence by Mr Bill Morrow and Mr Stephen Rue. Senate Estimates Committee on Environment and Communications. Australian Parliament. Hansard pp. 194-223. Retrieved from http://parlinfo.aph.gov.au/parlInfo/search/summary/summary.w3p;adv=yes;orderBy=customrank;page=0;query=nbn%20Date%3A24%2F10%2F2017%20Dataset%3Aestimate;resCount=Default

SECEC. (2018). Senate Estimates Committee on Environment and Communications. Australian Parliament. 24 May 2018. Retrieved from https://www.aph.gov.au/Parliamentary_Business/Senate_Estimates/ec

Smith, P. (2017a). "Government rejects calls to write down $30b NBN investment as Bevan Slattery predicts mobile advances". *Financial Review*. Fairfax Media. 17 April 2017. Retrieved from http://www.afr.com/technology/web/nbn/government-rejects-calls-to-write-down-30b-nbn-investment-as-bevan-slattery-predicts-mobile-advances-20170412-gvjl5a

Smith, P. (2017b). "Andy Penn's plan for Telstra to become a global tech giant takes shape". *Australian Financial Review*. Fairfax Media. 28 August 2017. Retrieved from https://www.afr.com/technology/andy-penns-plan-for-telstra-to-become-a-global-tech-giant-takes-shape-20170825-gy4e7c

Telstra. (2014). "Telstra Signs revised NBN Definitive Agreements". Telstra Corporation. 14 December 2014. Retrieved from https://www.asx.com.au/asxpdf/20141215/pdf/42vgkf12mxbyvb.pdf

TIO. (2018). "Telecommunications Industry Ombudsman". 5 May 2018. Retrieved from https://www.tio.com.au/

TLACC. (2018). Telecommunications Legislation Amendment (Competition and Consumer) Bill 2018. Parliament of Australia. 10 May 2018. Retrieved from https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r5923

TLADB. (2014). Telecommunications Legislation Amendment (Deregulation) Bill 2014. Parliament of Australia. 13 April 2015. Retrieved from https://www.aph.gov.au/Parliamentary_Business/Bills_LEGislation/Bills_Search_Results/Result?bId=r5367

TPG. (2018). "Media Release: TPG to offer Free Unlimited Mobile Data plan on its Brand New Australian Mobile Network". TPG Networks. 9 May 2018. Retrieved from https://www.tpg.com.au/about/media.php

http://doi.org/10.18080/ajtde.v6n2.155

TRBSCB. (2018). Telecommunications (Regional Broadband Scheme) Charge Bill 2018. Parliament of Australia. 10 May 2018. Retrieved from https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r5916

Turnbull, M. (2013). "Panel of Experts to conduct cost-benefit analysis of broadband & review NBN regulation". Ministers for the Department of Communications and the Arts, Government of Australia. 12 December 2013. Retrieved from http://www.minister.communications.gov.au/malcolm_turnbull/news/panel_of_experts_to_conduct_cost-benefit_analysis_of_broadband_and_review_nbn_regulation#.WxIOQEiFNaQ

Turnbull, M. (2014a). "NBN Co and Telstra sign revised Definitive Agreements". Department of Communication and the Arts, Government of Australia. 14 December 2014. Retrieved from http://www.minister.communications.gov.au/malcolm_turnbull/news/nbn_co_and_telstra_sign_revised_definitive_agreements#.WwU9dEiFNaQ

Turnbull, M. (2014b). "Vertigan panel lays out path to less telecommunications regulation", Department of Communication and the Arts, Government of Australia. 1 October 2014. Retrieved from http://www.minister.communications.gov.au/malcolm_turnbull/news/vertigan_panel_lays_out_path_to_less_telecommunications_regulation#.WxJpLUiFNaQ

USO. (2018). "Universal Service Obligation". Department of Communications and the Arts. Australian Government. 5 May 2018. Retrieved from https://www.communications.gov.au/what-we-do/phone/phone-services/universal-service-obligation

Van Onselen, P. (2015). "Embracing small government needs a philosophical shift". *The Australian*. News Limited. 21 March 2015. Retrieved from https://www.theaustralian.com.au/opinion/columnists/peter-van-onselen/embracing-small-government-needs-a-philosophical-shift/news-story/8b290b5dd435e21e5b81e9b32a494abb

Viasat. (2017). "Qantas Turns On Fast, Free, Gate-to-Gate In-flight Wi-Fi". Viasat. 7 April 2017. Retrieved from https://www.viasat.com/news/qantas-turns-fast-free-gate-gate-flight-wi-fi

Whigham, N. (2018). "Broadband start-up completes initial fibre rollout in parts of Melbourne." News.com.au. News Limited. 19 April 2018. Retrieved from https://www.news.com.au/technology/online/broadband-startup-completes-initial-fibre-rollout-in-parts-of-melbourne/news-story/24ce37c4aa704843abb5b70f5482bcba

Young Liberals. (2018). "We support small government, free enterprise and individual freedom". Young Liberals NSW Division. 5 May 2018. Retrieved from http://nswyoungliberals.org/

http://doi.org/10.18080/ajtde.v6n2.155

Endnote

On 20 June 2018, Telstra announced, as part of its Telstra 2022 plan, that it was "establishing Telstra InfraCo, a new standalone business unit within Telstra" that would be "accountable for our copper and HFC networks; all our fibre network that is not dedicated to supporting mobiles; all ducts, pits and pipes; property including exchange buildings and data centres; and international and domestic subsea cables. These assets will be combined with Telstra Wholesale and the teams in Telstra Operations that provide services to nbn co" (Irving, 2018). This announcement provides Telstra with the opportunity to participate in the future sale of the NBN. Telstra could spin off the business as a separate ASX-listed company, take on infrastructure investors for a future purchase of the NBN, or part of the NBN, and effectively follow what happened in New Zealand with Telecom New Zealand becoming Spark and Chorus. The potential impact of the Telstra announcement on Australian wholesale telecommunications reform is left for future research.

http://doi.org/10.18080/ajtde.v6n2.155