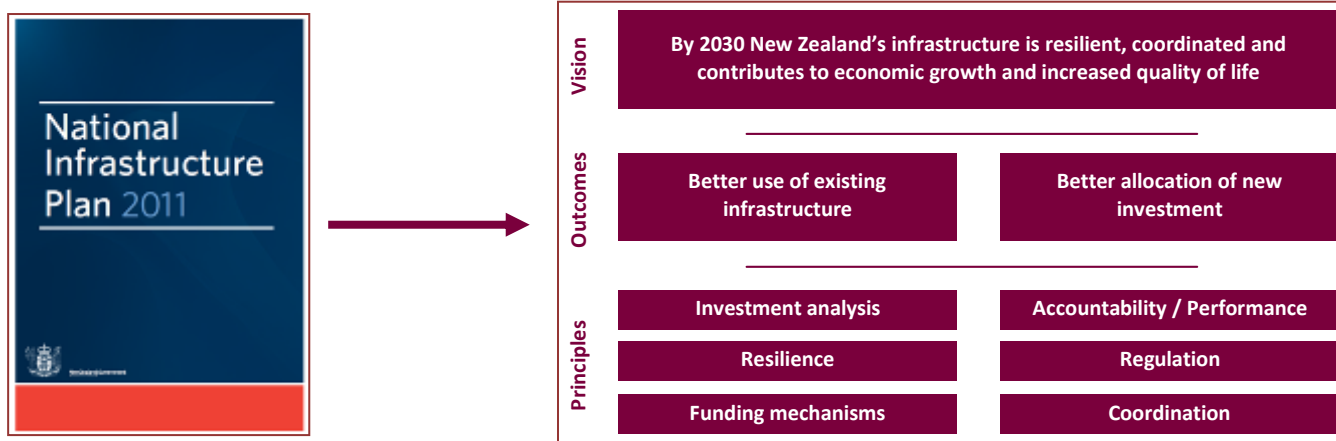# INFRASTRUCTURE
EVIDENCE BASE
2015 Refresh

Telecommunications Sector

March 2015

Introduction

Infrastructure is a crucial part of the New Zealand economy. It supports the day to day activities of New Zealanders, helps to improve living standards for all, and can be a driver for economic growth. As such, it is vital it is managed as well as possible. The National Infrastructure Plan 2011 sets out a long term vision for New Zealand's infrastructure and seeks to provide a common direction for how we plan, fund, build and use all economic and social infrastructure.

National Infrastructure Plan 2011

Vision	By 2030 New Zealand's infrastructure is resilient, coordinated and contributes to economic growth and increased quality of life

Outcomes	Better use of existing infrastructure	Better allocation of new investment

Principles	Investment analysis	Accountability / Performance
	Resilience	Regulation
	Funding mechanisms	Coordination

To support this, in 2014, the National Infrastructure Unit (NIU) published the first New Zealand Infrastructure Evidence Base, working with owners and providers across all sectors to provide quantitative data where possible, and good quality qualitative analysis where data is not yet available.

This document provides an update to the 2014 Evidence Base, providing the latest in time series data where appropriate, and reiterating and evolving key messages where required. It draws together work on performance indicators (the current state of the infrastructure), scenario and trend analysis (the future pressures or drivers of demand), the national resilience picture, and the first 10-year Capital Intentions Plan (what is known about indicative future spend). As before it has been compiled in collaboration with sector representatives and we believe is an accurate representation of the current state of New Zealand's infrastructure.

The timing of this iteration of the Evidence Base is aligned to provide a common understanding of the issues faced by New Zealand's infrastructure, in order to act as a strong platform for the next National Infrastructure Plan, due to be released later in 2015.

This document forms the substantive component of the Evidence Base for the telecommunications sector, defined by NIU as the assets needed to provide fixed line, mobile and internet services to consumers in New Zealand. It follows from the overview document, which can be found on the NIU's website. The updates included in this chapter are the latest time series data from the Commerce Commission Annual Monitoring Report, new international data from the OECD, the Global Information Technology Report, an update on the UFB and RBI programmes, and some additional information on emerging trends.

Where data has been provided, this is publicly available information, and has been provided with permission of the information owner.

NATIONAL INFRASTRUCTURE UNIT

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Overview messages

Overall, the sector remains in a strong position; however, there is still a significant lack of publicly available data in comparison with other infrastructure sectors. As a result, the evidence base for this sector also relies on engagement with sector stakeholders.

The telecommunications sector delivers services directly to consumers, as well as supporting the provision of infrastructure in other sectors. It is crucial in enabling greater efficiencies and productivity across all sectors.

Demand continues to rise in both urban and rural areas, with particular increases in demand for mobile services in urban areas and internet in rural areas. Data requirements are also increasing across the board, alongside a trend of increasing data caps.

However, forecasting is particularly difficult in this sector due to the speed of technology change. We have not updated the scenarios from the 2014 evidence base, though we have included some sector-specific emerging trends.

Consultation with the sector has raised concerns around constraints on building new mobile towers in urban areas, especially given increasing demand. Current limitations on the height of towers can limit co-location, which would be desirable for reasons of efficiency, cost, and location.

The sector has also raised concerns about inconsistency of planning legislation, which increases costs and can cause delays. This is an issue raised across the infrastructure sectors, and is not limited to telecommunications.

The Ministry of Business, Innovation and Employment is aware of these issues and looks to address them through current regulatory reviews.

There is significant uncertainty in the telecommunications market at present, and market participants are keen to return to stability as soon as possible. The completion of the Telecommunications Act review and the Final Pricing Principle review of both Unbundled Copper Local Loop (UCLL) and Unbundled Bitstream Access (UBA) prices, both undertaken due to statutory obligations, will help to address this uncertainty and provide a telecommunications regulatory framework that is fit for purpose for the future.

Notwithstanding these concerns, the market appears to be effective in delivering the quality and reliability of service required, with good coverage. There is a variety of technology in the backhaul network, providing good resilience, and the market has demonstrated effectiveness in re-establishing networks in the face of natural hazards.

Despite recent increases to average speeds (due to more users moving to faster technologies), for many users the speed of internet could still be improved. This will continue to be addressed by the roll out of programmes such as UFB and RBI, and as end users migrate to newer technologies.

These programmes contribute to the significant investment being made in this sector by both private and public sectors, which also includes extending mobile coverage and introducing 4G services. Given this, a key question may be how to ensure New Zealand gains the full benefits from these investments and the respective roles of the sector and Government in driving this.

Another issue to bear in mind in the sector is how to address slow adopters of technology. At some point it may become necessary to stop supporting legacy services, such as fax and dial up modems built in to medical and household alarms, which over time could become uneconomical to support or unnecessarily slow the deployment and uptake of new services.

The issue of digital and telecommunication convergence is also relevant as more content is provided online, rather than through traditional channels, and New Zealand is seeing the entry (or planned entry) of significantly more providers into the market, including major international players such as Netflix.

As the sector is privately owned, albeit with some government investment in certain areas, these and associated questions will need to be considered and addressed by both public and private parties.

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Context

The telecommunications sector provides services directly to consumers, and also indirectly by supporting delivery of other infrastructure-based services. The roll out of UFB, RBI, and 4G LTE are providing considerable new opportunities. As interdependencies between sectors continue to increase, its importance is growing, providing both opportunities and risks. It is one of the fastest moving and most dynamic infrastructure sectors in terms of technological changes.

In New Zealand, the telecommunications services market opened to competition in 1989. Until recently, private telecommunications planning and product advances have developed the market, with the Government role largely confined to that of regulator. Technology adoption timescales can be driven by external factors as a result of the relatively small size of the market; for example, mobile phones manufacturers tend not to produce products specifically for the New Zealand market; and New Zealand will need to manage importing cars with differing intelligent transport systems in order to benefit from technological advances.

As a result of the shift from analogue to digital infrastructure, the different industries within this sector (telecommunications, IT, and broadcasting) are converging.

We are seeing significant changes in the market, such as the emergence of competition in content. End users are also increasing their demands. In telecommunications, this specifically relates to the speed of connections and volume of data required. There are also shifts in the way end users access information, with an increase in cloud storage, data analytics and more and more content being provided online, rather than through traditional methods. In addition, the technological advancements in other sectors, such as the increase of smart devices, smart homes and smart cities, will continue to place demands on the telecommunications infrastructure.

A brief history of the telecommunications sector in New Zealand can be found online at the Encyclopaedia of New Zealand.

What do we have?

For the purposes of this document, the NIU defines the telecommunications industry as comprising international connectivity, fixed line voice, internet and mobile assets.

International Connectivity

New Zealand currently has two international submarine cables: Southern Cross (owned by Spark, Singtel-Optun and Verizon Business) connects New Zealand with Australia and the USA; and Tasman 2 (owned by Telstra & Spark) connects New Zealand to Australia. A map of submarine cables, alongside other information on the cables, can be found at www.submarinecablemap.com

The Southern Cross Cable has a total lit (traffic carrying) capacity of 2.6Tbps across the system, and was engineered with an expected life to 2025, while the Trans-Tasman cable has a total capacity of 560Mbps. The market is currently considering additional international cables: Vodafone, Spark and Telstra have announced an intention to build a new cable from Auckland to Sydney (see press release). There are also several companies currently considering a cable from New Zealand to Australia and the USA.

Fixed Line Services

Fixed line services are provided using copper, wireless, satellite and fibre access networks. About 80 percent of these are residential, with the remainder business and government services (Statistics New Zealand, Internet Service Provider Survey). The data provided by the Commerce Commission Annual Monitoring Report shows that the number of fixed lines had been static for several years, with Chorus's more recent annual report suggesting the total number of fixed lines is slightly higher than the figures collated by the Commerce Commission below, due to an increase in fibre connections and a growing population. Broadband connections continue to increase steadily, as does the number of residential broadband lines as a percentage of residential lines. So, in summary, the anticipated fall in fixed lines, as consumers switch to mobile only, has not yet occurred.

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FIXED LINE METRICS	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Fixed lines (millions)	1.85	1.85	1.86	1.87	1.88	1.88	1.88	1.85
Total fixed broadband connections (millions)	0.48	0.68	0.85	0.98	1.05	1.14	1.24	1.32
Fixed line broadband connections per 100 pop.	11.6	16.3	19.8	22.8	24.5	26	28	29.5
Residential broadband as % residential lines	-	-	-	-	65	70	78	85

Data reproduced from Commerce Commission Annual Telecommunications Monitoring Report 2013.

From 2009/10, Total fixed broadband connections do not include fixed wireless subscribers.
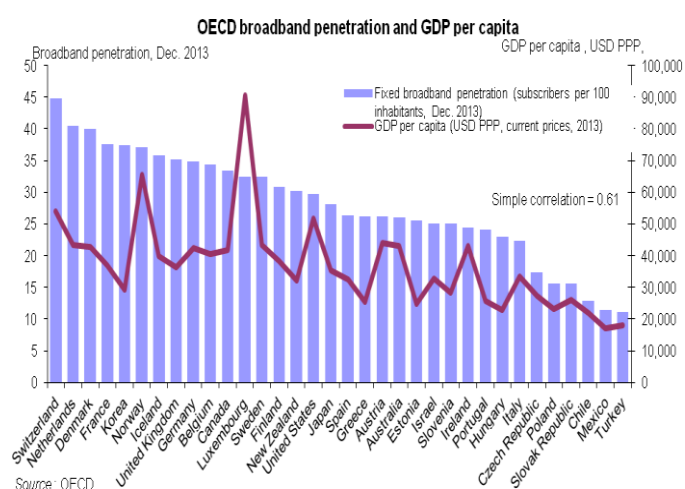
According to the Commerce Commission Annual Telecommunications Report, the OECD compares the rate of broadband penetration between countries by measuring connections per 100 people. As at December 2013, New Zealand had 30.2 fixed line broadband subscriptions per 100 people, compared with an OECD average of 27. New Zealand's fixed line broadband penetration result gave it a ranking of 15 out of 34 OECD countries, an improvement of one placing from the prior year.

New Zealand was ninth in its rate of growth for fixed line broadband penetration in the OECD for the year to December 2013, with 5.3 percent growth compared to the OECD average of 3 percent. More recent figures from the OECD Broadband Portal penetration statistics show New Zealand is now number one among developed countries for annual growth of fibre connections from June 2013 to June 2014, and in the top ten for wireless broadband.

The World Bank, which monitors the number of broadband subscribers with a digital subscriber line, cable modem, or other high-speed technology, also shows a trend of an increasing numbers of subscribers. The most recent data shows that New Zealand had 29.21 subscribers per 100 in 2013, significantly above the world average.

The Global Competitiveness Index, which measures countries by using a series of pillars and measures, includes the number of fixed telephone lines per 100 of the population as one of its infrastructure measures. The 2013 report notes New Zealand has 41.1 lines per 100 people, which gives it a ranking of 22nd out of the 144 countries included. As below, the report also notes mobile lines per 100 of the population.

Mobile Services

Mobile services are provided using cellular mobile networks operated by Vodafone, Telecom and 2degrees. Different sources provide different estimates of connection numbers. Data provided by the Commerce Commission Annual Monitoring Report shows that mobile connections are flattening out, to the point that the number reported has fallen slightly in the last year, though Spark's more recent annual report suggests a slight rebound with connections increasing. Mobile connections that are also mobile broadband connections have risen rapidly and now make up 77 percent of total mobile connections. The Commerce Commission report also notes a dramatic increase in data use, which has almost doubled in the last year.

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MOBILE METRICS	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Mobile connections (millions)	3.8	4.25	4.58	4.7	4.7	4.8	4.9	4.8
Active mobile connections per 100 pop	92	102	108	109	108	110	111	107
Share mobile pre-paid (%)	68.2	67.8	67.6	66.1	67.2	65.7	64.9	63.3

Data reproduced from Commerce Commission Annual Telecommunications Monitoring Report 2013.
From 2009/10 mobile connections refers to those active in previous 90 days. Prior to this, measure was of connections active in previous six months.

World Bank data also shows this slight decrease in number of mobile connections per 100 people, falling from 110 per 100 in 2012 to 106 per 100 in 2013. This is above the rapidly increasing world average.

The Global Competitiveness Index notes NZ has 105.8 connections per 100 people, giving NZ a ranking of 84th out of the 144 countries included in the report. Hong Kong tops the report with 238.7 connections per 100 people, whereas Australia is ranked at 81st with 106.8 connections.

New Zealand context update

Policy Delivery

Since the previous Evidence Base release, the Ministry of Business, Innovation and Employment (MBIE) has successfully auctioned the 700MHz spectrum band, which will be used in conjunction with other spectrum rights to provide 4G services, especially to rural New Zealand. Spark, Vodafone and 2degrees purchased rights to use the 700MHz band, with associated coverage requirements. For more information, see the press release on the Beehive website and full details on the radio spectrum management website. 4G services are also being rolled out in urban areas using 1800MHz.

The UFB programme has also continued throughout the last year, with connections now available in 32 of the UFB local areas, and deployment in six towns and cities complete. Over half a million end users are able to connect to UFB, and 92 percent of remote schools and 97 percent of rural hospitals are ready for service. For more information on this programme, see the MBIE website.

Finally, the RBI programme has also progressed with 79 percent of towers upgraded, 68 percent of new towers built and 80 percent of lines upgraded. For more information see the MBIE website.

Source: MBIE Broadband Deployment
Update Sept-Dec 2014

Is it where it needs to be?

Coverage in New Zealand for both fixed line and mobile services is good in urban areas and across most of New Zealand, although some remote rural areas do not have good mobile coverage.

The Telecommunications Service Obligations (TSO) for residential local telephone service ensures voice calls, dial-up internet and fax services are available to almost all of New Zealand. The TSO is currently being reviewed by MBIE. The 2013 database of electoral street addresses shows 1.67 million unique addresses, compared to 1.37 million geographical locations covered by the TSO. However, despite this indication that some households fall outside the TSO, the market appears to offer services to the majority of these areas, and there is no indication of a significant coverage issue in fixed line services.

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The current UFB and RBI programmes will ensure fast broadband is available across New Zealand (together reaching 98 percent of the population). Coverage maps can be found on the Chorus website for UFB and RBI coverage. In 2014, the Minister for Communications and Information Technology announced planned extensions to both programmes, extending UFB to reach 80 percent of New Zealanders and providing a contestable fund to extend connectivity to more remote parts of New Zealand. MBIE are currently working on the policy proposals for these extensions and details are expected to be available to the market in 2015. For more information on the announcement, visit the National Party website.

In the mobile market, high consumer expectations drive availability and the 700MHz auction had coverage requirements as a condition of successful bids. However, mobile coverage is not consistently available across all rural regions, and the coverage maps provided by Vodafone, Spark and 2degrees (which can be found on their websites) illustrate some areas of limited coverage. Satellite-based services are available to the most remote regions. NIU has not been made aware of any significant issues resulting from this.

The Global Information Technology Report assesses how well a country is able to apply the benefits of ICT to encourage economic growth and higher living standards. The report ranks 148 countries around the world by using a number of pillars and measures, including "Infrastructure and Digital Content". This pillar includes a measurement of mobile network coverage as a percentage of the population. New Zealand scores highly with 97 percent of the population receiving mobile network coverage in 2012; however, New Zealand ranks only 88th out of 148 countries. Given New Zealand's high level of coverage, this may suggest this measure is very competitive with very high levels of coverage being seen across all countries included in the report. In comparison, Australia has 99 percent coverage and ranks 58th. Thirty-two countries from all over the world have 100 percent coverage.

What quality is it?

Quality does not appear to be an issue in the telecommunications industry in general, although publicly available data to support this is limited at best.

NIU has not been made aware of any issues relating to the quality of fixed line or mobile calling, or internet connectivity. However, data suggests internet speeds for consumers, while increasing, are slow in comparison to other countries.

As a minimum, the TSO deed requires Telecom to provide line connection speed for standard internet calls of 14.4 kbps for 95 percent of existing residential lines and 9.6 kbps for 99 percent of existing residential lines; however, these speeds are now very out of date and most services are significantly faster than this. The

Data reproduced from Commerce Commission Annual Telecommunications Monitoring Report 2013.

introduction of UFB and RBI will continue to improve speeds available to New Zealanders, with RBI requiring download speeds of 5Mbps and UFB requiring 30Mbps. Data caps are steadily increasing with about 10 percent of connections now uncapped.
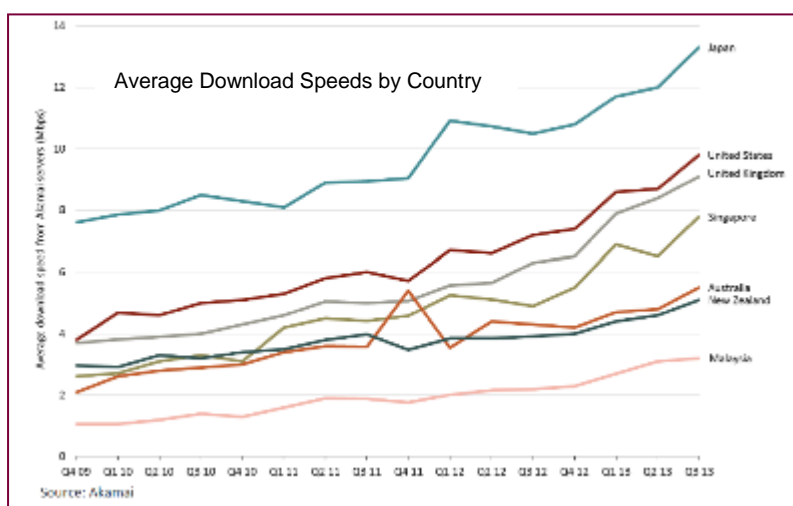
Most companies provide details of their average speeds online, and truenet.co.nz publishes monthly data. The October 2014 Urban Broadband Report showed all but three services operating at over 90 percent of the advertised speeds, and according to Truenet, the average New Zealand Broadband Speed has improved 34 percent in 2014 from 10Mbps to 14Mbps, due to increasing uptake of faster services. However, the Akamai Technologies State of the Internet Report for quarter three of 2014 puts New Zealand's average speed at only 7Mbps with a year on year improvement of 37 percent, 42nd in the world and ahead of Australia's 6.9Mbps.

The OECD's Communications Outlook 2013 shows New Zealand's average advertised download speed to be below that of the OECD average, although the median advertised speed is slightly above the average. The Outlook also shows actual speeds are lower than many other OECD countries. This data can be found on the OECD website here. The Global Information Technology Report ranks New Zealand's international internet bandwidth fo 2012 at 56 out of 148 countries. By comparison, Australia is ranked at 33 and the United Kingdom at nine.

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What capacity is it at?

There is no publicly available data to measure capacity constraints on either mobile or fixed line services, nor on the international cables; however, the sector does not consider capacity a problem.

Capacity is relatively easy to upgrade if the backhaul is already in place; however, it can take a long time to provide this due to planning legislation. This is a concern in areas of increasing growth and the sector has indicated that there is potential for more innovative solutions, for example tower sharing and co-location for mobile services, if flexibility in planning can be achieved.

International connectivity capacity does not appear to be a problem, despite some anecdotal complaints of speeds at peak time from business users. Southern Cross has just updated its network to provide total lit capacity across the system of 2.6Tbps, and the issue is more likely to be one of price for capacity, or domestic speed. The drop in speed at peak times also suggests a capacity limit at domestic level.

Investment continues in fixed network capacity, which should address these issues. UFB and VDSL are being deployed across the country, and service providers are also investing in core networks and in 4G LTE networks, which are optimised for mobile broadband services.

How resilient is it?

Required levels of resilience will vary depending on perspective. This assessment is made at a national level and is yet to be underpinned by robust supporting evidence. It does however assist in prioritising efforts.

In the table to the right, resilience expectations from a national perspective are identified as low, medium or high. When making these judgements a wide range of aspects require consideration. To demonstrate: under "International Systems", "Cable" has a very high economic value associated with it and generally carries time critical data. A high level of "Resilience expectation" is therefore attributed to it. An "Assessed Resilience" of medium reflects the significant vulnerability related to limited alternate options and the geographic proximity of landing points in New Zealand. In contrast "Landline – voice" is being superseded by new technologies and a medium "Resilience Expectation" reflects its transitionary state, its relatively low economic value and availability of alternatives. "Landline – voice" is also a good example of the level of resilience being dependent on your perspective; if your residence has this means of communication you could expect a high level of resilience and in many cases this probably exists.

The sector has indicated in discussions that it considers resiliency to be suitable for New Zealand, with diverse technology in the backhaul providing a good basis. Empirical evidence from the 2010 and 2011 Canterbury earthquakes also appears to support this view, with mobile services operating within 24 hours of the earthquake.

International connectivity is also fairly resilient, with the structure of the Southern Cross cable, and the second cable to Australia able to carry crucial data levels if required. While additional international cables will increase resilience, the quantum is hard to define.

The sector has raised a query regarding the resilience of 111 calls, which have a single point of failure as all calls must go through the public switched telephone network (PSTN), although only about 20 percent originate on it.

Key: Levels of Resilience

High — Medium — Low
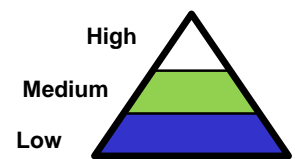
	Resilience Expectations	Assessed Resilience	Desired Movement
International Systems			
Cable		Medium	↑
Satellite		Medium	↑
Backhaul Systems (1)			
Regional			↑
National			↑
Access Systems (2)			
Landline – voice	Medium	Medium	–
Landline – narrowband data (dial-up)	Medium	Medium	
Landline – broadband data	Medium	Medium	–
Cellular Mobile – voice	Medium	Medium	
Cellular Mobile – data	Medium	Medium	–
111 Emergency Systems			
Initial Call Answering Platform (ICAP)		Medium	↑
Responder Platforms (Fire/Police/Ambulance)		Medium	↑
Air Broadcasting Systems			
Terrestrial television	Medium	Medium	–
Satellite television	Medium	Medium	–
FM audio	Medium	Medium	–
AM audio	Medium	Medium	–
Retail			
Customer Interface		Medium	↑

(1) Network connectivity linking access systems with points of interconnection.
(2) Network connectivity (fixed or mobile) linking subscriber devices with switching platforms.

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What are we investing?

Although the telecommunications sector is mostly privately owned, there are currently large levels of investment from both public and private parties.

Investment levels by private entities are not known; however, it is clearly spread across all parts of the sector: Southern Cross has just finished an upgrade to the international cable that connects New Zealand to the USA, and a second cable connecting New Zealand to Australia is being considered by the market; mobile operators are upgrading to 4G; and ultra-fast broadband is currently being rolled out across the country in a partnership between the public and private sector.

Public sector investment is also very high, with $1.35bn invested in the existing Ultra-Fast Broadband and $300m in the Rural Broadband Initiative (mostly funded from industry levies), and up to a further $360m announced for extensions to the two programmes. There is also ongoing investment in capabilities for the Network for Learning, Deaf Relay Service and 111 emergency services.

How productive is it?

There is limited information available about the productivity of the telecommunications sector in New Zealand.

The Global Competitiveness Index assesses a number of factors which involve the use of telecommunications.

New Zealand ranks well for technological readiness and ICT use, at 23rd and 25th out of 144 countries respectively. Actualising benefits from this seems to be more challenging, with very mixed results for innovation (ranging from 15th for capacity for innovation to 71st for government procurement of advanced technology products).

## How well are we managing it?

Telecommunications infrastructure is provided primarily by the private sector, regulated by the Commerce Commission, various Government initiatives (such as the Local Service and Deaf Relay TSOs, RBI and UFB initiatives), and general consumer and competition law.

The copper network is owned and operated by Chorus and, as per the Act and specific undertakings, provided to retail service providers on an open access basis. RBI-funded services are also subject to open access obligations. Wholesale UFB fibre services are provided by Local Fibre Companies in accordance with arrangements entered in to with the Crown (through the Crown agent Crown Fibre Holdings). Mobile services are provided by the market.

The Commerce Commission monitors telecommunications markets and regulates specific wholesale and interconnection services, while MBIE has policy responsibility for the sector. Information on the market can be found on the Commerce Commission's website.

Competition appears healthy in both the mobile and fixed lines services with a range of retail service providers, though the fixed line market has been becoming increasingly concentrated. The Commerce Commission calculates Herfindahl-Hirschman Index (HHI) for fixed line, mobile and broadband services. HHI is a commonly accepted measure of market concentration and is calculated by squaring the market share of each market participant that has a material number of subscribers and adding these together. This analysis can be found in their Annual Monitoring Report, on their website.

The market appears to be operating effectively in this sector, and there is no indication of management problems. Performance levels appear sufficient, with continuing investment. However,
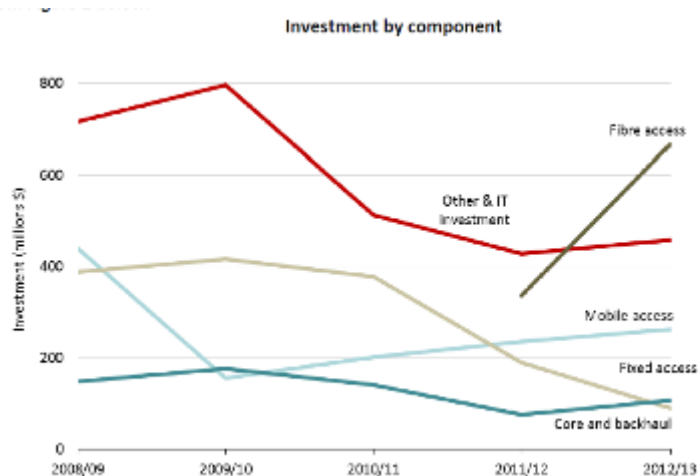
Data reproduced from Commerce Commission Annual Telecommunications Report 2013

inconsistency in planning legislation across the country can lead to inefficiencies for those providing infrastructure.

There is also significant regulatory uncertainty in the sector which should be addressed by the completion of several reviews, including the Telecommunications Act review and the Final Pricing Principle (FPP) review of UCLL and UBA. These should both be completed in 2015/16.

There is little available data on future forecasts, and the sector notes how difficult it is to make predictions due to the speed at which new technology and other innovations emerge in the international marketplace.

At present, increasing demand appears to be a constant, driven by the increasing availability of content. While the sector has plans in place to manage this, the importance of the telecommunications network both as a direct provider of services, and as an integral part of wider infrastructure provision, makes it crucial that quality services are provided at sufficient capacity.

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