Deloitte.

Deloitte
Access Economics

Unleashing fibre

The future of digital fibre infrastructure in New Zealand

OCTOBER 2024

Contents

New Zealand's digital fibre infrastructure is a success story worth celebrating, but the best is yet to come. Unleashing the power of our digital fibre infrastructure is critical to a brighter future – one that could be worth $163 billion over the next 10 years.

In today's world, digital fibre infrastructure is important for helping the economy to grow and sparking new ideas. It's the foundation of our communication networks, helping data move faster and enabling services that help all industries work better and households to connect. This report, developed by Deloitte Access Economics, takes a closer look at the substantial and long-lasting impact of digital fibre infrastructure in New Zealand.

The New Zealand Government initiated the Ultra-Fast Broadband (UFB) initiative in 2009,[1] with the rollout commencing in 2010. Fourteen years later and substantially faster, the fibre network has emerged as the public-private partnership success story, setting the gold standard for the delivery of significant infrastructure projects and fibre infrastructure investments.

As we look back at this 14-year journey, this report asks some important questions. How much has the fibre network changed our daily lives? Did it bring the improvements in productivity and economic growth that were promised in 2009? And as the technology matures today, what are the future benefits we can expect our fibre network to unleash?

What difference has digital fibre infrastructure made?

This report shines a spotlight on the significant economic impact that digital fibre infrastructure or the fibre network has and can make to New Zealand's economy.

WE FIND THAT:

Digital fibre infrastructure has grown the New Zealand economy by **$8.8 billion in 2023** through increased productivity

Digital fibre infrastructure has delivered **$31 billion of economic benefit between 2011 and 2023**

To model the economic impact of digital fibre infrastructure, we built upon previous research by **Deloitte Access Economics** and the OECD studying the relationship between digital technologies and economic growth to estimate the productivity benefits of fibre to the New Zealand economy. This approach studied how economies use 'better fibre' to produce more with the same amount of inputs through a capital growth framework. This is an economic framework under which economies apply human knowledge and enablers to produce output using capital and labour factors of production. Using fibre as an 'enabler' in the model, we are able to quantify how fibre enables digital adoption and how that flows through to productivity. We used this relationship to both attribute a portion of New Zealand's historical economic growth to fibre, as well as estimate what the future productivity benefits could be.

This estimated productivity impact does not capture the wider benefits to society, such as the flow-on impacts to healthcare, education, and mental wellbeing.

Having strong digital capabilities is the foundation for our country's success, and it makes us a standout in the world. However, despite the transformational impact of the fibre network to date, the most substantial benefits are yet to be realised.

What are the future benefits of our digital fibre infrastructure?

The best is yet to come.

As the digital fibre network matures, it will be able to support advancements such as live sport streaming, the transition from digital terrestrial television to data-intensive streaming and an increasing number of devices per household, on average from 25 today to 44 by 2030, each of which demanding an ever increasing amount of data. Also by having a fast, stable, and secure connection that is ubiquitous across the nation, next generation technologies such as AI and cloud will harness the network's potential. Through these factors, the true extent of fibre's productivity impact to the New Zealand economy will emerge. As the EU has noted as part of its Digital Decade initiative:[2]

> **"Fibre networks [are] critical for delivering gigabit connectivity and enabling the take-up of cutting-edge technologies such as AI, cloud, and the Internet of Things (IoT)."**

This report boldly finds that the economic impact of **digital fibre infrastructure**, due to productivity benefits, has the potential to **add $33.2 billion to the New Zealand economy by 2033. That's equivalent to $163 billion in net present value terms over the next 10 years.**

It is important to note that these benefits will accrue over the course of many years, not in any one particular year. This is highlighted in figure 1 below, which shows the benefit of the fibre investment over 20 years, over many stages. As the fibre network transitions into a maturity phase, the reliance on fibre and the fundamental shift in the way we operate becomes embedded in the economy. This is why we see a lag between implementation and benefit realisation. Lifting New Zealand's productivity is a long-term game and required careful investment and time to take root.

The productivity benefits stemming from the fibre network into the future will be driven by increasing usage, connectivity and top-line speed - these are benefits which are delivered by future-ready digital fibre infrastructure.

These results assume that uptake and coverage of fibre will continue to increase to 95% by 2033. Average broadband speeds are projected to increase from 442 Mbps in 2024 to 1,162 Mbps in 2033, based on publicly available forecasts and forecasts provided by Chorus on the effect of faster fibre speeds on average speeds.

However, this economic windfall is not guaranteed. For example, in a scenario where coverage and uptake remain at current levels of 87% and 75% respectively, **New Zealand leaves $17 billion in future productivity benefits on the table** in net present value (NPV) terms out to 2033. We must keep the pace and commit to unleashing the full potential of digital fibre infrastructure.

FIGURE 1:
OVERVIEW OF THE IMPACT OF FIBRE INVESTMENT TO THE NEW ZEALAND ECONOMY

$31b

total GDP impact
summed from **2012** to **2023** in 2023 NZD

$163b

total GDP impact
in NPV terms from **2024** to **2033** in 2023 NZD

$8.8b
of today's GDP

$33.2b
of 2033's GDP

Early adoption

Households and businesses are connected to the digital fibre network, but the use cases are limited.

Application development and innovation

New applications and technologies and other innovations allow households and businesses to begin making use of the network, but benefits are limited.

Maturity

The network matures and improvements from innovations start to translate into increasing productivity benefits.

Ubiquity and supporting next generation technology

As access to fibre becomes ubiquitous and next generation technologies are enabled, the productivity benefit accelerates.

WHAT GETS MEASURED GETS MANAGED

How can we unleash the power of digital fibre infrastructure?

We need to stay ahead. The good news is we have momentum. This report explores how we can unleash the power of our fibre network and in doing so, we can enable innovation, unlock business transformation and uplift our productivity in the future.

Progress in realising the productivity benefits of digital fibre infrastructure hinges on the following six dimensions. Each of these dimensions are explored in more detail throughout the report, but in summary the dimensions are:

DIMENSION	ACTION
Addressing digital equity by boosting fibre access and uptake in households Continue to enhance the accessibility of digital fibre infrastructure and increase household uptake to promote safe and efficient digital interactions for all New Zealanders. This will support bridging our digital equity and geographic divide in fibre access.	Government and industry to work together to consider how fibre coverage can be expanded from 87% to 95% to ensure $17 billion is not left on the table. This also involves closing the gap between uptake and access.
Make room to innovate with AI Actively harness AI's potential to drive innovation, productivity, and enterprise change, while creating awareness about the Government's prioritisation of AI usage and responsible regulation.	Policy makers to continue promoting increased AI usage and consider how current regulations will facilitate the responsible use of AI in the near future. Alongside this, business associations should work with their members to guide them through adopting new technologies and sharing success stories.
Small businesses need to lift their tech game Accelerate the adoption of digital tools and digital transformation, particularly among small to medium enterprises (SMEs), through providing digital incentives, support programmes, and enhanced digital capabilities.	Small businesses need to collaborate with industry in order to get businesses connected and lift online presence, by offering the right incentives and attracting the right talent. Larger businesses and network operators should support their small business customers through the process of digital adoption and facilitate knowledge sharing.

WHAT GETS MEASURED GETS MANAGED

DIMENSION	ACTION
Seize the opportunity to grow exports Leverage digital fibre infrastructure and expand adoption of high-speed internet for increased export potential, in particular, weightless exports, and ensure policy settings attract and retain a skilled workforce.	Businesses and government to promote New Zealand's digital infrastructure success and capability on the global stage.
Government to be an early adopter Leverage data and digital technologies to enhance government services for businesses from being an early adopter in open customer data, to taking a sector agnostic approach to digital building blocks known as Digital Public Infrastructure.	Government to harness digital infrastructure to inspire industry. For example, as an early adopter of open customer data and Digital Public Infrastructure.
Future regulation (or deregulation) Continuously review whether regulation for digital fibre infrastructure is fit-for-purpose and provide the right incentives to invest and innovate in infrastructure for the long-term benefit of New Zealand, as well as providing regulatory certainty to drive AI and other digital tools adoption.	Regulators and policy-makers need to ensure that regulations are fit-for-purpose and provide incentives for investment and innovation. This could mean reconsidering regulatory settings around different technologies such as copper, fibre and AI.

As our world becomes more connected, digital fibre infrastructure stands at the forefront of economic progress and innovation, empowering communication networks and boosting productivity.

Reflecting on our 14-year journey, this report highlights a remarkable $31 billion economic benefit unleashed between 2011 and 2023 due to the digital fibre infrastructure in New Zealand. With the exciting prospect of a potential $163 billion increase in economic benefits out to 2033, the focus now shifts to unleashing the potential of digital fibre infrastructure.

Developed by **Deloitte Access Economics**, the report delves into the substantial economic benefits of our current digital fibre infrastructure and its escalating significance for the future prosperity of our economy.

Te Waihanga, New Zealand's Infrastructure Commission's recent statement emphasises the enduring impact of past decisions on present infrastructure benefits.

> **"The benefits that we experience from infrastructure today depend upon past decisions about how to plan, build, and maintain these assets. Similarly, our current decisions will affect the quality and quantity of infrastructure services for future generations."[3]**

One example of New Zealand's past infrastructure investment decisions is the Government's Ultra-Fast Broadband (UFB) initiative. Recognising the benefits of a fibre network and a desire to "start delivering the infrastructure that will bring about the step-change in our economy," the Government initiated the UFB initiative in 2009,[4] with the fibre network rollout commencing in 2010. Fourteen years later and a lot faster, the fibre network has emerged as an exemplary large-scale public-private partnership, setting the global standard for the successful delivery of substantial infrastructure projects and fibre infrastructure investments.

As we reflect on this 14-year journey, pressing questions arise about the impact of the fibre network on our daily lives and whether the promised benefits from 2009 have materialised in increased productivity and economic growth. The pivotal role of digital fibre infrastructure during the COVID-19 lockdowns highlighted its unparalleled capacity and capability, further cementing its status as a world-class enabling digital infrastructure. The radical enhancements in internet connectivity ushered in by this ambitious **$5+ billion fibre network rollout**, have profoundly influenced our societal fabric, leading to a vital query about the untapped potential of digital fibre infrastructure for New Zealand.

In 2024, we find ourselves on the brink of a new phase, shifting from initial growth to maturity, prompting a critical moment for assessing the return on this investment and setting our sights on the future.

With the need to decarbonise our economy, uplift productivity, boost high-value and weightless exports, and support sustained growth in the technology sector, it is evident that our fibre network will serve as an instrumental enabler to realise New Zealand's future ambitions.

To address these crucial developments, this report is structured to cover the following key areas:

PART 1

An overview of the timeline and investment in digital fibre infrastructure, and the tangible impact on New Zealanders.

PART 2

The economic impact of our digital fibre infrastructure to date by presenting persuasive case studies and economic modelling insights that highlight its transformative influence.

PART 3

The future economic opportunity of our digital fibre infrastructure within the rapidly evolving digital landscape, providing insight into its profound implications for our economy.

PART 4

Considerations to unleash the future opportunity, focusing on seizing this chance to build a resilient economy, empowering every individual through enhanced connectivity, and paving the way for a thriving digital landscape that benefits all.

LAYER 2
Fibre network

LAYER 1
Data centers

LAYER 3
Mobile connectivity

We acknowledge the presence of additional layers, including data centres and mobile connectivity as part of our overall digital infrastructure.

We also recognise there are other broadband technologies, such as Starlink and wireless that have an important role to play. This report focuses on the pivotal element at the core of this digital transformation: New Zealand's fibre network.

This allows us to reflect on the impact of the public private partnership investment to date.

THE SUBSTANTIAL IMPACT OF THE FIBRE NETWORK TO DATE

How did we get here? The fibre network story

As a nation, we can celebrate this milestone that fibre coverage now extends to 87% of the population, offering unparalleled connectivity and enabling innovation, business transformation and community development.

Digital fibre infrastructure investment: A success story in future-proofing New Zealand's digital fibre infrastructure

New Zealand's digital fibre infrastructure involved a substantial upfront investment to build a once-in-a-generation, multi-billion-dollar fibre network ahead of demand. This socially beneficial investment was based on a deed of agreement or contract with Government, placing conditions on fibre providers around price, quality, service, and take-up levels. With investors embracing the considerable contractual and construction risks associated with the extensive infrastructure investment, long-term financing based on the contractual terms was pursued, supported by government debt financing.

Unlike Australia's mandated copper-to-fibre migration plan, New Zealand's fibre rollout was driven by delivery targets and provision of fibre products at prices set initially through contracts with Crown Infrastructure Partners, and then through regulation.

This approach led to the introduction of new fibre products and services, resulting in New Zealand consumers experiencing a step-change in the quality of fixed-line broadband services.

With over $5.5 billion invested in the fibre network to date, New Zealand stands among the most connected countries in terms of fibre broadband access.[5] Ongoing investment in the fibre network is anticipated to continue enhancing the nation's digital capabilities, exemplified by the Commerce Commission's recent approval of Chorus' $1.7 billion expenditure over the next four years.[6]

The timeline[7] below shows the events and milestones achieved during the fibre network rollout, demonstrating a strong alignment with delivering socially beneficial outcomes for consumers. The aim was to minimise deployment costs, provide higher-speed broadband services to those customers who value it most, and deliver services at the earliest possible time, reflecting a commitment to productive, allocative, and dynamic efficiency.

Today, **87% of New Zealanders have access to the fibre network.**

While 13% of the population is yet to be connected, it is pleasing to see fibre network providers continuing to extend this coverage.[8]

Fibre Connecting New Zealand

2010

UFB1 rollout commences, four companies (Chorus, Enable, Northpower, and Tuatahi) awarded contracts to rollout fibre across New Zealand. Target set for 75% of the population, with all schools and public hospitals to have access to UFB by 2019. Rural Broadband initiative also launched.

2014

Whangarei is New Zealand's first fully-fibred city under the Government's UFB programme.

2015

UFB rollout to all schools and public hospitals completed. Most private health centres and businesses also have access to fibre.

2017

UFB rollout expanded to include second stage UFB2, which extended targets from 75% to 87% of households and businesses having access to fibre by the end of 2022.

2018

50 towns now have access to fibre and 1.4m households and businesses have access to fibre, with uptake sitting at 44%.

CHORUS

enable fibre broadband

Tuatahi First Fibre

Northpower FIBRE

1 UFB1
rollout commences

75%
rollout target set

2 UFB2
rollout expands

87%
rollout target extended

50
towns with fibre

1.40m
businesses & homes with fibre access

44%
uptake

* All figures are for year ended 30 June

2019

110 towns now have access to fibre and 1.6m households and businesess now have access to fibre. UFB1 completed ahead of time and under budget.

110 towns with fibre

1.60m businesses & homes with fibre access

52% uptake

2020

195 towns now have access to fibre and 1.68m households and businesses have access, with uptake sitting at 60%.

195 towns with fibre

1.68m businesses & homes with fibre access

60% uptake

2021

309 towns now have access to fibre and 1.76m households and businesses have access, with uptake sitting at 65%.

Fibre300 plan introduced, tripling download speeds for household users.

X3 300 Fibre300 plan introduced

309 towns with fibre

1.76m businesses & homes with fibre access

65% uptake

2022

380 towns now have access to fibre and 1.81m households and businesses have access, with uptake sitting at 70%. December 2022 rollout completed on time and under budget.

Rollout complete

380 towns with fibre

1.81m businesses & homes with fibre access

70% uptake

2023

1.84m homes and businesses have fibre connections available, with fibre coverage reaching 87% of the population. 1.37m now have fibre, a 73% uptake.

87% fibre coverage

412 towns with fibre

1.84m businesses & homes with fibre access

73% uptake

Q1 2024

1.84m homes and business with fibre connections available. 1.39m have fibre connection, a 75% uptake.

1.84m businesses & homes with fibre access

75% uptake

* All figures are for year ended 30 June

What difference has the fibre network made?

New Zealand's fibre network has undergone a significant transformation, fuelling productivity growth across the country, and reshaping the way Kiwis live and work.

Then versus now

The influence of New Zealand's digital fibre infrastructure cannot be overstated. The usage and dependence on fixed-line fibre broadband has experienced exponential growth to date, underscoring the pivotal role of digital fibre infrastructure in New Zealand. Businesses and households are now consuming unprecedented volumes of data. To the right, we illustrate the remarkable progress of our digital fibre infrastructure over time.[9]

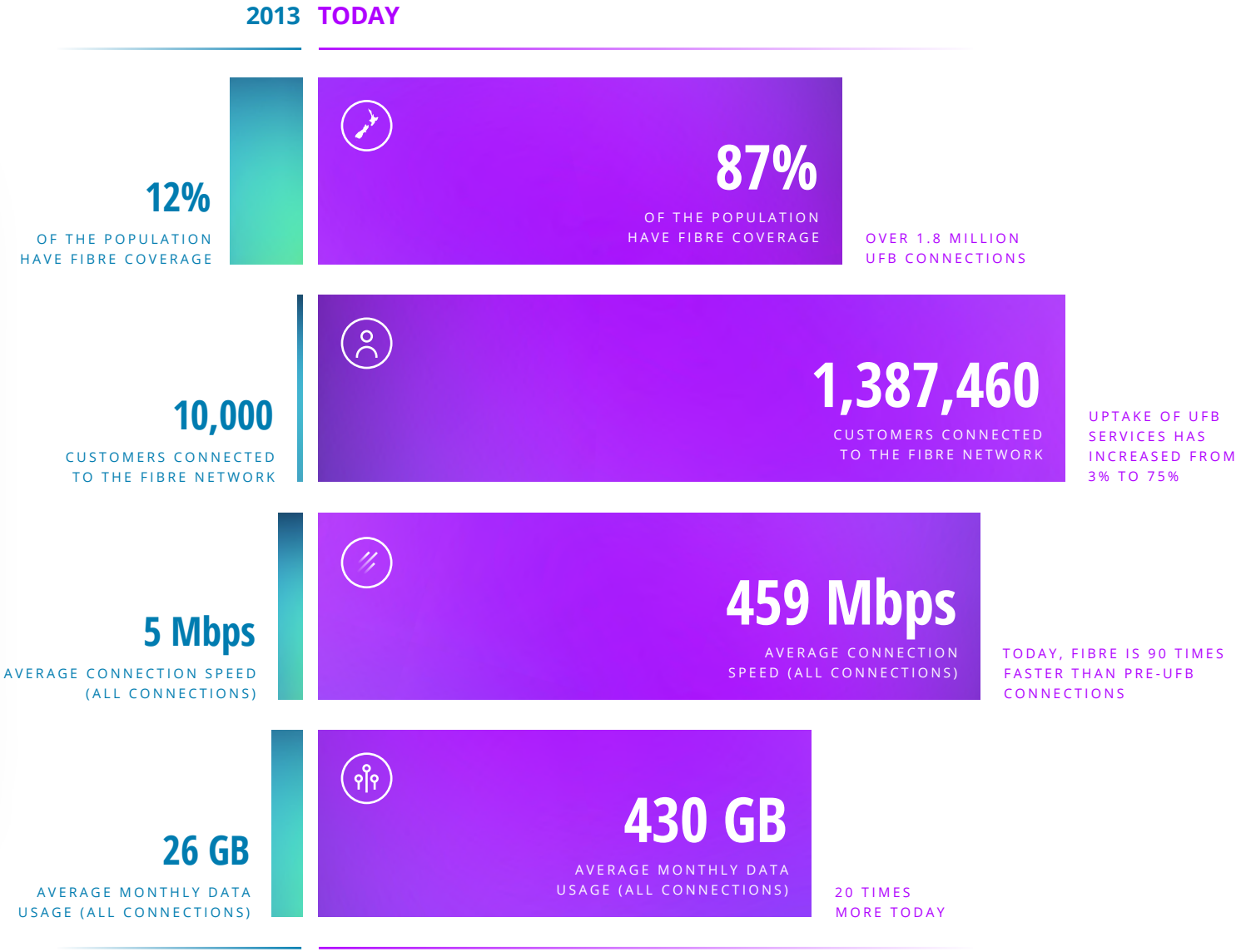
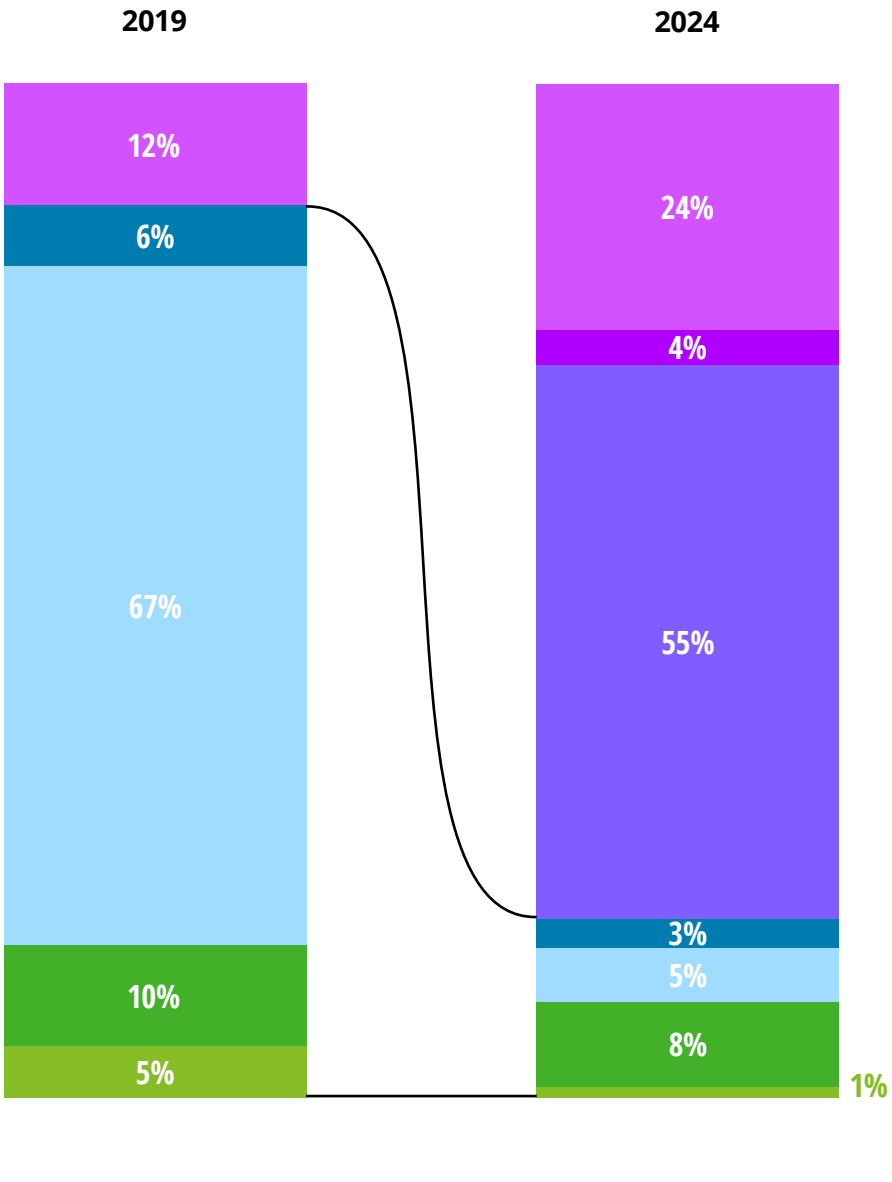


FIGURE 2:
COMPARISON OF FIBRE PLAN CHOICE



Kiwis have shifted over to faster fibre plans

To accommodate the increased use and ensure the digital fibre network remained congestion free, wholesale fibre providers commenced a performance upgrade of the fibre network. This has tripled the download speeds from 100Mbps to 300Mbps and quintupled the upload speeds from 20Mbps to 100Mbps.[10] Fibre300 is now New Zealand's most popular plan, with approximately 55% of connections using it. There are also a growing number of speed hungry businesses and households, with nearly one in four fibre connections adopting a 1 Gbps+ fibre plan.

Figure 2 shows the average speed composition of fibre connections, including both residential and business connections.

Source: Crown Infrastructure Partners quarterly update reports (December 2019 and March 2024 quarters)

Cause and FX
A local company gone global thanks to fibre

Cause and FX is an independent visual effects studio based in Auckland, that creates visual effects and computer graphic imagery for the film and television industry.

Since its establishment in 2011, Cause and FX has become one of New Zealand's fastest-growing VFX studios. For over a decade, the world's most influential film and television studios have trusted Cause and FX to create visual effects for their projects.

When asked how fibre has enabled their business, Cause and FX said:

> **"Without the investment in fibre, we would not be able to do what we do now."**

"Taking Rings of Power as an example (an Amazon Prime TV series), it was a very heavy project with an enormous amount of work done on set, meaning the delivery packages were enormous.

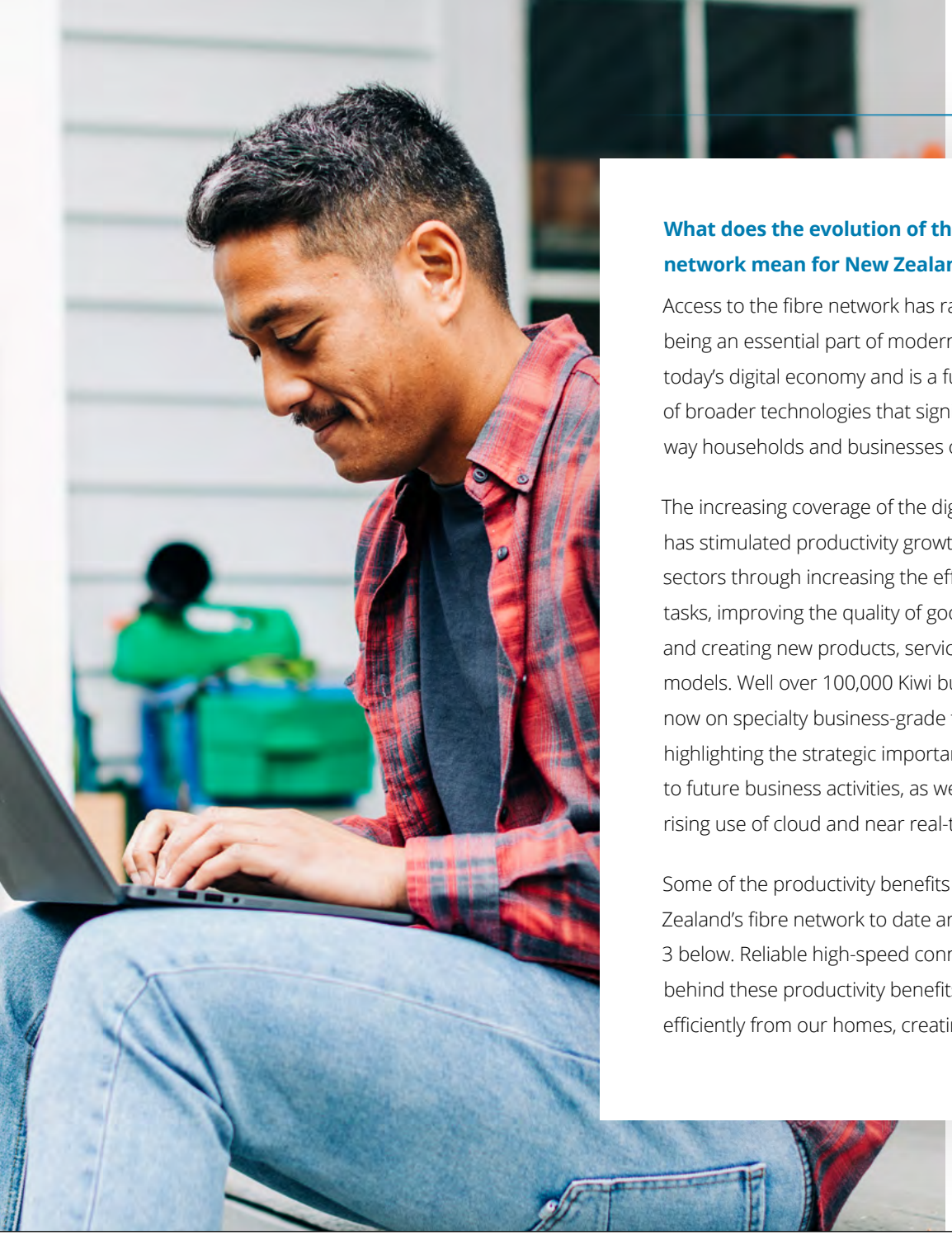
Our fibre plan, which has the same download and upload speeds, allowed us to take packages on board and send them back quickly, which is critical to competing and surviving in the industry."

Before COVID-19, Cause and FX was primarily focused on productions shot locally in New Zealand. But New Zealand's geographical location and time zone challenges created perceived barriers to being able to compete on a global scale.

With the investment in the fibre network and faster speeds becoming available, these barriers dissolved. With *"COVID-19 [pushing people to work remotely] and the technology getting to where it is now, allows us to effectively engage with productions globally and [location] is no longer an issue [or] barrier we need to talk around."*

"We're now getting engaged to complete work for global production companies no matter where it is shot in the world, or where people are based. This is primarily driven by the fact we have the technology that makes it feel like we are working seamlessly alongside them."

High quality fibre has also enabled Cause and FX to work with massive data files (both downloading and uploading data). *"It is not uncommon for us to receive client file packs that are in the tens of terabytes in size, so high speed, low latency fibre connection is critical to our data needs, as well as collaboration and the work we do, both as a team and with our clients."*



What does the evolution of the fibre network mean for New Zealand's productivity?

Access to the fibre network has rapidly evolved into being an essential part of modern life. It underpins today's digital economy and is a fundamental enabler of broader technologies that significantly influence the way households and businesses operate.

The increasing coverage of the digital fibre network has stimulated productivity growth in various sectors through increasing the efficiency of routine tasks, improving the quality of goods and services, and creating new products, services, and business models. Well over 100,000 Kiwi businesses are now on specialty business-grade fibre connections, highlighting the strategic importance of quality fibre to future business activities, as well as supporting the rising use of cloud and near real-time applications.[11]

Some of the productivity benefits enabled by New Zealand's fibre network to date are described in figure 3 below. Reliable high-speed connectivity is the driver behind these productivity benefits, allowing us to work efficiently from our homes, creating opportunities for New Zealand companies such as Cause and FX to compete in global markets, and facilitating the adoption of new technologies that contribute more efficient business processes.

Productivity is not just a nice-to-have, it's a fundamental driver of New Zealand's long-term economic wellbeing. One way to improve productivity growth is through the development and adoption of productivity-enhancing technology, enabled by digital fibre infrastructure. The next section of the report assesses the productivity benefits resulting from our digital fibre network.

Greater coverage and access to fibre support economic growth

Lifting productivity is a vital way for economies to grow sustainably and raise living standards over time. Various local and international studies have found that greater coverage and access to higher speed broadband leads to economic growth, and ultimately growth in a country's GDP. For example:

FIGURE 3:
PRODUCTIVITY BENEFITS ENABLED BY THE FIBRE NETWORK

Source: Deloitte Access Economics

What are the benefits of the fibre network to date?

Our modelling finds that from 2011 → 2023, digital fibre infrastructure's overall economic impact through productivity benefits was worth an estimated $31 billion.

It is important to acknowledge that investing in the future necessitates action in the present. Large-scale infrastructure projects, like the fibre network investment, usually entail extended periods before the benefits are realised. Infrastructure investment also tends to yield broader economic benefits, extending beyond the fundamental enhancement of the infrastructure itself. An example of this are the productivity gains unlocked by digital fibre infrastructure, illuminating the tangible returns from our investment in the fibre network.

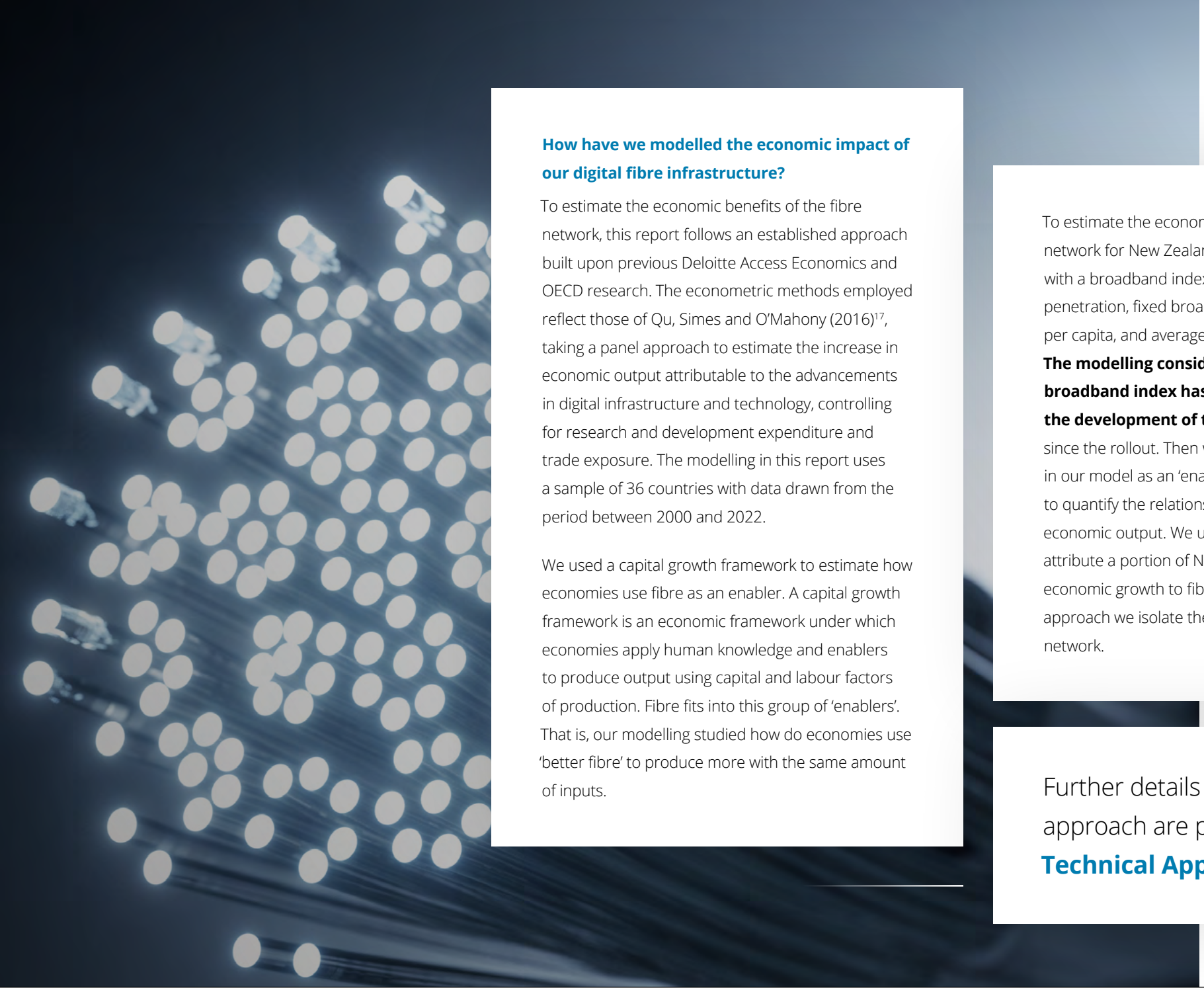
Greater coverage and access to fibre support economic growth

Lifting productivity is a vital way for economies to grow sustainably and raise living standards over time. Various local and international studies have found that greater coverage and access to higher speed broadband leads to economic growth, and ultimately growth in a country's GDP. For example:

TABLE 1:
STUDIES ANALYSING THE
IMPACT OF FIBRE SPEED ON GDP

Study	Date of the study	Period	Calculated economic benefit
Katz & Callorda	2018	2004-2017	Finds that for high income countries, 1 percentage point (pp) increase in fixed broadband penetration results in a 0.14 pp increase in GDP growth.[12]
Koutroumpis	2019	2002-2016	Finds that for OECD countries, the increase in broadband connections per 100 people contributed to a cumulative GDP increase of 4.34% for the countries in the sample.[13]
Gomez-Barroso & Marban-Flores	2020	2009-2018	Reports that for every 1 pp increase in broadband adoption results in an associated increase of 0.09 – 0.15 pp in GDP per capita.[14]
Appiah-Otoo & Song	2021	2002-2017	Reports that a 1% increase in fixed broadband connections, related to a 0.32% increase in economic growth in high income countries.[15]
Briglauer et al.	2021	2010 - 2015	Finds that a 1% increase in broadband adoption increases regional GDP per capita by 0.18%.[16]

Source: Deloitte Access Economics



How have we modelled the economic impact of our digital fibre infrastructure?

To estimate the economic benefits of the fibre network, this report follows an established approach built upon previous Deloitte Access Economics and OECD research. The econometric methods employed reflect those of Qu, Simes and O'Mahony (2016)[17], taking a panel approach to estimate the increase in economic output attributable to the advancements in digital infrastructure and technology, controlling for research and development expenditure and trade exposure. The modelling in this report uses a sample of 36 countries with data drawn from the period between 2000 and 2022.

We used a capital growth framework to estimate how economies use fibre as an enabler. A capital growth framework is an economic framework under which economies apply human knowledge and enablers to produce output using capital and labour factors of production. Fibre fits into this group of 'enablers'. That is, our modelling studied how do economies use 'better fibre' to produce more with the same amount of inputs.

To estimate the economic impact of the fibre network for New Zealand, modelling begins with a broadband index that includes internet penetration, fixed broadband connections per capita, and average broadband speeds. **The modelling considers how this broadband index has changed as a result of the development of the fibre infrastructure** since the rollout. Then we included this variable in our model as an 'enabler'. This allowed us to quantify the relationship between fibre and economic output. We used this relationship to attribute a portion of New Zealand's historical economic growth to fibre. Therefore, with this approach we isolate the impact of the fibre network.

Further details of our modelling approach are provided in the **Technical Appendix.**

FIGURE 4: ECONOMIC IMPACT OF THE FIBRE NETWORK TO ANNUAL GDP ($B, 2023 NZD)

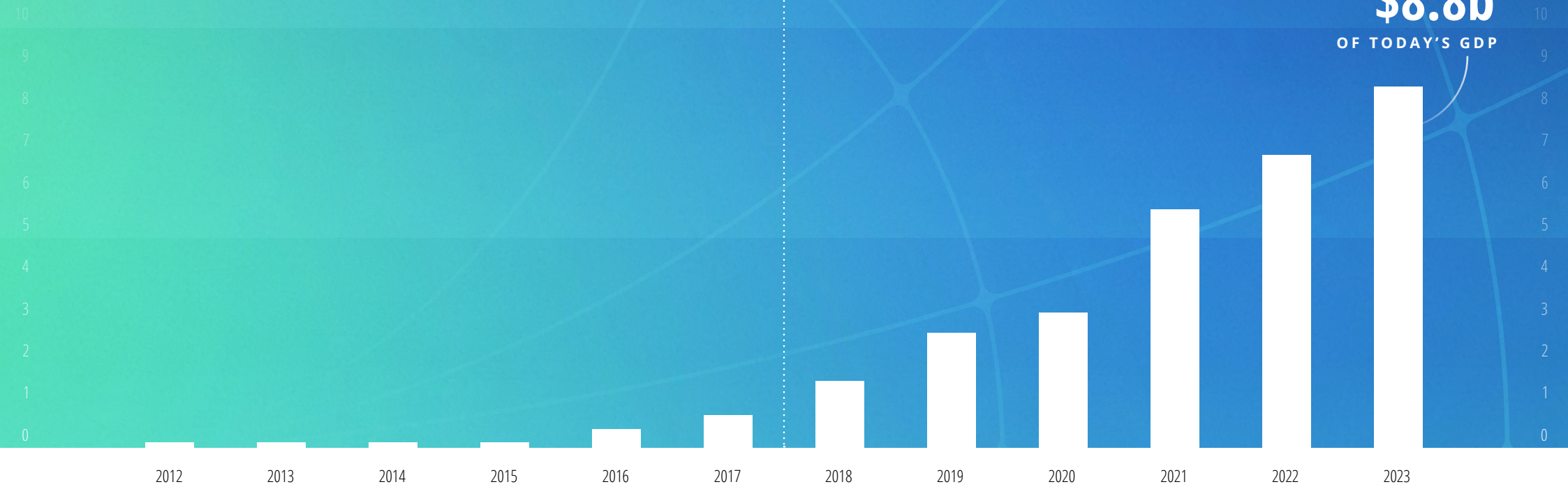
Source: Deloitte Access Economics

The impact of the fibre network to date

We find that, between 2012 and 2023, productivity benefits from digital fibre infrastructure **added $8.8 billion to New Zealand's annual GDP by 2023 – with a total benefit over the whole period of $31 billion.**

$31b

total GDP imapct
Summed from 2012 to 2023 in 2023 NZD



EARLY ADOPTION

Households and businesses are connected to the digital fibre network, but the use cases are limited.

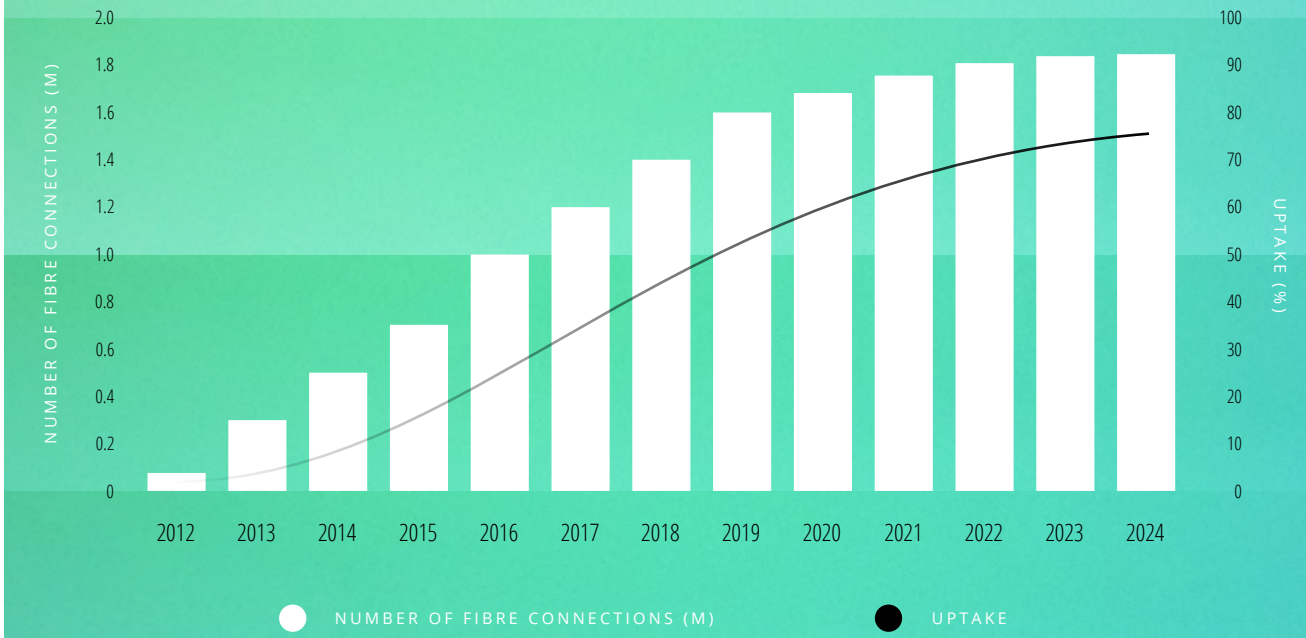
APPLICATION DEVELOPMENT AND INNOVATION

New applications and technologies and other innovations allow households and businesses to begin making use of the network, but benefits are limited.

EARLY ADOPTION

When the fibre rollout commenced in 2010, the economic benefits were initially negligible. Early adopters were beginning to use the digital fibre infrastructure, but uptake of the fibre was only just starting and the value-add from practical use cases was minimal. The focus in this phase was to establish the fibre network and the necessary infrastructure needed for the high-speed internet connectivity, increased data usage and latency needed by applications to come.

FIGURE 5: NUMBER OF FIBRE CONNECTIONS



Source: Deloitte Access Economics based on Crown Infrastructure Partners' Annual Reports

APPLICATION DEVELOPMENT AND INNOVATION

As access expanded, uptake of the fibre network grew. Increasing access and uptake, coupled with the development of new applications and other innovations, meant that the economic benefits from productivity enhancing applications reliant on the digital fibre network began to materialise. Whether it's paving the way for smart cities, empowering innovative business solutions, or enriching communities and households alike, the digital fibre infrastructure has undeniably served as the backbone of New Zealand's digital transformation to date.

LOCAL GOVERNMENT

SMART CITIES

A robust fibre network serves as the backbone of smart cities, laying the groundwork for smarter, more interconnected cities.

Smart cities require reliable, high-quality connectivity to utilise Internet of Things (IoT) technology. This technology allows everyday objects to share information and work together without people having to do everything manually. Sensors and applications help collect real-time data that can be communicated through the internet, creating areas that are safer, cleaner and greener while making better use of resources.

EDUCATION SECTOR

Interactive and distance learning became more accessible via enhanced connectivity, allowing students in even the most remote areas to experience world-class educational resources.

TRAFFIC MANAGEMENT

Intelligent traffic management systems rely on real-time data collected from cameras, sensors, and GPS devices to optimise traffic flow. The fibre network assists in facilitating seamless data transmission and effective implementation of these systems, resulting in reduced commute times, emissions, and stress for commuters.

COMMUNITY DEVELOPMENT

The fibre network enables the services that many community events (i.e. summer concerts) need to operate this includes security via CCTV cameras and greater connectivity through free public wi-fi networks.

This makes virtual community spaces, digital inclusion initiatives, and online government services more accessible, fostering a sense of belonging and participation.

BUSINESSES

KIWI STARTUPS AND BUSINESSES

Connection lies at the heart of our business models, driving innovation and productivity.

Reliable and fast internet has facilitated cloud computing, data analytics, and other digital technologies that are now central to modern business strategies.

Some New Zealand businesses have embraced the power of online tools, using them to streamline operations, engage with customers, and enter global markets from our remote shores.

Internet New Zealand research showed that in 2023, 61% of employed New Zealanders do work that allows them to work from home. Of theses, 75% worked from home all or some of the time.[18]

E-COMMERCE

High speed connectivity has allowed E-commerce platforms to flourish as the capacity to manage high volumes of online transactions has expanded.

HEALTHCARE

Healthcare providers have implemented telemedicine services, overcoming geographical barriers to deliver timely and efficient healthcare services.

REGIONAL BUSINESSES

Fibre has enhanced the ability to operate beyond the main business centres, benefiting businesses in regional areas.

Businesses, regardless of their location, have the capability to connect with customers, partners, and suppliers across New Zealand and the globe.

REMOTE WORKING

The COVID-19 pandemic and the subsequent lockdown periods fundamentally shifted the way we worked.

During the pandemic, high-speed and reliable fibre connections enabled a swift transition to a digital working environment, ensuring business continuity and sustaining educational activities with minimal disruption.

Today, the possibility of remote work has become viable, with many companies embracing a flexible work style. This has enabled people to work from regional centres, removing the need to relocate to where job opportunities are. Consequently, the demand for large physical office spaces has reduced significantly with some companies opting to be fully remote.

HOUSEHOLDS

SOCIAL INTERACTION

Physical location no longer dictates the relationships people have with one another. The advancement of social media, video calls and streaming platforms have created new ways of collaboration and communication in our society.

The fibre network was vital when physical distancing became the norm, enabling people to maintain personal connections, fostering a sense of community and well-being by allowing families and friends to virtually gather and support each other through challenging times.

GAMING

As online computer and video games are regarded as the most demanding on internet connection, fibre has entirely changed the overall gaming experience.

Improvements to gameplay, streaming, installation of updates or new games, and digital distribution have been driven by greater bandwidths.

ENTERTAINMENT

Fibre has been the force behind a new era of entertainment. The shift to online entertainment services such as Netflix, YouTube, Disney Plus, Neon and Amazon Prime would not have gained traction without reliable, high speed connection.

Households now experience uninterrupted streaming of HD and 4K video content across multiple devices simultaneously.

COVID-19
The ultimate test of the digital fibre network

The COVID-19 pandemic served as a catalyst for digital transformation on a global scale. The shift to remote working and online activities became essential to ensure the continuity of public, private, and social life during lockdowns. For example, Chorus' fibre network saw an immediate 34% increase in data usage during the March 2020 lockdown, without any congestion or discernible drop in service performance.[19] The ability to serve this increased demand highlights the often-unappreciated resilience of the digital fibre network. In its Autumn 2020 Measuring Broadband New Zealand report, the Commerce Commission noted that despite the unprecedented demand on broadband networks, fibre broadband connections experienced no significant drops in download speed, while average download speeds for fixed wireless decreased by 20-to-25%.[20]

Since the pandemic, the fibre network has enabled a shift in the use of digital applications across various facets of life. From individual experiences (including online learning, remote work, and e-commerce) to national transitions (moving towards digital economies and governance), and from corporate adaptations (pursuing new business models, services, and delivery methods) to industry shifts (embracing process automation and exploring the benefits of artificial intelligence), the impact of digital technologies has been far-reaching and profound. This transition has the potential to reshape everything from local governance to national administration, facilitating more transparent and efficient governance and the delivery of digital public services.

THE FUTURE OF FIBRE IS BRIGHT

What are the future benefits of the fibre network?

Our modelling suggests the most substantial benefits of the fibre network are yet to come, with an estimated **$163 billion of productivity benefits** that could be added to New Zealand's economy by 2033.

In addition to assessing the economic benefits of the fibre network to date, we have modelled the potential productivity benefits of New Zealand's fibre network into the future.

To do so, we leverage the results of the econometric methods used to estimate the economy-wide productivity impacts of the fibre network presented in the previous chapter of this report. Using the estimated historical relationship, or ratio between the broadband index and GDP per capita change attributable to digital adoption enabled by fibre broadband, we can estimate how changes in the broadband index may increase GDP per capita into the future. We also used broadband speed forecasts as the key driver of changes in the broadband index out to 2033.

The future benefits outlined in this report are attributed to the evolution of the fibre network. Fibre is the technology of the future as it has the bandwidth, quality, latency, and jitter to reliably support next generation technologies and data processing. These characteristics are required in order to create a truly connected society and unlock the future benefits.

The productivity benefits stemming from the fibre network into the future will be driven by increasing usage, connectivity and top-line speed – these are benefits which are delivered by a future-ready digital fibre infrastructure.

As outlined in the modelling approach above, we used the relationship between fibre, which is considered an enabling service, and economic output, to estimate what the future productivity benefits could be.

Further details of our modelling approach are provided in the **Technical Appendix.**

FIGURE 6: CONTRIBUTION OF BROARDBAND TO ANNUAL GDP ($B, 2023 NZD)

Source: Deloitte Access Economics

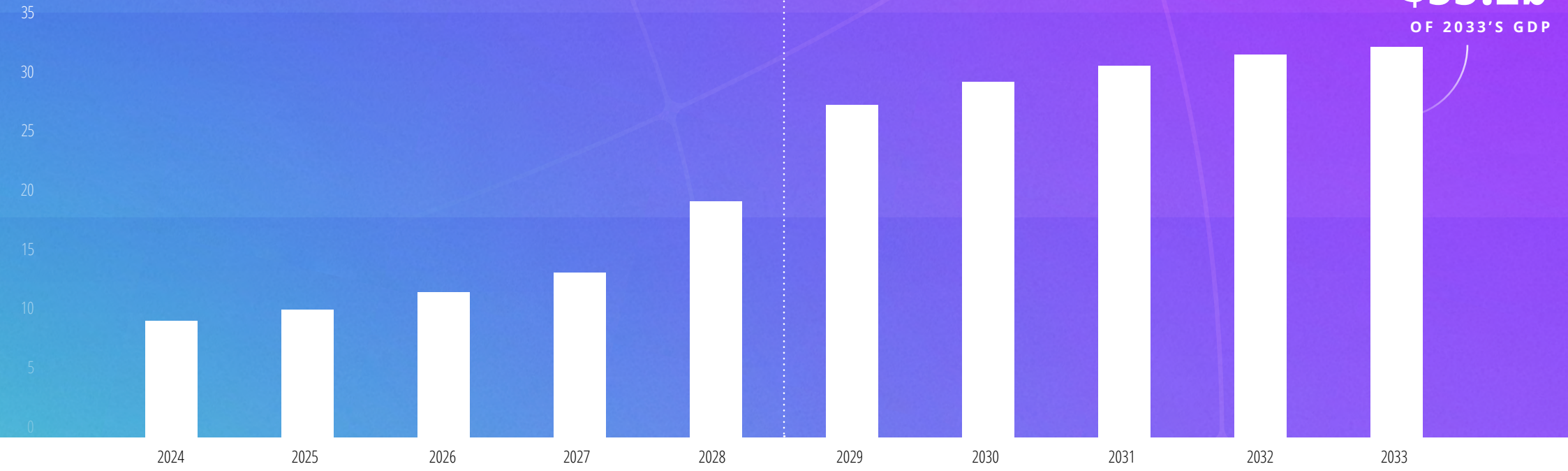
There is more value to extract from digital fibre infrastructure

Our modelling suggests the digital fibre network could add $33.2 billion to New Zealand's economy by 2033. Aggregating the productivity uplift from the projected developments in the fibre network over 2024 to 2033 suggests that $163 billion could be added to the New Zealand's economy in net present value terms.
(A 5% discount rate was used).

$163b

total GDP impact
in NPV terms from **2024** to **2033** in 2023 NZD

$33.2b
OF 2033'S GDP



MATURITY

The network matures and improvments from innovations start to translate into increasing productivity benefits.

UBIQUITY AND SUPPORTING NEXT GENERATION TECHNOLOGY

As access to fibre becomes ubiquitous and next generation technologies are enabled, the productivity benefit accelerates.

These results assume that uptake and coverage of fibre will continue to increase to 95% by 2033. Average fibre broadband speeds are projected to increase from 442 Mbps in 2024 to 1,162 Mbps in 2033, based on publicly available forecasts and forecasts provided by Chorus on the effect of faster fibre speeds on average speeds.

However, in a scenario where coverage and uptake remain at current levels of 87% and 75% respectively, **New Zealand leaves $17 billion in future productivity benefits on the table** in NPV terms out to 2033.

The potential productivity benefits could be driven by two distinct phases.

In contrast to the benefits driven by early adoption and application and innovation stemming from the fibre network, the future productivity benefits are likely to be characterised by two distinct phases: maturity and ubiquity and next generation technology.

MATURITY

There will be an element of **maturity** to the productivity impacts of the fibre network. The rise in the use and growing reliance on fibre and the fundamental shift in the way we operate will become embedded in the economy. The productivity benefits that this enables, ranging from digital transformation, such as cloud computing and data analytics to remote learning and working, will be ongoing for the economy.

Households and business data usage will continue climbing in this phase, as demand for connectivity broadens and diversifies. For households, video streaming will become more data intensive due to higher resolution formats, such as 4K and 8K television, extended reality and 3D screens enter the mass market.[21] For example, Sky tested 4K-Ultra High Definition (UHD) capabilities by trialling this new format during the New Zealand v Australia rugby match on Saturday 28 September 2024, with the intention of rolling out live sport in 4K-UHD next year.[22] As outlined by the Ministry for Culture and Heritage, the use of Digital Terrestrial Television (DTT) has been declining. As audiences move online and DTT is becoming increasingly unsustainable for broadcasters, fibre will be critical in enabling the transition to newer more cost effective technologies such as online streaming.[23] Fibre networks will evolve from connecting individuals and homes to connecting things, from everyday objects (in and out of homes) to items that consumers wear or even integrate with their bodies.[24] Research from OMIDA suggests that globally, the average number of connected devices per household will be 80% larger by 2030, increasing from 25 devices per household in 2025 to 44 in 2030.[25]

For businesses, there will be greater reliance on the cloud and bandwidth-hungry applications, driving the need for multigigabit networks. The move to the cloud may be embedded across firms in different industries, given its ability to substantially increase available computing power and the use of different service providers depending on the application being used.[26]

UBIQUITY AND SUPPORTING NEXT GENERATION TECHNOLOGY

The nature of the productivity benefits stemming from the fibre network into the future, won't be driven by connectivity, or solely top-line speed. The **ubiquity of internet connection** and the ability to handle traffic for an increasing range of connected individuals, things, and applications, will become reliant on advanced broadband networks. Speed will be important for the delivery of some applications, such as video and extended reality, but other applications will be far more reliant on metrics such as latency and jitter.[27]

Advanced fibre networks will also drive next generation technology, as they enable the high-performance computing needed for technologies such as AI and next generation data processing. Currently, use of AI is largely text dominated.

However, as we look into the future, the use cases of AI extend far beyond just text. For example, Generative AI models could take user prompts to generate video outputs, such as videos to showcase a new product or simulating scenarios for safety training. Another example is the shift from text or two-dimensional inputs. Future AI tools could extrapolate and generate data representing 3D objects including the creation of virtual renderings in an omniverse environment and AI-assisted prototyping and design in a purely virtual space.[28] The bandwidth and low latency provided by fibre networks are critical to leveraging such technologies.[29] While the adoption and evolution of the use of such technologies is inherently uncertain, the fibre network will be critical in any scenario. Seen in this light, we consider that our estimates of the potential productivity benefits of the fibre network into the future are conservative, as they do not capture the full efficiency impacts of the next generation technologies that the fibre network may be critical in enabling.

A key step to getting our productivity growth back on track is using our digital fibre infrastructure network to its full potential. The future of fibre is potentially bright. Our high-speed, future-oriented digital fibre infrastructure forms the backbone of countless broader technologies that are yet to be incorporated to their full potential by households and businesses. This untapped potential will be critical to redirecting our productivity trends and fuelling our future economic growth.

Some important caveats should be kept in mind when interpreting the potential future productivity benefits presented in this report:

- The potential productivity benefits are based on forecast broadband speeds provided by industry.
- The relationship between changes in the broadband index and GDP per capita could evolve in the future and there is inherent uncertainty on how this evolution may take place. We assume that the estimated ratio between the broadband index and GDP per capita change attributable to broadband stays the same into the future.
- The magnitude of future productivity benefits attributable to broadband technologies is inherently uncertain, as is the timing of when these will be realised.

Further details of our approach to estimating potential benefits into the future are detailed in the **Technical Appendix.**

AI Forum

Investment in fibre connectivity enables the use of AI

AI and its impact on how we work is a hot topic at the moment. We sat down with Madeline Newman, Executive Director of the AI Forum New Zealand, to understand how New Zealand's investment in fibre connectivity is enabling the use of AI now and into the future.

An example of the first use of AI in healthcare is Awa Digital 's AI tool to assist clinicians in transcribing patient notes.

With the patient's permission, the tool sits alongside clinicians, listening and completing notes and recording required diagnostics. At the end of the consultation, the clinician reviews, amends and approves notes, and sends diagnostics.

"GPs globally currently spend approximately 40% of their time doing paperwork. Awa's tool will change this dramatically, allowing clinicians to spend more time with patients, and to be more engaged with those conversations," said Madeline.

"Without fibre, we wouldn't be able to fully leverage the power of this AI tool and others like it."

"Fibre provides the bandwidth necessary speed and quality for clinicians to take advantage of the tool. More importantly, without the national UFB investment programme, this sort of capability would only be available to those who already had good broadband."

Health NZ Te Whatu Ora is working with Awa Digital, AWS, and Microsoft to develop a prototype, which they are now testing with clinicians before it moves to "proof of value" stage.[30]

"These kinds of technologies will result in massive productivity gains for doctors, and better experiences for both them and their patients."

A second use case of AI in health Madeline talked about was Toku Eyes, an AI tool that detects early signs of heart disease.

"Using retinal scans completed by optometrists, the tool is able to provide an instant health risk assessment by analysing those retinal images for preventable cardiovascular disease risk. It uses pre-trained AI models to provide a non-invasive and cost effective way to reach those who are at the edge of the health system."

Developing and maintaining AI tools such as this requires large data sets and compute power. Without a quality and stable connection such as fibre, our ability to develop and use these tools will be limited. A key benefit of the tool is that it is more transportable than a diagnostic lab but will give same results.

"AI tools such as this are data hungry, so without a quality and stable connection such as fibre, it would not be possible to use these tools."

We also asked Madeline about the future: If the fibre network starts delivering increasing bandwidth and speed, how does that support the rollout and use of current and future AI tools?

AI is both data and computer power hungry, and people have very short attention spans. All of which requires fast and stable connection to reap the productivity and experience benefits AI stands to generate.

"Quantum computing is very likely to increase that need exponentially. While Aotearoa New Zealand hasn't yet made any decisions around quantum computing, in Australia both Queensland and Victoria are planning their quantum computing capabilities." Closer to home, Madeline talked about robotics and how its assisting to bridge labour shortages in orchards.

MaaraTech[31] is part of the leading robotics research at the University of Auckland's Centre for Automation and Robotic Engineering Science (CARES). To help manage the shortage of trained fruit pickers, MaaraTech successfully trialled their technology in several orchards across New Zealand.

Pairing AI to interpret data (data informed decision making) with augmented reality, MaaraTech were able to successfully show untrained workers, and then automated robots, which fruit to pick and what growth to prune.

"Fibre underpins the ability for robotics to download information and get updates in rural settings, enabling them to work rurally, and in turn, helping us to address labour shortages."

AI Forum New Zealand's AI Blueprint for Aotearoa notes that to maximise the gains that AI will have on productivity and economic growth, we must ensure that the digital fibre infrastructure continues to be invested in, with a focus of building on existing digital infrastructure investment programmes to expand the internet coverage across all rural areas.[32]

UNLEASHING THE POWER OF FIBRE

Unleashing fibre — ensuring we realise the future benefits

We have tapped into just 16% of the productivity benefits from New Zealand's fibre network. However, greater opportunity lies ahead, with the potential to capture 84% of the benefits, equating to $163 billion in the coming years. While we recognise our achievements so far, we must not become complacent or assume that the job is done.

Committing to fibre connectivity as a core utility

Digital connectivity is no longer a luxury. Digital fibre infrastructure is crucial to many aspects of our lives, profoundly shaping how we live, work, and play. It is imperative that we do not take a passive approach or assume that the task is complete. As a country, New Zealand must ensure that momentum is maintained or risk missing out on capturing $163 billion, or 84% of the potential productivity-related benefits that investment in the fibre network could bring to our economy.

What are the essential components to ensure digital fibre infrastructure can advance rapidly and deliver this benefit to New Zealand ?

WHAT GETS MEASURED GETS MANAGED

DIMENSION	ACTION
Addressing digital equity by boosting fibre access and uptake in households Continue to enhance the accessibility of digital fibre infrastructure and increase household uptake to promote safe and efficient digital interactions for all New Zealanders. This will support bridging our digital equity and geographic divide in fibre access.	Government and industry to work together to consider how fibre coverage can be expanded from 87% to 95% to ensure $17 billion is not left on the table. This also involves closing the gap between uptake and access.
Make room to innovate with AI Actively harness AI's potential to drive innovation, productivity, and enterprise change, while creating awareness about the Government's prioritisation of AI usage and responsible regulation.	Policy makers to continue promoting increased AI usage and consider how current regulations will facilitate the responsible use of AI in the near future. Alongside this, business associations should work with their members to guide them through adopting new technologies and sharing success stories.
Small businesses need to lift their tech game Accelerate the adoption of digital tools and digital transformation, particularly among small to medium enterprises (SMEs), through providing digital incentives, support programmes, and enhanced digital capabilities.	Small businesses need to collaborate with industry in order to get businesses connected and lift online presence, by offering the right incentives and attracting the right talent. Larger businesses and network operators should support their small business customers through the process of digital adoption and facilitate knowledge sharing.

DIMENSION	ACTION
Seize the opportunity to grow exports Leverage digital fibre infrastructure and expand adoption of high-speed internet for increased export potential, in particular weightless exports, and ensure policy settings attract and retain a skilled workforce.	Businesses and government to promote New Zealand's digital infrastructure success and capability on the global stage.
Government to be an early adopter Leverage data and digital technologies to enhance government services for businesses from being an early adopter in open customer data, to taking a sector agnostic approach to digital building blocks known as Digital Public Infrastructure.	Government to harness digital infrastructure to inspire industry. For example, as an early adopter of open customer data and Digital Public Infrastructure.
Future regulation (or deregulation) Continuously review whether regulation for digital fibre infrastructure is fit- for-purpose and provide the right incentives to invest and innovate in infrastructure for the long-term benefit of New Zealand, as well as providing regulatory certainty to drive AI and other digital tools adoption.	Regulators and policy-makers need to ensure that regulations are fit-for-purpose and provide incentives for investment and innovation. This could mean reconsidering regulatory settings around different technologies such as copper, fibre and AI.

Each of the dimensions is explored in more detail below.

ADDRESSING DIGITAL EQUITY BY BOOSTING FIBRE ACCESS AND UPTAKE IN HOUSEHOLDS

As New Zealand's use and reliance of digital fibre infrastructure matures, the country will realise the first two phases of the benefits from investment in fibre. A high-quality fibre network that has widespread coverage is in place, but uptake in fibre has not kept up.

To kickstart unlocking the $163 billion of potential productivity benefits, there are two crucial steps required:

1. Maintaining momentum towards extended coverage, leaving nobody behind in this digital transformation. Currently, 87% of New Zealanders have access to fibre. However, a concerted effort is required to ensure high-speed reliable broadband is provided to as much of the country as possible. This crucial point has been recognised by fibre infrastructure providers, who have prioritised reducing the digital connectivity divide between urban and rural areas. For example, Chorus has funded a project that will extend fibre to 10,000 homes and businesses in 59 communities across New Zealand.[33] However, they cannot do it on their own.

2. New Zealand needs to continue promoting the benefits of digital fibre infrastructure to get more people onto the network. Currently uptake is sitting around 75% across the country, considerably lower than access. As shown in Figure 8,[34] the top five regions with gaps between access and uptake are Wellington (22%), Canterbury (16%), Otago (14%), Auckland (13%), and Hawke's Bay (12%), while other regions show a gap of around 10% or less.

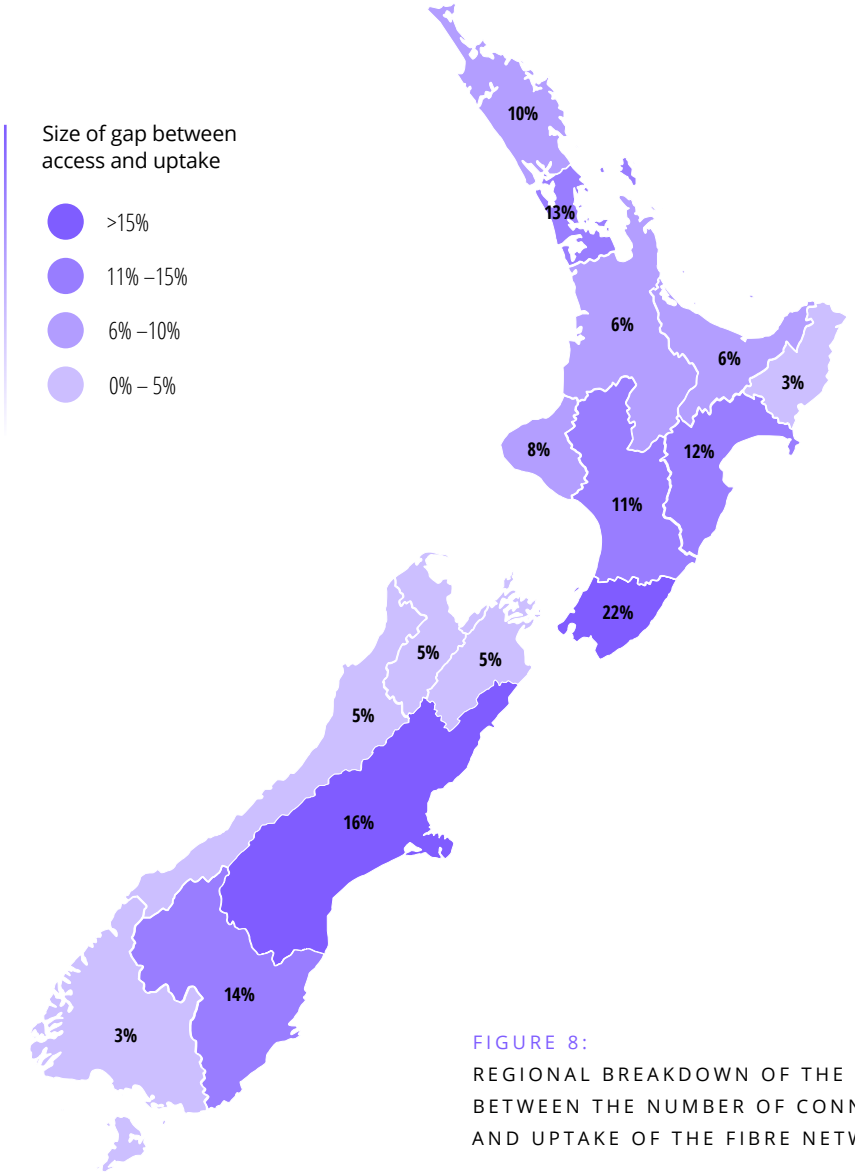


FIGURE 8:
REGIONAL BREAKDOWN OF THE GAP BETWEEN THE NUMBER OF CONNECTIONS AND UPTAKE OF THE FIBRE NETWORK

Source: Crown Infrastructure Partners, March 2024

Continuing to grow the accessibility of the network and getting those households that can connect connected will keep us on the right path, but more will be needed to realise the future benefits that our digital fibre infrastructure can bring. Although New Zealand ranks 9th in terms of fibre connections per 100 inhabitants, we rank 20th in terms of fixed broadband connectivity.[35] Improving our fibre connectivity will help us move up these ranks and remain competitive in the implementation of next generation technologies, in not only urban areas but also rural.

Increased fibre connectivity may also be a means to address digital inequities more generally. Nearly a quarter of Pacific peoples are without the internet in the home – three times the rate for New Zealand Europeans and almost twice the rate for Māori. Māori and Pacific peoples are particularly over-represented among younger people without internet access.[36] Increased fibre connectivity that addresses these differences would also ensure that the benefits of digital transformation, which the fibre network can unlock, are felt more equally across all New Zealanders. Making fibre available to the whole of New Zealand is an important step to addressing digital inequity in the country. However, more will need to be done to connect under-serviced households to the fibre network, particularly in cases where affordability is a constraint. This is even more important given a digital identity will be become more widespread and the development of the national data infrastructure is in progress.[23] We have resilient and strong digital fibre infrastructure and everyone in New Zealand needs to be able to interact safely and efficiently in the digital world.

Action to address digital equity by boosting fibre access and uptake in households

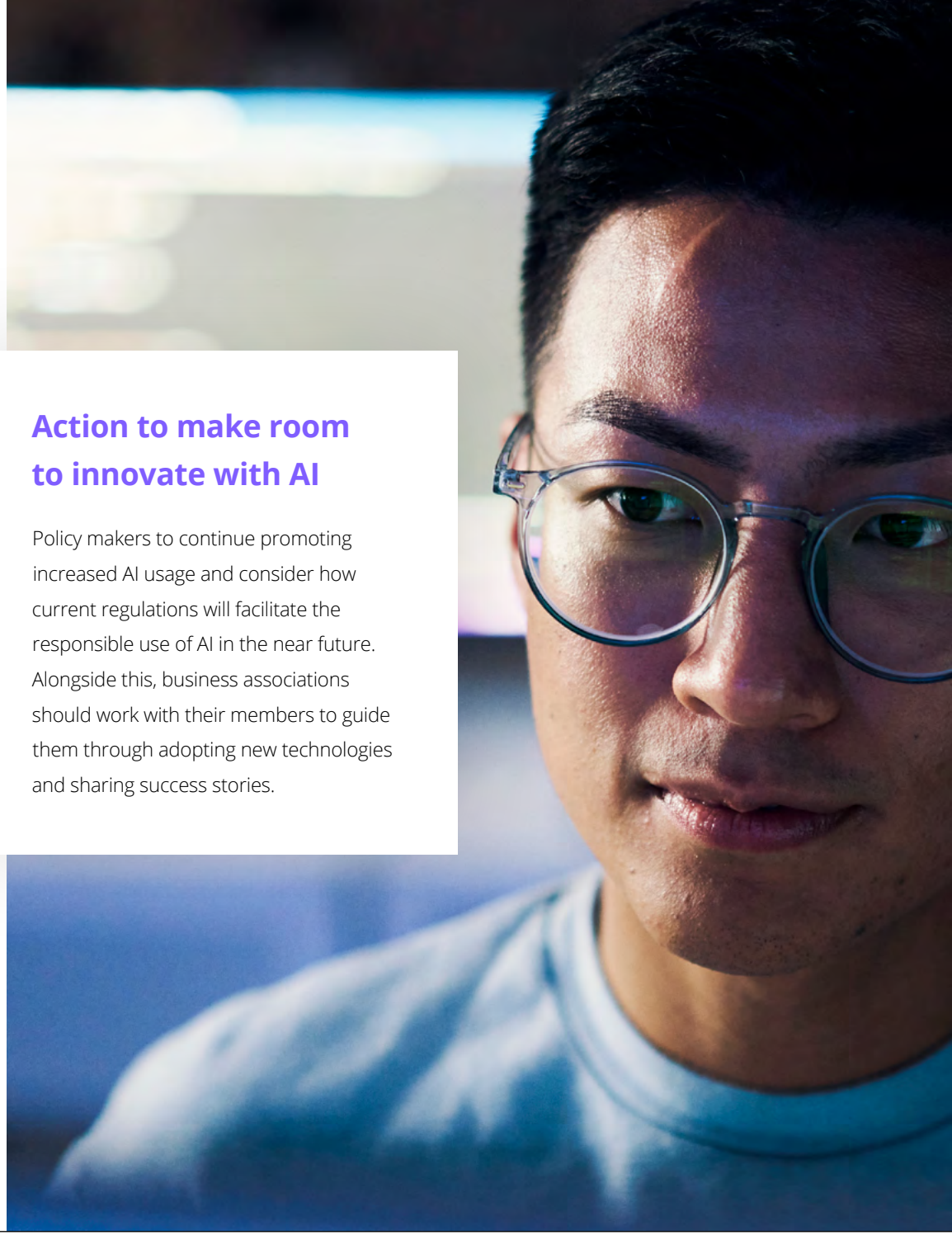
Government and industry to work together to consider how fibre coverage can be expanded from 87% to 95% to ensure $17 billion is not left on the table. This also involves closing the gap between uptake and access.

MAKE ROOM TO INNOVATE WITH GENERATIVE AI

To fully realise the benefits of digital fibre infrastructure, it is imperative that we take action to harness the potential of AI to drive innovation, productivity, and enterprise change for New Zealanders, as highlighted in a recent report:

"New Zealand's domestic network infrastructure is highly developed and enjoys a significant quantity of spare capacity, allowing space for a significant ramp up in network traffic created by data intensive Generative AI applications." [37]

We acknowledge that the Government is prioritising the promotion of increased AI usage in New Zealand to stimulate innovation and productivity growth, bolster our economy, and provide more efficient public services. The Government recently announced both the pilot of GovGPT and the "AI Activator", a programme supporting New Zealand businesses to improve their awareness and uptake of AI, in order to capitalise of the benefits AI has to offer.[38] Additionally, the Government has established a new Digital Regulators Forum, comprising members from the Ministry of Business, Innovation and Employment (MBIE), Department of Internal Affairs (DIA), Statistics NZ (Stats NZ), and the Commerce Commission.[39] The Forum has committed to investigating the advancement of public-facing guidance for businesses on how current regulations relate to and facilitate the responsible use of AI in the near future.[40]



Action to make room to innovate with AI

Policy makers to continue promoting increased AI usage and consider how current regulations will facilitate the responsible use of AI in the near future. Alongside this, business associations should work with their members to guide them through adopting new technologies and sharing success stories.

SMALL BUSINESSES NEED TO LIFT THE TECH GAME

Digital tools benefit businesses of all sizes in many ways. They can help a business grow its sales or market share and make a workplace more seamless and convenient, helping employers to retain talent. Digital tools can also reduce costs and facilitate innovation, allowing businesses to improve their productivity by producing more, or better goods and services with a given level of resources.

To ensure realisation of the productivity benefits of fibre, all businesses in New Zealand regardless of size, must embrace and adopt digital transformation to sustainably transform the entire economy and fully capitalise on the future benefits of digital fibre infrastructure. This was highlighted in the Aotearoa's Digital Priorities 2024 report, indicating that it is not just the development of tech companies, but the entire economy that needs to embrace technology.[41]

Table 2 below shows New Zealand's small businesses continue to be significantly less inclined to utilise technology compared to their counterparts in Asia Pacific.[42] The recent 2024 small business survey across Asia Pacific reveals that we notably lag our Asia Pacific counterparts in several key areas:

Social media use. While social media use has risen each year since 2019, almost a third of New Zealand businesses still do not use social media for business purposes, the worst result of the markets surveyed.

Online sales. The survey shows that 34% of New Zealand small businesses generated more than 10 per cent of their sales online compared with the survey average of 62%.

Adoption of new payment technologies. New Zealand small businesses were the least likely to receive more than 10% of sales through new digital and payment technologies such as Apple Pay and PayPal (41% compared with the survey average of 71%).

Cyber-attacks. The survey found that New Zealand small businesses were the least likely (12%) to have experienced a cyber security incident resulting in time and monetary losses in the last 12 months, in comparison to a survey average of 41%. While this result may seem positive, it is indicative of relatively poor technology integration across our SME businesses, which has an ongoing impact on performance, growth, and productivity.[43]

TABLE 2: SMES TECHNOLOGY UPTAKE

	2023		2022	2021	2020	2019
	New Zealand	Survey average				
More than 10% of revenue came from online sales	34.3%	62.2%	35.7%	40.0%	25.7%	26.0%
Did not use social media for business purposes	32.7%	15.4%	34.1%	36.8%	38.3%	39.3%
Lost time and/ or money due to a cybersecurity incident	11.6%	40.7%	n/a	n/a	n/a	n/a
More than 10% of sales received through digital payments	40.7%	70.8%	42.3%	39.7%	37.9%	42.1%

Source: CPA Australia Asia Pacific Small Business survey 2023-2024: NZ market

The fibre network is yet to fulfil its ambitions, in part due to limited business innovation. The Business Operation Survey shows the product innovation rate for SMEs has experienced a downward trend, declining from 27% in 2007 to 22% in 2021.[44] Additionally, our digital competitiveness rankings have seen a decline, dropping from 21 in 2019 to 31 in 2023. It is important we reverse this trend. Digital technologies also generate spillover effects, such as increased competition, which in turn fosters innovation and compels businesses to use resources more efficiently, thus enhancing productivity.

There is a need to take action to accelerate progress in elevating New Zealand's digital adoption and competition across all businesses. With the emergence of new technologies, there is an ongoing requirement for greater incentives and programmes to support SMEs through digitalisation, to ensure they can effectively leverage the opportunities facilitated by these advancements.[45]

We have seen what a fast and stable fibre network has done for households (from being able to stream content, and work from home during COVID-19), and we have shown what it can also do for business (with the Cause and FX case study). But for New Zealand to truly benefit from digital fibre infrastructure, action must be taken now.

Action for small businesses to lift their tech game

Small businesses need to collaborate with industry in order to get businesses connected and lift online presence, through offering the right incentives and attracting the right talent. Larger businesses and network operators should support their small business customers through the process of digital adoption and facilitate knowledge sharing.

Cause and FX
The need for fibre investment to continue

Keeping ahead of the game will be critical to ensuring Cause and FX can continue to work on a global scale, while based at the bottom of the world. They strongly emphasised that, ***"if the fibre network doesn't keep developing and stay ahead of the game, we will fall behind and it will be game over for us.*** *Our industry is just so data hungry, with requirements continually being pushed. For example, we're now getting 8k plates. Not so long ago, it was just HD and we are now delivering work up to 27k."*

"A lot of large clients don't want any hurdles, [they] just want us to deal with it. Send us everything and we sort it out. We need to receive files in a timely fashion. If we didn't have the ability to work at speed, we would be viewed as unable to meet requirements and [clients] would go elsewhere."

"On Rings of Power, we were a baby, the smallest vendor working with global juggernauts. To be able to compete at the global level means we are able to keep up and meet their requirements, if not, we would not be considered or dropped. Being far away should not be seen as a negative. It is critical that we can maintain the perception that we are in New Zealand but our location is not a problem and the investment in fibre infrastructure allows us to compete at a global level against studios around the world."

All studio work Cause and FX does comes with strict security and business continuity compliance it needs to adhere to. One of these is an offsite backup centre, which Cause and FX constantly backs up to via dark fibre to an offsite backup location. As files become larger, the heavier the data requirements. Having the ability to push data locally quickly is also critical.

SEIZE THE OPPORTUNITY TO GROW EXPORTS

New Zealand aims to double the value of exports within the next decade to aid in rebuilding the economy. In the case of a small open economy like New Zealand, which has historically faced trade disadvantages due to its geographical location, the availability of faster broadband and wider acceptance of digital communications offers an opportunity to bolster integration into the global economy and expand trade prospects.[46]

Sanderson et al., (2022) find that firms that adopted fibre in the early years of the digital fibre rollout were subsequently more likely to start exporting. The relationship was stronger for firms that were already using the internet intensively or making complementary investments to benefit from their ICT use. [47]

Firms that chose to adopt high-speed internet during the early phase of the fibre rollout may not have done so randomly but instead were likely motivated by the potential benefits of UFB adoption, including its potential in reducing the barriers to exporting. If this is the case, the observed positive relationships between UFB uptake and export entry may be driven at least partly by the self-selection of firms with such advanced foresight. [48]

These results suggest investments in fibre helped to set conditions under which firms can access a wider global market.

Recent technological developments, such as GenAI, along with a greater acceptance of online communication brought about by the COVID-19 pandemic, offer New Zealand the opportunity to broaden and diversify its exports by leveraging our digital fibre infrastructure.

To capitalise on these prospects, firms need continual access to a high standard of digital fibre infrastructure. Given New Zealand's excellent digital fibre infrastructure, we are well positioned to develop new export industries, including service / weightless exports and compete globally. Businesses simply need to seize this opportunity to a greater extent.

Leveraging New Zealand's digital fibre infrastructure to develop new service and weightless exports will need to be complemented by policies that attract, develop and retain a skilled workforce. This is crucial to harnessing recent technological developments and the fibre network that will support such technology's use to innovate and develop new export industries. Recent migration patterns suggest that broader policy settings and economic conditions may not be acting to attract and retain a skilled workforce, with a record 81,000 New Zealand citizens departing year to July 2024.[49] As the World Economic Forum's Future of Jobs 2023 Report notes, public policies that enable funding for reskilling and upskilling and allow for increased flexibility on hiring practices are seen by most organisations as the most effective way to accessing skills required for transforming their businesses.[50]

Action to seize the opportunity to grow exports

Businesses and government to promote New Zealand's digital infrastructure success and capability on the global stage.

GOVERNMENT TO BE AN EARLY ADOPTER

As we move into the maturity and ubiquity and next generation technology phases of our digital fibre infrastructure, it's critical for government to lead the way and inspire industry to keep the momentum that we currently have.

For example, government can use data and digital technologies to improve the efficiency and effectiveness of government services to firms. On a consumer front, the interactions with government agencies, from registering a motor vehicle to completing a tax return, have been improved using digital technologies and will continue to improve as the concept of a digital identity becomes more widespread and the development of the national data infrastructure progresses. However, a fully 'digital government' remains far from a reality. [51]

In the Commerce Commission's recent market study into personal banking services, it was recommended the Government should support open banking by being an early adopter and taking an all-of-government approach to adopting payments enabled by open banking functionality. For example, by supporting new payment methods for taxes, welfare, and government services such as vehicle licensing.[52] However, this is just the beginning. The concept of open banking, or open customer data, will also be considered in sectors such as electricity and insurance. The shift towards open customer data platforms and new consumer targeted digital products will need to be supported by robust, fast and reliable technology and infrastructure, such as fibre networks.

Other than initiatives around open banking and open customer data, New Zealand also needs to take a sector agnostic stance on digital building blocks known as Digital Public Infrastructure (DPI) to ensure the investment in UFB achieves its full potential. DPI includes capabilities like identity, consented data exchanges, digital payment infrastructure and discovery & fulfilment services, are fundamental in modern digital nations. These services play a national role spanning public and private business processes and services. Nations such as India, Estonia and Singapore have invested in DPI and are seeing exceptional digital transformation for their economies and societies. Like UFB, nations require public / private funding and delivery mechanisms to realise DPI. Given the success of our UFB rollout, New Zealand should be able to leverage the lessons learnt for the next phase of our national digital investment.

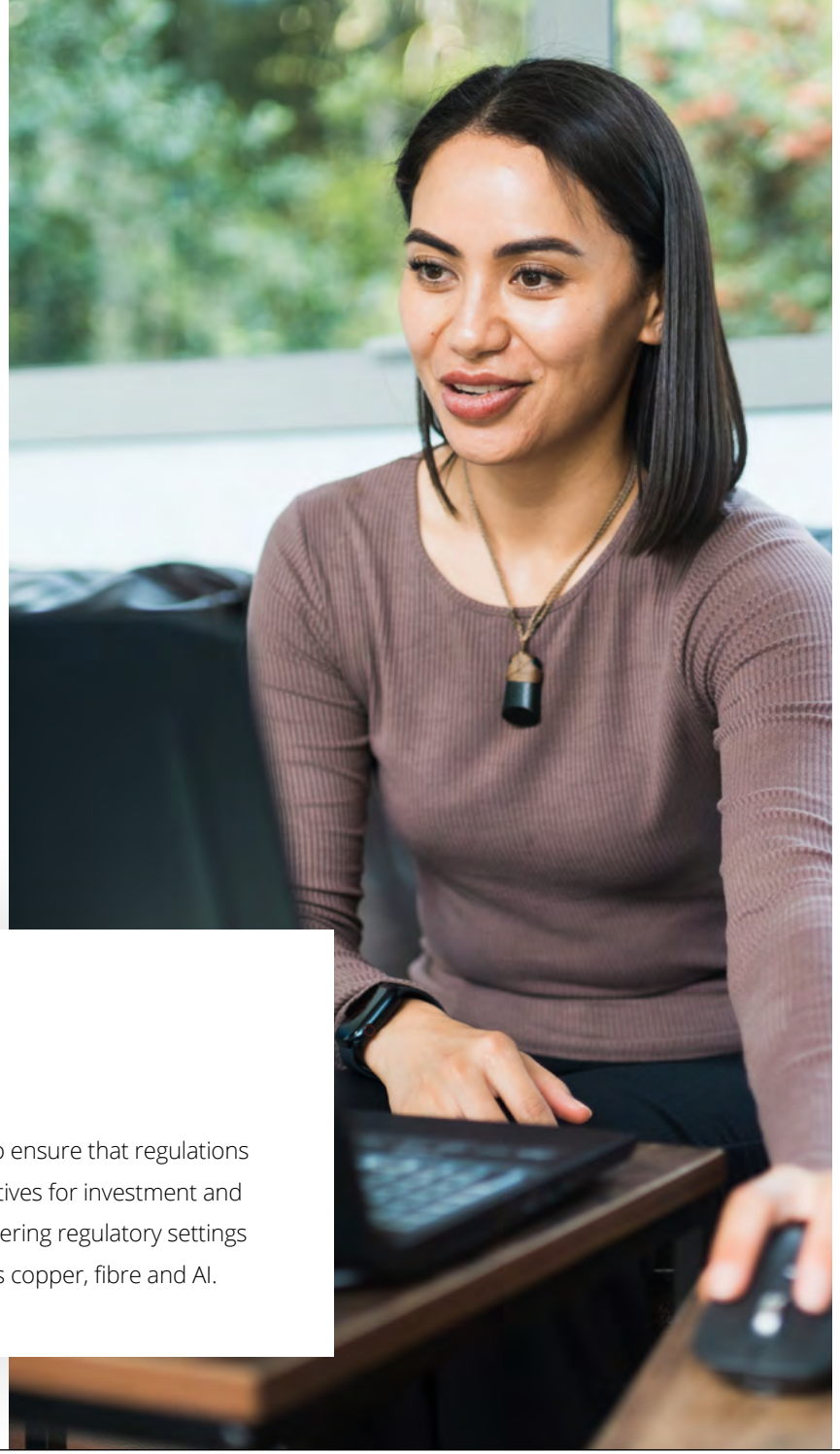
It's now also up to the Government to lead the way on innovation and the development of products that meet the challenges ahead, inspiring industry to keep momentum and deliver a bright digital future.

Action for government to be an early adopter

Government to be an early adopter in harnessing digital infrastructure to inspire industry. For example, as an early adopter of open customer data and Digital Public Infrastructure.

REGULATION (OR DEREGULATION)

Regular and thorough reviews of regulatory settings in digital fibre infrastructure are required, with a focus on removing out-of-date, inefficient and costly regulatory requirements across the sector, and continuous consultation to prioritise the legislation in most need of reform. If the regulatory regime is not fit-for-purpose and does not provide the right incentives to invest and innovate, the future dividend that the fibre network can bring is at risk. Another key consideration is to provide regulatory certainty to enable investors, enterprises, and users to commit to AI in New Zealand, driving adoption and supporting the realisation of the future digital fibre infrastructure benefit for all New Zealanders.



Action for regulation (or deregulation)

Regulators and policy-makers need to ensure that regulations are fit-for-purpose and provide incentives for investment and innovation. This could mean reconsidering regulatory settings around different technologies such as copper, fibre and AI.

What gets measured gets managed

Overall, these considerations will only really work if there is a concerted plan with measurable outcomes. This is something the European Union has done recently, in launching its digital targets for 2030.[53] A digital dashboard was developed that summarises Europe's performance across the four dimensions of the Digital Decade policy programme: digital skills, digital infrastructure, digitalisation of business and digitalisation of public services. The case study below further explores the European Union's digital future.

Europe's Digital Decade
Digital Targets for 2030

On 15 December 2022, the President of the European Commission (EU), Ursula von der Leyen, signed the European Declaration on Digital Rights and Principles, together with the President of the European Parliament, Roberta Metsola, and Czech Prime Minister, Petr Fiala, for the rotating Council presidency.
The declaration represents the EU's commitment to a safe, secure, and sustainable digital transformation that puts people at the centre, in line with core EU values and fundamental rights.

Clear digital goals

Underpinning the EU's declaration on Digital Rights and Principles are a set of clear and measurable goals that by 2030:

Skills

There are 20 million employed ICT specialists in the EU, with convergence between women and men and at least 80% of adults with basic digital skills.

Digital transformation of businesses

75% of European enterprises have taken up cloud computing services, big data, and AI, more than 90% of European SMEs reach at least a basic level of digital intensity and Europe will grow the pipeline of its innovative scale ups and improve their access to finance, leading to doubling the number of companies founded after 1990 with a valuation of over $1 billion.

Secure and sustainable digital infrastructures

All European households will be covered by a Gigabit network, with all populated areas covered by 5G. The production of cutting-edge and sustainable semiconductors in Europe including processors is at least 20% of world production in value. 10,000 climate neutral highly secure edge nodes are deployed, and by 2025, Europe will have its first computer with quantum acceleration, paving the way for Europe to be at the cutting edge of quantum capabilities by 2030.

Digitisation of public services

100% online provision of key public services available for European citizens and businesses, 100% of European citizens have access to medical records (e-records) and 80% of citizens will use a digital ID solution.

Frequent measurement and realignment

Progress towards 2030 goals is measured in a transparent and systematic way, with regular evaluation and biannual adjustments of strategic roadmaps for individual EU countries.

Measurement of progress towards 2030 goals is undertaken through the Digital Economy and Society Index dashboard, which contains a wide range of relevant performance indicators measuring progress towards 2030 goals by EU country, ranging from the total number of ICT graduates to the percentage of enterprises issuing e-invoices by size. Annual reporting is conducted, evaluating progress against goals, and providing recommendations for actions. For example, the second report on the State of the Digital Decade, released July 2024, found that progress fell short in a number of areas. One was in relation to connectivity targets, with the report finding that:

> **"[f]ibre networks, critical for delivering gigabit connectivity and enabling the take-up of cutting-edge technologies such as AI, cloud, and the Internet of Things (IoT), only reach 64% of households".**

Member States now have to review and adjust their national roadmaps to align with the ambition and goals of the Digital Decade Policy Programme before December 2024. The European Commission will monitor and assess the implementation of the adjusted roadmaps and report on progress made in the next State of the Digital Decade report in 2025.

We hope that this report has provided a view on the future benefits of our digital fibre infrastructure.

Fibre technology continuously evolves, giving us faster speeds, lower latencies, improved resiliency, greater security, and more flexible applications. Speed records are consistently being broken.[54] An exciting fibre future, with all stakeholders actively involved, will ensure New Zealand does not miss out on the $163 billion of potential productivity benefits to come, stifle innovation, or risk industry losing the competitive edge digital fibre infrastructure has enabled. More broadly, reliable, adaptable, and high-performing digital fibre infrastructure is fundamental for positive connectivity outcomes in Kiwi homes and businesses and generations to come.

Technical Appendix – Productivity Modelling

Theoretical modelling framework

This report follows previous Deloitte Access Economics and OECD research in taking a panel approach to identify the growth effects of digital technology usage with consideration to policy and institutional influences. The econometric methods employed largely follow the approach of Qu, Simes and O'Mahony (2016),[55] and Bassanini, Scarpetta and Hemmings (2001).[56]

The modelling approach adheres to previous research with some changes to the main variable of interest. The underlying framework is based on a human-capital augmented Solow-Swan model, where output at time t is given by:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} \left(A(t)L(t)\right)^{1-\alpha-\beta}$$

Y, K, H and L are respectively output, physical capital, human capital and labour, α and β are the partial elasticity of output with respect to physical capital and human capital, and A(t) is a composite measure of technological progress Ω(t) and economic efficiency I(t).

$$A(t) = I(t)\Omega(t)$$

Economic efficiency includes a range of 'enabling services', $V_j(t)$, such as advertising, trade, transport and logistics, professional and support services, and innovation. These enabling services provide support to firms at all stages of production. In addition to measures of broadband uptake and speed, controls are included for each economies research and development expenditure and trade exposure, both of which are widely recognised as key determinants of economic efficiency.

Other technological progress, Ω(t), is assumed to be exogenous and to grow at a rate g(t).

The following equations can be used to describe the time paths of the various factors of production over time.

$$\dot{k}(t) = s_k(t)A(t)^{1-\alpha-\beta}k(t)^{\alpha}h(t)^{\beta} - \left(n(t) + d + g(t)\right)k(t)$$

$$\dot{h}(t) = s_h(t)A(t)^{1-\alpha-\beta}k(t)^{\alpha}h(t)^{\beta} - \left(n(t) + d + g(t)\right)k(t)$$

$$\dot{A}(t) = g(t)A(t) = g(t)I(t)\Omega(t)$$

$$\ln I(t) = p_0 + \sum_j p_j \ln V_j(t)$$

$$\dot{\Omega}(t) = g(t)\Omega(t)$$

$$\dot{L}(t) = n(t)L(t)$$

Where k=K/L is physical capital in intensive terms, h=H/L stands for average human capital, s_k and s_h are the investment rate in physical and human capital respectively, n(t) is the growth rate of labour, g(t) is the rate of technological change and d is the common (time-invariant) depreciation rate.

Under the assumption that α+β<1 (decreasing returns to scale in human and physical capital), this system of equations can be solved to obtain steady state values of k*and h* defined by:

$$\ln k^*(t) = \ln A(t) + \frac{1-\beta}{1-\alpha-\beta}\ln s_k(t) + \frac{\beta}{1-\alpha-\beta}\ln s_h(t) - \frac{1}{1-\alpha}\ln\left(n(t) + d + g(t)\right)$$

$$\ln h^*(t) = \ln A(t) + \frac{\alpha}{1-\alpha-\beta}\ln s_k(t) + \frac{1-\alpha}{1-\alpha-\beta}\ln s_h(t) - \frac{1}{1-\alpha}\ln\left(n(t) + d + g(t)\right)$$

These steady-state values of physical and human capital can be used to express the steady state output per capita as:

$$\ln y^*(t) = \ln A(t) + \frac{\alpha}{1-\alpha}\ln s_k(t) + \frac{\beta}{1-\alpha}\ln h^*(t) - \frac{\alpha}{1-\alpha}\ln(g(t) + d + n(t))$$

Steady state human capital, h*, is unobservable, but can be expressed as a function of the actual level of human capital, h(t).

$$\ln h^*(t) = \ln h(t) + \frac{1-\psi}{\psi}\Delta \ln \frac{h(t)}{A(t)}$$

Substituting this into the previous expression for steady state output per capital yields:

$$\ln y^*(t) = \ln A(t) + \frac{\alpha}{1-\alpha}\ln s_k(t) + \frac{\beta}{1-\alpha}\left(\ln h(t) + \frac{1-\psi}{\psi}\Delta \ln \frac{h(t)}{A(t)}\right) - \frac{\alpha}{1-\alpha}\ln(g(t) + d + n(t))$$

Adding convergence dynamics and expanding the productivity term A(t) yields the transitional equation for output per capita.

$$\Delta \ln y(t) = -\phi\left(\ln y(t-1) - \frac{\alpha}{1-\alpha}\ln s_k(t) - \frac{\beta}{1-\alpha}\ln h(t) + \frac{\alpha}{1-\alpha}\ln(g(t) + n(t) + d) - g(t)t - \ln A(0)\right) + \frac{1-\psi}{\psi}\frac{\beta}{1-\alpha}\Delta \ln h(t) + \left(1 - \frac{\phi}{\psi}\right)g(t)$$

The last equation represents the functional form that was empirically estimated in this report. The coefficient estimate ϕ represents the convergence parameter, which reflects the speed at which countries converge to their new steady-state output.

Limitations

Its important to recognise that under the conditional convergence model used in this report, various forms of capital as well as policies and institutions are assumed to have a permanent impact on cross-market differences in GDP per capita levels but only temporary effects on growth rates. This means the observed growth in output in any given period, abstracting from cyclical fluctuations, is a combination of three different forces:

1. Exogenous growth in other technological progress.
2. A convergence process towards the steady-state path of output per capita.
3. Shifts in steady-state output per capita that arise from changes in policies and institutions, productivity enhancing services, as well as capital investment rates and changes in population growth rates.

It should also be noted that the framework is derived under the assumption of equilibrium employment and hence that variations in the intensity of labour utilisation are not explicitly considered.

Empirical approach

In this report we have used a standard growth equation from the human-capital augmented Solow-Swan model. When empirically estimating this equation, some simplifications can be made. Specifically, to the extent that g(t) is not observable, it cannot be empirically distinguished from the constant term. Thus, the estimated equation can be rewritten as:

$$\Delta \ln y_{i,t} = -\phi_i \left(\ln y_{i,t-1} - \theta_1 \ln s^k_{i,t} - \theta_2 \ln h_{i,t} + \theta_3 n_{i,t} - \sum_j p_j \ln V_{j,t} - \theta_{0,i} \right) + \epsilon_{i,t}$$

This form effectively represents an error-correction model where θ_1 represents the long-run elasticity of steady-state GDP per capita with respect to changes in the rate of capital accumulation, θ_2 the long-run elasticity of steady-state GDP per capita with respect to observed human capital and pj the long-run elasticity of steady-state GDP per capita with respect to changes in productivity enhancing policy variable Vj,t.

To estimate this equation the empirical work in this report employs a pooled mean-group estimator (PMG). The PMG approach provides an effective middle ground between imposing homogeneity on all slope coefficients when using a dynamic fixed effect estimator (DFE), and the imposition of no restrictions when using a mean group estimating approach (MG) (Qu et al., 2016). The validity of DFE depends on the assumptions of common technology and convergence parameters that in turn require both common technological change and population growth across countries. These are very strong assumptions which almost certainly do not hold empirically.

On the other hand, the MG estimator is consistent, but the number of parameters required to be estimated is so large', it makes it implausible for use in cases such as ours with relatively short panels for some countries (small T) and with many independent variables. Given the significant drawbacks both DFE and MG estimators have in situations such as ours the PMG estimator is the best available approach.

It is worth noting the PMG approach is not without its limitations. PMG still requires the estimation of a large number of parameters, which can cause likelihood convergence issues and estimates sensitive to model specification changes (Qu et al., 2016). In practice, this means that controlling for a large number of policy and institutional variables can be difficult. To help avoid this problem we take a parsimonious approach to the controls we include in our estimates and then check our results are consistent across other specifications with different combinations of control variables.

Index motivation

We employed an index approach to capture the effect of multiple broadband variables, for theoretical and empirical reasons. Theoretically, it is difficult to separate the effect of broadband speed, usage, and connections as there is significant crossovers between them. Empirically, an index of broadband variables also accounts for the limitations of the PMG estimator. Including multiple explanatory variables in the same model often resulted in convergence problems or the estimates highly sensitive to model specification changes.

The broadband index measures the contribution of fixed connection broadband as a whole and does not explicitly include any fibre technology specific measures. However, given the time period which our economic impact results cover (2011 onwards) coincides with the rollout of fibre broadband technologies in New Zealand, we consider that it is likely that it is fibre technologies driving a significant portion of the estimated economic benefit.

A brief analysis of growth in the broadband index subcomponents supports this view. Between 2011 and 2023, the internet penetration and fixed connections per capita sub-indices grew by 20.5% and 34.9% respectively. The broadband speed subindex grew by 1,344.2%. Speed growth of this magnitude would simply not be possible under a counterfactual scenario without fibre technology. It could also be argued that reliability benefits resulting from fibre, as well as services and products which would not have been possible without fibre, may have supported growth in the non-speed subindex components over this period.

Index methodology

To capture the effect of faster broadband connections on productivity growth, we use a combination of three measures of broadband: broadband speed, fixed connections per 100 people and internet usage penetration. It is important to note that these variables do not provide a perfect measure of changes in the usage of broadband. However, in the absence of further cross-country data, these variables serve as a useful basis to measure the impact of increased broadband speeds.

To combine the variables into a single index, they were weighted using the following weights:

Parameter	Weighting
Average broadband speed (Mbps)	60%
Fixed-broadband connections per 100 inhabitants	20%
Internet penetration (% of the population using the internet)	20%

A dataset of average broadband speeds was constructed using a combination of Cable.co.uk's Worldwide Broadband Speed League and Akamai's State of the Internet. Two databases were used to ensure sufficient time period coverage. While the methodologies of each do differ, both are measuring 'real-world' fixed broadband connection speeds, cover all countries in our sample, and both were used at various stages by the Commerce Commission in benchmarking New Zealand's broadband speeds. Where necessary, back casting was undertaken using a log-linear model.

Data on fixed-broadband connections and internet penetration were obtained from the OECD.

Data and modelling results

The modelling in this report uses a sample of 36 countries between 2000 and 2022 (shown in the table below). Where appropriate, data is converted to constant Purchasing Power Parity US dollars, consistent with OECD standards.

Country list			
Australia	France	Korea	Slovak Republic
Austria	Germany	Luxembourg	Slovenia
Belgium	Greece	Mexico	South Africa
Canada	Hungary	Netherlands	Spain
Chile	Iceland	New Zealand	Sweden
Czech Republic	Ireland	Norway	Switzerland
Denmark	Israel	Poland	Turkey
Estonia	Italy	Portugal	United Kingdom
Finland	Japan	Russia	United States

The table below outlines the parameters used in the econometric modelling. In addition to primary factors of production such as physical capital accumulation, the stock of human capital and population growth, the model also takes into account the contribution of other productivity enhancing factors, such as a market's degree of trade openness.

Parameter	Variable	Source
y_t	Gross domestic product per capita	OECD
h(t)	Human capital (average years of schooling)	UNESCO
n(t)	Total population growth	OECD
$s_k(t)$	Gross capital formation (% of GDP)	OECD
V_1	Imports of goods and services (% of GDP)	Worldbank
V_2	R&D expenditure (% of GDP)	Worldbank
V_3	Index of broadband variables	OECD, Cable.co.uk & Akamai

Parameter	Variable	Coefficient
Long-run coefficients		
$\ln n(t)$	Human capital (average years of schooling)	0.069
$\ln n(t)$	Total population growth	-0.269
$\ln V_1$	Gross capital formation (% of GDP)	0.321***
$\ln V_1$	Imports of goods and services (% of GDP)	0.562***
$\ln V_3$	R&D expenditure (% of GDP)	-0.526***
$\ln V_3$	Index of broadband variables	0.140***
Implied share of physical capital	24%	
Implied share of human capital	9%	
Implied share of labour	67%	

Source: Deloitte Access Economics

Note: * p<0.1, ** p<0.05, *** p<0.01

The results presented are consistent with the academic literature with respect to the estimated shares of capital and labour. Further, the estimated coefficients for the productivity variables (Vj) are all statistically significant at the 1% level. The coefficients for human capital and population growth were not found to be statistically significant at the 10% level, but none-the-less produce a sensible production function consistent with academic literature and are not the focus of our study.

The negative relationship between R&D expenditure and GDP per capita may be somewhat surprising, but also mirrors the findings of Qu et al. (2016) and Bassanini et al. (2001), who suggest that such a result may represent the effects of public R&D expenditure crowding out private investment. Given the significance of the estimated coefficient, and the fact that broadband productivity results are robust to alternative model specifications, this model remains our preferred option.

The coefficient on the broadband index, V3, can be interpreted as follows. If the index increases by x% and if y represents the resultant percentage change in long-run steady state GDP per capita, then:

$$y = V_3 \times x = 0.140x$$

Put another way, a 1% increase in the broadband index leads to an approximate 0.14% increase in steady state GDP per capita.

Sensitivity analysis and robustness tests

To address any potential issues created by the construction of the broadband index and assess the validity of the main results, we performed the following tests.

Firstly, we tested a number of alternative index specifications to determine whether the results are driven by index weighting decisions. Small adjustments of any of the three variable weights had minimal effect on the results.

Alternate model specifications including different combinations of control variables were run. The main results are consistent across tested specifications, specifically the coefficient of the broadband index variable was found to be relatively consistent across different model specifications.

Empirical considerations

There are drawbacks of our empirical approach to be aware of, beyond those associated with the PMG estimation.

Notably is the direction of causality between broadband uptake and economic productivity. Particularly at the microeconomic level, there is some debate as to whether firms who use faster broadband technologies are more productive because they use such technologies, or whether firms who are more productive are simply more likely to adopt faster broadband technologies. However, as discussed by Gómez-Barroso & Marbán-Flores (2020),[57] there is a general consensus on the importance of telecommunications for economic development and a number of studies support the hypothesis that access to broadband supports higher levels of productivity.

Qu et al. (2016), whose econometric approach is largely followed in this report, tested the robustness of their findings against a model specification controlling for possible endogeneity arising from reverse causality. They concluded that the result of endogeneity was likely small and that the original specifications remain valid.

Projected economic benefit methodology

To forecast the future contribution of broadband speed advancements, this report combined modelling estimates of the effect of changes in broadband technologies and uptake with broadband speed forecasts sourced from the industry.

Using these forecasts for broadband speed, and assuming that internet penetration and the number of fixed connections per capita remain at their 2023 levels, we were able to project the broadband index out to 2033.

Based on our estimates for the historical impact of broadband developments on GDP per capita, we were able to estimate the historical expected uplift in GDP per capita per 1 unit change in the broadband index. This was calculated as follows:

$$Ratio = \frac{\Delta GDP\ per\ capita\ attributable\ to\ broadband}{\Delta Broadband\ index}$$

This ratio was estimated based on the change between 2011 and 2023 and was found to be $29.29 per 1 unit change in the broadband index.

While in estimating the historical economic impact we were essentially allocating a portion of actual productivity growth to broadband developments, such an approach is not necessarily suitable for forecasting. Intuitively, our econometric modelling approach assumes that changes in the broadband index cause changes in productivity. That is, future productivity growth is dependent, in part, on the projected broadband index.

In producing these forecasts, we have implicitly assumed that the historical relationship between productivity and the broadband index between 2000 and 2022 holds for the projection period 2024 to 2033. We note that there are inherently significant levels of uncertainty associated with projecting the timing and magnitude of the future economic impact of changes in digital technologies. However, our approach provides an indicative view based on the extrapolation of historical trends seen to date.

Endnotes

1. New Zealand Government (2009) Announcement of the fibre investment programme. Available: Budget kick starts broadband investment | Beehive.govt.nz

2. European Commission (2024) Europe's Digital Decade: digital targets for 2030. Available: Europe's digital decade: 2030 targets | European Commission (europa.eu)

3. Infrastructure Commission, (2024) Build or maintain? New Zealand's infrastructure asset value, investment, and depreciation, 1990–2022. Available: https://tewaihanga.govt.nz/our-work/research-insights/build-or-maintain

4. New Zealand Government (2009) available: Budget kick starts broadband investment | Beehive.govt.nz

5. Crown Infrastructure Partners (2023), Annual Report 2023. Available: https://www.crowninfrastructure.govt.nz/wp-content/uploads/CIP-Annual-Report-2023.pdf

6. Commerce Commission (2024), Chorus' 2025-2028 fibre price-quality path. Available: Commerce Commission - Chorus' 2025-2028 fibre price-quality path (comcom.govt.nz)

7. Crown Infrastructure Partners (2024), quarterly connectivity reporting. Available: Crown Infrastructure Partners | Publications | New Zealand.

8. See, for example, Chorus (2024), Chorus extends fibre to 10,000 homes and businesses in 59 communities across New Zealand. Available: Chorus extends fibre to 10000 homes & businesses | Chorus NZ

9. Sources for figures referenced:

Crown Infrastructure Partners (2013), Annual Report 2013 (12%, 10,000). Available: CFH-Annual-Report-2013.pdf (crowninfrastructure.govt.nz),

Crown Infrastructure Partners (2023), Annual Report 2023 (87%). Available: https://www.crowninfrastructure.govt.nz/wp-content/uploads/CIP-Annual-Report-2023.pdf

Crown Infrastructure Partners (2024), quarterly connectivity reporting (1,387,460). Available: Crown Infrastructure Partners | Publications | New Zealand.

Commerce Commission (2015) 2014 Annual Telecommunications Monitoring Report (5 Mbps). Available: 2014-Annual-Telecommunications-Monitoring-Report-8-June-2015.pdf (comcom.govt.nz)

Crown Infrastructure Partners (2024), quarterly connectivity reporting (459 Mbps). Available: CIP-Connectivity-Quarterly-Report-March-2024.pdf (crowninfrastructure.govt.nz)

Commerce Commission (2023) 2022 Annual Monitoring Report Snapshot (26gb). Available: 2022-Annual-Monitoring-Report-Snapshot-statistics-10-August-2023.pdf (comcom.govt.nz)

Commerce Commission (2024) 2023 Telecommunications Monitoring Report (430gb). Available: 2023-Telecommunications-Monitoring-Report-15-August-2024.pdf (comcom.govt.nz) We note Chorus have reported monthly use of 623 gb per month.

10. See for example, Up to 600,000 Kiwi homes and businesses able to benefit... (chorus.co.nz) and 90,000 greater Christchurch fibre broadband customers set for faster speeds | Enable.

11. Chorus New Zealand (2021) Number of businesses on speciality fibre plans. Available: 100,000 Kiwi businesses now on specialty business fibre plans | Chorus

12. Katz & Callorda (2018), Accelerating the development of Latin American digital ecosystem and implications for broadband policy. Available: Accelerating the development of Latin American digital ecosystem and implications for broadband policy (repec.org)

13. Koutroumpis (2019), The economic impact of broadband: Evidence from OECD countries. Available: EconPapers: The economic impact of broadband: Evidence from OECD countries (repec.org)

14. Gomez-Barroso & Marban-Flores (2018) Telecommunications and economic development – The 21st century: Making the evidence stronger. Available: https://www.sciencedirect.com/Wscience/article/abs/pii/S0308596119304513

15. Appiah-Otoo & Song (2021) The impact of ICT on economic growth-Comparing rich and poor countries. Available: https://ideas.repec.org/a/eee/telpol/v45y2021i2s0308596120301725.html

16. Briglauer et al. (2021), A retrospective study on the regional benefits and spillover effects of high-speed broadband networks: Evidence from German counties Available: A retrospective study on the regional benefits and spillover effects of high-speed broadband networks: Evidence from German counties - ScienceDirect

17. Qu, Simes and O'Mahony (2016) How Do Digital Technologies Drive Economic Growth? Available: https://onlinelibrary.wiley.com/doi/10.1111/1475-4932.12340

18. Internet New Zealand (2023) New Zealand's Internet Insights 2023: A Verian Research Report. Available: https://internetnz.nz/assets/Uploads/New-Zealands-Internet-Insights-2023-v2.pdf

19. Chorus (2023) 15.0 Fibre Frontier. Available: Chorus-revised-Fibre-Frontier-chapter-5-February-2024.pdf (comcom.govt.nz)

20. Commerce Commission (2020) Measuring Broadband New Zealand Autumn Report, May 2020. Available: MBNZ Autumn Report_May 2020__FINAL_18 May 2020_FOR PUBLICATION (comcom.govt.nz)

21. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 4): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

22. Sky (2024) 4K-UHD Test Broadcast. Available: 4K - Ultra-High Definition (UHD) (sky.co.nz)

23. Ministry for Culture and Heritage (2024) Briefing for the incoming Minister for Media and Communications 2024. Available: Briefing to the incoming Minister for Media and Communications (mch.govt.nz)

24. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 4): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

25. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 7): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

26. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 15): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

27. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 4): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

28. Deloitte (2023) The Generative AI Dossier. Available: us-ai-institute-gen-ai-use-cases.pdf (deloitte.com)

29. World Broadband Association (2023) Next generation broadband roadmap 2023 to 2030. Available (page 4): Next-generation-broadband-roadmap-2023-to-2030.pdf (worldbroadbandassociation.com)

30. Health Informatics New Zealand (2024) Health NZ develops AI assistant with Māori tech company Available: https://www.hinz.org.nz/news/676744/Health-NZ-develops-AI-assistant-with-Maori-tech-company-.htm?mc_cid=a823ebefbf&mc_eid=8462cece8b

31. University of Auckland (2024) Robots in Primary Industries. Available: https://cares.blogs.auckland.ac.nz/research/robots-in-agriculture/

32. AI Forum New Zealand (2024) AI Blueprint for Aotearoa. Available: AI Blueprint for Aotearoa (aiforum.org.nz)

33. Chorus (2024) Chorus extends fibre to 10,000 homes and businesses in 59 communities across New Zealand. Available: Chorus extends fibre to 10000 homes & businesses | Chorus NZ

34. Crown Infrastructure Partners (2024) Connectivity Quarterly Report March 2024. Available: CIP-Connectivity-Quarterly-Report-March-2024.pdf (crowninfrastructure.govt.nz)

35. OECD (2023) Broadband statistics – fixed and mobile broadband subscriptions per 100 inhabitants. Available: Broadband statistics | OECD

36. NZIER (2022) Addressing the digital divide: The economic case for increasing digital inclusion. Available: Publication-of-Digital-Council-Research-Report-Addressing-the-digital-divide-The-economic-case-for-increasing-digital-inclusion-PDF.pdf

37. Accenture, Microsoft (2024) New Zealand's Generative AI opportunity. This report calls out one of New Zealand's competitive advantage in Generative AI is our network infrastructure. Available: https://news.microsoft.com/wp-content/uploads/prod/sites/433/2024/08/New-Zealands-Generative-AI-Opportunity.pdf

38. New Zealand Government (2024) Government unlocking potential of AI. Available: Government unlocking potential of AI | Beehive.govt.nz

39. MBIE (2024) Approach to work on Artificial Intelligence. Available: Approach to work on Artificial Intelligence (mbie.govt.nz)

40. National Data Infrastructure (2024) Blueprint for Aotearoa New Zealand. Available: National Data Infrastructure - Blueprint for Aotearoa New Zealand (wgtn.ac.nz)

41. One New Zealand (2024) Aotearoa's Digital Priorities in 2024. Available: tuanz-digital-priorities-2024-one-new-zealand.pdf (vodafone.co.nz)

42. CPA Australia (2024), NZ small business need to lift their tech game. Available: NZ small business need to lift their tech game | CPA Australia

43. CPA Australia (2023) Asia Pacific small business survey. Available: new-zealand-market-summary.pdf (cpaaustralia.com.au)

44. CPA Australia (2024), NZ small business need to lift their tech game. Available: NZ small business need to lift their tech game | CPA Australia\

45. This need was also called out in TUANZ 2023 Maintaining the momentum in improving digital adoption and capability in SMEs.

46. Sanderson, Lynda, New Zealand Productivity Commission (2022), Does high-speed internet boost exporting? Available: https://www.treasury.govt.nz/sites/default/files/2024-05/pc-wp-high-speed-internet-and-exporting-final-wp.pdf

47. Sanderson, Lynda, New Zealand Productivity Commission (2022), Does high-speed internet boost exporting? Available: https://www.treasury.govt.nz/sites/default/files/2024-05/pc-wp-high-speed-internet-and-exporting-final-wp.pdf

48. Sanderson, Lynda, New Zealand Productivity Commission (2022), Does high-speed internet boost exporting? Available: https://www.treasury.govt.nz/sites/default/files/2024-05/pc-wp-high-speed-internet-and-exporting-final-wp.pdf

49. StatsNZ (2024), International migration: July 2024.Available: International migration: July 2024 | Stats NZ

50. World Economic Forum (2023), The Future of Jobs Report 2023. Available: 5. Workforce strategies - The Future of Jobs Report 2023 | World Economic Forum (weforum.org)

51. Australian Government Productivity Commission, New Zealand Productivity Commission (2019), Growing the digital economy in Australia and New Zealand. Maximising opportunities for SMEs, Joint Research Report. Available: growing-digital-economy.docx (live.com)

52. Commerce Commission (2024) Personal banking services. Available: Final-report-Personal-banking-services-market-study-20-August-2024.pdf (comcom.govt.nz)

53. European Commission (2024) Europe's Digital Decade: digital targets for 2030. Available: Europe's digital decade: 2030 targets | European Commission (europa.eu)

54. Belden (2024) Looking at the future of Fiber Broadband in 2024. Available: Looking at the Future of Fiber Broadband in 2024 (ppc-online.com)

55. Qu, J., Simes, R., & O'Mahony, J. (2016). How Do Digital Technologies Drive Economic Growth? Economic Record, 93(1), https://doi.org/10.1111/1475-4932.12340

56. Bassanini, A., Scarpetta, S., and Hemmings, P. (2001). Economic Growth: The Role of Policies and Institutions: Panel Data. Evidence from OECD Countries, OECD Economics Department Working Papers, No. 283, OECD Publishing, Paris, https://doi.org/10.1787/722675213381

57. Gómez-Barroso, J. and Marbán-Flores, R. (2020). Telecommunications and economic development – The 21st century: Making the evidence stronger. Telecommunications Policy, Volume 44, Issue 2, International Telecommunications Society, https://doi.org/10.1016/j.telpol.2019.101905.

Deloitte.

Contact

Liza Van Der Merwe

Partner

Deloitte Access Economics

elvandermerwe@deloitte.co.nz

A special thanks to the Deloitte team members who provided the support to make this report possible:

John O'Mahony
Mayuresh Prasad
Ayden Dickins
Dr Ric Simes
Nicholas James
Emily Barron
Nick Hull
Nafees Beg
Oli Goodman