NERA
ECONOMIC CONSULTING

The economic benefits of digital inclusion and connectivity

Spark Foundation

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1. Introduction and summary

1. Digital equity is when individuals and households have equal opportunity and ability to participate in society using digital technologies, where there is access to the internet (particularly broadband) and the motivation, skills and trust to use the internet and online services.
2. Currently, there remain large segments of the population that are 'digitally excluded', that do not have access to the internet and cannot participate in society using digital technologies. Digital inclusion refers to the process of working towards digital equity by connecting the digitally excluded.
3. There are a wide range of benefits from digital inclusion that include both economic and social benefits to individuals, and wider benefits from having a more connected society overall.
4. The Spark Foundation is interested in understanding the social and economic benefits of digital inclusion and digital equity. In particular, understanding the value of digital inclusion in the context of household broadband connectivity (i.e., the value of connecting homes that were not previously connected and the value of keeping those at risk of disconnecting remaining connected).[1]
5. Against this context, we have been asked to prepare a report reviewing the social and economic benefits of household broadband connectivity that:
    a. Summarises the literature on, and quantitative analysis that have been made of, the economic and social benefits of digital inclusion, specifically in relation to increasing digital connectivity and moving towards digital equity;
    b. Comments on how these estimates might be applied or what inferences can be drawn for New Zealand; and
    c. Discusses whether connecting customers has increased in importance during and post-Covid.
6. A summary of our findings is as follows:
    a. The economic and social benefits (both public and private) of broadband connectivity are material and include increased employment, better health outcomes, increased productivity, better access to government services, reduced social exclusion or isolation, etc.
    b. Data from Stats NZ and the Commerce Commission suggests that currently 93% of households have an internet connection, meaning that approximately 130,320 households do not have an internet connection.
    c. Those who are digitally excluded are at risk of being left behind. Various studies on digital inclusion in New Zealand have identified groups that are at higher risk of being digitally excluded, including: families with children in low socio-economic communities, people living in social housing, disabled individuals, seniors, Māori and Pasifika youth, people living in rural communities, migrants and refugees with English as a second language, offenders and ex-offenders, unemployed people and those not actively seeking work.

[1] This report focuses on the value of connecting people and households to the internet rather than the value of keeping those at risk connected, as most of the research is focused on the value of gaining a connection. It is likely that the value of remaining connected is at least as large as the value of becoming connected, and the cost of losing internet access may even be higher as it can involve losing access to essential activities previously established online. As a 2018 study on digital and social inclusion in New Zealand states: "losing access can have a disproportionately harmful impact on people who are already experiencing social exclusion in other ways", see Elliott (2018), *Out of the Maze: Building digitally inclusive communities*, November 2018.

d. The Covid-19 pandemic has likely influenced the impact of digital inclusion. We expect that the benefits of digital inclusion are even more important now as the Covid-19 pandemic has accelerated the broader societal transition towards digitisation that was already occurring.

e. Extrapolating overseas studies on the benefits of digital inclusion to New Zealand suggests that the benefit of digital inclusion is material. The annual benefit per household ranges from $3,559 to $5,652 and per individual ranges from $1,318 to $3,410.

f. Using the estimated 130,320 digitally excluded households in New Zealand, the per household benefit studies gives an estimate of the total benefit of digital equity of approximately $464 - $737 million per year.

7. It is important to note that:

   a. Most of the studies on digital inclusion were done pre-Covid or using pre-Covid data, and therefore will not take into account any changes to digital inclusion or the benefits of digital inclusion resulting from the Covid-19 pandemic;

   b. The extrapolation of benefits quantified in overseas studies to New Zealand is an approximate estimate rather than an exact measurement; and

   c. Our work is not intended to be a full cost benefit analysis of any particular policy.

8. The rest of the report is structured as followed:

   a. Section 2 provides an overview of digital inclusion in New Zealand;

   b. Section 3 summarises the literature on the economic and social benefits of connecting digitally excluded households and summarises quantified benefits of digital inclusion in the literature; and

   c. Section 4 extrapolates these overseas estimates of the benefit of digital inclusion to the New Zealand context.

2. Digital inclusion

2.1. Digital inclusion and digital equity defined

9. Digital equity is when individuals and households have equal opportunity and ability to participate in society using digital technologies, where there is access to the internet (particularly broadband) and the motivation, skills and trust to use the internet and online services.

10. There remain large segments of society that are 'digitally excluded' and so do not have access to the internet (particularly broadband), or the motivation, skills and trust to use the internet and online services. Closing this divide is now often referred to as a goal of 'digital equity' and the process of moving towards digital equity as 'digital inclusion'.[2]

11. The Digital Equity Coalition Aotearoa defines digital equity and digital inclusion:[3]

> *Digital equity exists when everyone can access and effectively use digital technologies to participate in our society, democracy and economy.*
>
> *Digital inclusion refers to the initiatives and actions we undertake as we work towards digital equity. Digital inclusion is the means to achieve the goal.*
>
> *To achieve digital equity our communities need:*
> - *Affordable access to the internet and appropriate devices*
> - *The digital skills to navigate an increasingly online world, be safe online, and gain employment*
> - *Motivation, trust and confidence*
> - *Wrap-around support to get and stay online.*

12. The New Zealand government's *Digital Inclusion Blueprint* defines four interdependent elements of digital inclusion: motivation, access, skills, and trust:[4]

> ***Motivation**: Understanding how the internet and digital technology can help us connect, learn, or access opportunities, and consequently have a meaningful reason to engage with the digital world.*
>
> ***Access**: Having access to digital devices, services, software, and content that meet our needs at a cost we can afford; and being able to connect to the internet where you work, live and play. Access is a broad element, which can be broken into three key parts: connectivity, affordability and accessibility.*
>
> ***Skills**: Having the know-how to use the internet and digital technology in ways that are appropriate and beneficial for each of us.*
>
> ***Trust**: Trusting in the internet and online services; and having the digital literacy to manage personal information and understand and avoid scams, harmful communication and misleading information. This element also touches on online safety, digital understanding, confidence and resilience.*

13. Digital inclusion can be measured or quantified in relation to one or more of these elements. Although this report will mainly focus on the *access* element of digital inclusion (i.e., household connectivity), it is important to note that digital inclusion and digital equity are not just about providing access to broadband, it is also about increased digital skills, motivation, and trust.

14. This context should be kept in mind when reading this report, however, we think it is fair to regard access to broadband as being a critical component, indeed, even if individuals have the

[2] Digital Equity Coalition Aotearoa, see: www.digitalequity.nz

[3] *Digital equity messaging to support local government candidates*, Digital Equity Coalition Aotearoa. Available at: www.digitalequity.nz/blog-posts/digital-equity-messaging-to-support-local-government-candidates

[4] Department of Internal Affairs, *The Digital Inclusion Blueprint*, March 2019, pg.10

motivation, skill, and trust to use the internet, they will not be able to benefit if they do not have access.

2.2. Measuring digital inclusion in New Zealand

15. Digital inclusion can be measured in a variety of ways either directly or indirectly in relation to the digital inclusion elements. For instance, the New Zealand government's *Digital Inclusion Action plan* estimates that "one in five people in New Zealand lack at least one of the four elements needed to be digitally included."[5]

16. Focusing purely on the access element, Stats NZ data from the 2018 census indicates that 86% of households have access to the internet.[6] Using data from the Stats NZ Internet Service Provider (ISP) survey,[7] the NZCC Telecommunications Monitoring Report,[8] and Stats NZ dwelling and household estimates[9] suggest that in 2021 this figure is approximately 93%, which implies an estimated 130,320 households without access to a broadband connection.[10] Table 1 summarises this and some examples of other measures of digital inclusion on New Zealand.

[5] Department of Internal Affairs, *Digital Inclusion Action Plan 2020-2021*, n.d.

[6] Statistics New Zealand, 2018 Census, *Access to telecommunication systems for households in New Zealand*

[7] Statistics New Zealand, *Internet service provider survey: 2018*

[8] NZCC, *2018 Telecommunications industry questionnaire results – 18 December 2018*, August 2019; and NZCC, *2021 Telecommunications industry questionnaire results – 17 March 2022*, March 2022.

[9] Statistics New Zealand, *Dwelling and Household Estimates: March 2021 quarter*

[10] Calculated as the difference between total households and estimated residential broadband connections. Estimated residential broadband connections in 2021 is calculated by taking the growth rate in residential broadband connections in the NZCC Telecommunications industry questionnaire from 2018 to 2021 and applying it to the 2018 Stats NZ ISP survey residential broadband connections. For more detail on the calculation of estimated residential broadband connections see Appendix A.1.

Table 1: Different ways to measure digital inclusion in New Zealand

	Study / survey / estimate	Digital inclusion measure
Motivation	The World Internet Project New Zealand (2021)[11]	22% of internet non-users, stated their reason for non-use as there was 'no purpose' (i.e., the non-users did not feel like the internet could be useful to them).
Access	Stats NZ 2018 Census	86% of households have access to the internet.
	NERA estimate (using NZCC and Stats NZ data, 2021)	93% of households have access to broadband.
	Global Digital Inclusion: Progress to Parity Scorecard (2021)[12]	89% of the population are using the internet.
	The World Internet Project New Zealand (2021)	94% of respondents were internet users (i.e., had used the internet in the last three months).
	BNZ, Digital skills for life in Aotearoa (2021)[13]	95% of people have access to the internet at home, and 89% of people use the internet every day.
	World Bank Global Findex (2021)[14]	95% of the 15+ population has access to the internet.
Skills	OECD, Survey of Adult Skills PIAAC (2018)[15]	5% of respondents had no computer experience or lacked computer skills and around 45% of respondents had basic internet skills.
	BNZ, Digital skills for life in Aotearoa (2021)	20% of adult New Zealanders lack the essential digital skills needed to use the internet safely and effectively.
	World Bank Global Findex (2021)	Proportion of the 15+ population who made or received a digital payment (98%), that used a mobile phone or the internet to: check account balance (90%), buy something online (77%), pay bills (81%).
Trust	Internet NZ, New Zealand Internet Insights (2021)[16]	5% of respondents thought that the positives of the internet no not outweigh the negatives.
	Stats NZ, Well-being statistics (2021)[17]	68.7% of people who transact online feel safe or very safe doing so (down from 71.8% in 2018).

Source: NERA analysis

2.3. Digital exclusion in New Zealand

17. It is also important to understand the identity of the digitally excluded, and if there are groups that are disproportionately affected by digital inclusion or at risk of not being digitally included in New Zealand. A number of recent studies address these questions in the New Zealand context:

    a. Grimes and White (2019) conduct a detailed examination of internet access among different segments of society using various government data sets and conclude:[18]

[11] Díaz Andrade A., Hedges, M., Pacheco, G. & Turcu, A (2021), *The World Internet Project New Zealand 2021*, New Zealand Work Research Institute.

[12] IDEA 2030 Initiative (2021), *Global Digital Inclusion: Progress to Parity Scorecard*.

[13] BNZ (2021), *Digital skills for life in Aotearoa.*

[14] World Bank (2021), *The Global Findex Database 2021*

[15] OECD (2018), *Survey of Adult Skills (PIAAC) 2018*.

[16] Internet NZ (2021), *New Zealand's Internet Insights 2021*, A Kantar Public Research Report, December 2021.

[17] Stats NZ, *Wellbeing Statistics: 2021*, July 2022; Stats NZ, *Wellbeing Statistics: 2018*, June 2019.

[18] Grimes & White (2019), *Digital inclusion and wellbeing in New Zealand*, Motu Working Paper 19-17, October 2019, p.ii

> *[W]e identify several groups whose members are prone to relatively low internet access: people living in social housing; disabled individuals; Pasifika; Māori; people living in larger country towns (10,000-25,000 people); older members of society (particularly those aged over 75 years); unemployed people and those not actively seeking work. Those in social housing and disabled people are particularly disadvantaged with respect to internet access.*

b. A 2017 report by the Digital Inclusion Research Group for MBIE identifies groups that are at risk of not being digitally included as families with children in low socio-economic communities, people living in rural communities, people with disabilities, migrants and refugees with English as a second language, Māori and Pasifika youth, offenders and ex-offenders, and seniors.[19]

c. Research by the Citizens Advice Bureau found that among the 10% of Citizens Advice Bureau clients where digital exclusion was identified that Māori and Pacific peoples were disproportionately disadvantaged, and that:[20]

> *Digital exclusion is experienced across age groups. While older people are clearly represented amongst those who are digitally excluded, younger people also face difficulties because of information and services being online.*

18. We can also use New Zealand census data to explore this question. For example, data from the 2018 Census suggests that:

a. Those without internet connections are primarily lower income households (see Figure 1).

b. Disabled New Zealanders are less likely to have access to the internet than non-disabled New Zealanders (77.2% compared to 91.7%).[21]

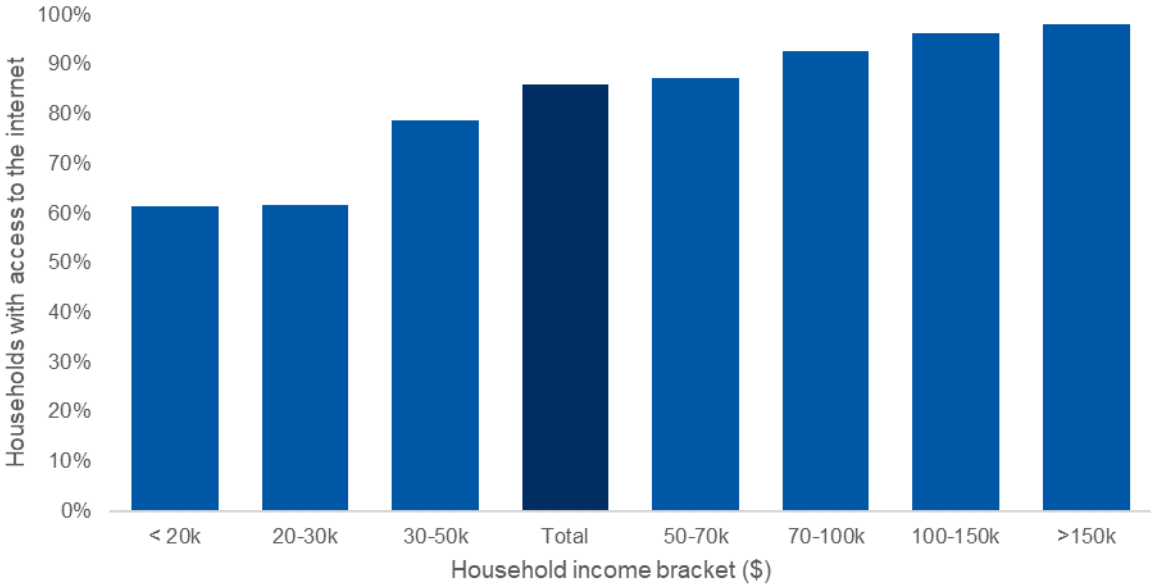
c. Household access to the internet also varies by household composition. As shown in Figure 2, single parent and single person households are more likely than average to not have access to the internet.

[19] Digital Inclusion Research Group (2017), *Digital New Zealanders: The Pulse of the Nation*, May 2017.

[20] Citizens Advice Bureau (2020), *Face to Face with Digital Exclusion*, February 2020.

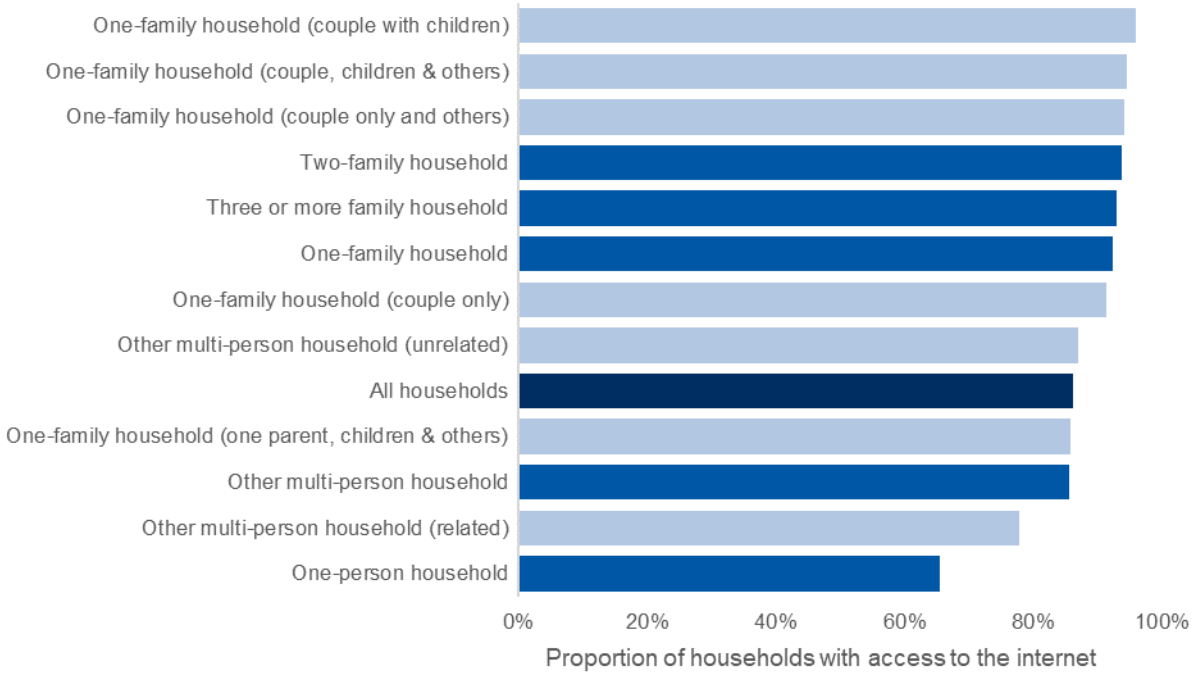
[21] Stats NZ, 2018 Census, *Measuring inequality for disabled New Zealanders - Household access to telecommunication systems 2018*.

Figure 1: Proportion of households with internet access, by household income



Source: Stats NZ, 2018 Census, Access to telecommunications systems by total household income

Figure 2: Proportion of households with internet access, by household composition



Source: Stats NZ, 2018 Census, Household access to telecommunication systems.

3. Benefits of digital connectivity

3.1. Introduction

19. Being digitally included is associated with a range of benefits to individuals, households and society. These benefits have been analysed by studies looking at the impact of digital inclusion, typically in relation to broadband connectivity (i.e., the access element of digital inclusion).

20. Broadband connections result in both private and social benefits. In theory it could also result in costs, though the literature almost exclusively finds a positive impact of internet connectivity (and of telecommunications more broadly) on economic outcomes. For example, Gomez-Barroso and Marban-Flores (2020) have conducted a survey of the empirical literature on the impact of telecommunications on economic outcomes and conclude that:[22]

> *All the evidence collected in the bibliographical review made by this article suggests that there is a throughout positive demonstrable impact of telecommunications – as a whole sector, or broadband connections or mobile telephony – on economic outcomes, even when the financial crisis had unfolded.*

21. Very broadly, the literature on the economic benefits of broadband connectivity can be divided into two categories:

    a. 'Economy-wide' or penetration studies: Analyse the macroeconomic effects of increasing broadband penetration;

    b. 'Bottom-up' or 'digital inclusion' studies: Analyse the effects of individual / household connectivity.

22. In the rest of this section we:

    a. summarise the conceptual effects analysed by both categories of literature in Section 3.2;

    b. summarise the literature which attempts to quantify the benefits of connectivity in Section 3.3; and

    c. discuss the impact of the Covid-19 pandemic on the importance of digital connectivity and inclusion in Section 3.4.

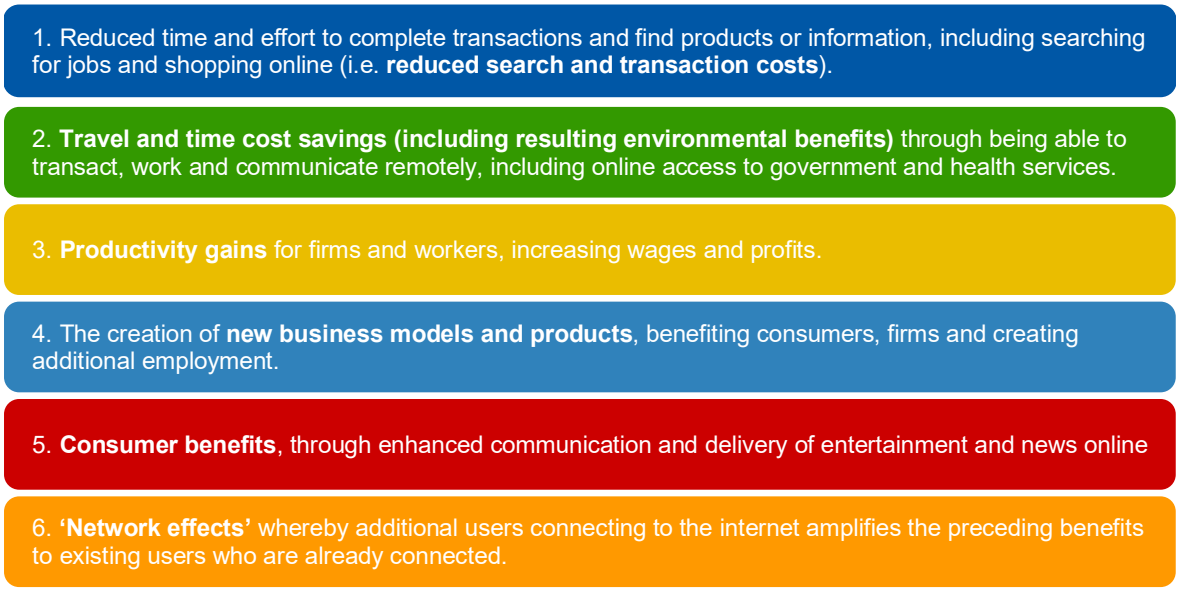
3.2. Conceptual benefit of connectivity

23. The economic and social benefits of internet access and connectivity are broad, encompassing factors that can be directly measured in monetary value (e.g., increase in incomes or increase in GDP growth) and factors that cannot be directly captured, or fully captured, using monetary value (e.g., well-being, time savings, social inclusion).

24. A non-exhaustive list of the broad categories of economic benefits provided by broadband connectivity is set out in Figure 3 below.

[22] Gomez-Barroso, J. L. and Marban-Flores, R., "Telecommunications and economic development – The 21st century: Making the evidence stronger", *Telecommunications Policy*, 44 (2020), p.10

Figure 3: Broad categories of economic benefits from connectivity



Source: NERA analysis

25. Digital inclusion studies in this context typically focus on the benefits to households of connecting, the costs associated with doing so, and the spill-over benefits to society. These studies therefore relate both to the inequality created by the lack of internet access, as well as the general economic benefits that would accrue from connecting the unconnected. In Table 2 below, we summarise some of the specific conceptual benefits of digital connectivity that sit within (and often overlap) the broad categories in Figure 3, and include examples of relevant references.

Table 2: Examples of the specific benefits of digital inclusion

Benefit	Description	References
Employment	Increased employment, benefiting workers and firms through: ▪ Reducing search and submission costs for job seekers, broadening the set of jobs a job seeker might apply for; ▪ Better matching employees to firms and reduced search costs for employees finding specific jobs; and ▪ Increased ability to work from home and opportunities for flexible working.	CEA (2016),[23] CEBR (2018),[24] CEBR (2021),[25] CEBR (2022)[26]
Social connectivity	Digital platforms can help reduce social exclusion or isolation.	CEBR (2018).
Earnings	Developing internet skills may positively affect a person's wages and more general employability.	Goss & Phillips (2002),[27] CEBR (2018), CEBR (2022)
Health outcomes and healthcare costs	Broadband-enabled virtual visits with trained medical professionals can improve patient outcomes at lower cost and with a lower risk of infection than comes with conventional care provided in person.	Finkelstein et al. (2006)[28]
Education	Broadband enables access to lower-cost online education.	Deming et al. (2015)[29]
Small business support	Supporting entrepreneurship and small businesses through streamlining retail transactions.	FCC (2010),[30] CEBR (2018)
Time savings	Time-savings as transactions are undertaken online rather than in person.	CEBR (2018), CEBR (2022)
Access to information	Better access to information and reduced burden on government services.	CEBR (2018), CEBR (2022)
Civic participation	Access to broadband may increase civic participation.	Tolbert & McNeal (2003)[31]
Inequality	Broadband connectivity reduces income inequality.	Houngbonon & Liang (2021)[32]
Environmental	Reduced CO_2 emissions from increased ability to work remotely.	CEBR (2021), CEBR (2022)

Source: NERA analysis

[23] Council of Economic Advisors (2016), *The Digital Divide and Economic Benefits of Broadband Access*, March 2016

[24] CEBR (2018), *The economic impact of digital inclusion in the UK,* Report for Good Things Foundation, September 2018

[25] CEBR (2021), *Ultrafast Full Fibre Broadband: A Platform for Growth*, Report for Openreach, April 2021.

[26] CEBR (2022), *The Economic Impact of Digital Inclusion in the UK: A report for the Good Things Foundation*, July 2022.

[27] Goss, Ernest P. and Joseph M. Phillips (2002), "How information technology affects wages: Evidence using Internet usage as a proxy for IT skills", *Journal of Labor Research* 23: 463–74.

[28] Finklestein, Stanley, Stuart Speedie, and Sandra Potthoff (2006), "Home Telehealth Improves Clinical Outcomes at Lower Cost for Home Healthcare", *Telemedicine Journal and e-Health* 12(2): 128-36.

[29] Deming, David, Claudia Goldin, Lawrence Katz and Noam Yuchtman (2015), "Can Online Learning Bend the Higher Education Cost Curve?", *American Economic Review: Papers & Proceedings* 105(5): 496-501.

[30] Federal Communications Commission, (2010), *Connecting America: The National Broadband Plan*.

[31] Talbot, David (2013), "Google Fiber's Ripple Effect", *MIT Technology Review*, (April 26, 2013).

[32] Houngbonon, Georges & Liang, Julienne (2021), "Broadband Internet and Income Inequality", *Review of Network Economics*, 20, no. 2 (2021): 55-99.

26. The benefits of digital inclusion are likely influenced by who exactly is digitally excluded. As discussed in Section 2.3, certain groups are more likely to be digitally excluded than the general population, and therefore are disproportionately impacted by the costs of digital exclusion and would likely disproportionately benefit from digital inclusion.

27. In addition to the foregone benefits of digital inclusion, there can also be costs associated with digital exclusion in itself. A 2017 report by the Digital Inclusion Research Group for MBIE notes that while digital technologies can improve the livelihood of traditionally disadvantaged groups:[33]

> *There is a growing inequality whereby people are digitally excluded due to issues such as access and proficiency with digital devices. This leads to diminished wellbeing and opportunity, and other forms of deprivation.*

28. In a similar vein, the 2018 study *Out of the Maze: Building digitally inclusive communities* looked at the barriers to and impact of digital inclusion in New Zealand and found that "people described the impact of not being able to access the Internet in terms of exclusion, isolation, powerlessness and limited opportunity."[34] Additionally that, "losing access can have a disproportionately harmful impact on people who are already experiencing social exclusion in other ways."

3.3. Empirical estimates of the benefit of connectivity

29. As already noted, studies that look to quantify the economic benefit of broadband access typically fall into two categories:

    a. **'Economy-wide'** (or top-down/macro) studies, which attempt to quantify the relationship between broadband penetration (or other metrics)[35] and economy-wide economic indicators (i.e., GDP or measures of well-being) and;

    b. **'Bottom-up'** (or 'digital inclusion'/targeted) studies, which attempt to quantify the benefit of increasing digital inclusion of individuals or households, and can include both the direct benefit and spill over effects to society more broadly.

30. We summarise the results of these two strands of literature in turn.

3.3.1. Economy-wide studies

31. There is a broad empirical literature that examines the relationship between broadband penetration and/or measures of broadband quality and GDP. Gomez-Barroso and Marban-Flores (2020)[36] present a very comprehensive survey of this literature, covering peer reviewed academic articles.[37] This literature generally finds a positive relationship between broadband connectivity and GDP, but there is debate around the shape of this relationship. The surveyed studies conducted during the 'broadband years' (which the authors define as 2009 onwards) report that a 1 percentage point increase in broadband penetration results in an increase in per capita GDP growth between 0.09 to 0.15 percentage points.

32. Table 3 summarises a selection of recent economy-wide studies.

[33] Digital Inclusion Research Group (2017), *Digital New Zealanders: The Pulse of the Nation*, May 2017, pg.4

[34] Elliott (2018), *Out of the Maze: Building digitally inclusive communities*, November 2018.

[35] For example, connection speed.

[36] Gomez-Barroso, J. L. and Marban-Flores, R. (2020), "Telecommunications and economic development – The 21st century: Making the evidence stronger", *Telecommunications Policy*, 44.

[37] With a small number of exceptions for works that have been repeatedly cited.

Table 3: Selected examples of economy-wide studies

Study	Period	Calculated economic benefit
Gomez-Barroso & Marban-Flores (2020)	2009-2018	Surveyed studies report that a 1 percentage point (pp) increase in broadband penetration results in an increase in per capita GDP growth between 0.09 to 0.15 pp.
Katz & Callorda (2018)[38]	2004-2017	For high income countries, 1 pp increase in fixed broadband penetration results in a 0.14 pp increase in GDP growth. For the whole sample 1 pp increase in broadband penetration results in a 0.08 pp increase in GDP growth.
Koutroumpis (2019)[39]	2002-2016	For OECD countries, the average increase in broadband penetration over the sample contributed to a cumulative GDP increase of 4.34%. Also finds that broadband speed has a positive but diminishing impact on GDP for OECD countries.
Zhang (2021)[40]	2019-2020	Looking at provincial districts in China pre-Covid and during Covid, a 10% increase in broadband penetration rate results in a 0.82 pp increase in GDP growth during the first three months of 2019, while a 10% increase in broadband penetration rate results in a 1.87 pp increase in GDP growth during the first three months of 2020 (i.e., at the peak of lockdown in China).
Appiah-Otoo & Song (2021)[41]	2002-2017	1% increase in fixed broadband connections, related to a 0.32% increase in economic growth in high income countries.

Source: NERA analysis

3.3.2. Bottom-up studies

33. Bottom-up studies are generally related to digital inclusion or achieving digital equity, and typically examine the benefits of connecting a specific group who do not currently have internet access. In this sense, they are bottom-up estimates of the benefits of connecting a group of marginal users, in contrast to the macro level studies which essentially give the average effect over a certain time period.

34. A 2017 report by the Digital Inclusion Research Group for MBIE summarised the literature in this area.[42] Based on this literature, they concluded that:[43]

> *If we assume that 10% of the households/population are currently not connected or lack the motivation to be connected, then the cost to New Zealand is at least $NZ 150 million per annum.*

35. Table 4 below takes that summary and expands it to include a selection of subsequent studies. As this table demonstrates, the empirical/quantitative literature finds material benefits from digital inclusion.

[38] Katz, R., and F. Callorda (2018), "The economic contribution of broadband, digitization and ICT regulation.", *International Telecommunication Union*, published in Switzerland, Geneva.

[39] Koutrumpis, Pantelis (2019), "The economic impact of broadband: evidence from OECD countries", *Technological Forecasting and Social Change*, 148.

[40] Zhang, Xiaoqun (2021), "Broadband and economic growth in China: an empirical study during the COVID-19 pandemic period", *Telematics and Informatics* 58.

[41] Appiah-Otoo, Isaac, and Na Song (2021), "The impact of ICT on economic growth-Comparing rich and poor countries", *Telecommunications Policy* 45, no. 2.

[42] Digital Inclusion Research Group (2017), *Digital New Zealanders: The Pulse of the Nation*, May 2017

[43] Digital Inclusion Research Group (2017), *Digital New Zealanders: The Pulse of the Nation*, May 2017, p.40.

Table 4: Digital Inclusion Research Group (2017) sample of economic benefit studies, updated to include recent analysis (blue shading)

Study	Country	Calculated economic benefit
PWC (2009)[44]	UK	7.8 million offline households are missing out on benefits from online shopping, paying bills and accessing government services online of £5.4 billion per year or £22.5 billion in overall lifetime benefits (also including lifetime benefits from increased access to employment and education).
Digital Impact (2010)[45]	USA	USD 55 billion per year cost of having 40 million households without access to the internet.
Booz & Company (2012)[46]	UK	£63 billion (or 4.2%) increase in GDP if the UK achieved global leadership in digitisation (i.e., reaching top position in digitisation metrics).
Lawlor (2014)[47]	UK[48]	Benefit from digital inclusion per person of £1,064 for new users, £1,756 for advanced users and £3,568 for professionals.
CEBR (2015)[49]	UK	10-year NPV net benefit of £14.3 billion from various benefits relating to improving digital skills from reduced unemployment, earnings increases, NHS cost reduction, etc. for digitally including 788,000 individuals.
CEA (2016)[50]	USA	Unemployed living in households with internet access are 4 percentage points more likely to be employed after one month than those who do not.
Internet NZ (2018)[51]	NZ	Closing digital divides could be worth $NZ 280m for the economy (based on CEBR 2015).
CEBR (2018)	UK	10-year NPV net benefit of £21.8 billion for digitally including 694,000 individuals (including benefits from increased earnings, employment, time savings, online transactions, communications, health cost savings, etc.).
Grimes & White (2019)[52]	NZ	Positive relationship between internet access and measures of subjective wellbeing.[53]
NZIER (2022)[54]	NZ	Estimates annual benefit to rural households from full rural digital connectivity of $1.79 billion (or approximately $6,505 per household) including benefits from time savings, online transactions, improved earnings, health and social connection.
Zou (2021)[55]	USA	Estimates the income effect of a subsidised broadband programme for low-income households in the US as $1,385 per individual or $2,202 per household.
CEBR (2022)	UK	10-year NPV benefit of £12.2 billion for digitally including 508,000 individuals (including benefits from increased employment, earnings, time savings, health cost savings, decreased CO_2 emissions, etc).

Source: Digital Inclusion Research Group (2017) and NERA analysis

[44] PwC (2009), *Champion for Digital Inclusion: The Economic Case for Digital Inclusion*, October 2009.

[45] Digital Impact (2010), *The Economic Impact of Digital Exclusion*, Digital Impact Group & Econsult, March 2010.

[46] Koss, V., S. Azard, A. Gurm & E. Rosenthal (2012), *This is for everyone: The Case for Universal Digitisation*, Booz & Company, 2012. Hereafter, Booz & Company (2012).

[47] Lawlor, E. (2014), *Valuing Digital Inclusion,* Just Economics report for the BT Get IT Together Project, June 2014.

[48] Does not specifically state that benefit calculation is focusing on the UK but is in GBP and uses inputs from the UK.

[49] CEBR (2015), *The economic impact of Basic Digital Skills and inclusion in the UK: A report for Tinder Foundation and GO ON UK*, November 2015.

[50] Council of Economic Advisors (2016)

[51] Internet NZ (2018), *Solving digital divides together - An InternetNZ position paper*, May 2018.

[52] Grimes & White (2019), *Digital inclusion and wellbeing in New Zealand*, Motu Working Paper 19-17, October 2019.

[53] This paper does not explicitly quantify wellbeing in $ terms but is included for completeness.

[54] NZIER (2022), *Rural connectivity: Economic benefits of closing the rural digital divide,* 4 November 2022.

[55] Zuo, George W. (2021) "Wired and hired: Employment effects of subsidized broadband Internet for low-income Americans", *American Economic Journal: Economic Policy* 13, no. 3 (2021): 447-82.

3.4. Covid-19 and the benefits of digital connectivity

36. In general, we would expect that the broad benefits of connectivity have been even more important in magnitude during the Covid-19 pandemic and will continue to be in the new state of the world following the pandemic. Covid-19 has accelerated the broader societal transition towards digitisation that was already occurring.

37. Recent surveys looking at business digitisation have found that firms accelerated digitisation in response to the Covid-19 pandemic, and expect the increase in digitisation to remain in the long-term:

    a. The European Investment Bank, in the EIB investment survey found that:[56]

    > ***The coronavirus crisis has accelerated the digital transformation of Europe's economy.*** *Close to half of firms in the European Union report investing in digitalisation as a response to COVID-19 — for example, by providing services online — according to the results of the EIB Investment Survey (EIBIS) conducted from April to July 2021.*

    and: [57]

    > ***The coronavirus pandemic crisis has led to wider recognition of the importance of innovation and digital transformation****. According to the latest results of the EIB Investment Survey (EIBIS), most firms in the European Union and the United States expect the COVID-19 outbreak to have a long-term impact on the use of digital technologies, with more than a third of firms expecting it to affect their service and product portfolio or supply chain.*

    b. A global survey by McKinsey in October 2020 found that in response to Covid-19, companies have "accelerated the digitization of their customer and supply-chain interactions and of their internal operations by three to four years."[58] Additionally, the survey found that these changes were made with the long term in mind, and respondents expect that these technology related changes will continue in the future.

38. An increase in digitisation has also had an impact on workers and may also impact who is able to enter the labour force. In 2021, CEBR conducted an analysis of the spatial and workforce impact of 'full fibre'[59] and how this has changed with the impact of Covid-19. The study found that the "cultural change brought about by Covid-19, together with the technological impact of nationwide full fibre rollout" is likely to result in an increase in home working and changes to where people live and the composition and size of the workforce.[60] Regarding the composition and size of the workforce, the study found that:

    > *Groups previously unable to fully participate in employment, including working-age carers, parents of dependent children, and older people may be enabled to enter work. This will provide social and economic benefits, including reduced poverty and inequality, improved mental health, and a lower welfare bill and increased tax revenue. This will be especially important in mitigating some of the economic and social challenges caused by the pandemic.*

39. As digitisation increases and more activity moves online, the benefits of being digitally connected increase and therefore the gap between the digitally included and excluded also increases. Having

[56] European Investment Bank (2022), *Digitalisation in Europe 2021-2022 - Evidence from the EIB Investment Survey*, May 2022.

[57] European Investment Bank (2021), *EIB investment report 2020/2021 - Building a smart and green Europe in the COVID-19 era,* January 2021.

[58] McKinsey & Company (2020), *How COVID-19 has pushed companies over the technology tipping point and transformed business forever*, October 2020.

[59] CEBR defines 'full fibre' as fibre-to-the-premises (FTTP)

[60] CEBR (2021), *Ultrafast Full Fibre Broadband: A Platform for Growth*, Report for Openreach, April 2021, pg.7

a segment of society that is not connected may impede this transition and slow New Zealand's economic recovery from the pandemic.

40. Digital inclusion likely provided significant benefits in the context of the Covid-19 pandemic, as the effectiveness of social distancing is facilitated by a broadband connection. Chiou and Tucker (2020) have analysed American mobile location data sets and have found that the strongest driver of compliance with stay-at-home directives is income and the availability of high-speed internet in an area:[61]

> *Devices in regions with either high-income or high-speed Internet are less likely to leave their homes after such a directive. However, the combination of having both high income and high-speed Internet appears to be the biggest driver of propensity to stay at home. Our results suggest that the digital divide - or the fact that income and home Internet access are correlated - appears to explain much inequality we observe in people's ability to self-isolate.*

41. That is to say, the authors found that the lack of high-speed internet makes it more difficult for lower-income groups to comply with self-isolation. This suggests that the efficacy of social distancing measures, and therefore the flow on effects of slowing the spread of Covid-19, were to some degree dependent on having access to high quality internet.

42. Additionally, the increased availability of healthcare services and resources online will likely increase the benefits of digital inclusion. The use of telehealth and online healthcare increased during Covid-19 lockdowns and will likely remain higher than pre-Covid levels in the future. A 2020 survey on how Covid-19 has changed online behaviours in New Zealand found that the share of people who had used telehealth services increased from 24% pre-Covid to 40% at the end of 2020, and that 32% of people indicated that they would like to use telehealth services more in the future.[62]

43. Access to telehealth and other online healthcare services and resources can help patient engagement and improve health outcomes.[63] However, greater reliance on digital tools and online healthcare has the potential to reinforce existing social and health inequalities.[64]

[61] Chiou, L. and Tucker, C. (2020) "Social Distancing, Internet Access and Inequality", NBER Working Paper, No. 26982, April 2020.

[62] Shannon Williams, *NZ's shift to online during COVID-19 here to stay – report*, IT Brief, December 2020.

[63] Sieck, C.J., Sheon, A., Ancker, J.S. et al (2021), "Digital inclusion as a social determinant of health", *npj Digital Medicine*, 4, 52 (2021).

[64] Heponiemi T, Jormanainen V, Leemann L, Manderbacka K, Aalto AM, Hyppönen H, (2020), "Digital Divide in Perceived Benefits of Online Health Care and Social Welfare Services: National Cross-Sectional Survey Study", *J Med Internet Res*, 2020 Jul 7;22(7).

4. Extrapolating quantified benefits to New Zealand

44. In this section, we extrapolate the benefit estimates set out in Table 4 to consider the benefit of digital inclusion and connecting households in New Zealand that were previously digitally excluded, focusing on the results from the CEBR (2022) and Zou (2021) studies.

45. As we are interested in the benefit of digital inclusion, we focus on 'bottom-up'/'digital inclusion' studies for extrapolating quantified benefits to New Zealand. This is because bottom-up studies typically examine the benefits of connecting a specific group who do not currently have internet access. In this sense, they are estimates of the average benefits of connecting a group of marginal users, in contrast to the macro level studies which essentially give the average effect over a certain time period.

46. Both the CEBR (2022) and Zou (2021) studies were either done prior to the Covid-19 pandemic, or predominantly use data from prior to the pandemic. The CEBR (2022) study was completed while data from 2020 was available, however, benefits in the study are intentionally calculated using assumptions based on 2019 data as to avoid abnormal trends in 2020 data due to the pandemic.[65] So for the reasons discussed in section 3.4, the benefit estimates in these studies likely understate the benefits of connectivity today.

47. Table 5 below uses studies on the economic benefit of digital inclusion described in Table 4 and estimates the benefit for New Zealand of connecting a household to the internet that was not previously connected. We report the estimated benefit for all eight studies in the table, but in drawing conclusions from the extrapolated economic benefits, we only consider results from the two most recent studies Zou (2021), and CEBR (2022).

48. The New Zealand benefit from digital inclusion has been extrapolated using the following general methodology:

    a. Calculate the benefit of inclusion per household or individual from the source study;

    b. Convert this benefit into NZD using the PPP exchange rate;[66]

    c. Inflate to 2022 dollars using the NZ CPI index; and

    d. If figures are expressed on a per individual basis, convert to per household by using the average household size in New Zealand. On the basis that a household is the relevant unit of measurement for broadband connection.

49. More detail on these calculations is contained in Appendix B.

50. It should be noted that the individual and household benefits estimated in the literature represent the average cost per household of digitally including an excluded household or individual, and that the total cost of digital equity may differ from the sum of these benefits. Benefits may differ depending on specific characteristics of the digitally excluded (particularly for the most marginalised households). Studies have generally taken some of these characteristics into account in their benefit estimations (e.g., digitally excluded households are more likely to be low income), but there are likely additional factors that are not taken into account that will influence the impact of digital inclusion to these households.

[65] CEBR (2022), pg.21

[66] The PPP estimate in the year the value was calculated for. PPP exchange rates from: https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm

Table 5: Extrapolating benefits of digital inclusion to New Zealand

		Annual benefit (NZD $2022)	
	Study economic effect	**per person**	**per household**
PWC (2009)	£5.4 billion for 7.8 million digitally excluded households.[67]	698	1,884
Digital Impact (2010)	USD 55 billion cost of having 40 million excluded households.	978	2,642
Booz & Company (2012)	£63 billion (or 4.2%) increase in GDP if the UK achieved global leadership in digitisation.	1,384	3,737
Lawlor (2014)	Benefit from digital inclusion per person of £1,064 for new users.	2,617	7,066
CEBR (2015)	£507 average annual benefit per person.	1,141	3,080
CEBR (2018)	£770 average annual benefit per person.	1,868	5,043
Zou (2021)	Income effect of 12.4% per person.	3,410	5,652
	Income effect of USD 1,385.	2,434	4,034
CEBR (2022)	£614 average annual benefit per person.	1,318	3,559
	£633 annual benefit per person by year 10	1,358	3,666

Source: NERA analysis using benefits calculated in studies stated.
Note: These calculations estimate total benefit (rather than net) and therefore make no assumptions around the costs of connecting households

51. Table 5 shows that extrapolating the two most recent overseas studies on the benefit of digital inclusion, suggest an annual benefit of connecting households of between $3,559 and $5,652 per household with an average of $4,606, and an annual benefit of $1,318 to $3,410 per individual with an average of $2,364. While we have calculated ranges, we note that the numbers in each study are not necessarily directly comparable as they focus on different benefits and use different methods.

52. We note that a recent study by NZIER on rural connectivity also estimates the value of digital connectivity in New Zealand, focusing specifically on closing the *rural* digital divide.[68] Although the connectivity benefit assessment is partially based on the 2018 CEBR study used in this report, due to a different application of the methodology and different focus on the connectivity of rural communities, the household benefit estimated by NZIER differs from (and are not directly comparable with) those calculated in this study. For more detail see Appendix C.

53. Using the estimated 130,320 digitally excluded households in New Zealand (from section 2.2), gives an estimate of the total benefit of digital equity of approximately $464 - $737 million per year.

[67] Note: Only includes annually calculated benefits from online shopping and accessing government services online, and not other 'lifetime benefits' quantified by PwC such as increased access to employment and education.

[68] NZIER (2022), *Rural connectivity: Economic benefits of closing the rural digital divide,* 4 November 2022

Appendix A. Measuring digital exclusion

A.1. Excluded households calculation

54. The NZCC Telecommunications Monitoring Questionnaire results may not capture all connections as it is a voluntary survey of the industry. As a result, simply using the NZCC survey in 2021 may undercount the number of connections and therefore overcount the number of excluded households.

55. The Stats NZ Internet Provider Survey (discontinued in 2018) was a census of all ISPs in New Zealand and so likely captured a larger population than the NZCC survey. Indeed, Stats NZ reports that the 2018 ISP survey was sent out to 85 ISP businesses and achieved an 85% response rate, while the 2018 NZCC questionnaire results reports responses from only 20 ISPs.

56. So, to correct for any potential underestimation of connections from the NZCC survey, we have estimated the residential broadband connections in 2021 by taking the NZCC survey growth rate in residential broadband connections from 2018 to 2021 and applying it to the 2018 Stats NZ ISP survey residential broadband connections.

A.2. Stats NZ ISP survey and Census data comparison

57. The Stats NZ ISP survey 2018 value of 1,505,000 residential broadband connections is also corroborated by the 2018 census, if we apply the proportion of surveyed households with internet access to the total number of households in 2018.

58. That is to say, of the subset of households that responded to this census on this question, 86% had internet access. If we apply this proportion to the total number of households, we get 1,526,777 households with an internet connection. 1,526,777 households with an internet connection less an estimated 19,000 dial up connections in 2018 gets 1,507,777 households with a broadband connection, which is very similar to the Stats NZ ISP survey 2018 value of 1,505,000.

Appendix B. Detail on extrapolation of benefit calculations

Table 6: Benefit calculation workings

Study	Study result	Benefit per household / person	PPP rate (1 = NZD)[69]	NZD (in est year)	CPI ratio (2022/year)[70]	NZD ($2022)	NZD / household ($2022)[71]
PWC (2009)	GBP 5.4 billion for 7.8 million excluded households	GBP 692 per household	2.07	1,435	1.31	$1,884 per household	$1,884
Digital Impact (2010)	USD 55 billion for 40 million excluded households	USD 1,375 per household	1.50	2,058	1.28	$2,642 per household	$2,642
Booz & Company (2012)	4.2% increase in GDP for 10.8 million excluded individuals	0.000000389% GDP per person	-	-	-	$1,384 per person[72]	$3,737
Lawlor (2014)	GBP 1,064 per person	GBP 1,064 per person	2.06	$2,195	1.19	$2,617 per person	$7,066
CEBR (2015)	GBP 464 per person (average benefit)[73]	GBP 464 per person	2.06	$957	1.19	$1,141 per person	$3,080
CEBR (2018)	GBP 770 per person (average benefit)	GBP 770 per person	2.09	$1,610	1.16	$1,868 per person	$5,043
Zou (2021)	12.4% per person (income effect)		-	-	-	$3,410 per person**	$5,652
	USD 1,385 per person*	USD 1,385 per person	1.48	$2,047	1.19	$2,434 per person	$4,034
CEBR (2022)	GBP 614 per person (average benefit)	GBP 614 per person	2.15***	$1,318	1.0	$1,318 per person	$3,559
	GBP 633 per person (year 10 benefit)	GBP 633 per person	2.15***	$1,358	1.0	$1,358 per person	$3,666

** We assume the results for this study are in $2015 as this is not stated and income data used is from 2012-2015*
*** See below for detail of how the % income effect benefit is applied*
**** The PPP rate for 2021 is used as the OECD 2022 PPP data is not yet available*

[69] The PPP estimate in the year the value was calculated for. PPP exchange rates from: data.oecd.org/conversion/purchasing-power-parities-ppp.htm

[70] Stats NZ - CPI All Groups for New Zealand (Qrtly-Mar/Jun/Sep/Dec)

[71] Stats NZ average household size estimate of 2.7 people from: www.stats.govt.nz/news/new-data-shows-1-in-9-children-under-the-age-of-five-lives-in-a-multi-family-household

[72] 0.000000389% multiplied by NZ 2022 GDP of 355,917,000,000 = $ 1,384 ($2022)

[73] This is the average yearly benefit per individual (calculated each year as the cumulative total benefit over cumulative individuals)

59. The method used to apply the % income effect from Zou (2021) is as follows:
    a. Start with the average percentage income effect (increase in individual income) from digital inclusion from the source study;
    b. Apply the 12.4% income effect to the New Zealand 28th percentile individual income for 2022.
60. The reasoning behind using the 28th percentile income to apply the percentage income effect benefit is:
    a. The US results are specifically for households that are eligible for the subsidised plan, which households are if household income is less than 185% of the federal poverty line;
    b. In 2021, 28% of the US population was at or below 200% of the federal poverty line (the closest data point to 185%).[74] So essentially the lowest 28% of the US population would be eligible for this plan;
    c. To apply this to New Zealand, we want to find what the income level is that 28% of individuals will be below. Inland Revenue have data on income percentiles, so we can use the 28th percentile household income to apply the 12.4% income effect.[75]
61. To apply this income effect benefit to households we estimate the average number of income earners (or potential income earners) per household, and multiply the calculated individual benefit by this estimated number of income earners. We do this by:
    a. Use Stats NZ demographic population data to calculate the estimated share of the New Zealand population who are potentially income earners (i.e., the share of the population between the ages of 18-64), as 61%.
    b. Multiply this by the average household size in New Zealand (2.7) to get an estimated number of income earners per household of 1.66.

[74] Kaiser Family Foundation, *Distribution of total population by Federal Poverty Level*, 2021. From: www.kff.org/other/state-indicator/distribution-of-total-population-by-federal-poverty-level-cps

[75] Inland Revenue, *Wage and salary distributions for individuals*, December 2022. From: www.ird.govt.nz/about-us/tax-statistics/revenue-refunds/wage-salary-distributions

Appendix C. Comparison with NZIER estimates of benefits of rural connectivity

62. We note that a recent study by NZIER on rural connectivity also estimates the value of digital connectivity in New Zealand, focusing specifically on closing the rural digital divide.[76]

63. Although the connectivity benefit assessment is based on the CEBR methodology used in this report, the benefit calculations differ for a number of reasons:

    a. The aggregate benefits calculated differ. Our aggregate benefit estimate (of $464 - $737 million per year) is an aggregation of calculated household benefit range across all 130,320 digitally excluded households. The NZIER aggregate benefit estimate (of $1.79 billion) is an aggregation of calculated household benefit across all 275,496 rural households.

    b. The per household benefits also differ. Our calculated household benefit for New Zealand applying the CEBR (2022) study ($3,559 per household) is smaller than the NZIER calculated household benefit (of $6,504). There are similarities between our CEBR (2022) and the NZIER benefit calculations and benefit categories used, but ultimately differences in the application of the calculation methodologies, inputs and focus areas of digital inclusion result in differing final benefits.

        i. One of these differences is the social connection benefit category. The NZIER household benefit includes a social connection benefit category where the CEBR (2022) study does not. The NZIER study estimates a social connection benefit of $2,180 per household, if we add this benefit to our CEBR (2022) benefit estimate, it increases to $5,739.

[76] NZIER (2022), *Rural connectivity: Economic benefits of closing the rural digital divide,* 4 November 2022

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