Economic impact of completing the upgrade of nbn's FTTN network

Key Insights
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This report has been commissioned by NBN Co and prepared by Accenture.

This report serves as an addition to Accenture 'The economic and social impact of investment in the **nbn** network' (2024) which can be found here.

Results and analysis presented in this report are a direct extension of the methodology and models presented in this report. Detail on the methodology from the report can be found here.

The analysis in this report is based on third-party data sources, and inputs provided by NBN Co.

01

This report models the economic benefit of completing the upgrade of nbn's FTTN network

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This report presents new modelling of the economic benefits of high-speed broadband services delivered by the **nbn** network. Specifically, it models the economic impact of completing the upgrade of nbn's fibre-to-the-node (FTTN) network (hereafter 'completing the upgrade' or 'completion of the upgrade').

Completing the upgrade would provide more customers on the **nbn** network with access to **nbn**'s FTTP services, which are the fastest and most reliable of **nbn**'s residential services.

This report builds on the 2024 *The economic and social impact of investment in the **nbn** network* report (hereafter the '2024 economic and social impact report'), which modelled the impacts of:

- the initial nation-wide rollout of the **nbn** network
- **nbn**'s major upgrade programs announced since completion of the initial rollout, including the N2P program, the C2P program and the Fixed Wireless upgrade program.

The modelling in this report, as well as the *2024 economic and social impact report*, are based on take-up assumptions and projections provided by NBN Co.

The completion the upgrade of nbn's FTTN network, modelled in this report, builds on previously modelled programs, including the initial rollout[1]

Upgrade Program		Description
Focus of this report	Completing the upgrade of nbn's FTTN network	Additional investment to upgrade up to approximately 620,000 more premises from FTTN connections to FTTP, enabling connectivity beyond 100Mbps.[1]
Previously modelled programs	Announced FTTN to FTTP (N2P) upgrade program	Planned infrastructure upgrades to 3.5 million premises from fibre-to-the-node connections to fibre-to-the-premises enabling connectivity options close to 1Gbps.
	Announced FTTC to FTTP (C2P) upgrade program	Planned infrastructure upgrades to 1.5 million premises from fibre-to-the-curb connections to fibre-to-the-premises enabling connectivity options close to 1Gbps.
	Fixed Wireless upgrade program	Planned upgrades across **nbn**'s fixed wireless network to expand its coverage by 120,000 premises and significantly uplift speeds available on the network.
Initial Rollout	Initial Rollout	Initial rollout of broadband to Australia supported by a fibre backbone.

Note: 1. For more detail on previously modelled programs see overleaf, or *The economic and social impact of investment in the **nbn** network (2024)*.

This work builds on previous modelling, which estimated the impact of average broadband speeds on the Australian economy at a detailed location level (SA2)

The insights in this report are based on a first-of-its-kind model in Australia that links average broadband speeds to economic development. The approach used leans on the highly cited international academic literature of Wolfgang Briglauer[1], based on county-based analysis in Germany. The method requires detailed data at the granular location level, including of economic outcomes, broadband take-up and speeds obtained and for appropriate control variables such as population size, labour and capital inputs. **Using publicly available data and detailed nbn data, we developed a bespoke panel dataset at the ABS Statistical Area 2 (SA2) level to enable this first-of-its-kind analysis.**

Our approach to estimating productivity benefits links GDP per capita at a regional level to average broadband speeds, controlling for the key inputs to economic output: capital and labour. By controlling for these factors, the model identifies **changes in GDP that are attributable to multifactor productivity**[2]. Other controls modelled include educational attainment (to control for human capital stock), a variable to recognise mining regions[3] and fixed effects for region and time.

The improvements made by completing the upgrade will provide further connectivity and optionality to the **nbn** network. The modelling in this report focuses only on the economic benefits delivered by an expanded program that are additional to the benefits delivered by the initial rollout and announced programs. As a result, the results and analysis in this report are a direct extension of, and consistent with, the methodology and modelling in the 2024 economic and social impact report. Dollars have been updated to 2023 terms.

This report builds on 'The economic and social impact of investment in the nbn network' (2024) which includes a key insights and methodology report

Source: Accenture; 1. Google scholar, Wolfgang Briglauer; 2. Multifactor productivity (MFP) is defined as a ratio of GDP to combined inputs of labour and capital. MFP is also called Total Factor Productivity (TFP). 3. The Briglauer specification did not include this variable. Given the structure of Australia's economy, particularly the concentrated impact of mining in some regional areas (e.g. Pilbara where up to 20% are employed in mining), we have controlled for this effect to improve the robustness of estimates. See the Accenture report 'The economic and social impact of investment in the **nbn** network' (2024) for further discussion of the underlying methodologies.

02

Economic benefit of completing the upgrade of the nbn's FTTN network

Broadband speed increases associated with completing the upgrade for approximately 620k premises would deliver an estimated $10.4 billion increase in GDP cumulatively between 2026-2034

Completing the upgrade of **nbn**'s FTTN network would provide upgrades to an additional 620,000 premises. According to NBN Co, this will be completed by the end of 2030, with customer upgrades on the FTTN footprint occurring from 2026.

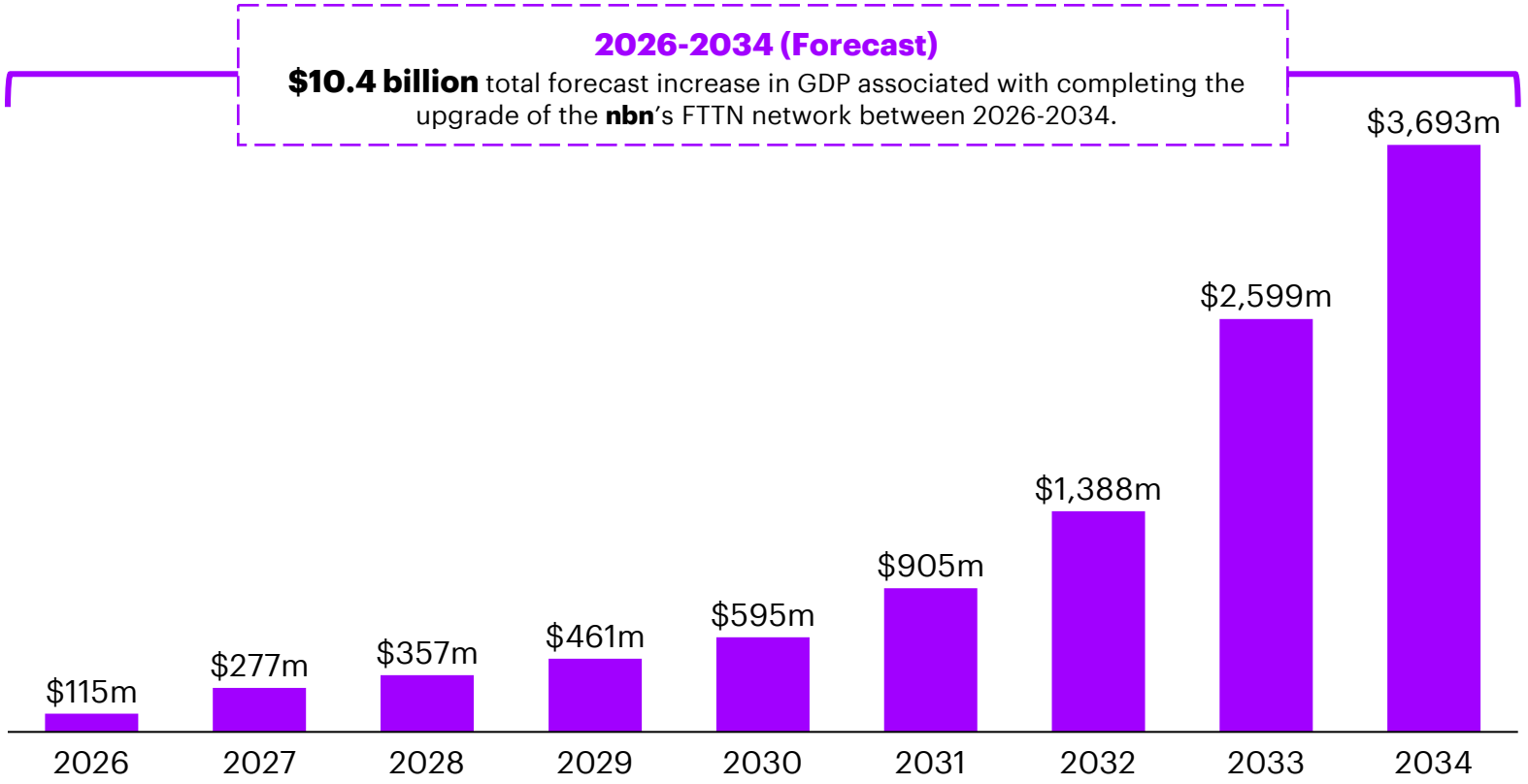
nbn connected premises upgraded by this program may experience a forecast four-fold increase in average broadband speeds reaching an average of 404Mbps by 2034.

This speed increase is forecast to contribute an additional **$3.7 billion** to Australia's GDP annually by 2034. This is based on forecasted take-up rates and speeds provided by NBN Co. Cumulatively, the program is forecasted to add **$10.4 billion** to GDP over the decade to 2034.

This modelling is based on speed increases forecast by NBN Co if all FTTN premises were upgraded to FTTP. The actual technology that premises are upgraded to will affect the estimate of speed increases and therefore the economic forecasts presented in this report. The investment is expected to benefit 620,000 homes and businesses, with more than 95 per cent of them having the option to upgrade to **nbn** full fibre via **nbn** FTTP.

Uplift to GDP attributable to the nbn network[1] as a result of the completion of the upgrade

$, millions, 2026-2034, forecast uplift in national GDP attributable to the completion of the upgrade

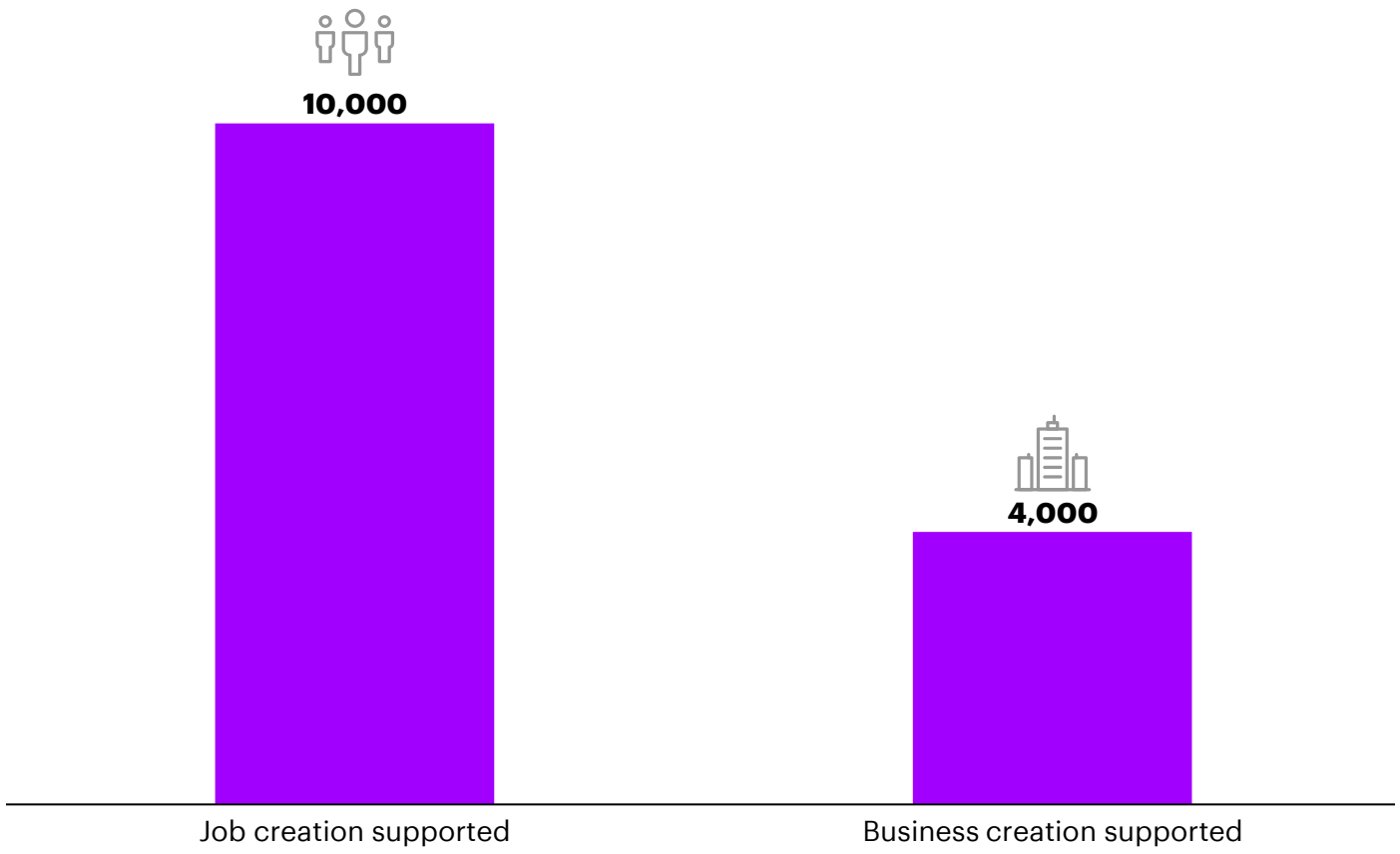


Source: Accenture modelling, see *The economic and social impact of investment in the **nbn** network – methodology report* (2024) for detailed modelling approach. 1. The numbers of premises active in the proposed programs, and on the underlying **nbn** network is based on NBN Co's forecast and assumptions about future connectivity outlined in the methodology report. This model estimates the impact of all broadband speeds on GDP. The GDP figures shown are the portion of this productivity impact that is attributable to the **nbn** network. This has been calculated in each year by determining the portion of average speed increases that has been driven by increased take up of the **nbn** network or the increases in speeds of those already connected to the **nbn** network. Results shown are based on the main model (square root specification) from *The economic and social impact of investment in the **nbn** network – methodology report* (2024), a feature of which is a diminishing marginal return of GDP uplift for each increment of broadband speed. Dollars are in CY2023 terms in line with the latest ABS accounts and are not inflated or discounted.

Completing the upgrade would support an estimated 10,000 additional jobs and the creation of 4,000 additional businesses over the decade to 2034

The effect of completing the upgrade on jobs and business creation

Number of jobs and businesses enabled by completion of the upgrade (2026-2034)



Faster broadband speeds can help reduce barriers to employment and help businesses start and expand.

- **Faster internet connections can help job seekers find employment and advance their careers**.

  High-speed broadband can help job seekers to access employment opportunities beyond their local area through remote work. This may improve equality of opportunity for job seekers in regional and remote areas. It can also reduces barriers to finding a job – 43% of job seekers who used the **nbn** network during their search reported having a better understanding of the job market. 25% of people who were already employed reported being able to find a better job.[1] The **nbn** network also offers access to educational and upskilling opportunities, enabling workers to engage in remote learning.

- **Faster broadband speeds may help reduce barriers to starting a business.**
  Faster broadband facilitates opportunities for a business to reduce costs, access new markets and create innovative new products and services. In doing so, it can enable new market entrants. This has supported the establishment of start-ups in industries such as e-Commerce, education technology, financial technology, and others. The ABS estimates growth in digital activities averaged 7.8% p.a from 2010-2023 (1.6x the all-industry average).[2]

Source: 1. *The economic and social impact of investment in the **nbn** network (2024)*. 2. ABS 'Digital activity in the Australian economy 2020-21'. Chart: Accenture modelling. See *The economic and social impact of investment in the **nbn** network – methodology report* (2024) for detailed modelling approach. The figures shown are the portion of total impact from increased broadband speeds that is attributable to the **nbn** network. The impact attributable to the **nbn** network considers both upgrades to the network and other increases from changes to speed tier mix over time.

Appendix

The modelling of the benefits of completing the upgrade shares the same specifications as modelling presented in the 2024 economic and social impact report

Overview of model specifications

The productivity impact of faster broadband speeds was estimated using a structural regression model, based on a Cobb-Douglas production function in which regional economic output (GRP) is assumed to have a log-linearised relationship to the level of capital (K), labour (L) and human capital (EDUC) within a region, i. Fixed effects for region and time (α) were also used. As an enabler to a general-purpose technology, broadband speed is assumed to effect economic output through its impact on total factor productivity (TFP). Thus, the effect of a 1Mbps increase in average broadband speeds on GRP can be directly interpreted from the coefficient β_4 in the following equation:

$$\log(GRP\_pc_{it}) = \beta_1 \log(K_{it}) + \beta_2 \log(L_{it}) + \beta_3 \log(EDUC_{it}) + \beta_4 BSpeed + \beta_5 \log(mining_{it}) + \alpha + \epsilon_{it}$$

Except for the $mining_{it}$ term[1] and the absence of regional spillover variables[2], this model is identical to the one implemented in Briglauer et al. (2021)[3]. This model estimates a comparable effect of broadband speed on regional economic output (0.10% increase in GRP per Mbps, versus 0.18% in the 2021 Briglauer study.)

In the square root model, the specialisation of capital, labour, human capital, and mining are identical, with the broadband term replaced by the square root of speed. This transformed parameter describes a relationship of diminishing marginal returns between broadband speed and regional economic output. The specification for the square root model is:

$$\log(GRP\_pc_{it}) = \beta_1 \log(K_{it}) + \beta_2 \log(L_{it}) + \beta_3 \log(EDUC_{it}) + \beta_4 \sqrt{BSpeed} + \beta_5 \log(mining_{it}) + \alpha + \epsilon_{it}$$

Both models were trained on data between 2012 and 2020. Observations during 2021 and 2022 were excluded because of anomalies arising over this period due to COVID-19 (effecting both broadband speeds and the economy).

Summary results – Coefficient (p-value)

Variable	Linear model	Square root model
$Broadband\ Speed_{it}$	0.0009916 (0.0000002)	
$\sqrt{Broadband\ Speed}_{it}$		0.0040199 (0.0118602)
$\log(K_{it})$	0.5669810 (0.0000000)	0.56650588 (0.00000000)
$\log(L_{it})$	-0.0128961 (0.0014043)	-0.0122992 (0.0022986)
$\log(EDUC_{it})$	-0.0194974 (0.5348524)	-0.0123190 (0.6966201)
$\log(mining_{it})$	-0.0149651 (0.0000040)	-0.01559859 (0.0000017)

Notes: 1. This variable captures the share of a region's GRP that is attributable to the mining sector. This was considered an important inclusion to the model in the Australian context, given the significant share of mining in total Australian GDP, and the role of international commodity prices in determining this share. Factors that are not otherwise incorporated in this domestically focused model. That said, the effect of broadband speed on GRP was robust to the exclusion of this variable; 2. Regional spillovers increased the observed effect of broadband speed on GRP. These were excluded from our model to ensure results were sufficiently conservative. 3. While the variables controlled for in each model were largely the same, the data used to proxy for each variable differed in some circumstances.

The process of estimating the GDP impacts to 2034 also followed the same steps

The following steps were undertaken to estimate the GDP impact in each year:

1. **Estimate average broadband speed in each year**

   a. Historical years: In historical years this is straightforward, taken straight from our comprehensive dataset as the weighted average of each technology and the speed of that technology. In simple terms, the average speed in a given year is:

   $$Average\ broadband\ speed\ (Speed_{All}) = n\ Speed_{nbn} + (1\ - n)Speed_{non-nbn}$$

   Where n is the percentage of all premises on the **nbn** network and $Speed_{nbn}$ is the average speed obtained by premises on the **nbn** network, accounting for the known speed tier distribution. $Speed_{non-nbn}$ is the average broadband speed across all non-**nbn** broadband technologies, including unconnected premises which have a broadband speed of zero. This implicitly accounts for coverage over time.

   b. Future years: In future years we project forward $Speed_{nbn}$ based on forecasts of active premises by speed tier provided by **nbn**. These forecasts account for the expected impact of growth in customer bandwidth demand on **nbn**'s speed tier mix , and the impact of upgrade programs from the **nbn**'s integrated operating plan. Whilst over 5 million premises are expected to be eligible for upgrades, not all switch on the technology. Take-up assumptions have been provided by **nbn**. Assumptions provided by **nbn** have not been verified.

   For simplicity, the value of n and $Speed_{non-nbn}$ are kept at their latest actual values.

2. **Estimate the GDP impact due to an increase in broadband speed in each year**

   a. Estimate GDP in each year. We took historical estimates from the ABS[1], and for years beyond 2023, forecasts from the Budget 2024-2025[2]. Figures were adjusted to be as-at December in each year, and were expressed in CY2023 dollars, unadjusted for inflation or discounting.

   b. Estimate the uplift percent in that year due to the increase in broadband speeds. When estimating GDP impacts, the square-root model specification was used. This approach is more conservative, as it allows for diminishing marginal returns to speed over time. The formula used was based on our square-root model specification;

   $$\%Increase\ in\ GDP = \exp(b * ((x + M)^{0.5} - x^{0.5})) - 1$$

   where b is the coefficient on the broadband speed variable (0.0040199) in the square-root specification, x is the average broadband speed at the start of the year and M is the increase in average speed since the baseline year (December 2011). Note, where comparisons of the log-linear model are shown (for ease of comparison to Briglauer), the following formula is used:

   $$\%Increase\ in\ GDP = \exp(b * M) - 1$$

   where b is the coefficient on the broadband speed variable (0.0009916) in the log-linear specification and M is the increase in average speed since the baseline year (December 2011).

   c. Estimate the GDP dollars in that year as GDP in the previous year, multiplied by the increase in GDP factor above.

3. **Determine the proportion of this uplift attributable to the nbn network**

   Our model describes a relationship between total average broadband speeds and GDP. To fairly represent the impact of the **nbn** network (only one part of the total broadband story in Australia), we then disaggregate this total GDP impacts into **nbn** and non-**nbn** effects. In each year we calculate the weighted impact of the **nbn** network on the all-Australian average broadband speed, accounting for take-up and average speeds, using the following formula:

   $$\%GDP\ Uplift_{nbn} = \left(\frac{Premises_{nbn} * Speed_{nbn}}{Premises_{total}}\right) / Speed_{All}$$

   This fraction increases over time with the **nbn** roll out, from 0.6% in 2012 to close to 90% in 2023. This fraction accounts for the fact the other non-**nbn** technologies exist and these too are providing some of the GDP benefit. This same scaler factor was applied to the business and jobs estimates.

Notes: 1. ABS National Accounts (Re-expressed in CY2023 dollars). 2. Australian Federal Government Budget Paper 1 (2024-2025)

The modelling in this report shares the same assumptions as the previous report, with some additional assumptions documented below

Component	Assumptions, Limitations, and Possible Refinements
Accounting for new active premises on the nbn network	Completing the upgrade involves the construction of a local fibre network that runs past customer premises. Individual connections to the local fibre network are made for a number of reasons, including: (i) a premises with an active **nbn** FTTN service orders an upgraded FTTP service; (ii) a premises without an existing connection to the **nbn** network orders an **nbn** service; and (iii) a premises with an existing connection to the **nbn** network but not an active service orders an upgraded FTTP service. **nbn**'s forecasts of active services by speed tier assume that, following construction of the new FTTP footprint, there would be a net increase in the number of active services on the **nbn** network as a result of an improvement in the speed and reliability of FTTP services relative to FTTN services. In the model, these premises are deducted from the group of premises with non-**nbn** network supplied services and added to the group of premises with **nbn**-network supplied services. The net impact on the average broadband speed of each group reflects the speed tier of the premises that has moved to the **nbn** network.
Premises activating applied as net changes	The change in the number of active premises on the nbn network, as well as the number of premises connected to individual programs (e.g. the initial rollout, C2P upgrades, N2P upgrades and completing the upgrade of the FTTN network) are modelled as a net change in total premises moving between speed tiers. The denominator used throughout is the overall size of the **nbn** network which avoids potential issues associated with double counting individual premises that may be involved in multiple programs.

Source: Accenture analysis.
See *The economic and social impact of investment in the **nbn** network (2024) for a full set of modelling methodology as well as the assumptions, limitations and possible refinements that are carried into the report.*

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