Infrastructure for the long haul

A need for transparency and durability

Report to Association of Consulting and Engineering
11 September 2020

SENSE PARTNERS
DATA LOGIC ACTION

Key points

The Association of Consulting and Engineering (ACE) commissioned this report for a broad thematic overview of infrastructure investment in New Zealand in the context of the Covid-19 pandemic.

The Covid-19 pandemic has led to one of the biggest economic shocks in modern history. The government is unleashing massive fiscal stimulus to soften the blow. This will lead to significant additional borrowing. Investing in high-quality infrastructure will boost economic growth now and ensure we increase our future economic growth by removing current infrastructure constraints and adding to the productive capacity of the economy.

Infrastructure is the go-to sector for governments delivering fiscal stimulus. That is because infrastructure investment is job-rich (seven jobs for every $1m of spend) during the investment period and creates long-term economic growth (10% increase in public capital stock increases long-term economic growth by 1%), especially when starting from a position of deficit. (We estimate the current infrastructure deficit may be as high as $75b, with additional need for future adaptations due to urbanisation and climate change.)

However, short-term job and economic gains can be blunted by delays from decision making to implementation, so rapid decision making, transparency on process and projects and prioritising simpler projects in the sequence of the investment programme are critical.

There is a risk that local government, which accounts for a third of public investment, will reduce investment through the recession – amplifying a sharp reduction in private sector investment. As a result, the recession will be deeper and long-term economic gains will be deferred – a pattern that played out in the last recession a decade ago.

The infrastructure sector lost around 8% of jobs and business in the last recession. Once capacity is lost, it is slow to return. But as demand for infrastructure investment returned, the sector faced significant costs to regain capacity and capability, the purchaser (largely local and central government) ended up paying more ($2.7b over the past decade) for the same infrastructure and suppliers did not see improved profits.

We do not have to repeat history. To sustain capacity and capability in the infrastructure sector to implement the massive fiscal boost, we need transparency and certainty of projects and their sequencing. To maximise economic and social impact, projects need be consistent with broader public policy objectives. We need to prioritise high-quality projects (supported by cost-benefit analyses that take into account fiscal, economic and social factors), remove obstacles (fast tracking) and enable high-quality procurement that is not just a race to the lowest cost but rather with a view to co-ordinating an optimal outcome.

New Zealand already has the ingredients to do this successfully. We recommend that the Infrastructure Commission is given sufficient resources, authority and accountability to:

- deliver a national infrastructure strategy and pipeline
- ensure value for money and appropriate monitoring (project and whole of life)
- influence investment in capacity and capability within the public service.

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1. Context

The Association of Consulting and Engineering (ACE) commissioned this report from Sense Partners to better understand the broad themes affecting the infrastructure sector in New Zealand and chart a path that, in the wake of the Covid-19 pandemic, will both boost the economy (short-term and long-term) and make the industry more resilient.

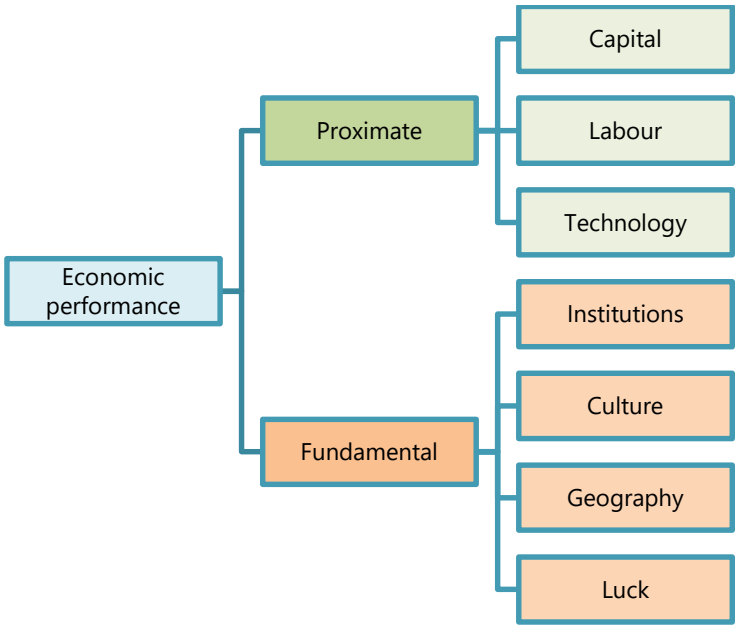
2. Why infrastructure matters

Infrastructure is a key ingredient of economic growth. Economic growth can be described by its drivers (Figure 1). In proximate terms, economic activity is a function of how we use our capital, labour and technology. These key ingredients are all necessary to enable economic growth. Infrastructure is a component of the capital stock of the economy and, according to the definition we use, is a little different to other types of capital.

Economic literature shows that increasing public capital stock leads to a sustained increase in economic growth. This is because this capital is a platform for or enables more economic activity. That additional economic activity may require additional investment and employment by the private sector.

However, this proximate decomposition does not answer why economic prosperity varies so much across countries or what social choices we can make to increase our economic performance.

FIGURE 1: ECONOMIC GROWTH CAN BE EXPLAINED IN TERMS OF ITS PROXIMATE COMPONENTS AND ITS FUNDAMENTAL DRIVERS



Source: Acemoglu (2009)[1]

[1] Acemoglu, D. (2009). *Introduction to modern economic growth*. Princeton, NJ: Princeton University Press.

Economic growth theory classifies fundamental divers of economic growth into four main hypotheses of:

- institutions – rules, regulations and policies affect economic incentives
- culture – beliefs, preferences and values affect economic choices such as occupation, savings and investment in human and physical capital
- geography – the presence of natural resources (e.g. water, coal or soil quality), the distance to markets, climate, disease burden and population density affect economic options and performance
- luck – otherwise identical countries experience different paths because of, for example, different choices in technology adoption.

We have choice in how we manage our institutions, while culture is difficult to change and we have no control over geography and luck. If we want to affect economic performance, the choices we make are at an institutional level.

This paper follows this logic:

- First, we present data on the size and structure of the infrastructure sector in New Zealand.
- Second, we present the literature on the economic impact of increasing infrastructure investment and thus capital stock.
- Third, we present key challenges facing the infrastructure sector, and in the following section, we illustrate them with themes emerging from long-term trends.
- Fourth, we note the need to think radically differently when it comes to infrastructure and the effects of climate change.
- Fifth, we outline why infrastructure is a favoured delivery channel for fiscal stimulus during recessions.
- Finally, we present some thoughts on institutional settings that will improve outcomes for the nation and the infrastructure sector.

3. The size and contribution of the infrastructure construction sector

We use heavy and civil engineering construction as our lens into the infrastructure industry in this report. In the year to March 2020, total spend on heavy and civil engineering construction was $10b, compared to $23b in residential and $10b in non-residential buildings.

We estimate that, of the spending (or revenue) of $10b, $6.8b was used in purchasing goods and services from others, $2.4b was wages and salaries and $0.8b was pre-tax profits to shareholders and business owners.

As such, the direct contribution to gross domestic product (or value add) is $3.2b. The remaining $6.8b goes on to support wages and profits in other businesses.

FIGURE 2: THE SIZE AND IMPORTANCE OF THE INFRASTRUCTURE SECTOR

Measure (2020 or latest)	Unit	Heavy & Civil Engineering Construction	Building Construction			Construction Services
			Total	*Residential*	*Non-residential*	
Economic Activity Contribution						
Total expenditure	$m	10,040	32,971	*23,355*	*9,616*	26,768
Purchases from others	$m	6,800	27,700	*19,621*	*8,079*	15,900
GDP Contribution	$m	3,240	5,271	*3,734*	*1,537*	10,868
Share of all industries	%	1.0	1.7	1.2	0.5	3.5
Salaries & wages*	$m	3,043	3,408	*2,387*	*1,021*	7,027
Profit (EBITDA)*	$m	1,017	1,860	*1,468*	*510*	3,971
Employees						
Direct	#	40,100	73,200	*60,000*	*13,200*	133,100
Indirect	#	30,900	73,700	*38,400*	*35,300*	35,300
Total	#	71,000	146,900	*98,400*	*48,500*	168,400
Per Employee Measures						
Average wage (direct employees)*	$	85,900	80,500	*79,500*	*82,800*	71,200
Productivity (GDP/Employee)	$	80,800	72,000	62,200	116,500	81,700

* 2019 data

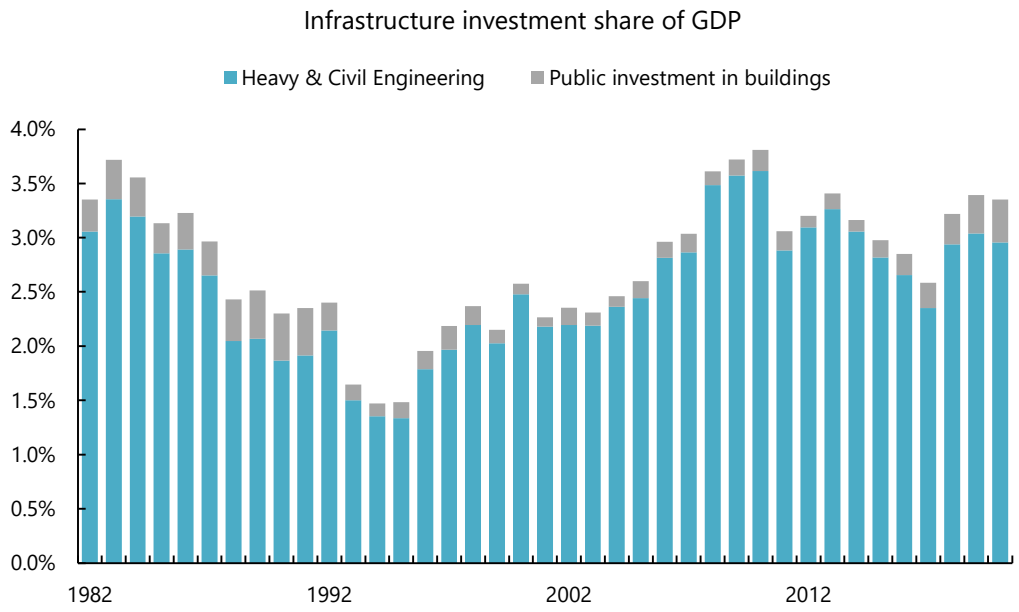
Source: Sense Partners estimates and Statistics New Zealand

The infrastructure sector is a significant employer, accounting for 40,100 jobs in the year to March 2020.[2] The jobs on average are well paid. In 2019, the average income for workers in the infrastructure sector was $85,900, compared to $79,500 in residential, $82,500 in non-residential and $71,200 in construction services (a broad range including plumbers and electricians). This compares to an average of $47,600 for all industries.

The delivery of infrastructure investment requires a range of related industries, which support a further 30,900 jobs.[3] There are supplying industries such as those selling cement, aggregates, manufactured metals and construction services, and there are industries that generate demand for infrastructure construction, such as non-residential building construction. The top 10 industries affected by activity in infrastructure construction are shown in Figure 4.

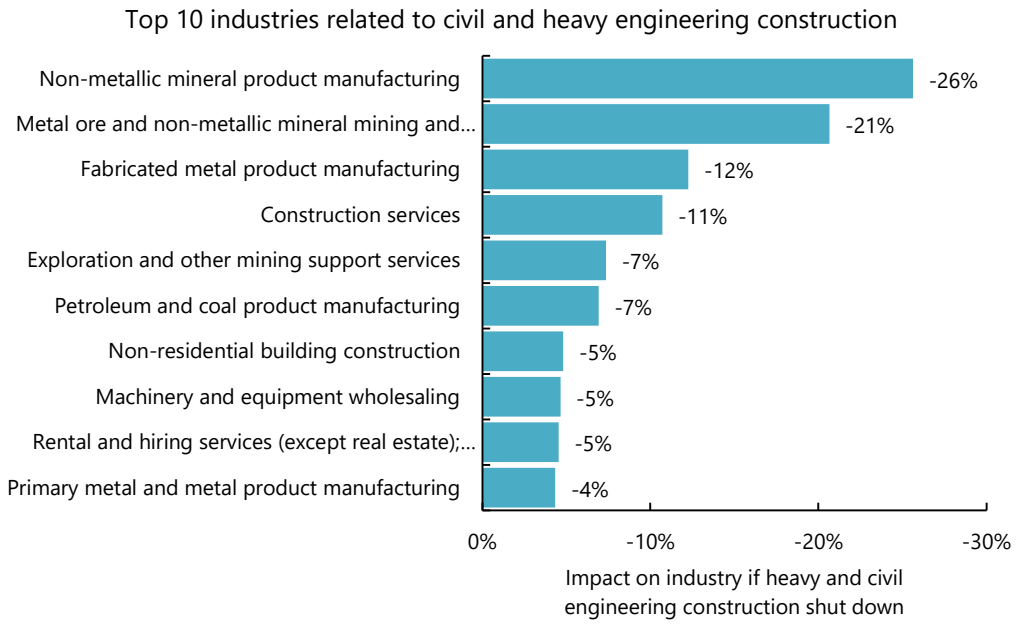
[2] This updates Census 2018 data to the latest estimates for the March 2020 Household Labour Force Survey.
[3] We use the extraction method outlined in Dietzenbacher, E. & Lahr, M. L. (2013). Expanding extractions. *Economic Systems Research*, *25*(3), 341-360.

FIGURE 3: INFRASTRUCTURE INVESTMENT MAKES UP MORE THAN 3% OF THE ECONOMY



Source: Statistics New Zealand and Sense Partners

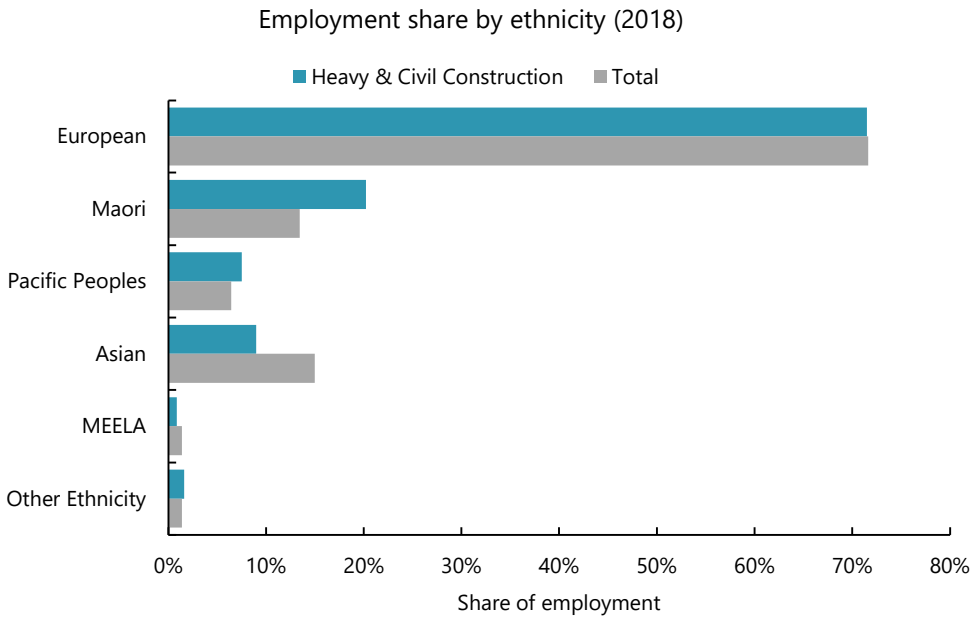
FIGURE 4: SEVERAL INDUSTRIES RELY ON INFRASTRUCTURE CONSTRUCTION



Source: Sense Partners

The infrastructure industry is also more likely to employ Māori and Pacific Peoples (Figure 5). This means that booms and busts in the industry tend to affect Māori and Pacific Peoples disproportionately.

FIGURE 5: MĀORI AND PACIFIC PEOPLES ARE MORE LIKELY TO WORK IN THE INFRASTRUCTURE SECTOR



Source: Statistics New Zealand and Sense Partners

For the direct contributions, we have focused on the heavy and civil engineering construction industry because of its discrete nature and ability to analyse the data over time and detail available. However, some of the residential and non-residential building construction activity can be classified as infrastructure as well, for example, social housing, schools, hospitals and prisons. Investment in public buildings totalled $1.2b in 2020 with a GDP contribution of $198m and 1,703 direct jobs (and 4,554 indirect jobs). Including these buildings would increase the size of our estimated infrastructure sector in 2020 by around 6% (Figure 3).

4. Economic impact of increasing infrastructure investment

4.1. Short-term impact

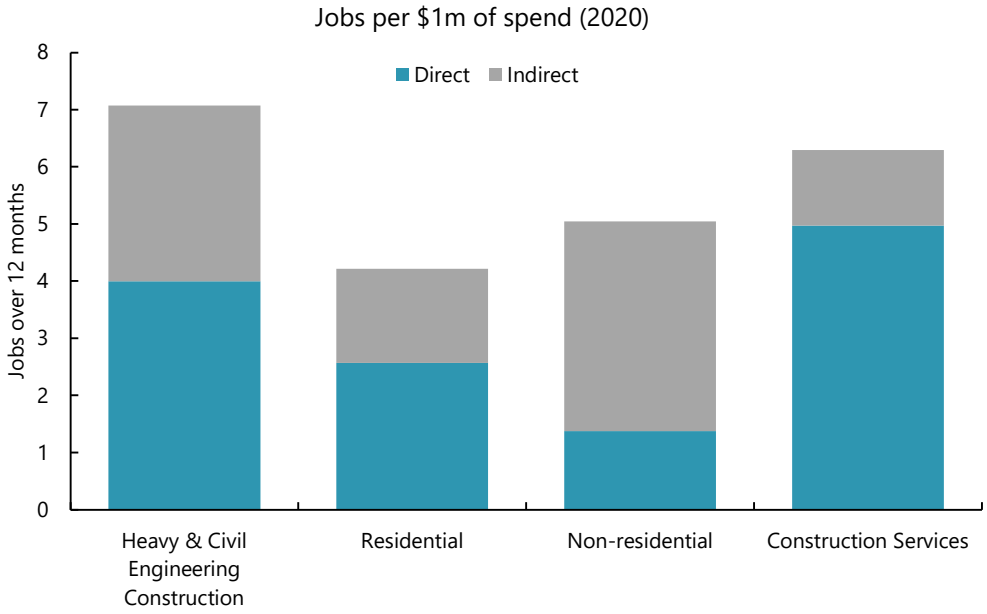
Our analysis also shows that infrastructure spending is job rich. For every $1m of spending, infrastructure investment supports around four jobs for a year and a further three jobs indirectly in other parts of the economy, based on the latest data to 2020 (Figure 6).

From an economic impact perspective, infrastructure investment also boosts the wider economy. Traditional multiplier analysis looks at the direct contribution by sector, the indirect contribution from related industries and the induced effect from incomes and spending associated with these jobs. While this type of analysis needs to be interpreted with care, it gives one measure of total economic impact. Rather than focus on the economic output multiplier, we are particularly interested in the relative economic impact of various industries.

Our results across 106 industries are summarised in Figure 7. We found that infrastructure has relatively high economic impact, although this is lower than other types of building construction. Within the types of investment that government has significant direct control over, infrastructure investment has the highest short-term economic returns behind only education and health.

These impacts can be considered the short-term economic gains. Once infrastructure is built, it is an enabler of private capital and effort, which leads to sustained additional economic growth.

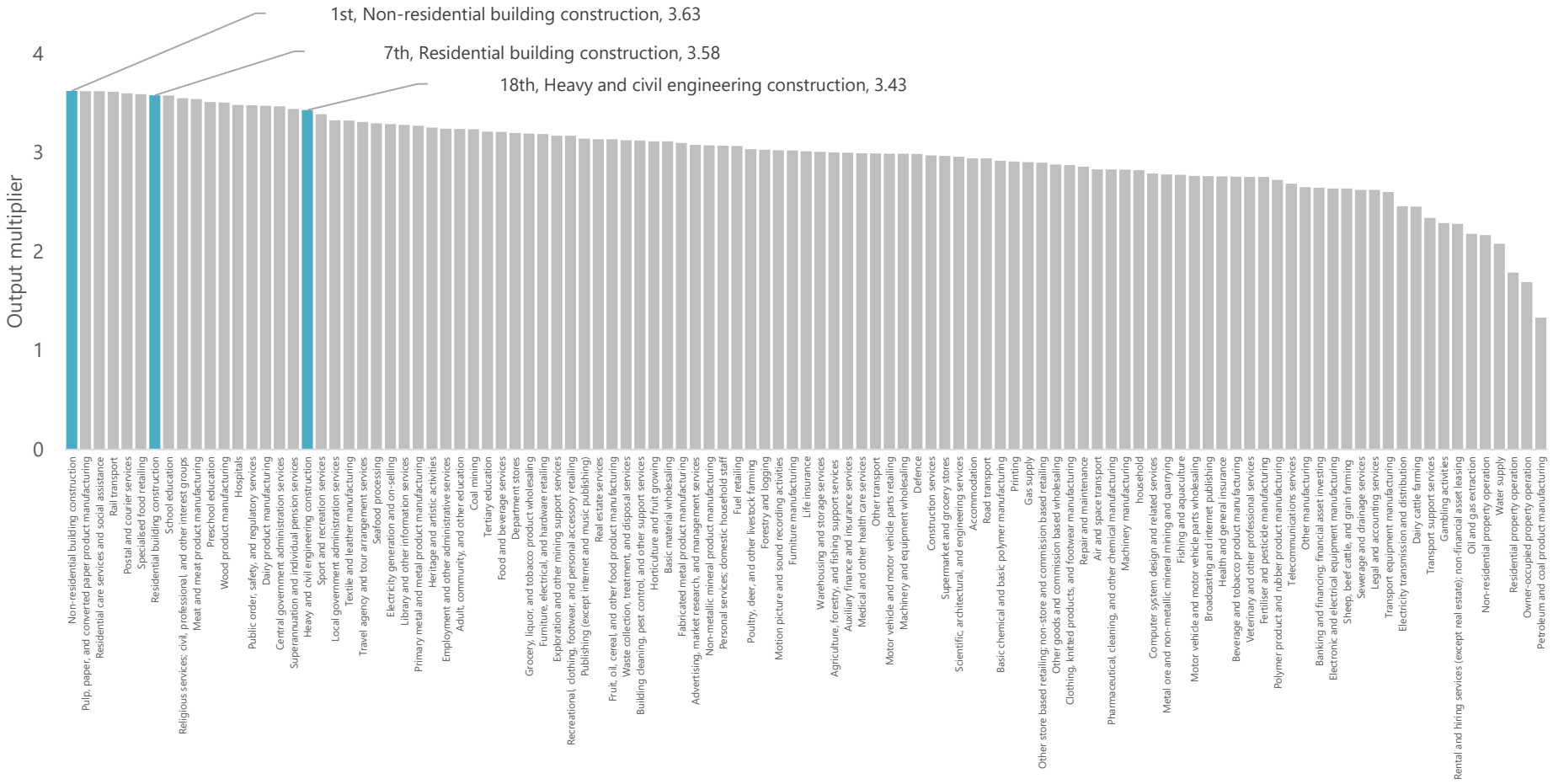
FIGURE 6: INFRASTRUCTURE INVESTMENT IS JOB RICH



Source: Sense Partners

FIGURE 7: BANG FOR BUCK – MULTIPLIERS FOR NEW ZEALAND'S SUB-INDUSTRIES

Fiscal multipliers constructed from Statistics New Zealand's 2013/14 input-output tables

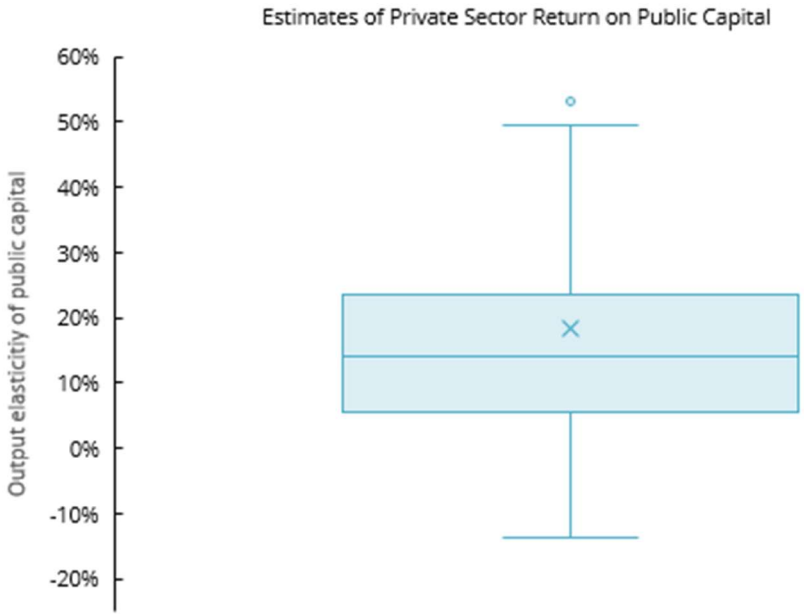


4.2. Long-term impact

A 2014 meta-analysis[4] of economic studies on the long-term economic effects of investment in public capital found that a 1% increase in the public capital stock increases economic activity by 0.1% a year on average. That is, $100m of public capital created increases economic output by $10m a year permanently.

The study analysed 578 estimates of the output elasticity of public capital investment spanning the 1983–2008 period. The authors found that variation in the literature (with the elasticity ranging from 6–24%, Figure 8) was largely due to estimation methods and publication bias. After adjusting for this, they found the average output elasticity of public capital of 10.6%. They found that investments by regional and local authorities and investments in core infrastructure (roads, railways, airports and utilities) had larger impact (nearly twice as big).

FIGURE 8: THE OUTPUT ELASTICITY OF PUBLIC CAPITAL IS HIGH AT 10%



Source: Bom and Ligthart (2014)

A more recent study[5] of public investment found similarly positive impacts from public investment, but the study highlighted that short-term economic boost can be slowed by delays inherent in infrastructure projects. Even so, long-run multipliers can be sizeable when government capital is productive. Moreover, these multipliers are greater if the economy starts from a point below the socially optimal amount of public capital.

[4] Bom, P. & Ligthart, J. (2014). What have we learned from three decades of research on the productivity of public capital? *Journal of Economic Surveys*, *28*(5), 889-916.

[5] Ramey, V. (2020). The macroeconomic consequences of infrastructure investment. NBER Working Paper 27625. Cambridge, MA: National Bureau of Economic Research.

The two studies have important implications.

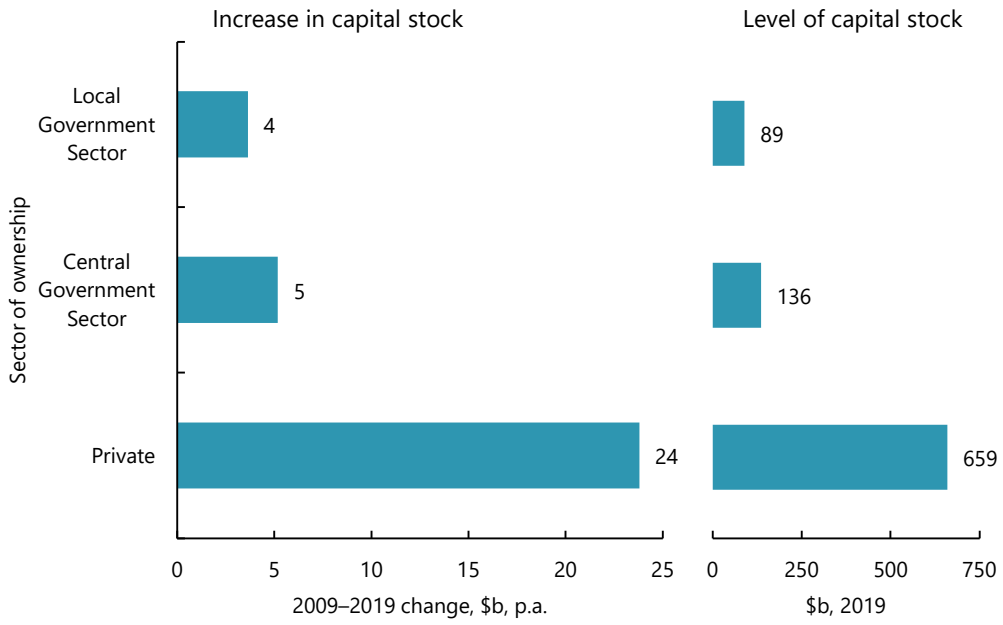
First, the long-term gains can be very large. That is, increasing infrastructure investment, particularly where there is a deficit or shortage, can lead to sustained improvement in economic performance in the long term.

Second, short-term gains can be blunted by delays from decision making to implementation, so rapid decision making, transparency on process and projects and prioritising simpler projects in the sequence of the investment programme are critical.

Third, local government investment tends to boost economic returns more than other types of public investment. In New Zealand, around a third of our public investment is by local government (Figure 9), but after growing strongly for many years, many are finding it increasingly difficult to increase rates and/or borrow more. In the wake of the Covid-19 pandemic, which has affected local government revenue streams, many local governments are likely to reduce their capital investment programmes, which would both reduce activity in the infrastructure and could be a drag on long-term future economic growth.

Fourth, central government will get the best bang for its buck by focusing on areas that are currently in deficit and in core infrastructure assets.

FIGURE 9: PUBLIC SECTOR INVESTMENT (ALL, NOT JUST INFRASTRUCTURE) IS AN IMPORTANT BUT SMALL PART OF THE TOTAL INVESTMENT LANDSCAPE



Source: Statistics New Zealand and Sense Partners

5. Infrastructure challenges

A common definition is that infrastructure is an enabler of other activities – that is, infrastructure encompasses the basic systems and services that an organisation or a country uses in order to work effectively. Infrastructure can be categorised as horizontal (road, rail and electricity networks) or vertical (major buildings such as hospitals and courts).

Key economic characteristics of this infrastructure are:

- large-scale, complex and capital intensive, with high up-front costs
- long lived, with a stream of benefits over decades
- high fixed costs and low marginal cost (economies of scale) so that marginal cost pricing will not be profitable and provision is likely monopolistic
- network effects where the greater the use of the assets, the greater the value and where the cost of service failure can be large.

In practice, the implication of these characteristics is that government tends to be involved to ensure provision of significant and socially beneficial infrastructure, for example, as owner or funder (as a response to financing or revenue risks) and/or regulator (to manage monopoly risks).[6]

The challenges in respect of investment in infrastructure in New Zealand and internationally are well known – although the solutions remain a 'work on'. A 2018 report for Infrastructure New Zealand[7] identified among the 12 key challenges:

- pipeline uncertainty – undermining firms' confidence and investment in capability (people, knowledge and capital)
- policy U-turns – creating the risk that firms' investment in capability does not pay off
- public agency silos – feeding the boom/bust cycle through a lack of co-ordination and missing opportunities by agencies just focusing on solutions in their sector rather than broader economic, social and environmental outcomes
- incentive issues – a funding and procurement environment that rewards least-cost offers and risk-shifting that end up exposing all parties to higher whole-of-life cost.[8]

In addition, infrastructure maintenance and investments are an obvious candidate for deferral to manage fiscal pressures. This may have short-term cash and management benefits (as the immediate impact is often not so visible and deferral is an easier option than finding permanent savings elsewhere) but can accumulate to become a bigger issue in the future.

In New Zealand, approaches such as the Construction Accord and institutional solutions such as the New Zealand Infrastructure Commission – Te Waihanga have been put in place to address these

[6] Government involvement is not, however, a given or necessary condition. In New Zealand, central and local government organisations are the dominant commissioners of infrastructure, while it is the private sector that tends to design and deliver the projects.

[7] Singer, L. (2018). *Creating value through procurement: A report into public sector procurement of major infrastructure projects.* Auckland: Infrastructure New Zealand. Available at: https://www.infrastructure.org.nz/resources/Documents/Reports/Infrastructure%20NZ%20Procurement%20Study%20Report%20FINAL.pdf

[8] In recent times, the collapse of Carillion in the UK and massive project losses at Fletcher Building are spectacular instances of procurement and risk-sharing issues in infrastructure projects.

issues. The Commission has a mandate to publish a 30-year infrastructure strategy, a pipeline of projects and 10-year investment intentions and best-practice guidance and support for procurement and delivery.

These institutional solutions are useful important features that will require constant monitoring and reinforcement by Ministers and Cabinet to insist on high-quality business cases and overcome the temptation for agencies to ignore or bypass these strategies and plans and focus on solutions for their own sector.

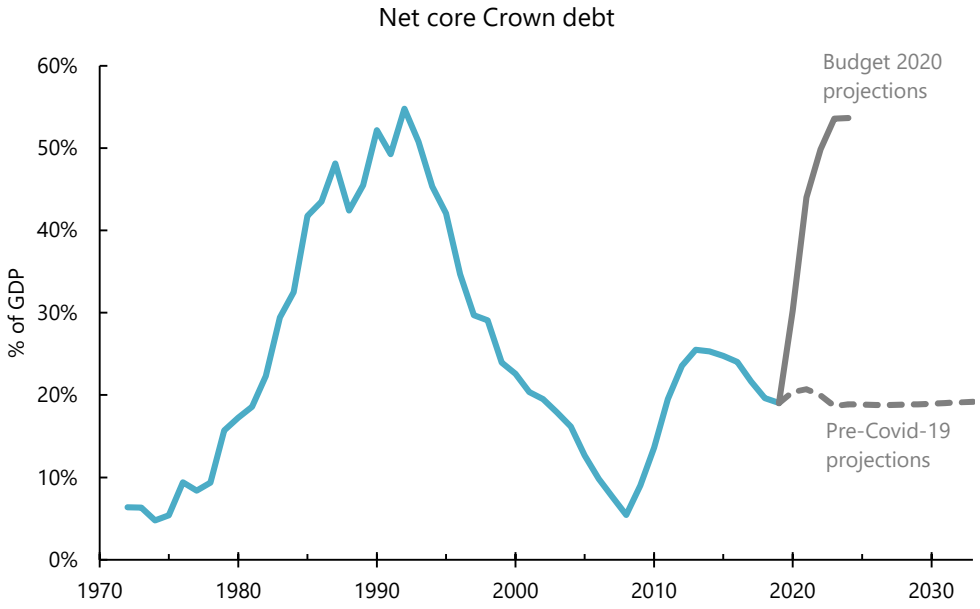
6. Infrastructure and fiscal stimulus

The Covid-19 pandemic is likely to lead to the biggest recession in a century.[9] The disruption due to movement restrictions, changes in consumer behaviour, job losses, reduced private investment and disrupted international trade and travel are all taking their toll.

The central bank has slashed interest rates to near zero levels and has implemented quantitative easing to improve financial liquidity and lending. But the bulk of the economic stimulus will come from government spending or fiscal stimulus. New Zealand has committed to one of the largest fiscal stimulus programmes in the OECD,[10] amounting to over 20% of GDP.

The fiscal stimulus and the recession (which will reduce tax revenue and increase spending on safety nets) will lead to a significant increase in government borrowing. Core government net debt is projected to rise to 55% of GDP, the highest level since the early 1990s (Figure 10).

FIGURE 10: GOVERNMENT BORROWING WILL RISE SHARPLY – WE NEED TO MAKE SURE THE SPENDING CREATES STRONG FUTURE RETURNS



Source: Statistics New Zealand and Sense Partners

The fiscal stimulus was initially focused on protecting lives (health, border, quarantine support) and livelihoods (wage subsidies and lending support) by moderating job losses and business failures. The next phase of stimulus is about sparking short-term and long-term economic growth.

Public infrastructure spending will be a key feature of this. This is because infrastructure projects are job rich but also because private investment falls sharply during a recession as households and businesses become risk averse and credit becomes harder to access. Public investment can act as a

[9] See, for example, the RBNZ's August 2020 Monetary Policy Statement at https://www.rbnz.govt.nz/monetary-policy/monetary-policy-statement/mps-august-2020

[10] For detailed country-level fiscal stimulus arrangements, see the IMF's Policy Responses to Covid Policy Tracker https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#top

countercyclical force. Further, there is a long list of projects that can be fast tracked, so they can be approved quickly.

This presents a broader opportunity. The literature reviewed above shows that investing in high-quality infrastructure has the potential to increase our future economic growth by removing current infrastructure constraints and deficits, by adding to the productive capacity of the economy and by increasing resilience – making our communities better prepared for natural disasters and future challenges such as climate change.

However, international literature shows that complexity and size of many infrastructure projects can lead to implementation delays, reducing short-term economic benefits.[11]

Our analysis shows that investment in the sector is volatile and significant capacity is lost during recessions, slowing a subsequent recovery. Transparency and certainty of infrastructure projects would help to retain capacity and capability in the sector.

The lesson from the last recession of 2008/09 is that capacity and capability lost in a recession can take many years to reverse. This hampered the sector's ability to respond to later demand for additional infrastructure spending and led to significant cost inflation. This highlights the value in pipeline planning and securing some stability in commissioning or workflow, which would reduce both volatility in the sector and result in better outcomes for taxpayers and the community.

[11] Ramey, V. (2020). *The macroeconomic consequences of infrastructure investment*. NBER Working Paper 27625. Cambridge, MA: National Bureau of Economic Research.

7. Thematic lessons from history

We mapped New Zealand's key infrastructure over the last century to tease out key themes affecting the infrastructure sector. Because the assets are long lived, a sweeping historical perspective is useful in being able to see important patterns.

We found the following:

- There is an infrastructure deficit equivalent to around 25% of GDP or nearly $75b. Low investment is not unique to New Zealand, but we seem to have been tracking at a low level of investment for many decades.
- Local government had been taking a greater share of public investment but is running out of fiscal headroom and democratic support.
- Volatility can lead to lack of investment and capacity loss in the sector and cost inflation.
- Ideology can drive big swings in investment, for example, from rail to road. Once we swing away from one asset type, it can be difficult to recover if desired in the future.
- Experience of water assets shows how some deficits are not well known and delays are costing us billions.
- Ports and electricity appear to keep pace with demand. Ownership, funding and regulatory structures appear to have a bearing on understanding customer demand and the ability to invest in capacity.
- The electricity sector highlights how a changing economy can affect demand or need for infrastructure.
- Internet connectivity has been an exception in terms of its rapid rollout and adoption. The model requires greater analysis to replicate the best to other types of infrastructure rollout where appropriate.

7.1. Historical deficit worth nearly 25% of GDP

A long-term perspective of investment in New Zealand shows a substantial reduction in public investment from the mid-1980s, which did not really rebound until the 2000s (Figure 11).

In the 1960s to the mid-1980s, growth in investment was constrained. A command and control economy meant that capital was difficult to access. However, public investment was relatively high. While Think Big projects loom large on public minds, public investment was across a broad range of assets.

However, economic reforms and necessary fiscal constraints (because New Zealand had too much debt and crippling interest costs) led to a sustained reduction in public investment from the mid-1980s to late 1990s, alongside deep cuts in welfare and other spending.

Initially, the reduction in investment did not lead to material issues with congestion or other deficits, mainly because population and economic growth were relatively low until the economy rebounded strongly in 1993. Population growth also accelerated (Figure 12), but public investment did not accelerate until late 1990s. By that time, we estimate that a significant public infrastructure deficit had opened up.

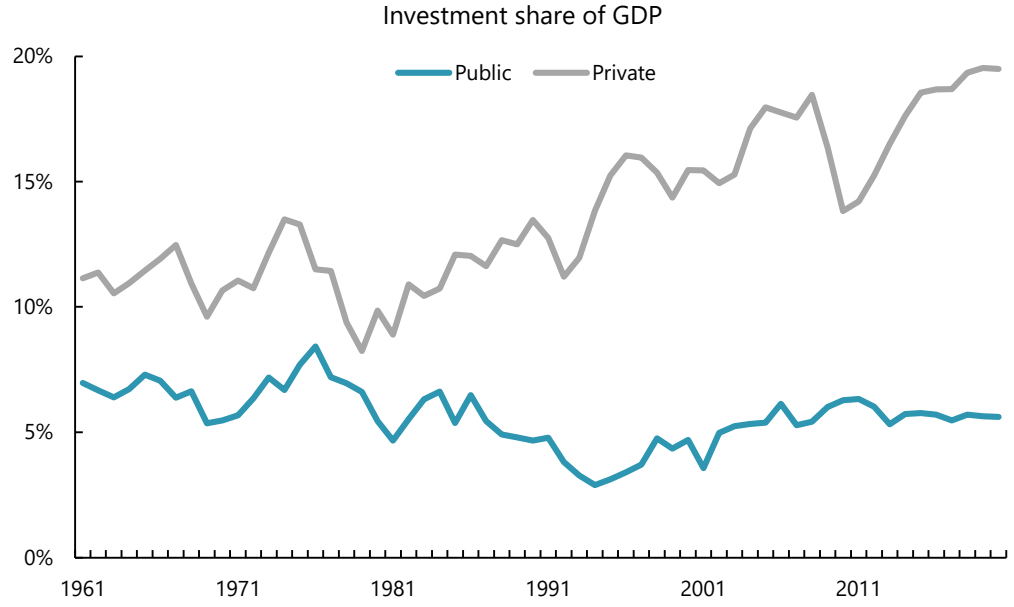
If we assume that private sector capital is complemented by public infrastructure, the infrastructure shortfall may be as high as $75b in 2019 or worth around 25% of GDP. To put this in context, the Infrastructure Commission has identified a pipeline of $26b–76b of projects.[12]

We can see the impact of underinvestment in growing traffic congestion in many parts of New Zealand, for example (particularly Auckland, Hamilton, Tauranga and Wellington), as well as significant upgrades needed in water infrastructure around New Zealand.

Whether we take a historical approach or the size of pipeline of work, there is a significant task over the decades ahead.

Our experience of low public investment (all investment, not just infrastructure) in the 1980s and 1990s is not isolated. Our neighbour Australia followed a similar pattern (Figure 13).

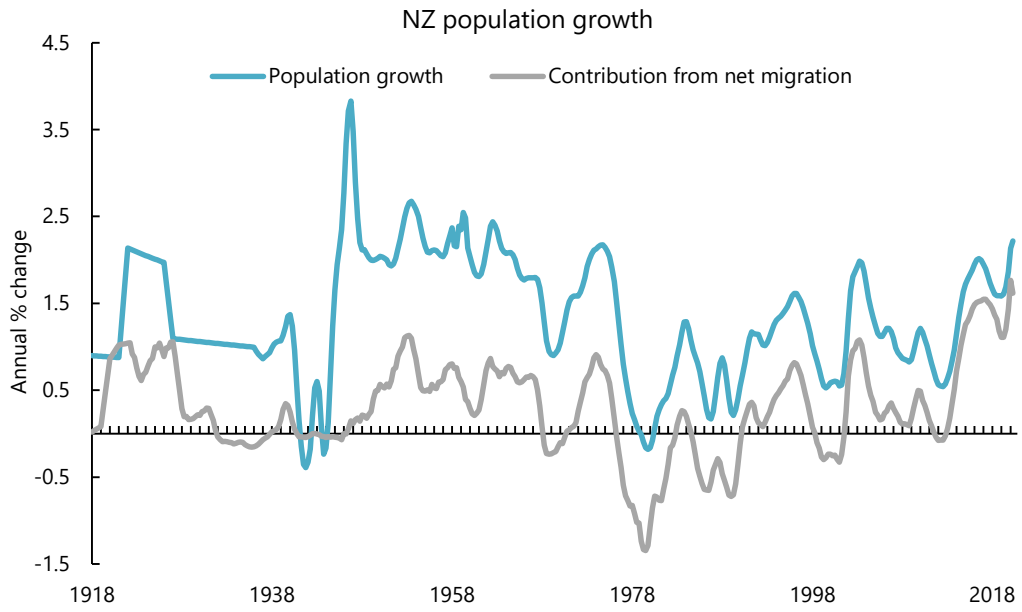
FIGURE 11: PUBLIC INVESTMENT WAS LOW FOR OVER A DECADE FROM THE MID-1980S TO LATE 1990S



Source: Statistics New Zealand, Lattimore and Eaqub (2011),[13] AUP and Sense Partners

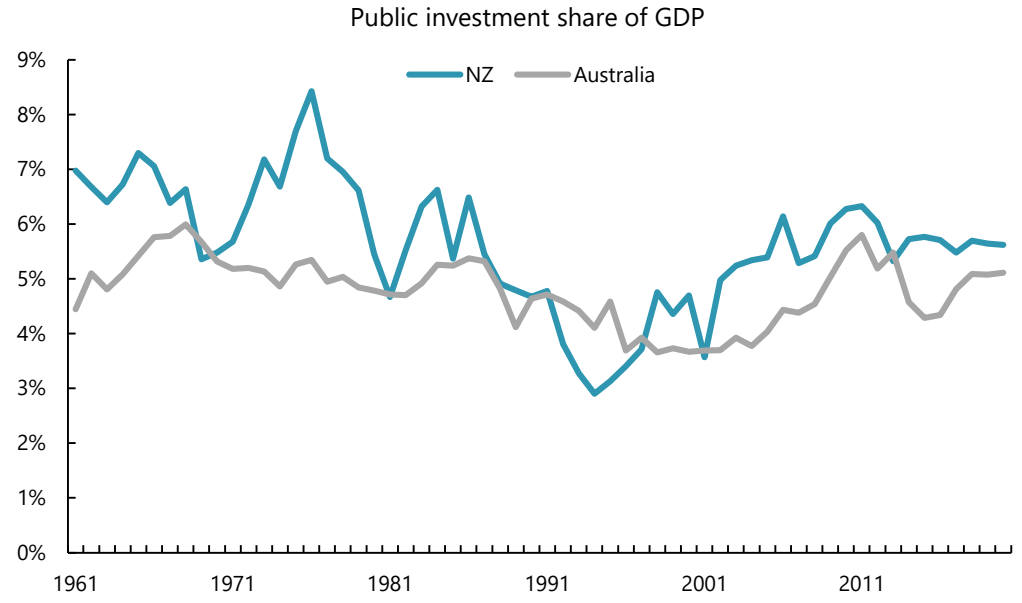
[12] https://infracom.govt.nz/projects/data-in-open-formats/
[13] Lattimore, R. & Eaqub, S. (2011). *The New Zealand economy: An introduction.* Auckland: Auckland University Press.

FIGURE 12: POPULATION GROWTH ACCELERATED FROM THE 1990S



Source: Statistics New Zealand, Lattimore and Eaqub (2011), AUP and Sense Partners

FIGURE 13: OUR INVESTMENT PATTERN IS NOT UNIQUE

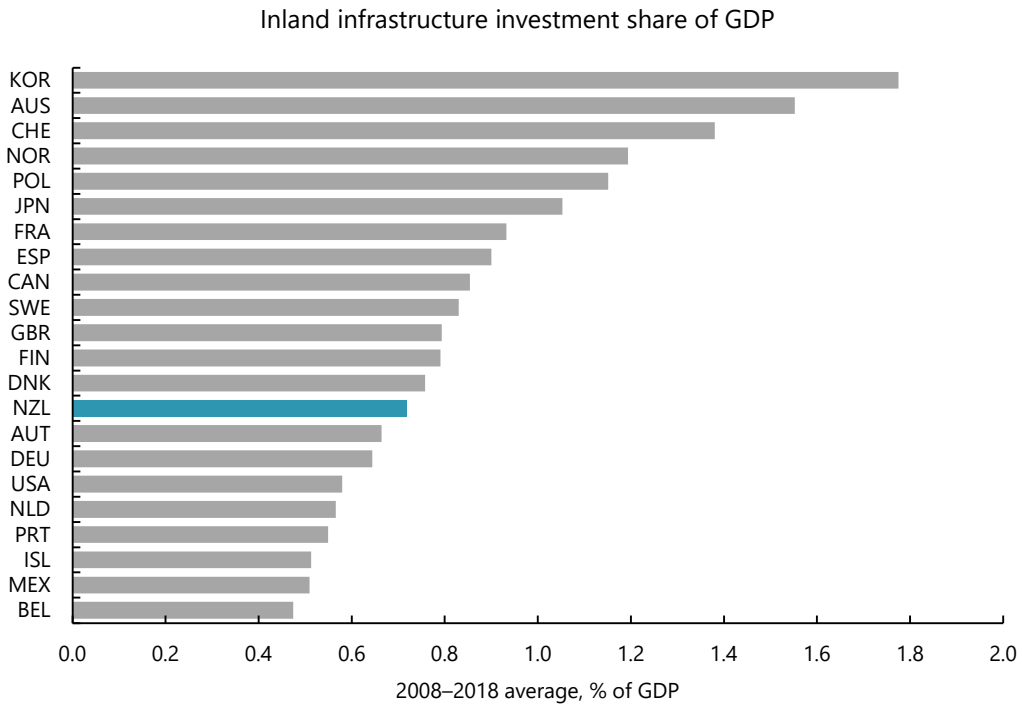


Source: Statistics New Zealand, ABS and Sense Partners

There have been larger economic and political forces at play. However, when we compare our inland (road and rail) infrastructure investment as a share of the economy over the past decade, we significantly lag behind Australia, and we come out in the lower half of the OECD range (Figure 14).

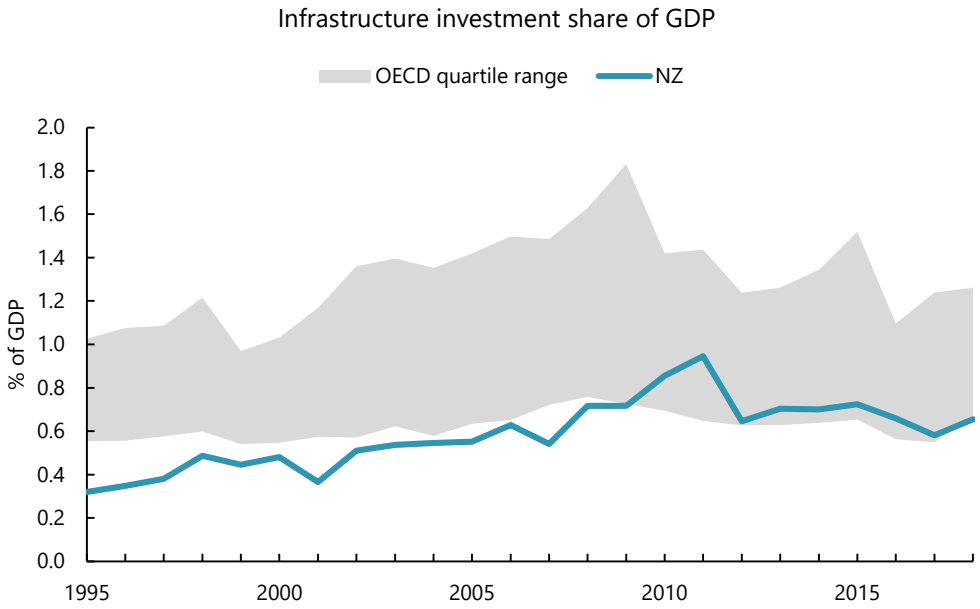
When we take a longer perspective, we find that New Zealand appears to be consistently in the lower quartile of investment (Figure 15).

FIGURE 14: NEW ZEALAND INVESTMENT RANKS AT THE LOWER END OF THE OECD ...



Source: OECD and Sense Partners

FIGURE 15: ... CONSISTENTLY

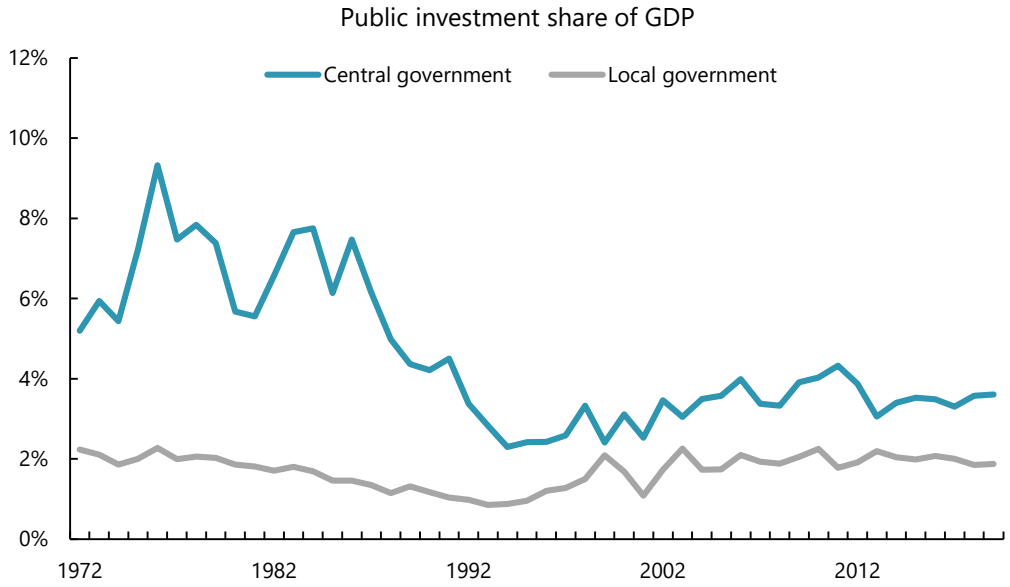


Source: Statistics New Zealand, OECD and Sense Partners

7.2. Local government tapped out

Our analysis shows that local government investment in infrastructure has increased and has remained at a sustained high level, while central government investment has not recouped much of the highs of the 1970s and 1980s (Figure 16).

FIGURE 16: LOCAL GOVERNMENT HAS STEPPED UP INVESTMENTS MORE THAN CENTRAL GOVERNMENT



Source: Statistics New Zealand and Sense Partners

While local government investment has been relatively steady, investments are not keeping up with plans. Most councils spent less than 80% of their budgeted capital expenditure in the mid-2010s.[14]

There are numerous challenges to delivering on planned capital expenditures, including a lack of capacity and capability to deliver large and complex projects as well as political unwillingness to increase rates and borrow.

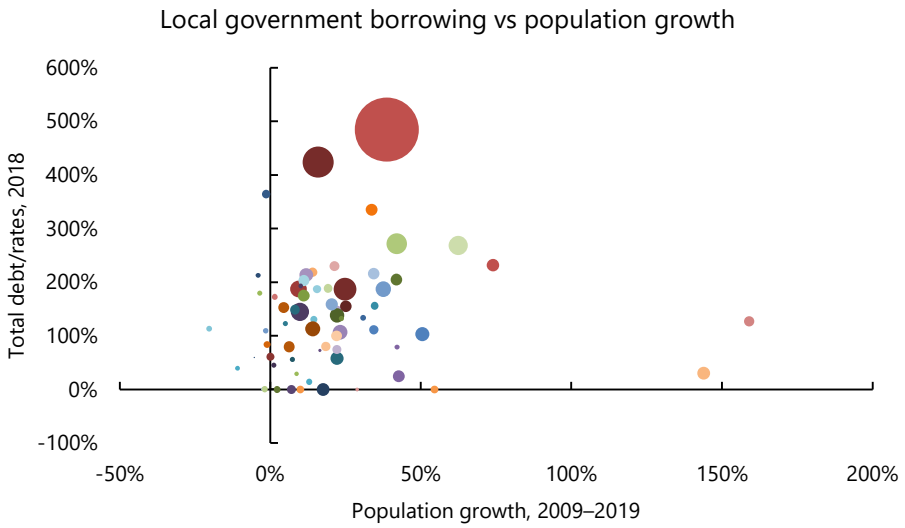
Rates have increased by an average of 4.7% a year over the last decade, compared to overall consumer prices at 1.6% a year and median household incomes at 4.0% a year. In many council areas, there is little appetite for further large rate increases, and many high-growth councils now have a lot of debt (Figure 17).

There is a risk that councils reduce their investment in the current pandemic-induced recession. This would be counterproductive. Rates reductions have only a modest impact on the economy, but the deferred investment has a large impact on short-term and long-term jobs.

However, current decision making at many councils shows that local government may be tapped out. For fast-growing localities, the cost of keeping up with infrastructure is outstripping the social licence to increase rates and borrowing.

[14] Controller and Auditor-General. (2019). *Our 2018 work about local government*. Wellington: Office of the Auditor-General. Available at: https://oag.parliament.nz/2019/local-govt/docs/local-govt.pdf

FIGURE 17: LOCAL GOVERNMENT DEBT IS HIGH IN MANY FAST-GROWING COUNCIL AREAS

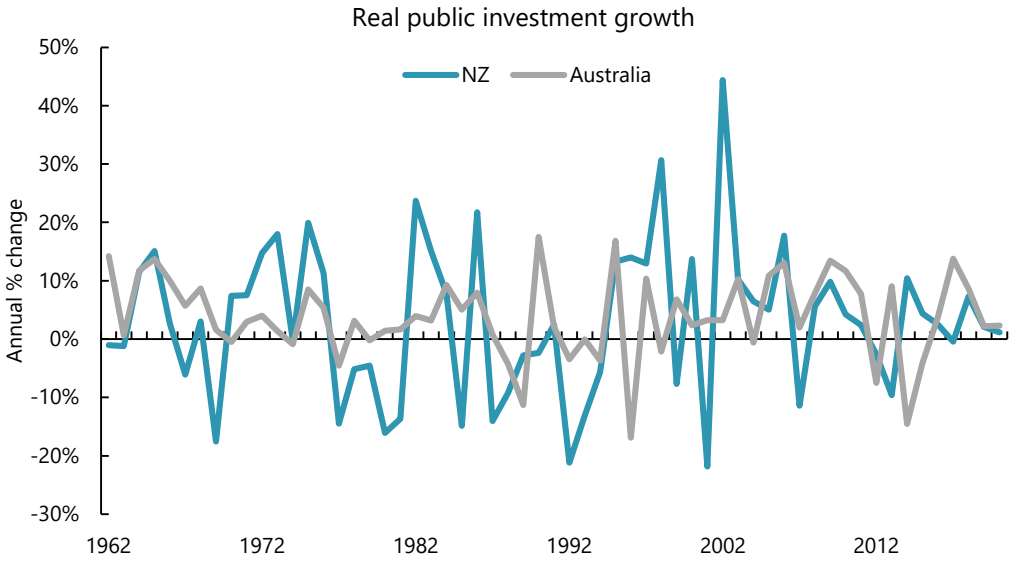


Source: Statistics New Zealand and Sense Partners

7.3. Volatility as a source of risk

Volatility in infrastructure investment is damaging for capacity and capability building in the industry. Volatility is caused by public investment being inherently lumpy (Figure 18) because of often large projects and uncertainty around start and end times.

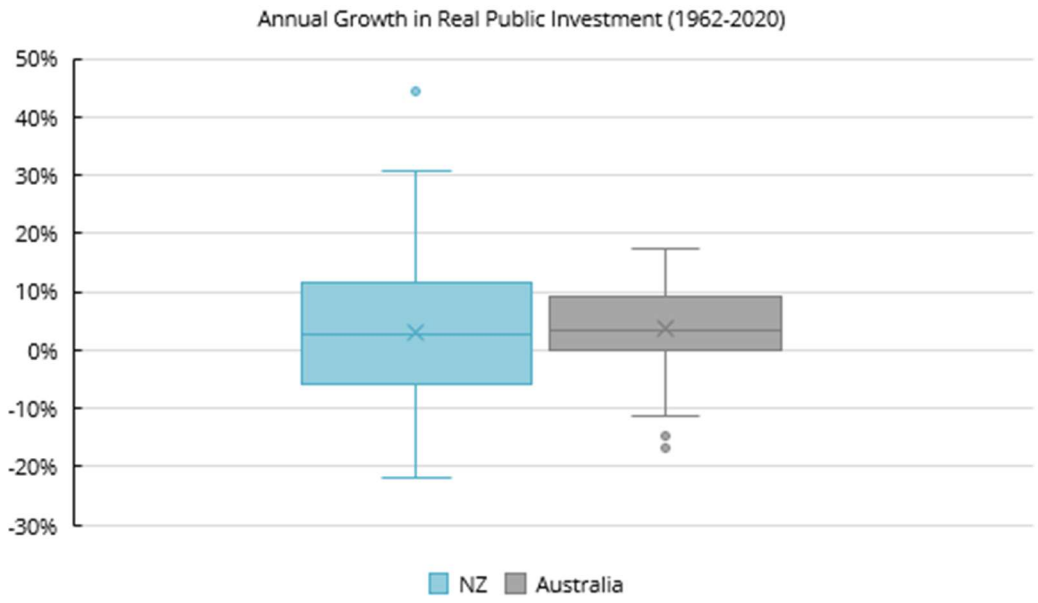
FIGURE 18: PUBLIC INVESTMENT IS LUMPY…



Source: Statistics New Zealand, ABS and Sense Partners

However, our analysis shows that public investment in New Zealand tends to be more volatile than in Australia (Figure 19).

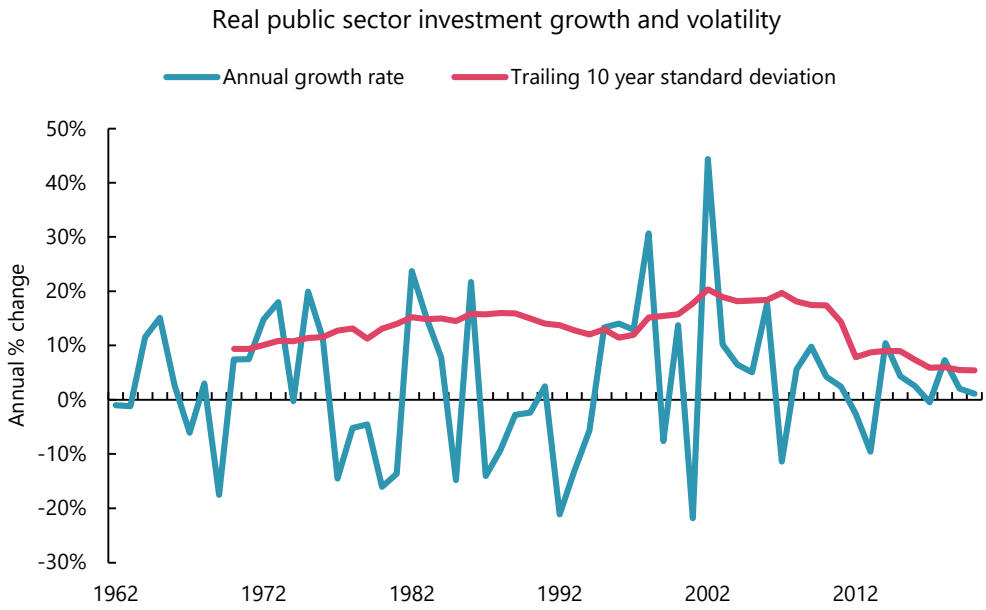
FIGURE 19: … BUT APPEARS TO BE MORE SO IN NEW ZEALAND THAN AUSTRALIA



Source: Statistics New Zealand, ABS and Sense Partners

Over the last decade volatility has reduced, but so has the rate of growth in public investment (Figure 20).

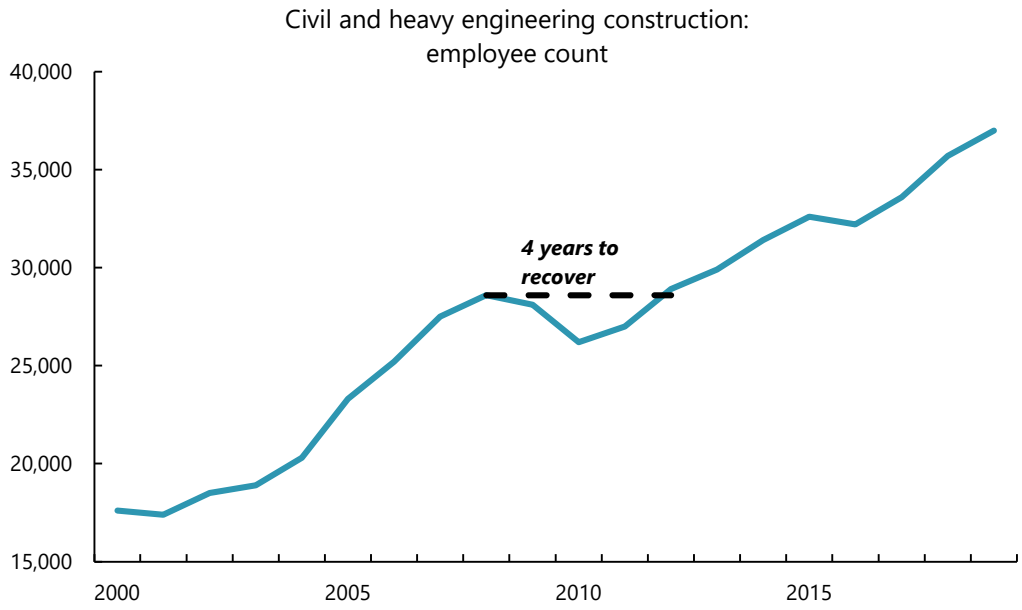
FIGURE 20: VOLATILITY HAS REDUCED IN RECENT YEARS, BUT SO HAS GROWTH IN INVESTMENT



Source: Statistics New Zealand and Sense Partners

The last Global Financial Crisis (GFC) recession of 2008/09 is a good case study. There were significant job losses in civil and heavy engineering construction that took 4 years to recover to the pre-recession level (Figure 21).

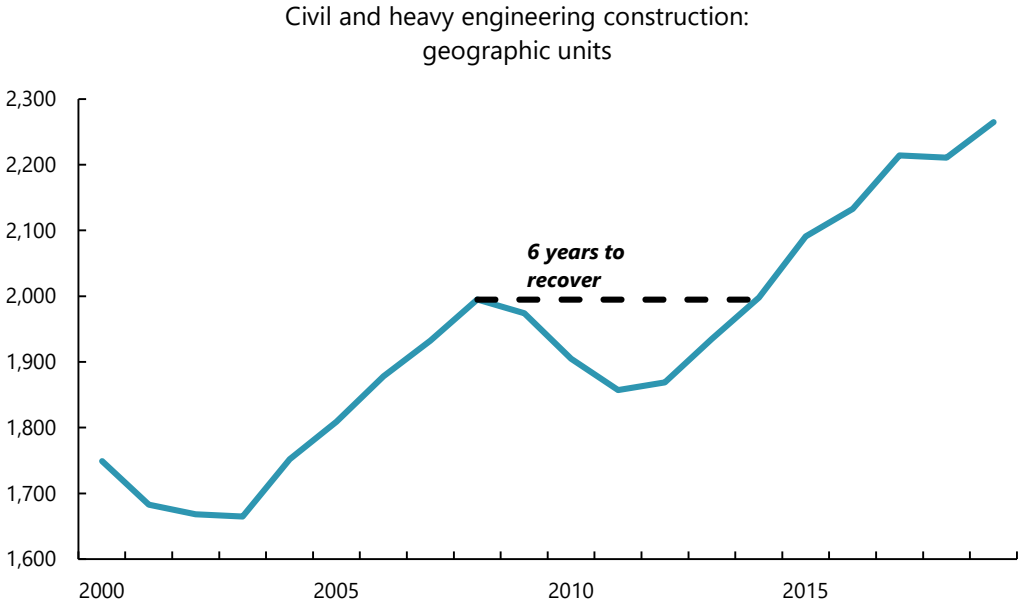
FIGURE 21: IT CAN TAKE YEARS TO RECOVER FROM A RECESSION



Source: Statistics New Zealand and Sense Partners

Once capacity is lost, it is slow to return. The number of businesses did not recover to the pre-recession levels until 6 years later (Figure 22). This meant there were fewer providers and less capacity and capability available in the marketplace.

FIGURE 22: CLOSED BUSINESSES ARE NOT QUICKLY REPLACED

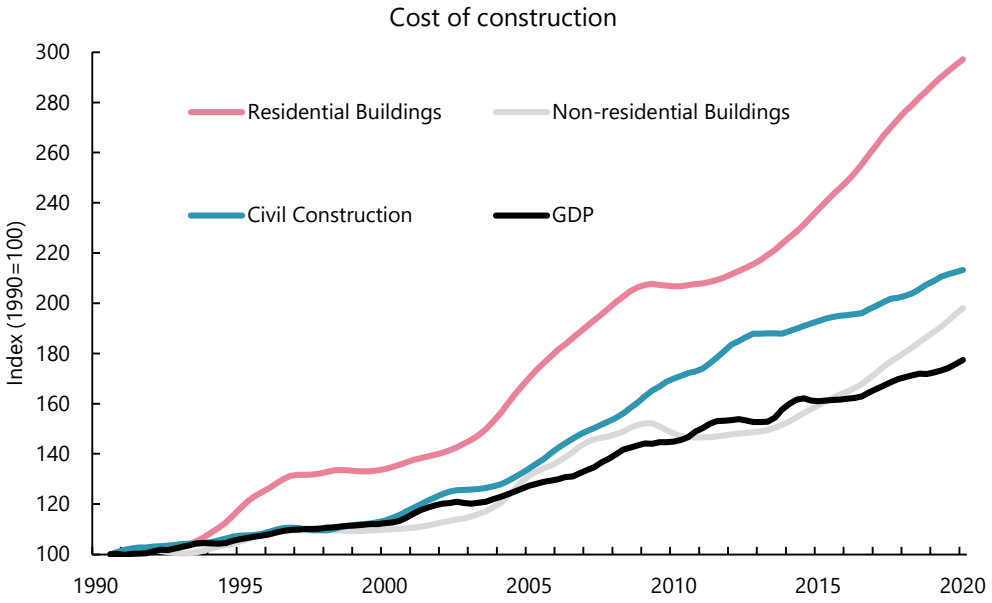


Source: Statistics New Zealand and Sense Partners

Unsurprisingly therefore, during the decade following the GFC, there was sustained increase in infrastructure construction costs as investment picked up (Figure 23). There was little increase in

profit margins as prices rose[15] – suggesting that the increase in construction costs was not about a lack of competition but rather a high cost of recouping lost capacity. We estimate the excess infrastructure cost inflation over the past decade has cost the country $2.7b.

FIGURE 23: CONSTRUCTION SECTOR INFLATION SUGGESTS THE LOST CAPACITY HAD A LASTING IMPACT



Source: Statistics New Zealand and Sense Partners

There is a key message in this analysis. With a looming debt mountain, it can be tempting to cut back on maintenance and new investments in infrastructure. But such decisions risk losing the benefits of investing in infrastructure as well as losing capacity and capability in the sector and end up costing us more for the same infrastructure.

7.4. Lock-in effect and difficulty reversing course

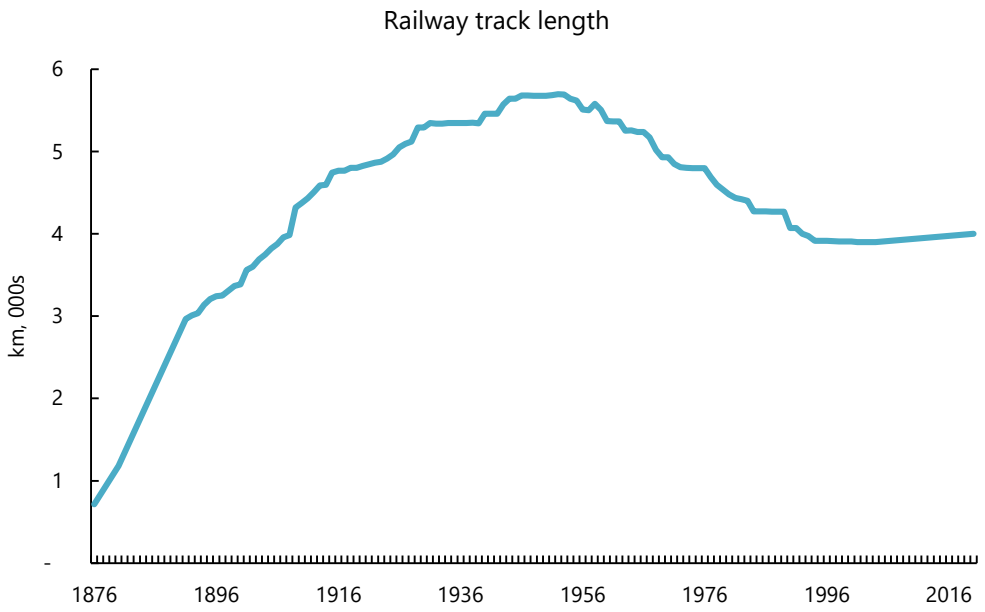
The recent history in transport has been characterised by an increase in road infrastructure and a decline in rail. However, investment in roading has not kept up with demand. Current debates about increasing investment in transport include the role of rail as a greener solution to relieving road transport congestion, but reinvigorating rail after a very long period of low investment and decline is a large and expensive task.

Rail capacity grew through much of New Zealand's early history until a peak in the 1950s (Figure 24). Investment stopped abruptly, and investment and the network shrank in the years that followed until bottoming out in the late 1990s.

Not without coincidence, road investment accelerated from the late 1940s (Figure 25). There had been a shift. Cars and private transport gained ascendency. After an initial significant increase in roading investment, there was a long lull until an inflection around mid-1990s. Since then, investment has continued to trend higher.

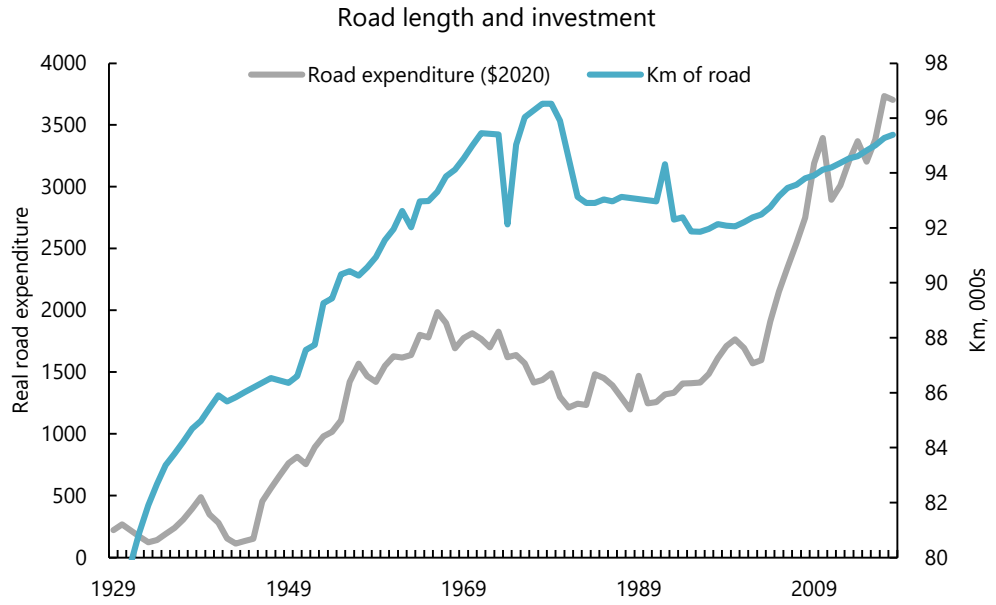
[15] Pre-tax profits relative to sales, from Statistics New Zealand Annual Enterprise Survey 2019.

FIGURE 24: RAIL INVESTMENT PEAKED IN THE 1950S



Source: Statistics New Zealand, KiwiRail and Sense Partners

FIGURE 25: ROAD INVESTMENT ACCELERATED FROM THE 1950S



Source: Statistics New Zealand, Ministry of Transport, NZTA and Sense Partners

The two modes have three broad lessons for us.

First, when there is consensus (as in road investment), we are capable of significant and sustained investment. However, even with roads, we have significant bottlenecks. For example, TomTom, a traffic monitoring and GPS navigation provider, ranked Auckland 105th most congested out of the

416 cities it tracks.[16] A typical 30-minute commute normally takes an additional 20 minutes during the morning and afternoon rush hours.

Other cities are not immune. Wellington, Christchurch, Dunedin, Hamilton and Tauranga also experience significant rush-hour congestion that delays typical 30-minute trips by 10–20 minutes, depending on the city.

Second, faced with increasing demand, we are more likely to respond with increasing capacity rather than use other tools to manage demand, for example, congestion charging and other demand management tools (such as staggering school start times), which can spread peak demand and delay or reduce need for infrastructure. This experience is not unique to us. The Netherlands, for example, abandoned a trial for congestion charging in 2011 in the face of vehement opposition.[17] Good infrastructure decision making should include the full suite of policy tools at our disposal.

Third, once a new course is taken, the scale of infrastructure projects and their longevity creates a momentum that is difficult and costly to reverse. Greater rail capacity may have the potential to reduce traffic on some of our roads both through greater movement of goods and passengers (as well as contribute to other public policy objectives), but once capacity is lost, as in rail, it can be a slow, difficult and expensive process to reverse.

7.5. Gaps out of sight

Infrastructure assets are long lived. In some instances, such as underground water assets, their physical state is not well known – out of sight and out of mind. Over the past decade, the focus on the three waters (drinking water, stormwater and wastewater) has intensified. In some areas such as Wellington, old pipes are failing. A third of Wellington wastewater pipes are in poor condition and around 10% in Auckland and Christchurch.[18]

Reports in 2009 and 2019 estimated[19] the cost of upgrading wastewater infrastructure nationally to meet national standards would be significant: $3b–$4b for wastewater (Figure 26), $0.3b–$0.6b for drinking water and an unidentified sum for pipes (which make up 80% of the water asset base).[20]

The cost of large centralised infrastructure is particularly difficult for smaller communities to afford. A July 2020 funding package ($0.8b)[21] will help, but there is still a large gap.

The experience of the three waters shows the risks of delayed maintenance and investment. Poor knowledge of asset inventory, condition and performance meant that it was a significant undertaking merely to understand the current state, let alone begin the process of repairs and investments. There were also issues of affordability, capacity and capability to manage large asset inventories.

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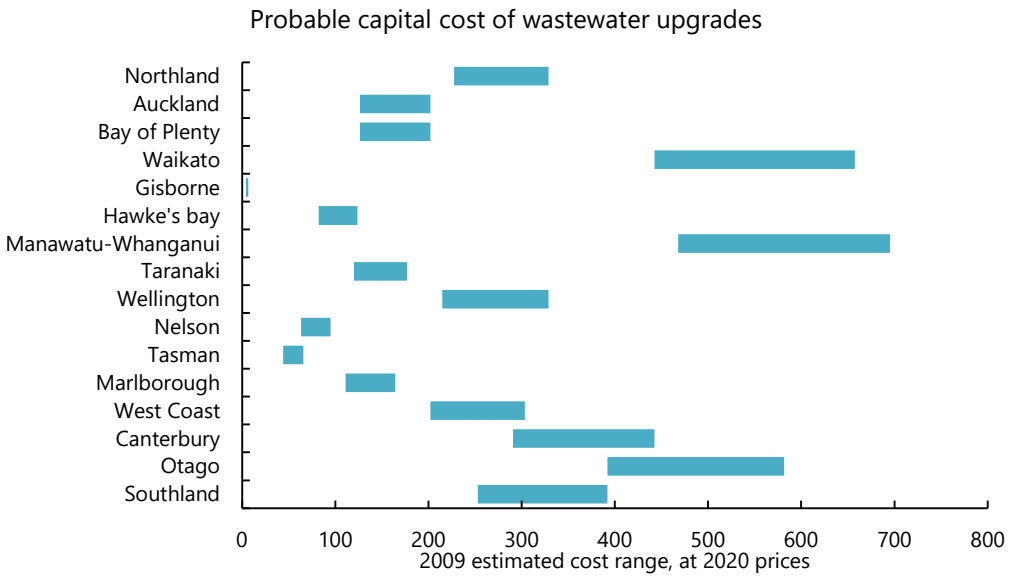
[16] https://www.tomtom.com/en_gb/traffic-index/ranking/
[17] The Economist. (2017, 3 August). *Jam every day: How and why road-pricing will happen.* Retrieved from: https://www.economist.com/international/2017/08/03/how-and-why-road-pricing-will-happen
[18] McManus, J. (2020, 28 July*). 2 billion litres of water lost in widespread Wellington drinking water leakage.* Retrieved from: https://www.stuff.co.nz/dominion-post/wellington-top-stories/122269064/2-billion-litres-of-water-lost-in-widespread-wellington-drinking-water-leakage
[19] GHD. (2019). *Cost estimates for upgrading wastewater treatment plants*. Wellington: Departments of Internal Affairs.
[20] https://www.dia.govt.nz/diawebsite.nsf/Files/Three-waters-reform-programme/$file/Slide-pack-from-July-Aug-2020-workshops.pdf
[21] https://www.dia.govt.nz/Three-Waters-Reform-Programme#Documents

FIGURE 26: WASTEWATER UPGRADES MAY COST $3B–$4B



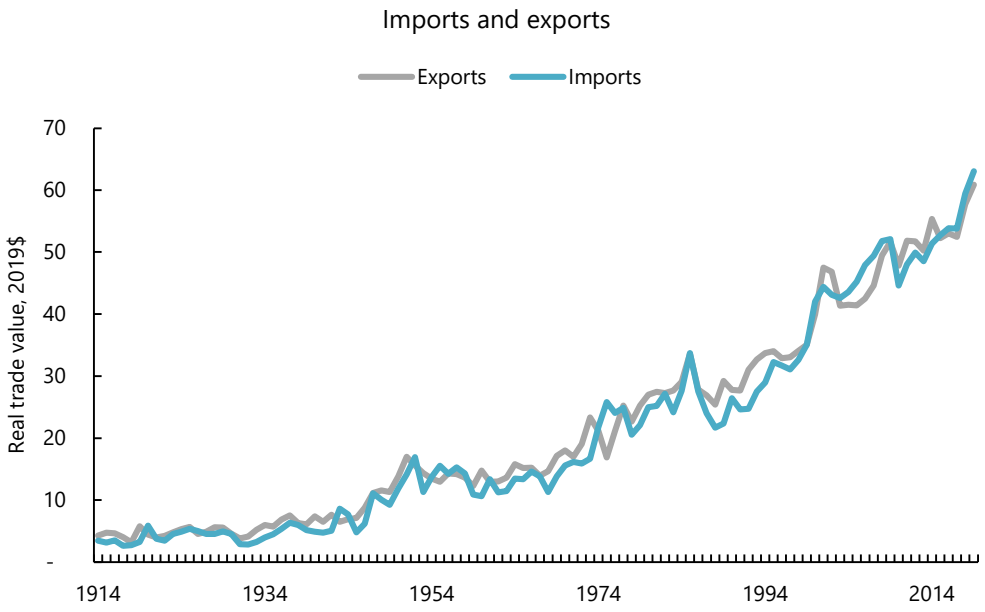
Source: GHD, DIA and Sense Partners

7.6. Keeping up with demand

Not all infrastructure is falling behind. There has been strong growth in capacity in our seaports (Figure 27) and airports (Figure 28) for movement of goods and passengers. The electricity sector has also significantly increased capacity (Figure 29).

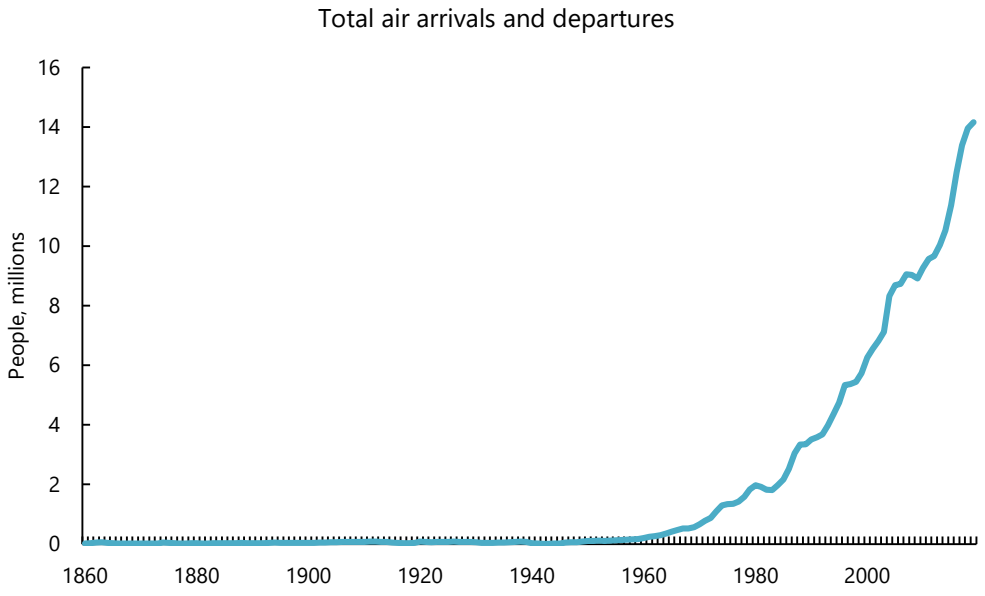
While these are large infrastructure assets, they are owned, funded and regulated differently to many other core infrastructure assets such as road and rail. The differences in these structures mean that they are not easily comparable or lumped into one broad category or to suggest there are no issues facing them. Nevertheless, the sweep of the past century shows that, whatever their differences, they have one thing in common. When faced with increasing demand, supply has kept pace. Commercial gains are good economic incentives to invest in capacity, especially when regulators are good at minimising the downside of monopoly-like provision.

FIGURE 27: TRADE VOLUMES HAVE TRENDED HIGHER OVER TIME – PORT CAPACITY HAS MATCHED GROWTH



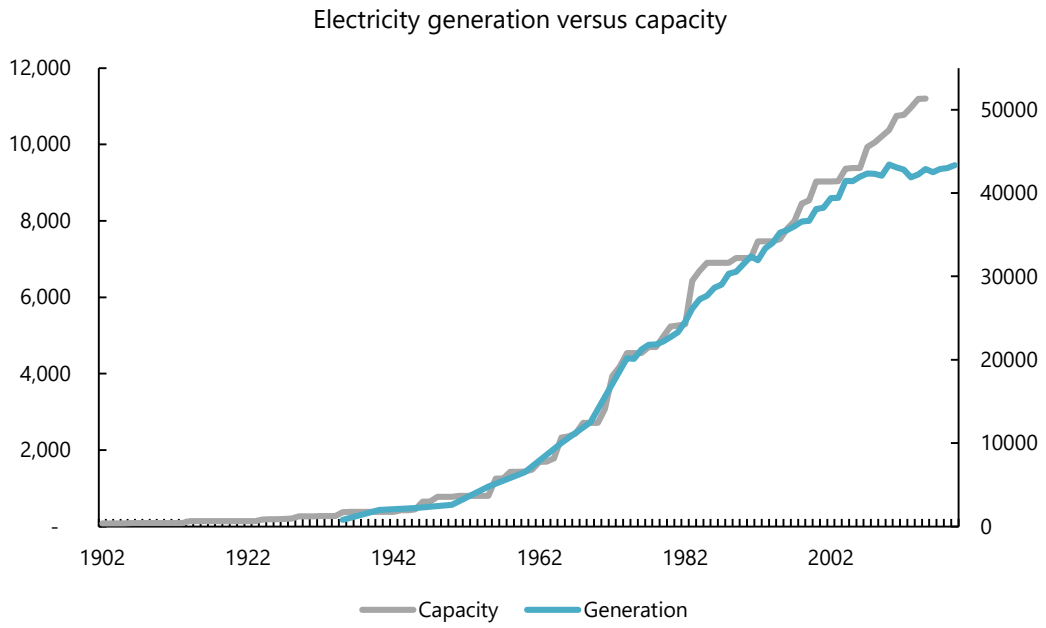
Source: Statistics NZ and Sense Partners

FIGURE 28: AIR TRAVEL HAS BOOMED IN RECENT DECADES – AIRPORT CAPACITY HAS MATCHED THAT DEMAND RELATIVELY WELL



Source: Statistics NZ and Sense Partners

FIGURE 29: GENERATION CAPACITY HAS KEPT PACE WITH DEMAND



Source: Statistics NZ, NZTA, EA and Sense Partners

However, for publicly funded infrastructure, there need to be other mechanisms to match supply with demand. Long-term infrastructure planning that is transparent and stable and regular performance monitoring are two key tools to do so. A good understanding of the true value of infrastructure to users is also necessary. This is difficult for public infrastructure, as there are no easily discoverable pricing and other market-based signals – but there are methodologies available (for example, see NZTA), and there is value in putting in the effort to develop tools and indicators to measure and understand the (economic, social and environmental) value to users and the community at large.

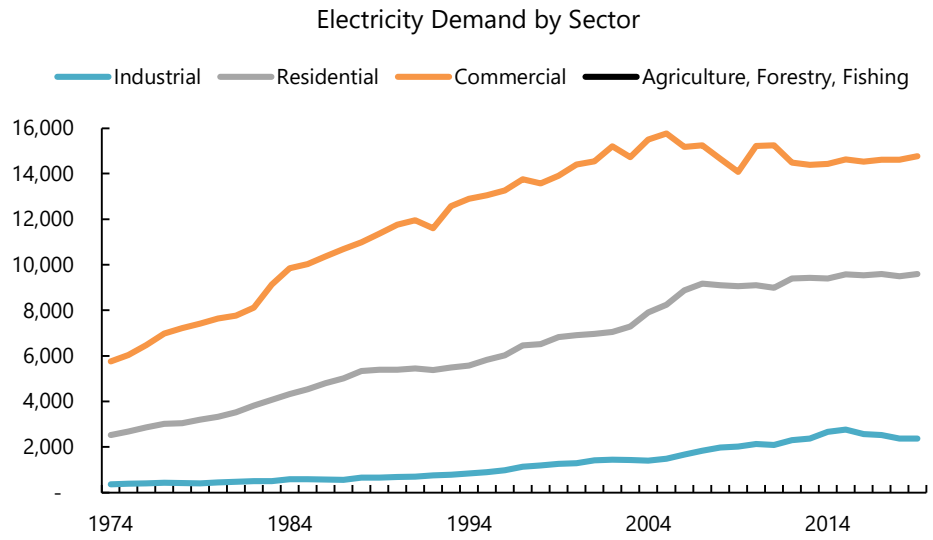
7.7. The future may look different

The New Zealand population and economy has grown over time, increasing the need for infrastructure. Future economic growth will increase the demand for infrastructure assets. However, the volume and nature of demand may change.

The economy is changing. Over the course of the last century, New Zealanders have become more likely to work in services, rather than in 'making' industries like agriculture, manufacturing and construction. The shift has been driven by technological change (which has allowed for mechanisation and automation) and globalisation (where production has moved to locations that are cheaper and closer to supply chain hubs).

While the demands from the 'making' parts of the economy are not growing as fast, we are increasingly reliant on the movement of goods. This is increasing demand for infrastructure assets at ports, roads, rail and storage. We can see these changes in patterns of electricity use (Figure 30). Industrial and primary sector use have declined in the last decade. Commercial demand has barely grown – growth in the sector has been offset by efficiency gains. Residential demand has been flat, despite strong population growth.

FIGURE 30: DEMAND DOES NOT ALWAYS FOLLOW OLD PATTERNS – ELECTRICITY



Source: MBIE

This change in the type of jobs has also accelerated a long trend of urbanisation in New Zealand and globally. These broad trends do not capture localised impacts. Trends can diverge spatially or geographically. In some parts, there may be a hollowing out, which may leave stranded assets. Other places may require significant new investment to meet disproportionately fast population and economic growth.

Our infrastructure planning needs to have a good awareness of the big trends driving our economy and demographics but also a localised view. Climate change will also play a big role in the future.

7.8. We can build slow and fast

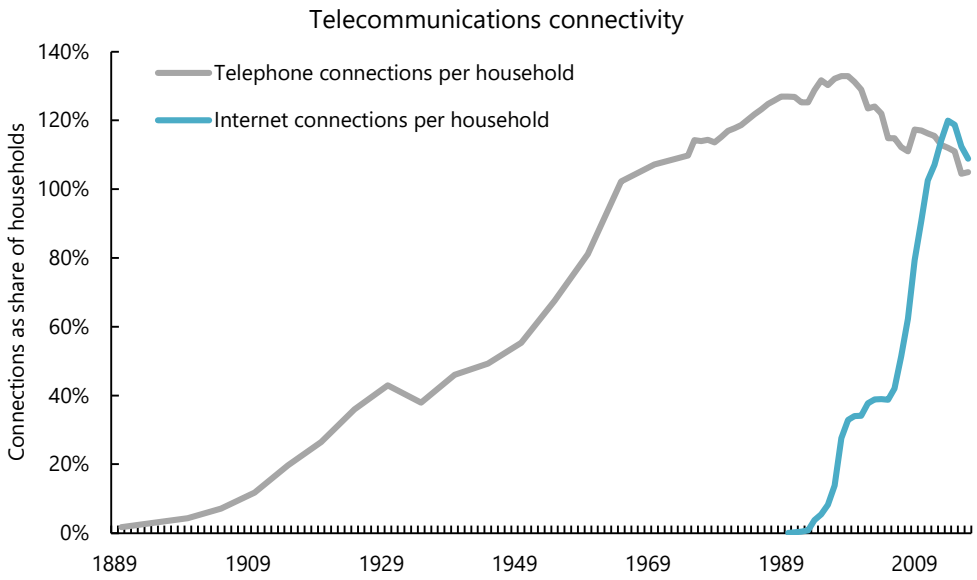
The experience of the telecommunications sector is a good example of how our infrastructure investment can both last the distance but also ramp up quickly when needed.

Telephone connections trended higher until a peak in the 1990s (

Figure 31). Then the internet took over. Internet connectivity grew fast, but really exploded with the arrival of fast broadband, initially with ADSL and later with fibre.

We estimate it took over 50 years for the landline to reach half of New Zealand households. In contrast, the internet got there in 15 years. While the telecommunications sector is largely privatised, the government drove the rollout of ultra-fast broadband, which has increased the speed and connectivity of most New Zealanders.

FIGURE 31: DEMAND DOES NOT ALWAYS FOLLOW OLD PATTERNS – TELECOMMUNICATIONS



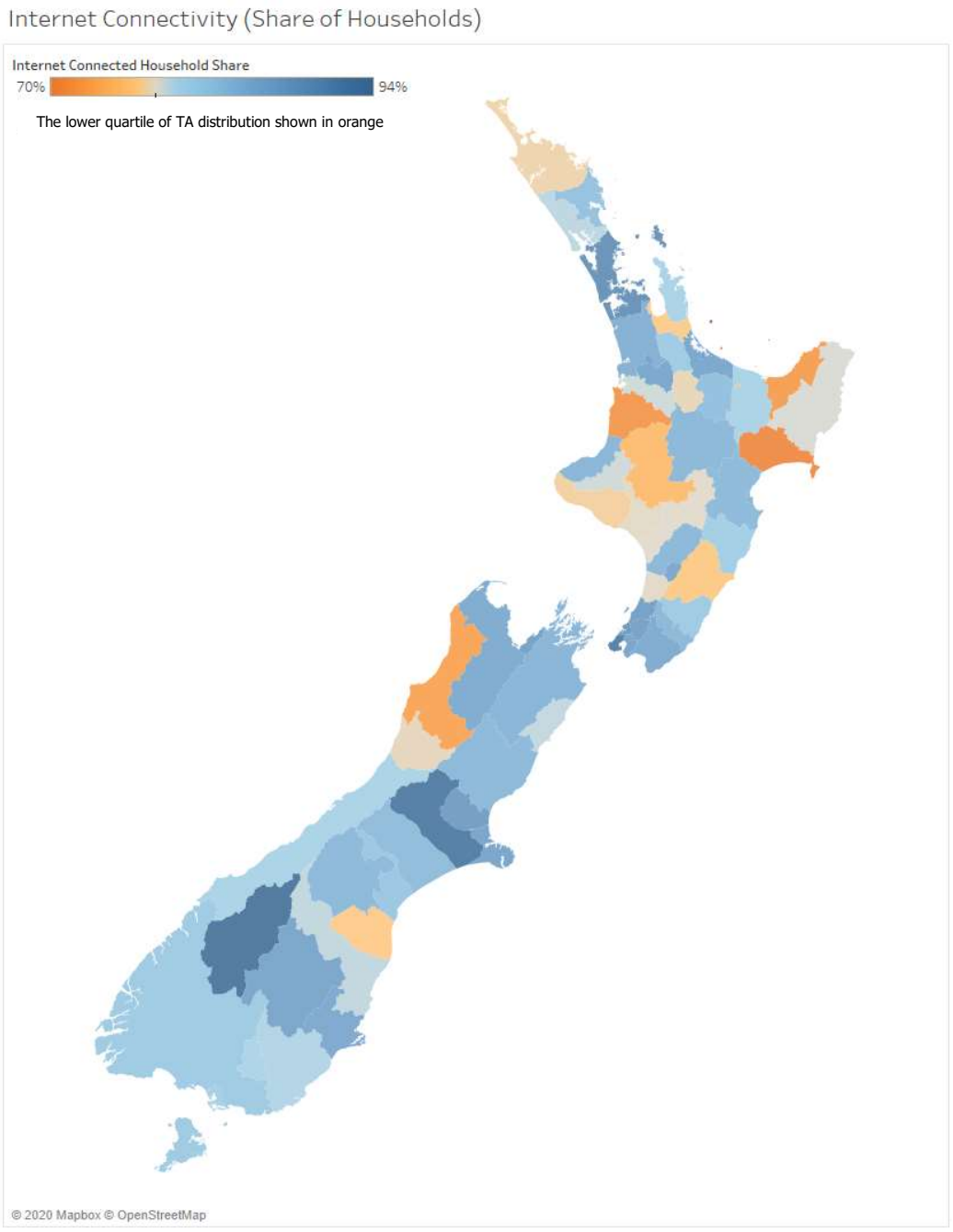
Source: Statistics NZ and Sense Partners

While New Zealand broadband rollout and use has increased rapidly over the past decade, there is a clear digital divide – cutting off places and people.

Figure 32 shows some parts of New Zealand face barriers to connectivity. This is lost economic potential. Research shows every 10% increase in broadband uptake adds 1.6% to annual economic growth.[22] For equitable access, policy makers need to weigh up when and how to intervene when there are market failures. There are such deliberate policies in place with broadband (such as the rural broadband initiative), but affordability remains a key barrier as well as slow rollout of connectivity. Social and spatial equity is also an important lens for public investment decisions.

[22] Murray, K., Davies, P., Blick, G. & Ryan, M. (2016). *Economic value of the uptake of ultra-fast broadband in New Zealand*. Wellington: Sapere Research Group. Available at https://srgexpert.com/wp-content/uploads/2018/02/Sapere_economic_value_of_UFB_uptake.pdf

FIGURE 32: ISOLATED AND LOW-INCOME COMMUNITIES ARE MORE LIKELY TO HAVE LOWER LEVELS OF CONNECTIVITY



Source: Statistics New Zealand 2018 Census and Sense Partners

8. Climate change

The built environment was considered as a specific domain risk in the 2020 National Climate Change Risk Assessment (Figure 33).[23]

The report found that climate change, rising sea levels and increasing adverse weather conditions will have extreme adverse effects on various elements of the built environment: housing, public amenity, water, wastewater, stormwater, energy, transport, communications, waste and coastal defences.

FIGURE 33: BUILT ENVIRONMENT RISKS FROM CLIMATE CHANGE

Built environment		
	Ratings	
Most significant risks	**Urgency**	**Consequence**
B1 Risk to potable water supplies (availability and quality) due to changes in rainfall, temperature, drought, extreme weather events and ongoing sea-level rise.	93*	Extreme**
B2 Risks to buildings due to extreme weather events, drought, increased fire weather and ongoing sea-level rise.	90	Extreme
Other priority risks (Stage 2)		
B3 Risks to landfills and contaminated sites due to extreme weather events and ongoing sea-level rise.	85	Major
B4 Risk to wastewater and stormwater systems (and levels of service) due to extreme weather events and ongoing sea-level rise.	85	Extreme
B5 Risks to ports and associated infrastructure due to extreme weather events and ongoing sea-level rise.	70	Major
B6 Risks to linear transport networks due to changes in temperature, extreme weather events and ongoing sea-level rise.	60	Extreme
B7 Risk to airports due to changes in temperature, wind, extreme weather events and ongoing sea-level rise.	55	Extreme
B8 Risks to electricity infrastructure due to changes in temperature, rainfall, snow, extreme weather events, wind and increased fire weather.	55	Extreme
Opportunities		
BO1 Opportunity for reduction in winter heating demand due to warmer temperatures.	65	n/a

* Urgency rating: the adaptation and decision urgency rating for this risk.

** Consequence rating: the highest consequence rating for this risk out of all three periods (now, 2050, 2100). The technical report provides the consequence rating for each risk and period.

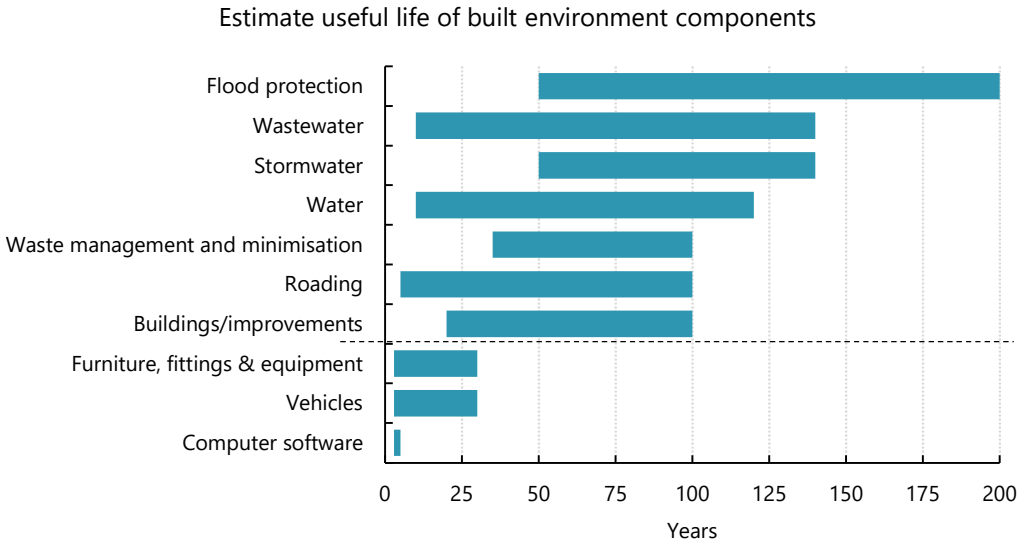
Source: Ministry for the Environment (2020)

[23] Ministry for the Environment. (2020). *National climate change risk assessment for New Zealand*. Wellington: Ministry for the Environment. Available at: https://www.mfe.govt.nz/publications/climate-change/national-climate-change-risk-assessment-new-zealand-main-report

The challenges are extreme and relatively well identified. The capacity to adapt is low because at-risk infrastructure is fixed, large, complex and centralised. Coastal areas are at particular risk. Local government assets alone worth $5.1b would be at risk[24] from a 1 metre further rise in sea level.[25] Climate change is likely to mean that we will need to invest in repairing or replicating at-risk infrastructure.

It also means that, when we are choosing investment projects, we need to make sure they are consistent not just with our economic and financial objectives but also our climate regulations and commitments. Locking in long-lived assets (Figure 34) can trap us into old ways of doing things or risk creating stranded assets that have low economic value in the future.

FIGURE 34: INFRASTRUCTURE ASSETS ARE LONG LIVED



Source: New Plymouth District Council and Sense Partners

Climate change adaptation will involve infrastructure in one way or another[26]. Either because climate change will affect infrastructure, or because our choices of infrastructure now will decide the path of climate, or because much of the mitigation and adaptation

[24] Simonson, T. & Hall, G. (2019). *Vulnerable: The quantum of local government infrastructure exposed to sea level rise*. Wellington: LGNZ. Available at: https://www.lgnz.co.nz/our-work/publications/vulnerable-the-quantum-of-local-government-infrastructure-exposed-to-sea-level-rise/

[25] For existing coastal development and asset planning, the Ministry for the Environment recommends a minimum transition value for sea-level rise of 1 metre above the 1986–2005 baseline – see https://www.mfe.govt.nz/climate-change/climate-change-and-government/adapting-climate-change/adapting-sea-level-rise

[26] Neufeldt, H., Sanchez Martinez, G., Olhoff, A., Knudsen, C. M. S., & Dorkenoo, K. E. J. (Eds.) (2018). The Adaptation Gap Report 2018. United Nations Environment Programme (UNEP), Nairobi, Kenya. United Nations Environment Programme.

9. Implications for the future

Countries around the world are pursuing significant fiscal stimulus to nurse their economies from the Covid-19 pandemic-induced recession. Infrastructure investment is a key component. However, the issues we have canvassed are not unique. A recent UK Parliamentary Select Committee report[27] on delivering infrastructure commitments through major projects reflected many of the issues we face and recommended solutions:

1. Provide a **national infrastructure strategy**, which will provide clarity to all stakeholders and better co-ordination.
    a. New Zealand has made various attempts at this, for example the National Infrastructure Unit in the Treasury, the Infrastructure Commission and the newly created Infrastructure Reference Group to oversee 'shovel-ready' projects for delivery of fiscal stimulus.
    b. The Infrastructure Commission is well placed to build on previous work (for example, The Thirty Year New Zealand Infrastructure Plan in 2015 and 2016 and various efforts at collating investment pipelines) with a cohesive national infrastructure strategy it is tasked to develop.
    c. There should be clearly articulated principles guiding the investments – for example, short-term jobs, long-term prosperity and consistency with climate regulations and commitments.
    d. The strategy should be the subject of inquiry in Parliament.
2. Ensure there is **value for money and appropriate monitoring**.
    a. New Zealand has good processes to test whether infrastructure projects are value for money, which includes wider benefits as identified by the Infrastructure Commission.[28] They should be scrutinised and published by the Infrastructure Commission.
    b. Returning to the discipline of good-quality cost-benefit analyses and Regulatory Impact Statements, which have been suspended during the unprecedented Covid-19 pandemic period, will ensure projects are prioritised on their merit.
    c. Monitoring should not just be about being on time and on budget but also whether the stated benefits materialised through better reporting throughout the life of the project and proper follow-up after completion (including of the original business case to improve in the future).
3. **Invest in capacity and capability within the public service** to better manage procurement and monitoring, as well as training for ministers to ensure they understand the project management of large and complex projects.

Infrastructure is an enabler of long-term economic growth, especially when coming from a position of deficit. International research shows that increases in public investment lead to sustained long-term economic gains.

[27] https://publications.parliament.uk/pa/cm5801/cmselect/cmpac/125/12502.htm
[28] https://infracom.govt.nz/assets/Uploads/Lifting-our-gaze-EY-Infracom.pdf

Our analysis also shows that New Zealand has underinvested in its infrastructure through the 1980s and 1990s. Subsequent recovery in public investment has not made up for the deficit accumulated in those two decades, nor are we well prepared for the significant demand on our infrastructure due to climate change, ongoing population and economic change, which are changing in their geographic and sector makeup.

Therefore, we have good reason to believe that investing in infrastructure will deliver long-term economic gains in the sector through the cycle and good visibility of projects and spending over time.

This means that at least some of the investment pipeline, once approved, needs to be secure from political and other interference. This independence could be delivered by a more powerful Infrastructure Commission, which would need to have the authority and influence to ensure good projects are chosen, and once chosen, there is high certainty of those projects being implemented. In its absence, public investment is volatile and uncertain.

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