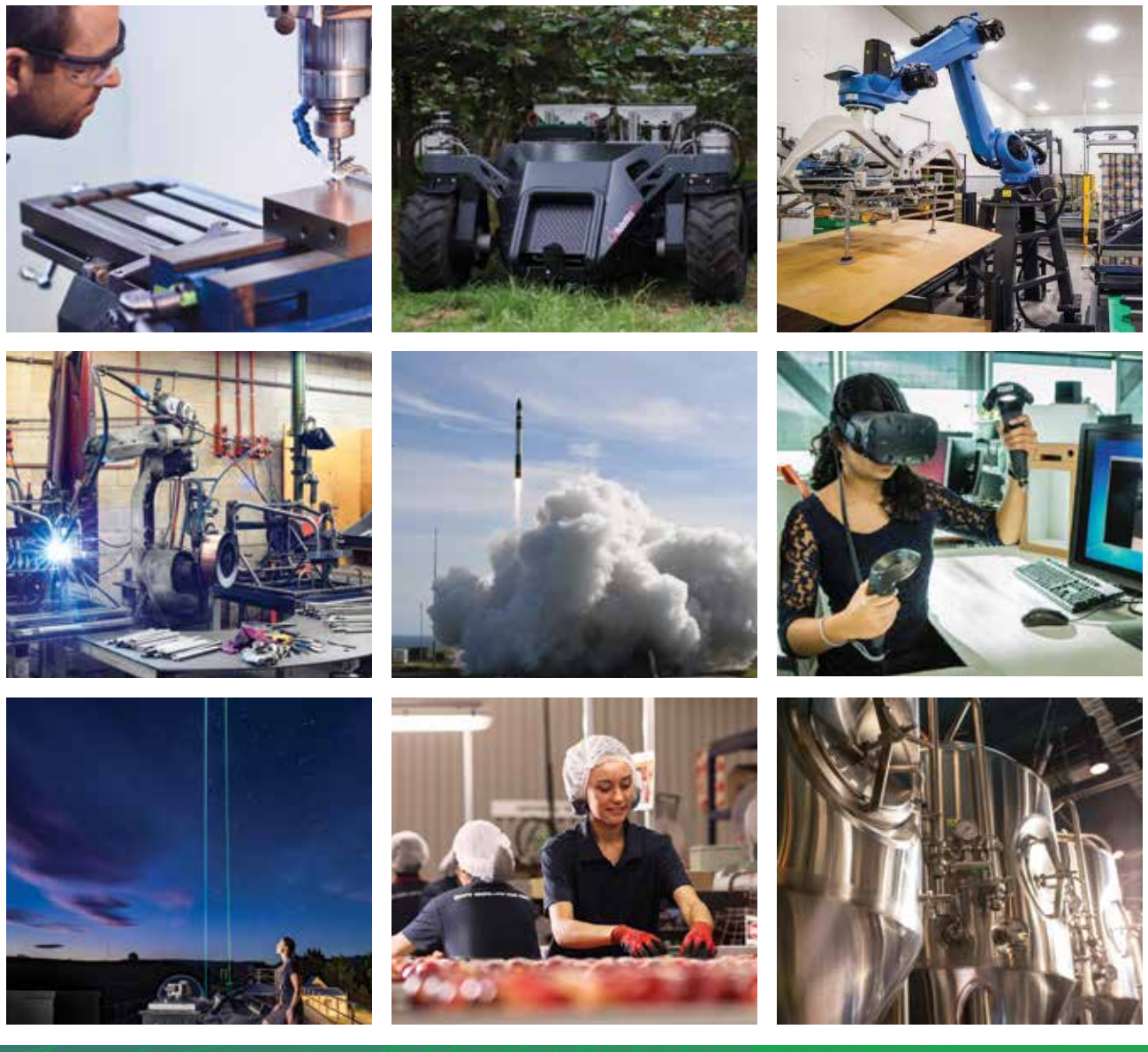
GROWING INNOVATIVE INDUSTRIES IN NEW ZEALAND

From the Knowledge Wave to the Digital Age

MAI I TE AO MĀTAURANGA KI TE AO MATIHIKO NEI

JULY 2019



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Contents

Foreword

KUPU TAKAMUA

> **"PRODUCTIVITY ISN'T EVERYTHING, BUT, IN THE LONG RUN, IT IS ALMOST EVERYTHING. A COUNTRY'S ABILITY TO IMPROVE ITS STANDARD OF LIVING OVER TIME DEPENDS ALMOST ENTIRELY ON ITS ABILITY TO RAISE ITS OUTPUT PER WORKER."**
> – PAUL KRUGMAN, NOBEL LAUREATE

New Zealand's economy is facing challenges, which also create opportunities.

What is our place in an increasingly digitised world, where technological change and innovation is creating a new – a fourth – industrial revolution? How can prosperity be achieved sustainably within our share of the planet's environmental limits? How do we make sure the benefits of our economy are shared fairly?

The digital revolution is affecting many facets of our economy. It is changing the way we grow and harvest food, manufacture goods and deliver them to market. It is playing a major role in the requirements of both consumers and the environment.

As we prepare to meet these challenges, we start with a strong foundation. Currently, we have low unemployment, inflation is under control, the budget is in surplus and economic growth forecasts are solid.

Productivity is key

However, we also face challenges, particularly with our levels of productivity growth and our history of drawing down our natural capital.

As the Paul Krugman quote above illustrates, increasing our productivity is key to our standard of living. Our productivity growth has been weak for some time. Our economy has been excessively reliant on property speculation and high rates of immigration. Per capita investment in our productive industries is too low. This all needs to change.

The government is focused on achieving an economy that is productive, sustainable and inclusive. We are encouraging productive investment in our areas of comparative advantage.

To realise our vision, the key sectors in our economy need to be performing at closer to their full potential.

Policies that promote these goals often have complementary outcomes. For example, changing and improving land use can utilise and prompt the development of new technologies, improve productivity, enhance water quality and lower our greenhouse gas emissions. It also promotes a higher-wage economy by moving skills and incomes up the value chain.

Industry has a crucial role to play in this vision. We need our industries to commit more capital and people to innovation so that we can produce more high-value products and services.

Government's role

Some economic signals can only be modified by the government. Government policy can encourage innovation, adjust investment signals and fund skills training, all of which have a major influence on the shape of the economy.

When industry and governments have a plan, capital and people can be mobilised to implement it. This makes a difference.

This publication discusses the innovation framework that will help deliver our vision. It is one component of the Government's overall Economic Strategy, which Finance Minister Grant Robertson and I lead. The Economic Strategy catalogues what the government is doing to build a productive, sustainable and inclusive economy and shows how it fits together. Other examples of how government is working differently are the Future of Work Tripartite Forum and the Just Transition work programme.

In this document, we describe the current position and our vision for the future. We set out where we have come from and how we can take the next steps on our journey from volume to value.

Established economic theory shows we must make the most of our comparative advantages. Industry Transformation Plans are underway across large sectors of our economy. These include agriculture via the Primary Sector Council and the construction sector via the Construction Accord. More Industry Transformation Plans are needed.

Agritech sector

The agritech sector is one of the prime areas for expansion, as it is attracting attention worldwide. A draft agritech strategy and action plan to seize this opportunity is being developed by a cross-agency taskforce in partnership with industry. This strategy will provide the foundation for an agritech Industry Transformation Plan.

We look forward to engaging with all sectors of society as we grow the economic prosperity of our country within our environmental limits. ■

Hon. David Parker
Minister for Economic Development

Our economic strategy

TĀ MĀTOU RAUTAKI OHAOHA

The Government's vision is for an economy that is productive, sustainable and inclusive to improve the living standards and wellbeing of all New Zealanders. We want all New Zealanders to benefit from economic growth, both current and future generations.

The wellbeing of our people and environment are at the centre of the Government's economic strategy. We seek transformational change to make sure the benefits of growth are shared more widely, and that the transition to a lower-emissions and more sustainable economy is just and fair. This Government is prepared to take a more active role to help bring about this change.

When the Prime Minister outlined the government's priorities last year, she identified four economic outcomes that will help deliver on our vision of a productive, sustainable and inclusive economy. These are to:

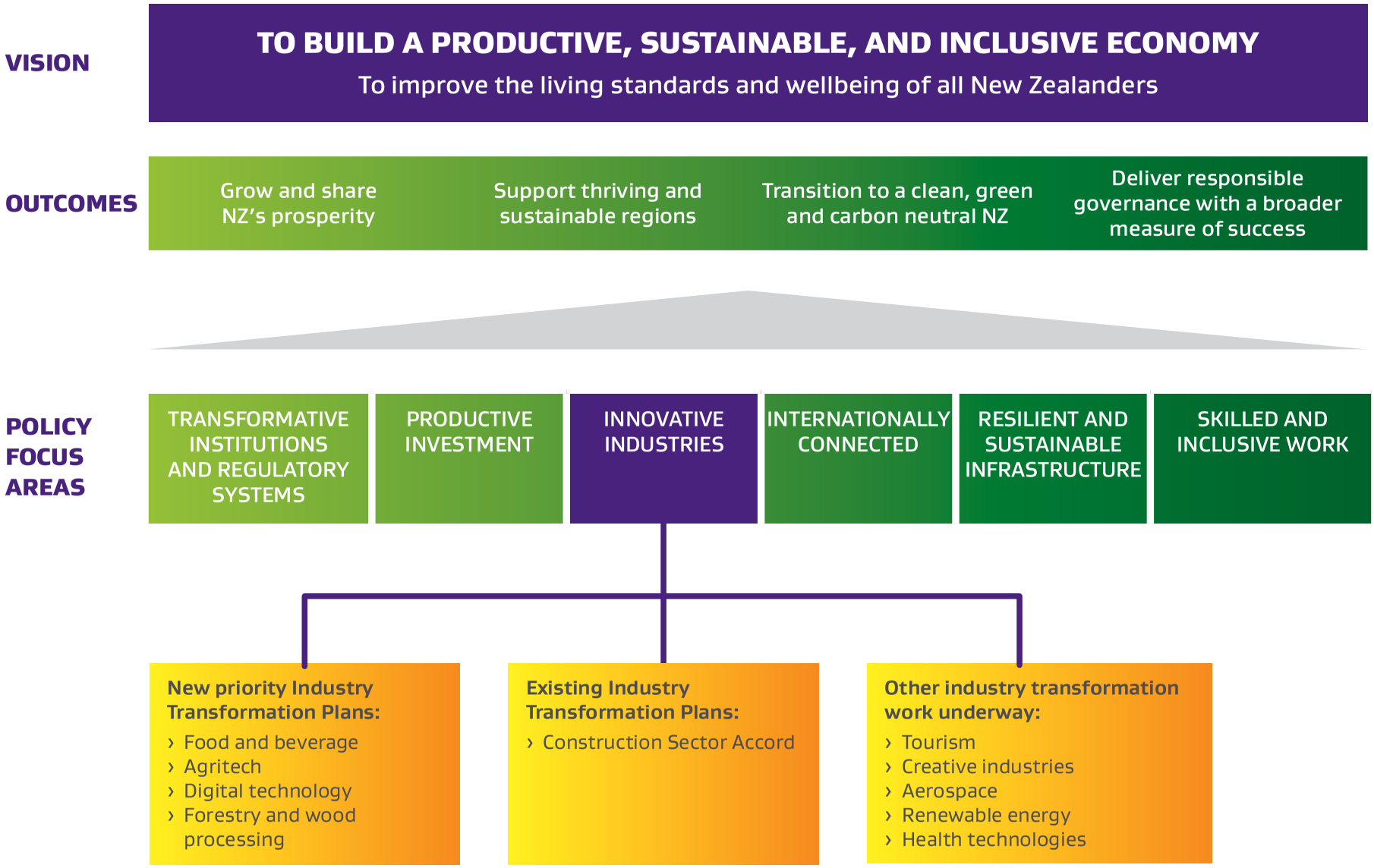
- grow and share New Zealand's prosperity more fairly
- support thriving and sustainable regions
- transition to a clean, green and carbon-neutral New Zealand
- deliver responsible governance that has a broader measure of success.

Achieving these outcomes will require a number of key shifts, and the Government's programme of initiatives to deliver these key shifts is organised into six policy focus areas. This document describes how we intend to deliver one of the policy focus areas – growing innovative industries in New Zealand. In particular, it outlines the more active approach this government is taking in partnering with key sectors to build capacity and capability as we develop new points of competitive advantage.

This includes the development of sector-led and government-supported Industry Transformation Plans to transition these sectors to a more productive, sustainable and inclusive future.

Sectors and industries do not operate in isolation. Growing more innovative industries requires effort across a range of policy focus areas. We will support the changes needed to grow incomes by bringing together science and innovation, industry, and skills policy to add value to volume, leverage new low-emissions opportunities, and grow the Māori economy.

As with all the key shifts the Government is seeking through its Economic Strategy, supporting the growth of innovative industries in New Zealand will require us to work as a system across different policy focus areas and Ministerial portfolios. In particular, our investment environment, international connections and skills system will be critical to achieving the industry transformation necessary to deliver on our vision.


VISION
TO BUILD A PRODUCTIVE, SUSTAINABLE, AND INCLUSIVE ECONOMY
To improve the living standards and wellbeing of all New Zealanders
OUTCOMES
Grow and share NZ's prosperity
Support thriving and sustainable regions
Transition to a clean, green and carbon neutral NZ
Deliver responsible governance with a broader measure of success
POLICY FOCUS AREAS
TRANSFORMATIVE INSTITUTIONS AND REGULATORY SYSTEMS
PRODUCTIVE INVESTMENT
INNOVATIVE INDUSTRIES
INTERNATIONALLY CONNECTED
RESILIENT AND SUSTAINABLE INFRASTRUCTURE
SKILLED AND INCLUSIVE WORK
New priority Industry Transformation Plans:
› Food and beverage
› Agritech
› Digital technology
› Forestry and wood processing
Existing Industry Transformation Plans:
› Construction Sector Accord
Other industry transformation work underway:
› Tourism
› Creative industries
› Aerospace
› Renewable energy
› Health technologies

Where have we come from?

KUA AHU MAI MĀTOU I HEA?

We are not starting from scratch on the transition that the New Zealand economy needs to make. The underlying competencies needed to compete in the digital age have already been developed. Since the 1970s, successive governments have wrestled with the challenges facing our economy, with one recurring theme – how can we add value, upskill and diversify? How can we move our economy from volume to value?

The collapse in wool prices and the weakness of dairy and meat prices in the late 1960s, compounded by the loss of privileged market access to the UK in the 1970s, forced business and government to chart a new course for New Zealand's economy. The situation was further exacerbated by rising unemployment and inflation. The government reacted with inward-looking protectionism, spending on 'Think Big' projects and erratic macroeconomic policies.

New Zealand then undertook a raft of market-based reforms at a scale and speed seen in few other countries, rapidly opening the economy and unilaterally lowering the barriers to trade.

CER a pivotal agreement

A critical strategy in opening up the previously closed and highly distorted New Zealand economy was the negotiation and conclusion of the Closer Economic Relations (CER) agreement with Australia, which took effect from 1983. This exposed New Zealand's previously totally protected manufacturing sector to international competition from Australia and instigated the process of specialisation.

The consequences of these reforms were mixed. The economic slide of New Zealand was halted, but some of New Zealand's intractable social problems, with inter-generational poverty and rural dislocation, can be traced back to this time. Those who were able to adjust and take advantage of the resultant new opportunities prospered, while those who could not were often left behind. Traces of this remain in our labour market today, with Māori and Pasifika over-represented in low-skilled and low-wage work and with higher rates of unemployment than the rest of the population.

On the positive side, New Zealand's economy has become more nimble, diverse and efficient. The profile of New Zealand's exports has become more sophisticated and is increasingly capable of competing strongly in global markets.

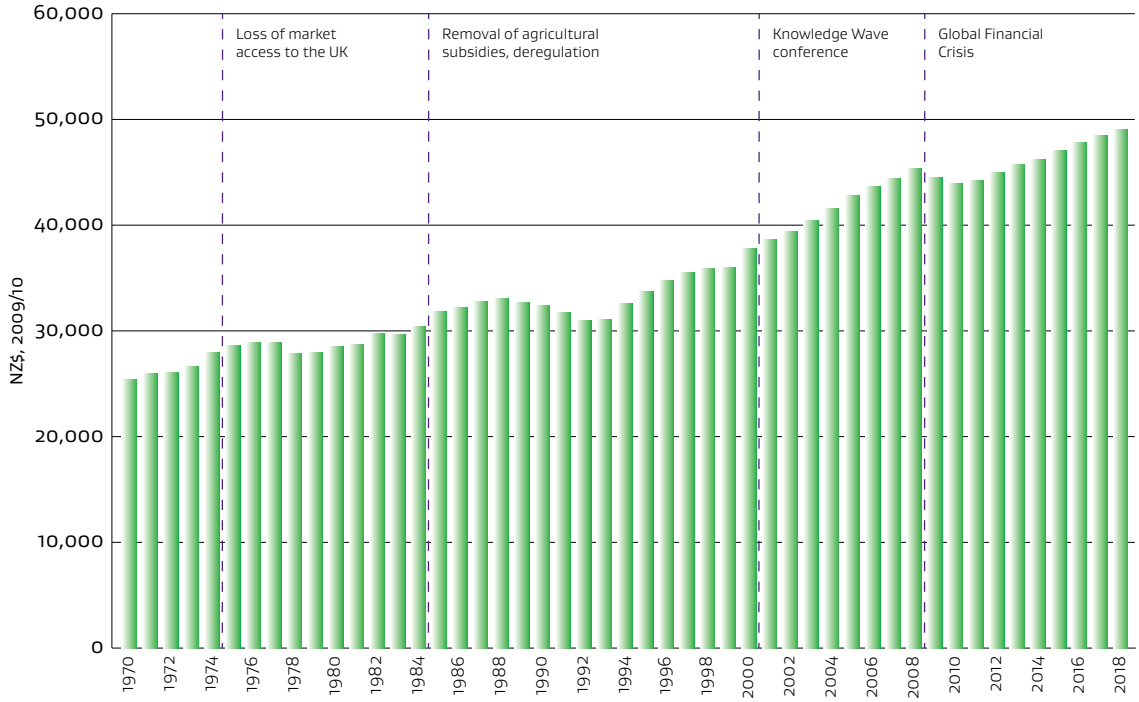
Since 1996, the macroeconomic parameters have broadly remained unchanged. Within that framework, successive governments, in partnership with businesses and labour, have progressed a number of fruitful microeconomic initiatives that have boosted innovation and diversified New Zealand's export economy. ■

TIMELINE

1966	The wool price collapses and dairy and meat prices weaken.
EARLY 1970s	Active migration policies attract migrants from the Pacific Islands to fill labour shortages in New Zealand's manufacturing sector.
1974	New Zealand loses preferential market access to the UK owing to the admission of the UK to the European Economic Community.
LATE 1970s TO EARLY 1980s	'Think Big' industrial projects are undertaken, such as the construction of the Waitara and Motunui methanol plants and the Clyde Dam, and the expansion of the Marsden Point Oil Refinery, funded by large increases in government debt.
1975	The Waitangi Tribunal is established to investigate Māori Treaty claims.
1982–1984	A wage and price freeze is imposed by the government in an attempt to combat rising inflation.
1983	New Zealand and Australia sign the CER trade agreement, agreeing to remove all restrictions on trans-Tasman trade by 1995 at the latest.
1984–1993	New Zealand undergoes rapid market liberalisation.
1984	The 1984/85 Budget removes or phases out various subsidies and incentives, including agricultural subsidies.
1985	The New Zealand dollar is floated to improve the efficiency of the foreign exchange market and resource allocation throughout the economy.
1986	GST is introduced and income tax is reduced.
1987	The New Zealand Stock Market crashes in October. By February 1988, New Zealand shares are down 55% from their pre-crash peak.
1988	GST increases to 12.5%, while income and company tax rates are reduced.
1989	The Reserve Bank adopts inflation-targeting monetary policy.
1991	The Employment Contracts Act is enacted, making union membership voluntary. Industry awards and apprenticeship systems are abolished.
1995	The World Trade Organisation is established to operate a global system of trade rules, acting as a forum for negotiating trade agreements and settling trade disputes between countries.
1999	The Economic Development portfolio is established.
2000	The Employment Relations Act is enacted, requiring employers and employees to act in good faith and promoting mediation to resolve industrial disputes.
2000	The Regional Partnership Programme is launched to provide funding to strengthen regional economies.
2001	The Catching the Knowledge Wave conference is held to generate consensus on ways for New Zealand to create high-value industries that drive job opportunities and foster a fair society.
2001	The New Zealand Super Fund is established to help manage future superannuation costs.
2002	The New Zealand Venture Investment Fund is established to build the early-stage capital market in New Zealand.

2002	The Growth and Innovation Framework sets out the government's focus on the ICT, biotech, screen production and design sectors.
2002	The Modern Apprenticeships scheme is started to remedy the low number of young people in training. The scheme increases awareness of, and promotes, workplace-based training.
2003	New Zealand Trade and Enterprise (NZTE) is established with responsibility for developing and implementing trade, industry and regional development policies.
2003	The Large Budget Screen Production Grant is established to support the growth of the screen sector in New Zealand.
2004	Māori Television is established.
2006	The Economic Transformation Agenda sets out the government's updated policy statement on economic development.
2006	KiwiSaver is established to encourage long-term savings by New Zealanders.
2008	The Global Financial Crisis occurs. Unemployment in New Zealand increases from below 4% to 6.5% in the space of a year.
2008	The Emissions Trading Scheme is established.
2008	New Zealand's Free Trade Agreement with China enters into force, the first free trade agreement that China has signed with any OECD country.
2010	The Primary Growth Partnership is launched to fund innovation in the primary sector.
2010	GST increases to 15%.
2011	Telecom New Zealand is structurally separated into Chorus and Spark.
2011	The Productivity Commission is established to provide advice to the government on improving productivity in a way that supports the overall wellbeing of New Zealanders.
2012	The government launches the Business Growth Agenda.
2013	Callaghan Innovation is established to partner with businesses to help them become more innovative and to enhance the operation of New Zealand's innovation ecosystem.
2013	He kai kei aku ringa, the Crown–Māori Economic Development Strategy is launched.
2014	The Ka Hao: Māori Digital Technology Development Fund is established (originally known as the Māori ICT Development Fund).
2015	New health and safety legislation is enacted, reforming health and safety requirements in all New Zealand workplaces.
2017	The Provincial Growth Fund is established to invest in building regional economies.
2018	The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) enters into force.
2019	Major review of polytechnics and work-based training is undertaken.
2019	A 15% tax incentive is introduced to encourage businesses to carry out more R&D activity.

Figure 1: Real GDP per capita



Source: Statistics NZ

Developing appliances at Fisher & Paykel's Auckland campus.
Source: NZ Story

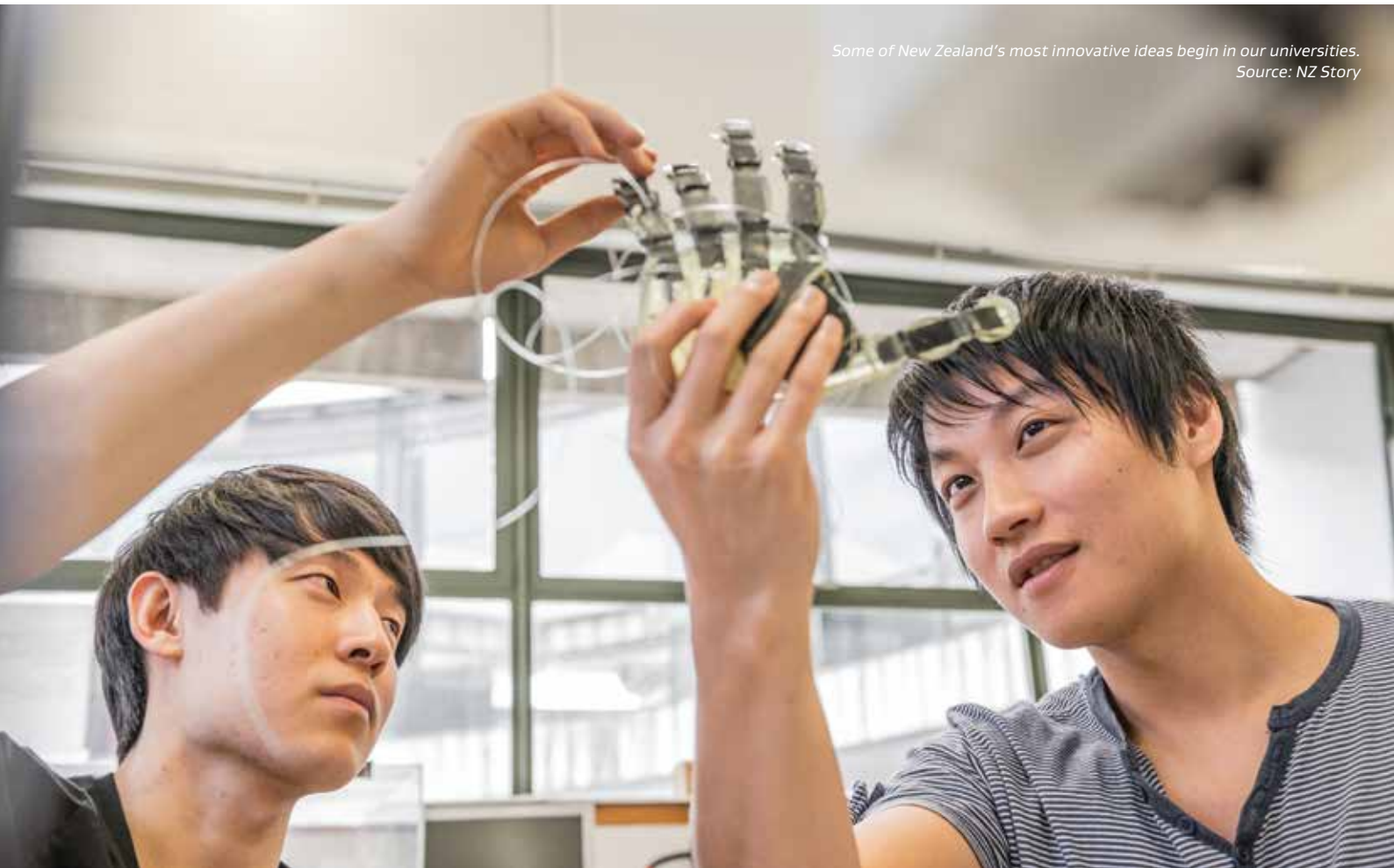
Innovation since the Knowledge Wave

TE TANGONGITANGA MAI I TE AO MĀTAURANGA

Many of the things we are good at today have evolved from activities we have been good at in the past. There are numerous examples of innovative industries being developed out of our traditional strengths: from crop dusting to pilot training, from producing wool to making luxury apparel, and from success in sailing to creating super yachts.

While the private sector and markets have been the key drivers of change, government policy has supported the shift to industries that are more value based, helping build on what we are good at and increasing investment in higher-value activities such as research and development, branding and after-sale service. In space technologies, government actions have supported the development of the regulatory system and the robust ecosystems necessary for a new and emerging industry to thrive.

Astute management of funds received as part of Treaty Settlements has also seen solid growth in the Māori economy, which is now diversifying into areas adjacent to its traditional base, including biotechnology and high-tech manufacturing. Further growth is expected as incomes improve and new opportunities emerge that are closely aligned with Māori values.



Some of New Zealand's most innovative ideas begin in our universities. Source: NZ Story

Successive governments have laid down the foundation for future economic growth, including through the development and reform of key infrastructure – notably in the telecommunications sector and the roll-out of broadband. Investment in connectivity infrastructure has positioned us well for the digital future.

A key part of our innovation story was the three-day Knowledge Wave conference in 2001. It aimed to encourage new ways of achieving economic prosperity, recognising that New Zealand's economic performance was inadequate to sustain the quality of life, the quality of public services and the social cohesion valued by New Zealanders.[1] It was noted that New Zealand's reliance on primary production gave us a profile that did not match that of other first-world countries.

The Growth and Innovation Framework

The Growth and Innovation Framework (GIF) that was put in place after the Knowledge Wave conference focused on three sectors: ICT, biotechnology and the creative sectors, primarily screen production and design. These were seen as core competencies needed to drive success across the economy, including in our traditional primary industries.

Growth and Innovation Framework: The GIF that keeps on giving

Successful companies have flourished in sectors identified as priorities by the GIF: ICT, biotechnology and screen production and design.

Soul Machines

Artificial Intelligence company Soul Machines was launched in November 2016 by Dr Mark Sagar (who won Oscars for his work creating computer-generated faces for characters in Avatar and King Kong) and serial entrepreneur Greg Cross.

Soul Machines' Soul Platform™ is a Digital Brain™ that combines neural networks and biologically inspired models of the human brain to allow its realistic digital humans to synthesise human behaviour in real time.

Soul Machines' digital humans and autonomous characters can be deployed in a wide range of uses across a number of different industry sectors. Soul Machines was supported by a growth grant from Callaghan Innovation.

Vesper Marine

In the ICT sector, Vesper Marine brought an IT solution to the America's Cup when it developed a marine safety system that uses Automatic Identification System (AIS) technology to mark the edge of the race course with virtual buoys.

Vesper Marine was supported by a project grant and a growth grant from Callaghan Innovation to develop their technology.

Revolution Fibres

Revolution Fibres is a leading biotech firm that has created products used in everything from sound control and fishing rods to Formula 1 cars and anti-allergy bedding. Callaghan Innovation has supported Revolution Fibres with project and student grants, as well as by providing wide-ranging advisory support. For further information, see page 49.

1 www.beehive.govt.nz/release/knowledge-wave-conference-statement-co-chairs

Public institutions and industry bodies have developed over time to support the ICT sector, such as the IoT Alliance[2] to accelerate the adoption of IoT technologies and the creation of the AI Forum to undertake research on Artificial Intelligence opportunities in New Zealand.

The screen production sector was given a significant boost through the introduction of a Large Budget Screen Production Grant in 2003. The grant has evolved over time to preserve our international competitiveness, and the industry has responded with growth in training, talent and business development. We have grown new points of comparative advantage in adjacent sectors, including computer gaming and Artificial Intelligence.

In the biotech sector, New Zealand has seen the growth of successful firms such as Revolution Fibres and Fisher and Paykel Healthcare.

Independent research institutions such as the Malaghan Institute of Medical Research, the Cawthron Institute and Gillies McIndoe Research Institute, as well as other government-funded organisations, have grown specialist expertise. In 2002, the Maurice Wilkins Centre was established as one of seven New Zealand Centres of Research Excellence (CoREs) and to date, the Centre's investigators have been responsible for bringing a number of drugs and vaccines to clinical trials.

These organisations work with start-up companies, attracting domestic and international private investment and also contract research for international companies, contributing to our weightless export income. In 2016, New Zealand was ranked fourth globally for biotech innovation, behind the United States, Singapore and Denmark.[3]

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2 The Internet of Things (IoT) is a collection of things that are connected to the internet (such as devices, objects, machines, animals or people) that collect and exchange data.

3 Scientific American Worldview, Overall Scores, 2016.

Revolution Fibre's actiVLayr face masks are made by electrospinning liquid collagen extracted from fish skins into nanofibre. Source: Sanford

Around the same time as the Growth and Innovation Framework was launched, NZTE was established with a mandate to develop and implement trade, industry and regional development policies, in partnership with industry, businesses, iwi, central and local government, and relevant community groups.

Since its inception, NZTE has supported many New Zealand firms to gain a foothold in international markets. Callaghan Innovation similarly partners with businesses at all stages to support development and uptake of new products, services and processes. The introduction of the New Zealand Venture Investment Fund (NZVIF) and tech incubators has enhanced the prospects of new and emerging businesses by addressing a hole in the capital market that was inhibiting growth in many of our innovative industries.

As with all innovation, it has taken time to see the returns on these investments. But today we can see the fruits of this thinking in the success of cutting-edge businesses such as Weta Digital, Rocket Lab and Xero.

The New Zealand technology sector is now a significant part of the wider economy, and it is becoming more widely used across other sectors, in both society and government. In 2018, the top 200 technology exporting firms in New Zealand experienced growth of 11 per cent.[4] $1.1 billion in private equity and venture capital funds were also invested in New Zealand companies in the technology sector.[5]

New Zealand sits among the most desirable international film and television production locations, and is well positioned to take advantage of the significant global growth in demand for new content, including for platforms such as Netflix and Amazon Prime. Investment has also increased in other creative sectors, such as video game development. In 2016, Rocketwerkz, a Dunedin-based studio, secured significant investment from Tencent, a Chinese online games company, allowing the firm to expand locally.

Telco reforms: bringing New Zealand to the digital cutting edge

Investment in telecommunications infrastructure over the last decade has put in place a strong foundation for the country's digital future. Digital healthcare, precision agriculture and integrated smart cities are now presenting as real commercial opportunities for New Zealand with wider co-benefits, such as land use that is more effective and better access to healthcare.

From the structural separation of Telecom, through to the roll-out of ultra-fast broadband, the range of interventions and regulatory changes in the telecommunications sector by successive governments has underpinned these developments.

We are gearing up to roll out 5G in 2020. 5G will not just bring faster broadband speeds and connection times. It will change the way we do things, bringing new possibilities to our firms working with emerging technologies like the Internet of Things, virtual reality experiences and driverless cars. For further information, see page 50.

4 TIN 2019 Investors Guide.
5 NZ Private Equity and VC Monitor.

In contrast, while some gains have been made in the biotech sector, growth there has been hampered by a lack of investment. Many biotech opportunities are relatively high risk (particularly compared with opportunities in ICT) and require large investments that take a long time to see a return. To date, New Zealand venture funds have not invested heavily in biotech. To help fill this gap and enhance commercialisation options for early-stage biotech opportunities, New Zealand joined Australia's Medical Research Commercialisation Fund (MRCF) in 2016 – an early-stage venture capital fund that provides capital and hands-on expertise to support the development and commercialisation of promising biomedical discoveries. Despite the difficulties in securing investment, New Zealand biotech researchers are well regarded internationally and we are beginning to see signs of success. However, unrealised potential remains in this sector and there is more to be done.

TIN200 export success

New Zealand's technology sector is a significant part of our wider economy. It is estimated that the sector grew by more than $1 billion in 2018, according to the Technology Investment Network (TIN).[6]

The TIN top 200 New Zealand tech companies are attracting substantial investment from all over the world and driving growth in diverse global markets. Fintech, agritech, digital media and healthcare have been among the best performers. New Zealand also has a solid start-up and accelerator ecosystem for new tech companies. Callaghan Innovation and NZTE have a strong focus on growing New Zealand's tech sector and tech sector exports, with 43 per cent of all NZTE tech customers experiencing growth of more than 40 per cent in the 12 months to April 2019.

There is still much to be done. Significant disruption is expected in the coming years. New technologies, such as augmented and virtual reality, the Internet of Thing, and Artificial Intelligence, hold significant opportunities, as well as challenges that will need to be managed. For further information, see page 51.

6 TIN 2019 Investors Guide.

Looking ahead, the investments we are making today in areas such as space, robotics, sensors and Artificial Intelligence will create a new wave of opportunities for New Zealand businesses, with huge economic potential.

Change is inevitable and inaction is not a viable option. When the tide is running, if we don't sail forwards, we will be carried backwards.

We need to redefine our goals for the current technological revolution, just as the Knowledge Wave and the GIF set targets for their time.

Some of those goals are familiar, while others involve a new emphasis as we strive to achieve the productive, sustainable and inclusive economy that we want.

We need to continue to move from volume to value in our key sectors while decreasing our environmental impact.

We need to move into new and adjacent high-tech sectors, including those that build on our established expertise in food and beverage production.

We need to make sure our regulatory settings are right, invest in new opportunities and incentivise private sector investment.

We need to make sure New Zealanders have the right skills and that the benefits of growth are shared equally, including in the regions. ■

Into the future with digital skills

Digital technology is a cause of disruption as well as part of the solution for facing future of work challenges.

At the moment, New Zealand's digital technology sector, as well as the industries relying on digital technology workers, are facing a significant skills shortage. Addressing this shortage will help the tech sector and other industries to grow, and move more New Zealanders into highly paid work in digital technology careers. Ensuring New Zealanders have digital skills is one way to help workers be more resilient to the technological disruption that a number of our industries are facing.

This Government and industry are working together to address these challenges through the Digital Skills Forum.

To gain an understanding of the digital skills required in this area, the Forum surveyed employers of digital technology workers and developed the *Digital Skills for a Digital Nation* report, which included detailing demand in growth of particular digital skills. In March 2019, the Forum hosted a national hui, at which more than 250 people from industry, the government, unions, NGOs and the education sector came together to propose answers to three sets of challenges: preparing for the future of work; bridging the gap between education and employment; and diversity and inclusion. The recommendations from this hui (and the *Digital Skills for a Digital Nation* report) are being progressed through the Future of Work Tripartite Forum. ■

Growing the Māori economy

The Māori economy is a critical part of our future economic success. The Māori economy is broadly defined as privately and collectively owned businesses that acknowledge their genealogical links to Māori ancestors.

In the past 30 years, through settlements with the government, Māori authorities and enterprises have negotiated a total of almost $2 billion in assets and financial redress. Through astute management, the value of these assets has grown at an average 10 per cent per annum since settlement.

To date, Māori economic growth has been centred in sectors with strong links to natural resources, land and culture. These include the agri-sector, forestry and fishing, property, construction and infrastructure, tourism, and technology and innovation.

Collectively, Māori own $13 billion in primary sector assets, which is approximately 10 per cent of the total New Zealand agriculture, forestry and fishing asset base. Māori control 50 per cent of New Zealand's fishing quota and approximately 30 to 40 per cent of the land that has forests on it. Although the forestry rights for the trees on Māori land are often held by corporate/foreign interests, many Māori groups wish to progressively take over forest ownership. For further information, see page 52.

Robotic machinery being used to stack apples. Source: NZ Story

The starting point: a sound economy, but low productivity

TE WĀHI TĪMATA: HE ŌHANGA MŌMONA, ENGARI HE ITI ŌNA WHAKAPUTARANGA

Much about the New Zealand economy is currently going well:

- Economic growth is solid and forecast to remain so over the next five years.
- Inflation remains low and steady.
- Unemployment is low at just over 4.2 per cent.
- Government debt and inflation are low, which supports a lower level of interest rates.

We have strong institutions, clear legislation and effective regulation. These settings ensure fairness and underpin New Zealand's ranking among the best in the world for ease of doing business.

All of these attributes provide a good platform for future economic growth. Our well-educated population, abundant natural resources, extensive investment in connectivity infrastructure, and well-respected New Zealand brand are other important assets.

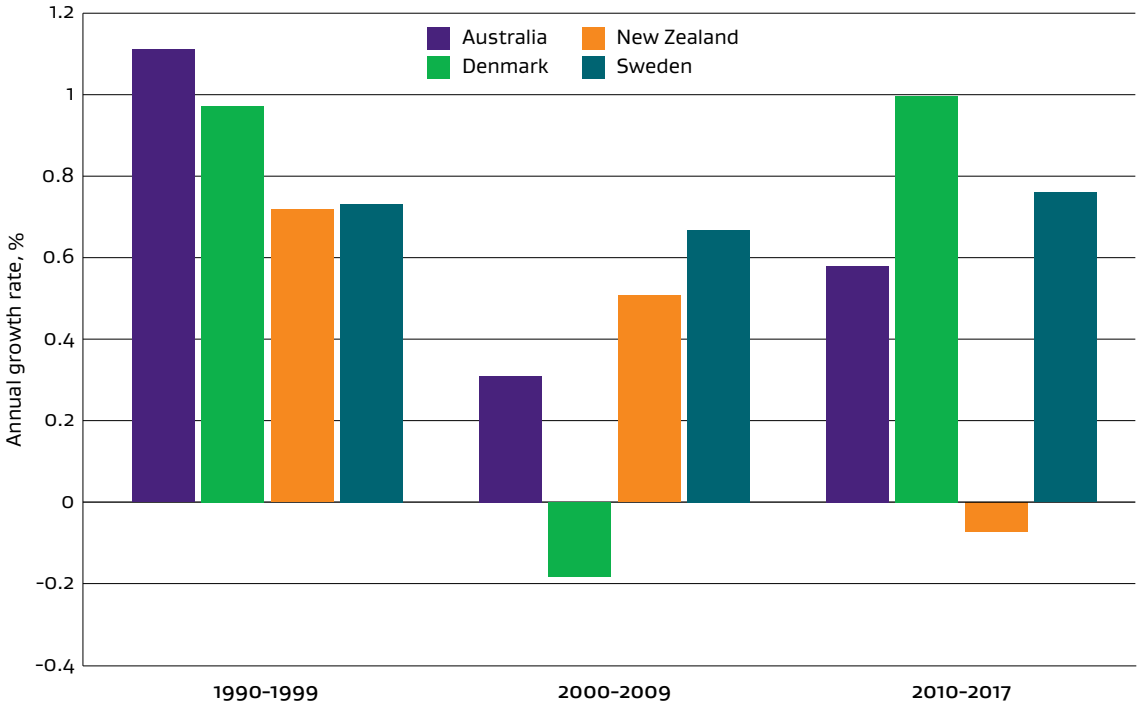
Despite this, our productivity performance has remained poor and in international terms, we have continued to fall behind our main competitors, as illustrated in Figure 2.

Our economic growth has been too dependent on high levels of net migration and house price inflation driving consumption and demand for extra infrastructure. Too much of our capital has been skewed towards speculative asset classes, like rental properties, rather than investment in growing new points of competitive advantage.

The Productivity Commission[7] notes that these factors have contributed to low capital intensity in our productive sectors – put simply, there has not been enough money invested in our productive enterprises. Technology transfer and resource allocation is poor and our exports remain focused on low-complexity products. While some progress has been made in diversification, our exports remain focused on too few products and too few markets.

7 Paul Conway, *Achieving New Zealand's productivity potential* (November 2016), p36, https://www.productivity.govt.nz/sites/default/files/Achieving%20NZ%27s%20productivity%20potential%20November%202016_0.pdf

Figure 2: Multifactor productivity growth comparison

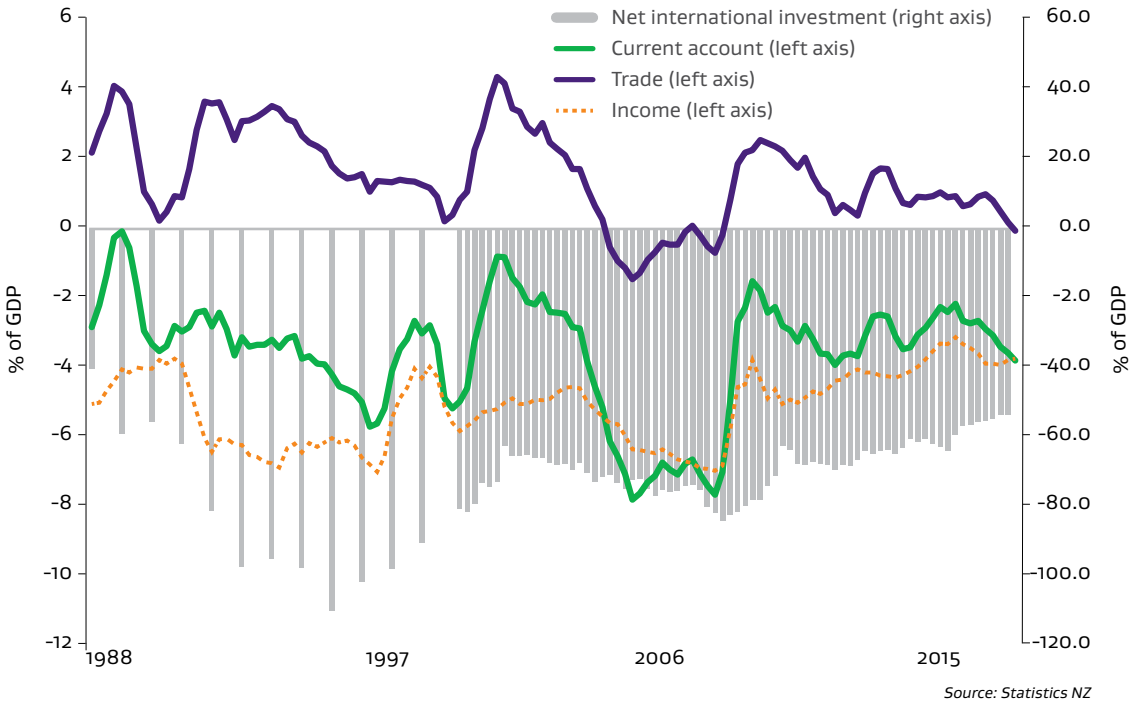


Source: OECD

We are also reliant on foreign funding to finance our spending and investments, increasing our vulnerability to the swings and roundabouts of global economic sentiment.

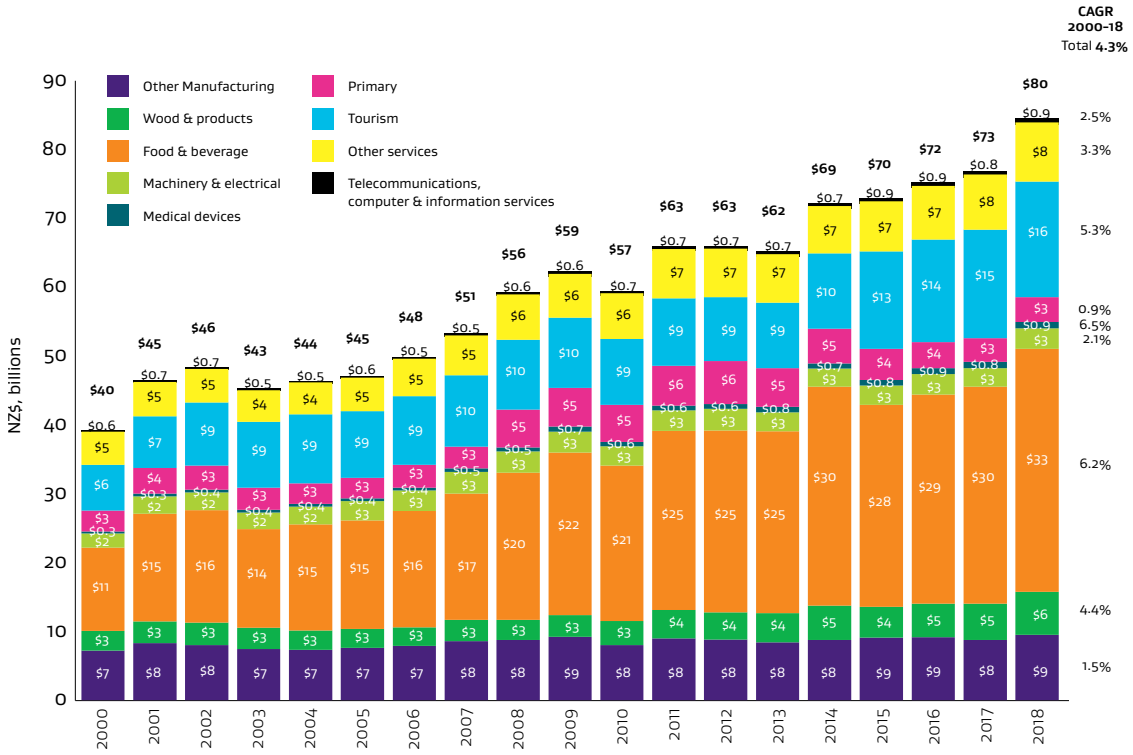
Our current account – the balance of our transactions with the rest of the world – has been in deficit for more than 40 years.

Figure 3: New Zealand's external balance



Source: Statistics NZ

Figure 4: New Zealand export growth



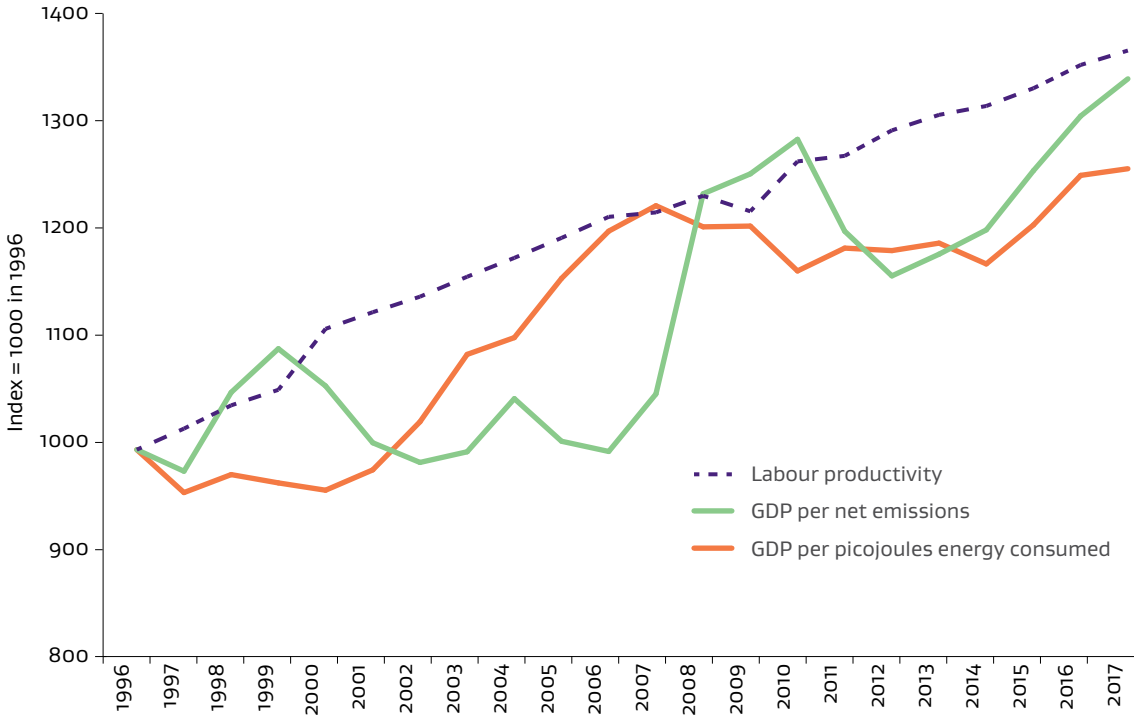
Source: Statistics NZ

Construction and operation of the Ngatamariki power station requires collaboration. Source: NZ Story

In addition, some of our economic growth has brought about worsening environmental impacts. Water quality has degraded and while greenhouse gas emissions per unit of GDP have decreased, total emissions have increased.

Although our economy has grown overall, some New Zealanders have been left behind, with growing disparities across regions and between groups in society.

Figure 5: Labour productivity and the intensity of emissions and energy



Source: Statistics NZ, MBIE, Mfe (note: emission intensity data has been extrapolated from 2015)

NEW OPPORTUNITIES AND CHALLENGES

New Zealand also faces new opportunities and challenges:

- The fourth industrial revolution and new digital technologies are disrupting traditional industries. The nature of work is being profoundly affected by Artificial Intelligence, machine learning and automation.
- These same technologies are creating significant business opportunities for those who innovate and develop businesses using these new technologies. Many applications of technology have global reach and are highly valuable.
- Globalisation and digitisation are both reducing the tyranny of distance, but paradoxically, they are increasing reward for scale, as the capital required to expand new digital goods and services into global markets can favour larger economies with deeper pools of capital.
- A rising tide of protectionism in many countries is bringing with it increasing friction in world trade and threatening New Zealand exporters' ability to access offshore markets fairly. Increasing tensions between the US and China, Brexit and threats to the WTO rules-based system are particularly concerning to New Zealand's interests.
- Consumer preferences are changing. Growing global action on climate change means that carbon-intensive industries are likely to face significant challenges. Food preferences are changing and vegetable-based protein substitutes for dairy and meat are being developed.

As a small, trade-exposed nation, New Zealand needs to innovate to maintain our competitive advantage in key areas such as our primary production.

In the face of all these challenges, we need to chart a course to take advantage of new opportunities while achieving a just transition for those affected by change.

Supporting start-ups and innovation: New Zealand Venture Investment Fund

The New Zealand Venture Investment Fund (NZVIF) was established in 2002 as a response to the lack of supporting infrastructure and funding options for the early-stage capital market.

Since its inception, NZVIF has invested over $223 million into 287 companies incorporated in New Zealand through partnerships with venture capital funds and angel networks. Those companies have raised a further $2.4 billion from private investors, with 54 per cent from international investors, and earned $5.6 billion in revenue and $3.9 billion in export earnings.

This growth notwithstanding, New Zealand's venture capital market has yet to reach its full potential. Venture capital markets typically take 20 to 30 years to mature. Further investment is required to build a vibrant and self-sustaining early-stage investment ecosystem.

The 2019 Budget committed $300 million of government support for series A and series B capital rounds. For further information, see page 53.

Emirates Team New Zealand.
Source: NZTE

Key Highlights

THE TECH SECTOR IN 2015

28,749
TECH SECTOR FIRMS

CONTRIBUTED
$16.2B
GDP (8% OF GDP)

EXPORTED
$6.3B
GOODS & SERVICES
(9% OF EXPORTS)

3RD
LARGEST EXPORT SECTOR

EMPLOYED
98,911
PEOPLE
(5% OF THE WORKFORCE)

AN ADDITIONAL
20,154
TECH WORKERS
WORK IN OTHER SECTORS

THE TECH SECTOR HAS **HIGHER PAID** AND **HIGHER QUALIFIED** EMPLOYEES THAN ALL OTHER SECTORS, **ON AVERAGE**

ICT'S CONTRIBUTION TO **GDP GROWTH** IN NEW ZEALAND HAS BEEN
HIGHER
THAN ANY OTHER **OECD COUNTRY** FROM 2001 TO 2013

EACH NEW TECH SECTOR JOB CREATES UP TO
5 NEW
SERVICE JOBS AROUND IT

EACH **4% PRODUCTIVITY IMPROVEMENT** IN THE TECH SECTOR IS ESTIMATED TO DELIVER AN ADDITIONAL **$2.7B GDP**

Source: From Tech Sector to Digital Nation, NZ Tech, 2016

Developing innovative industries

TĀ MĀTOU ARONGA KI TE WHAKATIPU AHUMAHI AUAHA

> **"IN MY VIEW, THE STATE SHOULD BE ACTIVE AND WORK IN COOPERATION WITH PRIVATE BUSINESSES TO SPUR GROWTH THAT'S SUSTAINABLE AND INCLUSIVE. THE POLICY PROCESS IS ABOUT CO-CREATING AND CO-SHAPING OF MARKETS, CREATING NEW OPPORTUNITIES FOR BUSINESS INVESTMENT – AND NEGOTIATING A BETTER DEAL FOR THE PUBLIC TOO."**
>
> *– PROFESSOR MARIANA MAZZUCATO, THE ENTREPRENEURIAL STATE*

The Government is committed to stimulating the productive economy by creating a conducive policy environment and directly working with our partners to support key sectors in reaching their full potential.

MOBILISING CAPITAL INTO THE PRODUCTIVE SECTOR

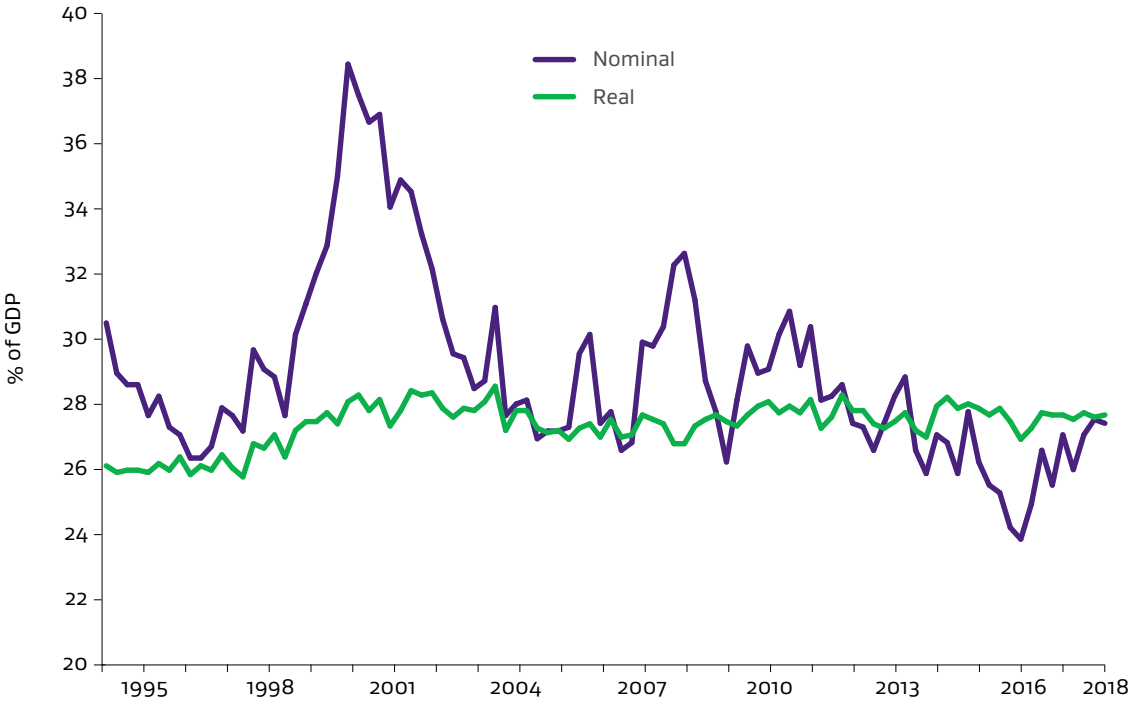
Already this Government has taken a number of steps to direct investment into the productive sector and away from speculation in land assets. This includes:

- introducing a 15 per cent R&D tax credit
- ring-fencing losses from rental portfolios
- extending the bright line test from two to five years, so that profits from residential investment properties that are bought and sold within five years will generally be taxable
- banning foreign buyers of existing New Zealand homes.

Prudent fiscal management has also helped ease the pressure on monetary policy, accommodating lower interest rates and exchange rates than might have otherwise been the case.

The Cora autonomous aircraft. Source: Zephyr Airworks

Figure 6: New Zealand exports as a percentage of GDP



Source: Statistics NZ

ROLE OF INDUSTRY POLICY

Our new approach to industry policy will assist the reallocation of resources to the productive sector. It is not focused on picking winners, but on setting the stage for winners to emerge, to help achieve our collective vision for a more productive, sustainable and inclusive economy.

Reservations with regard to the role of industry policy have typically centred on the risk of government failure. In particular, governments have insufficient information about the economy, its interdependencies and opportunities to appropriately target actions in a way that benefits broader society. In the past, some countries have also used industry policies defensively to protect industries undergoing structural change, locking in wasteful activities and slowing necessary transitions.

Modern industry policy is strategic and forward looking. Instead of protecting old industries, governments work to support industries through transition and back new opportunities as they emerge. Rather than providing subsidies or tax breaks that lock in unsustainable activities, the government can help address coordination failures both within and across sectors, assist with skills development, improve access to capital, provide targeted support for R&D and the commercialisation of innovative products, and use its own power as a purchaser to create demand for new and innovative ways of doing things.

This approach to economic development is more important in smaller economies, such as New Zealand, than in larger economies, such as the United States, where the benefits of scale and agglomeration mean industry policy is less important.

The aim of our approach to industry policy is to drive productivity growth, sustainability and diversification through:

- **Moving from volume to value: looking for productivity growth in our high-volume sectors:**

  New Zealand needs to move from volume to value in the largest areas of our export economy, such as agriculture and tourism. This involves a shift away from a growth strategy based on labour absorption and immigration to one in which productivity plays a much bigger role.

Moving from volume to value can include enhancing existing products as well as creating new products, and services using innovation and R&D at the early product development stage. Value can also be added at the customer end of the product-development stage, such as through innovative branding, packaging and marketing, or by providing services along with a product.

Reducing our environmental impact can also support the shift by improving efficiencies and enhancing the clean, green brand that New Zealand relies on for premium prices.

- **Leveraging opportunities in adjacent sectors: opportunities arising from our points of expertise and comparative advantage:**

  The government is fully committed to responding to the opportunities and challenges of our changing world. We will continue to look for opportunities that are adjacent to our existing strengths, to grow new points of comparative advantage, create new opportunities for export and enable higher value and more sustainable land use domestically.

- **Backing emerging sectors: being prepared to seize opportunities in new sectors of the economy:**

  New Zealand will not be at the forefront of all new technologies, but to use Sir Paul Callaghan's phrase, some of our key strengths will lie in the 'weird stuff', important niches where there is not yet any other obvious global frontrunner and where we have a bit of a head start. Digital film services, satellite launch services and medical devices are examples of this.

  Early adopters of new-to-world technologies can gain the biggest returns from their investment. Business and government need to work together to maximise our share of these opportunities now, such as in robotics, sensors and Artificial Intelligence, where we can leverage our competitive advantages as a nation with expertise in agricultural production and with a skilled and well-educated workforce.

Through our approach to industry policy, we will spur innovation and its diffusion across the economy in two key ways.

First, we will continue to build the foundations for our ongoing success through broad-based interventions that cut across key elements in the Government's Economic Strategy, notably innovation, trade and international connections, investment, regional economic development, skills and the future of work. These will include: targeted schemes for the development of particular skills; capital market interventions to fill holes in the capital cycle; non-trade-distorting support for emerging export companies in specific sectors; support for R&D and commercialisation of innovative products, including the grants and business services provided by Callaghan Innovation; and selective government procurement.

Second, we will work in partnership with key sectors to ensure a more proactive approach is taken towards capacity and capability building as we build new points of competitive advantage. This will involve partnering with sectors to develop Industry Transformation Plans, which will set out an agreed vision for the future state of the sector and the actions needed to get there.

Climate change, environmental degradation and the distribution of wealth have reinforced the need to shift to a more strategic approach to industry policy that includes a focus on long-term sustainable development and inclusivity. Collectively we must ensure that innovation, trade, investment and skills development support the transformation of key sectors and the development of new sectors.

The drivers of improved productivity will help our economy to prosper in the 21st century.

The following section provides an overview of how we will build the foundations for growing more innovative industries through cross-cutting initiatives. The other central component of our approach – Industry Transformation Plans – will be discussed in the next section.

INNOVATION – GROWING R&D

Innovation is a critical input for a more productive economy and the development of our sectors. Innovation is important for diversifying the economy, creating new industries and businesses and creating highly skilled jobs – benefits that spill over to society at large.

To drive innovation, the government aims to lift investment in R&D from today's figure of 1.3 per cent of our economy to at least 2 per cent of GDP by 2027. This will require a step-change in New Zealand's knowledge investment, which will be a real challenge for New Zealand, but is likely to generate significant productivity gains.

While some of this increase will be delivered directly through government investment in R&D, the key lift needed is more R&D investment by the private sector.

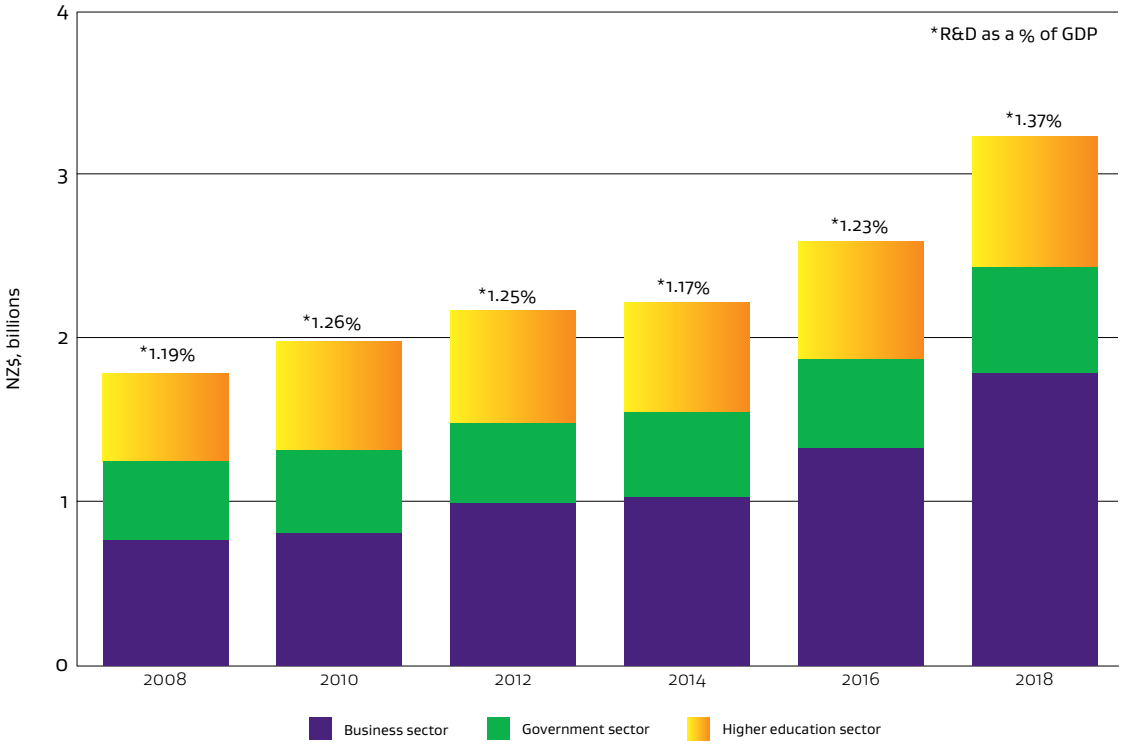
The R&D Tax Incentive will stimulate private sector investment. The R&D Tax Incentive has a competitive rate of 15 per cent on eligible R&D, while also offering support to pre-profit businesses, such as start-ups, through a tax refund. The R&D Tax Incentive uses a definition of R&D that ensures the credit can be accessed more easily across all sectors, including the technology sector. This is a major initiative, totalling $1 billion over four years, to lift our R&D investment and thereby, our levels of innovation and productivity. Callaghan Innovation also supports innovation in the economy by providing innovation services to businesses, including technology and product development, grants, access to experts and training in innovation skills.

The government is also developing a Research, Science and Innovation Strategy, which will focus on increasing New Zealand's rate of innovation at the leading edge of what the world knows and can do – the 'frontier' of knowledge and its application. Innovation at the frontier means generating new knowledge and technology, and using that to introduce products, services and processes that are new to the world.

By contrast, innovation 'behind' the frontier is a key focus of economic development, as it drives productivity in our existing industries. Innovation behind the frontier is about adopting ways of doing things that are new to an organisation but are already known to others. The Productivity Commission identified that a number of New Zealand's industries are disconnected from the global innovation frontier and that New Zealand has a long tail of unproductive firms in some industries.

Innovation 'at the frontier' and 'behind the frontier' are complementary. Economic development policy may encourage the adoption of new technology and frontier innovations, which in turn, generates demand for innovation within these sectors, stimulating new investment and R&D activity. Increasing the level of innovation behind the frontier within existing firms is important for supporting key industries to add value to volume.

Figure 7: Total R&D expenditure in New Zealand



Source: Statistics NZ

We are also building international connections to support New Zealand's thriving innovation system. Our Innovative Partnerships programme attracts world-leading innovators to New Zealand to carry out research and development activities, and has already seen success with companies like Zephyr Airworks. We are investing in government-to-government science partnerships, connecting our researchers with international expertise to tackle challenges at the global frontier.

Callaghan Innovation and NZTE are helping our innovators to act globally, providing them with the tools, investment advice and market information to create products for the international market.

The government supports innovation through our mission-led research institutes. The Crown Research Institutes play a unique and important role, supporting their sectors to innovate and grow. Each of the seven institutes is aligned with a productive sector of the economy or a grouping of natural resources and they strive to achieve economic growth by improving productivity and the sustainable use of natural resources in relation to that area. These are complemented by the four Regional Research Institutes, which are designed to stimulate leading-edge, industry-exploitable and commercially focused research in sectors relevant to their home regions.

To help lead New Zealand's transition to a low-carbon economy, the government has set aside $27 million to support the establishment and operations of a National New Energy Development Centre. The Centre will be based in Taranaki to capitalise on the region's energy talent, infrastructure and international connections, but it will serve as a national energy systems integrator, working across multiple organisations, agencies and locations. The centre will work with industry and the research sector to test, trial, demonstrate and deploy new technologies across a range of emerging options such as offshore wind, solar batteries, hydrogen and new forms of energy storage.

TRADE AND INTERNATIONAL CONNECTIONS

As a country with a small domestic market, limited domestic manufacturing and a comparative advantage in primary production, New Zealand is dependent on international trade and investment. We need to import many of the consumer goods and services we enjoy, as well as many of the intermediate goods and inputs that we use in the goods and services we produce. We also depend on access to bigger markets in which to sell what we produce.

Recent tensions in international trade are challenging previous assumptions that global markets will continue to open more and more. For trade to flourish and benefit all, there need to be agreed rules and processes that trading partners abide by.

The benefits of trade also need to be widely shared, to avoid having a backlash against trade. Our Trade for All agenda will help make sure New Zealand's trade policy is working in harmony with domestic policy and is spreading its benefits from the farm gate to the workers, from the factory owners to those on the factory floor.

New Zealand has long stood for increased trade liberalisation, reflecting the high levels of protectionism we have faced as a producer of primary products. Our CER trade agreement with Australia, formed in 1983, remains New Zealand's most comprehensive agreement. Our FTA with China has served both countries well.

We are pursuing a broad free trade agenda at a number of different levels. At a global level, we support the World Trade Organisation (WTO) as the appropriate forum for setting and enforcing global trade rules. We are working actively together with other countries to find acceptable ways to reform the WTO so that it can continue to play this role.

The CPTPP is now in force, providing preferential trade conditions with 10 other regional economies, including three G20 countries: Japan, Canada and Mexico. This is already generating significant benefits for our exporters.

New Zealand has first-rate, modern research facilities. Source: NZ Story

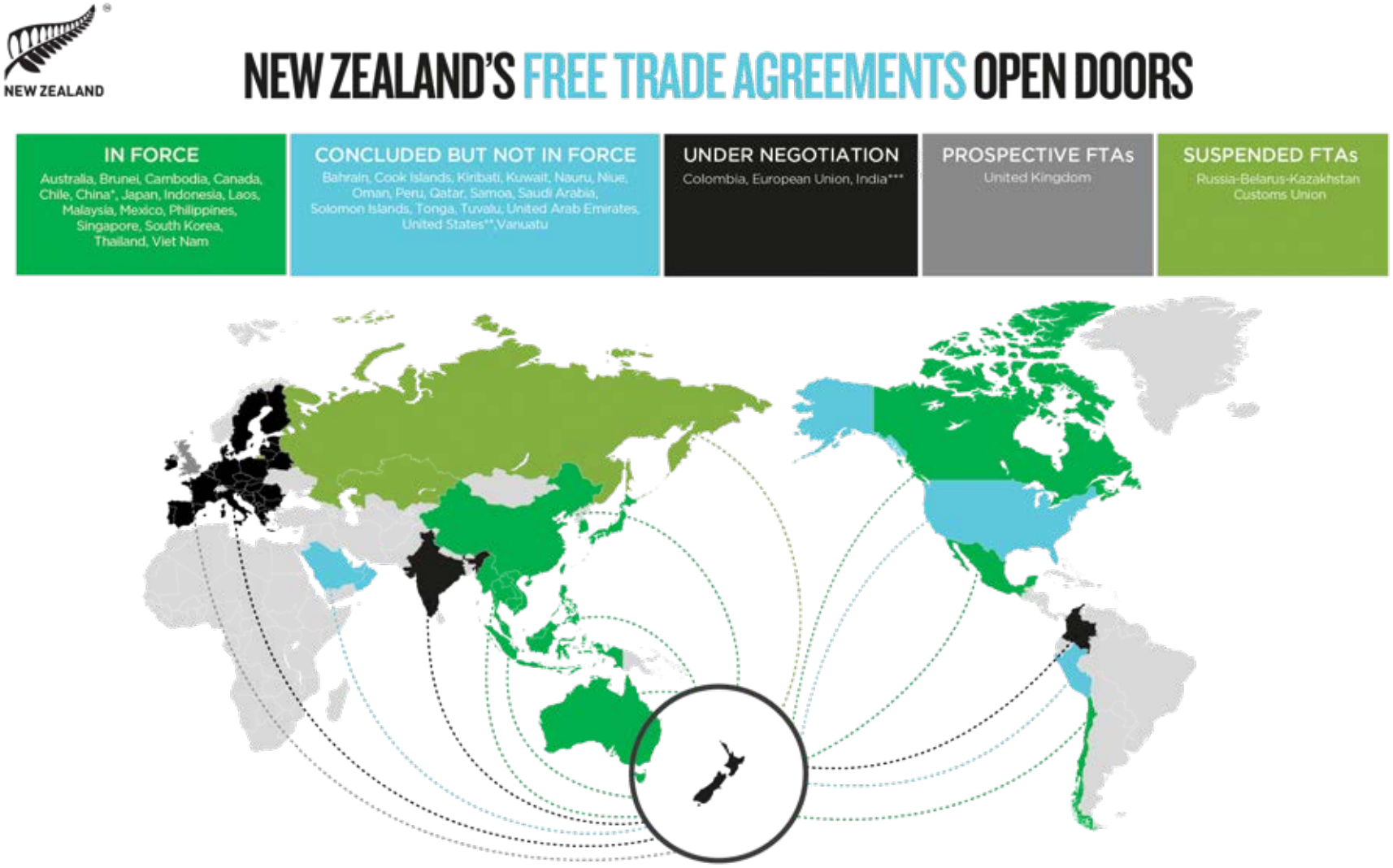


Figure 8: New Zealand's free trade agreements

Source: Ministry of Foreign Affairs and Trade, January 2019

** New Zealand has FTAs with China, Hong Kong China and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu.*

*** The US signed the TPP but then withdrew its support (without which the deal cannot enter into force).*

**** India is a party to two FTAs that New Zealand is negotiating: a bilateral FTA, and also a regional agreement – the 'Regional Comprehensive Economic Partnership' with 15 other economies.*

The Pacific Agreement on Closer Economic Relations Plus (PACER Plus) is a trade and development agreement that aims to create jobs, raise standards of living and encourage sustainable economic development in the Pacific region.

Within the region, we continue to engage in negotiations for a Regional and Comprehensive Economic Partnership with another 15 economies including India, and to join a free trade agreement with the Pacific Alliance (Mexico, Colombia, Peru and Chile), as well as upgrading our agreements with China, Australia and ASEAN.

We are also pursuing trading opportunities beyond our immediate region. The highest priority is to negotiate a high-quality agreement with the European Union (EU). In due course, we will pursue an agreement with the UK. As Brexit approaches, we have been putting effort into ensuring that New Zealand companies that do business with the UK and EU will not be adversely affected. With the United States, we continue to discuss the possibility of trade negotiations, given their status as the second-largest trading partner with whom we are yet to have a trade agreement in force.

Most of our main trading partners can be found within the Asia Pacific region. Accordingly, it is vital for our economic future that we play an active part in regional forums and processes. We are an active participant in Asia Pacific Economic Cooperation, which we will be hosting in 2021.

We are also pursuing opportunities to align regulatory settings with like-minded trading partners. Australia and New Zealand provide an example of how achieving greater regulatory and economic alignment and integration can facilitate trade. We continue to negotiate mutual recognition arrangements with other countries to facilitate trade in covered products, support the global standard setting process and help build the capacity of other countries so that they can implement best-practice regulation.

Collectively, the 'NZ Inc' agencies (Ministry of Foreign Affairs and Trade, Ministry of Business, Innovation and Employment, NZTE, Ministry for Primary Industries, Education New Zealand, Tourism New Zealand, New Zealand Customs Service and NZ Story) continue to work with businesses to help them succeed in international markets, by providing access to capital, advice and mentoring, as well as working directly with other countries to address specific barriers to trade.

The Trade Barriers (www.tradebarriers.govt.nz) website – where New Zealand businesses can seek assistance in resolving trade barriers overseas – is an example of the kind of service NZ Inc is now providing to help New Zealand exporters succeed offshore.

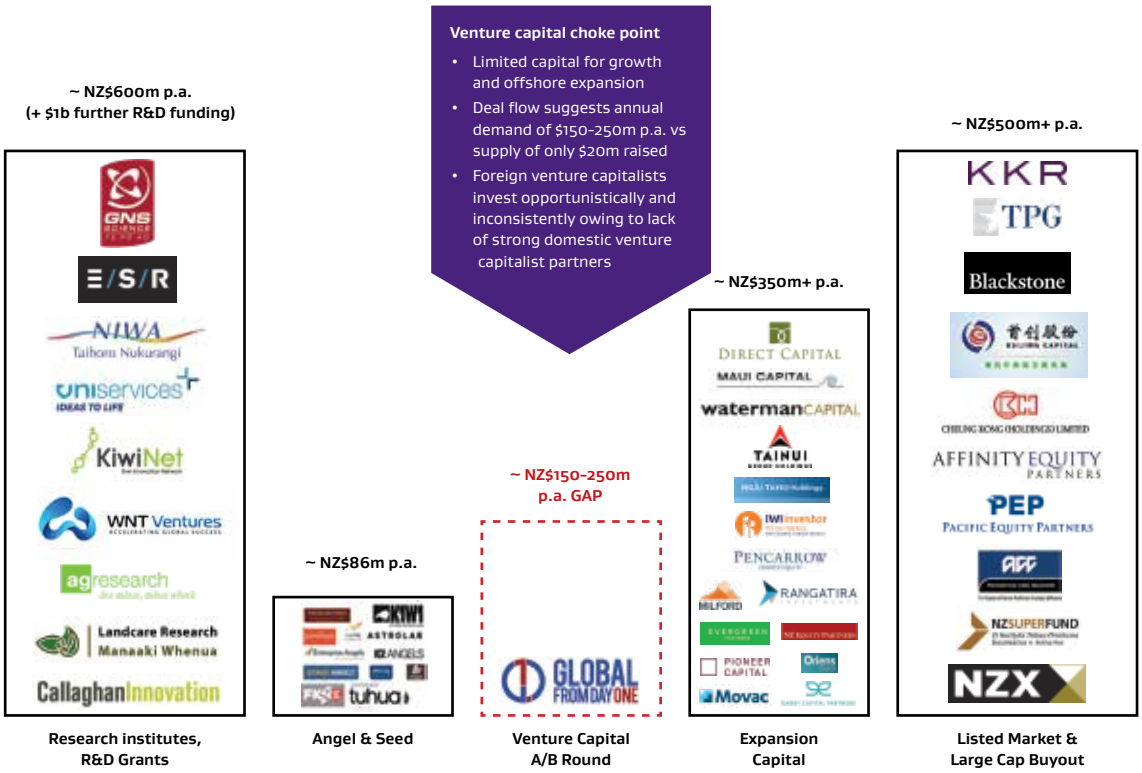
INVESTMENT CAPITAL

All countries need investment and access to capital to grow their economies and lift productivity. In New Zealand, we have poor domestic capital investment patterns, with a large proportion allocated to non-productive assets such as housing.

The shallowness of key capital markets in the New Zealand market and the inability of many firms to source expansion capital along a pathway from start-up, to scale-up, to global competitor has made it harder for some firms at the cutting edge of innovation to access capital.

The development and commercialisation of disruptive innovation and technology requires particular skills and a business environment that large, established corporates typically do not have. We need fast-growing firms operating in a healthy, well-capitalised start-up ecosystem. But there are large gaps in the early-stage capital markets , especially for series A and B capital rounds, and no new firm has listed on the public exchange for a number of years. Many of these high-growth firms are forced to seek capital abroad and can end up leaving our shores prematurely as a consequence.

Figure 9: Total venture capital deals in New Zealand



Source: New Zealand Venture Capital Association, Ernst and Young Capital monitor, MBIE calculations

The government is committed to ensuring our early-stage capital markets are strong enough to support the growth of our innovative firms by increasing the amount of capital invested; the number and quality of investors and fund managers; the international connectivity of those funds; and the participation of institutional investors.

To do this, the government is deepening early-stage capital markets by creating a new fund under the guidance of the Guardians of the New Zealand Superannuation Fund, which will invest in early-stage companies via the NZVIF and a fund of funds model. $300 million in total has been set aside for this. Private sector venture capital fund managers will make and manage the investments. Those private sector venture capitalists will bring matching funding to multiply the $300 million into between $600 million and $1 billion.

More broadly, we want to support a healthy start-up ecosystem to grow the knowledge economy. We need to develop a strong pipeline of start-ups that progress through successive rounds of funding.

The government is also committed to ensuring that investment choices appropriately reflect their wider impact on the inclusivity or sustainability of the economy. Not all investment should be short-term profit driven. Where longer-term signals are required, it is often the government that must step in, and not just for infrastructure.

As outlined in the next section, the $3 billion Provincial Growth Fund is focused on developing regions and raising the inclusivity of investment flows so that regions that are challenged with higher unemployment, lower productivity, finding skilled workers, or have people who are struggling economically, are not left behind.

We are also establishing the new Green Investment Finance company, which will make investments in companies that lower greenhouse gas emissions on a commercial basis. Many of these investments will be for technology that is at a more mature stage than technology qualifying for investment from the venture capital fund. This finance company will receive a $100m capital injection from the government and will operate independently.

In addition, the government is working to attract more high-quality inward investment to New Zealand that is in the best interests of all New Zealanders. NZTE's Investment team, with members around the world, seeks the right kind of investment for New Zealand. It looks for investors that have an ability to add more value than just capital (eg. skills, capability, technology and networks that can open up export markets for New Zealand products).

Our current focus in the rewrite of the Overseas Investment Act is to reduce complexity, improve investor certainty and cut unnecessary red tape, while ensuring investments are consistent with New Zealand's national interest.

We know that more can be done to simplify the Overseas Investment Act for those making productive investments in our economy, while adequately protecting our most sensitive assets, including our farms and homes. This review will make sure New Zealand remains an attractive destination for beneficial, long-term foreign direct investment.

Through the Investment Attraction Taskforce, we are actively promoting well-intentioned inward investment that is able to unlock doors and help domestic companies to achieve their true global potential. We are reviewing the Investment Attraction Strategy to improve the benefits of inward investment, including in the tourism accommodation sector.

The other side of the picture is outward investment. New Zealand has very low levels of outward investment, which limits our ability to benefit financially from favourable economic conditions elsewhere in the world and to leverage off the skills, ideas and technology from the frontier firms located there. We will continue to support work to identify opportunities for increasing offshore investments that benefit New Zealand. The TIN200 report shows some progress being made by our most innovative companies expanding offshore.

REGIONAL ECONOMIC DEVELOPMENT

The government is committed to unlocking the full potential of regional New Zealand. In 2017, we established the Provincial Growth Fund (PGF), a $3 billion investment over three years, to enhance economic development and employment opportunities in regional New Zealand.

The PGF's objectives are to create jobs, enable Māori to realise their aspirations in all aspects of the economy, increase the environmental sustainability of our economy and help New Zealand meet its climate change commitments, and improve resilience through investing in critical infrastructure and diversifying the economy.

The PGF supports our regions, particularly the six surge regions – Northland, Bay of Plenty, Tairāwhiti, Hawke's Bay, Manawatū-Whanganui and West Coast – which have fallen behind on a number of key economic indicators. Supporting our regions will enable all New Zealanders to participate fully in a sustainable, inclusive and productive economy.

In its first year, the PGF focused investment on identifying economic opportunities, building local capability and on infrastructure, such as roads and digital connectivity, to enable growth. In its second year, the PGF broadened its focus to sector investments that can increase the productivity potential of the regions and grow the breadth of job opportunities available to New Zealanders. Sector investments are an important building block in the Government's approach to growing more innovative industries across New Zealand.

By working with firms directly on projects that provide employment and deliver other benefits, the government can achieve some of its wider social objectives.

Beyond the PGF and other funding mechanisms, the government has a number of additional tools it is deploying to help regions seize opportunities presented by the transition to a more productive, sustainable and inclusive economy. Industry partnerships, such as Ministry for Primary Industries' work with the primary sector and the Food Innovation Network, have significant flow-through effects to regional economic development. We are also investigating options to leverage better outcomes for regional New Zealand, alongside Māori and the Pacific community, through our approach to the government procurement.

Towards a low-emissions economy – a partnership approach

In April 2018, the government announced there would be no new exploration permits for offshore oil and gas. This decision had implications for Taranaki in particular, as New Zealand's oil- and gas- producing region. Since then, the government has worked with the region to develop the Taranaki 2050 Roadmap, which sets out the region's vision for a low-emissions future. The process to develop the Roadmap involved 29 co-design workshops with over 700 participants. These workshops brought together the ideas and knowledge from iwi, community groups, business, workers, youth, and local and central government to create a plan for the future of Taranaki. The draft Roadmap was launched at the National Just Transition Summit in New Plymouth in May 2019. The government will continue to partner with the Taranaki region through the implementation phase of the Roadmap.

SKILLS AND THE FUTURE OF WORK

Future of work trends will generate considerable changes in demand for skills, and workers may see considerable changes in the type of work they undertake. This will have serious ramifications for New Zealanders and our economy. This is not unique – past waves of technological change radically altered the job landscape – but it creates challenges that must be addressed.

Unions and employers are engaging with government to plan for the future. Workers of the future can expect to spend more time on activities that machines are less capable of, such as managing people, applying expertise and communicating with others. They will spend less time on predictable physical activities and on collecting and processing data.

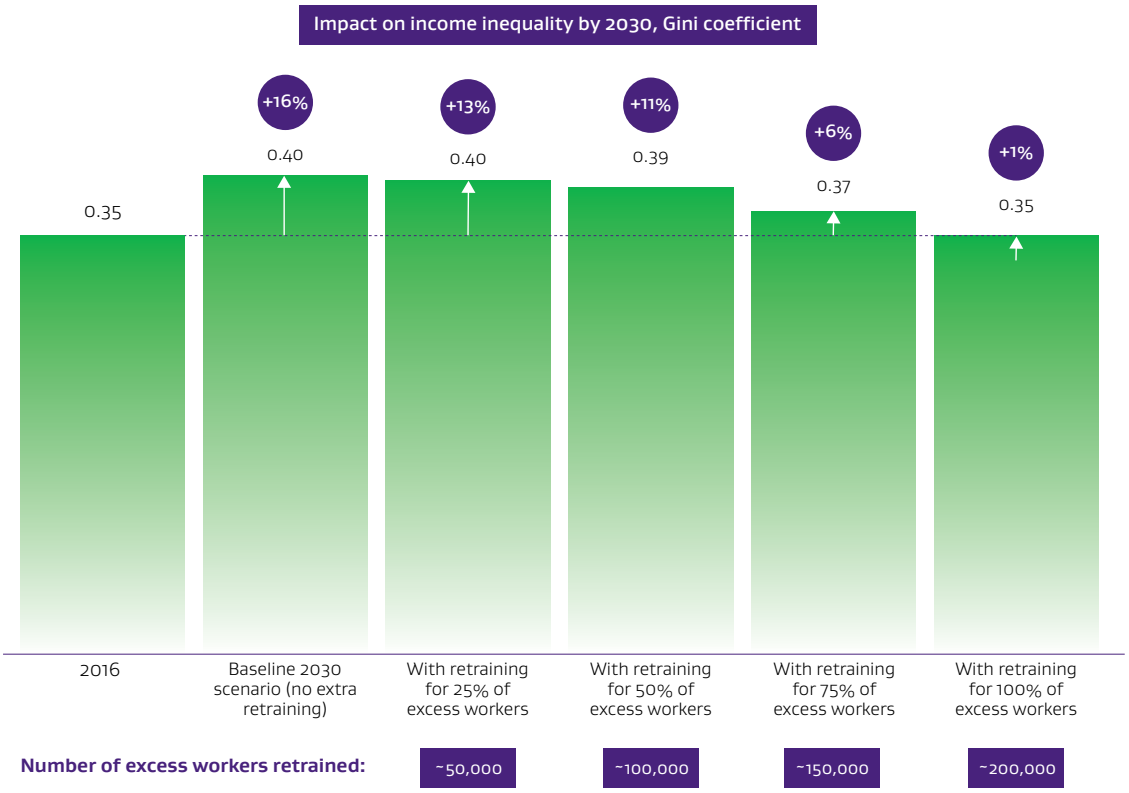
The skills and capabilities needed to succeed in the workforce will also shift. Many jobs will require more social and emotional skills, as well as more advanced cognitive capabilities, such as logical reasoning and creativity.

The risks associated with future of work trends are not evenly distributed; they sit disproportionately with workers rather than businesses, and with groups and regions that may be experiencing labour market disadvantages already. Workers with lower levels of education are particularly at risk of their jobs being automated and they may need to develop new skills to stay employable. Climate change mitigation measures may also see decline or growth in employment within different industries, requiring workers to acquire new skills.

These changes can drive greater income inequality. Analysis by McKinsey suggests that in the absence of intervention and because of a shortage of higher skills, there will be an excess of lower-skilled workers owing to the changing skills demand. If no retraining is provided (the baseline scenario), the result will be worse inequality in New Zealand, pushing our Gini coefficient from 0.35 to 0.40.[8] An effective programme of upskilling and retraining can mitigate increasing inequality.

8 The Gini coefficient is a measure of income equality. It is a comparison of cumulative proportions of the population against cumulative proportions of the income they receive; a value of 0 represents perfect equality and a value of 1 represents perfect inequality.

Figure 11: Impact of retraining on income inequality



Source: McKinsey Analysis, McKinsey GTAP model

The Future of Work Tripartite Forum (the Forum) is investigating how New Zealand can maximise the opportunities and manage the risks of disruptive change and its impacts on workers and businesses.

A fair sharing of risks between the government and the private sector is needed. Employers need to take an active role in developing a long-term view of their skills needs, and building the training and talent infrastructure to realise that vision. Educational institutions need to be adaptable and innovative in meeting the needs of businesses and workers. Employees need to drive their career paths actively. The government needs to bring these actors together, creating the right economic incentives and supporting the appropriate infrastructure.

To meet the challenges the future of work is bringing, the work programme of the Forum has a strong focus on improving the skills system.

The Reform of Vocational Education is intended to improve coordination and cooperation between the various actors in the vocational education system. We want to support businesses to take a greater leadership and planning role through Industry Skills Bodies and enable vocational education providers to have a more comprehensive oversight over the way training is delivered.

The Careers System Strategy is designed to address information gaps that undermine New Zealanders' ability to adapt to the changing nature of work – delivering relevant career information and tools, helping jobseekers identify their transferable skills, increasing career choice and lifting workers' aspirations.

These initiatives form part of a broad suite of programmes designed to ensure New Zealanders have the right skills for the future. Reforms of earlier education (such as the reviews of Tomorrow's Schools and the National Certificate of Educational Achievement) will also contribute to this goal, as will the implementation of the recommendations in the *Digital Skills for a Digital Nation* report and collective action on the Skills Shift in Manufacturing initiative.

There is an opportunity to do more. To address the need for future work skills, this government wants everyone to have access to education that is appropriate for their current stage in life and their career.

We made a start by introducing a no-fees policy in the first year for everyone starting tertiary education or training for the first time, as well as no fees for the first two years of apprenticeships. This approach is largely targeted at increasing access to education for school leavers. We need to take a similar approach to improving access to education for those looking to retrain when they are mid-career. ■

Fisher & Paykel is leading the world with collaborative human-centred design. Source: NZ Story

Key Highlights

NEW ZEALAND'S DIGITAL SKILLS SHORTAGE

Demand for digital skills is already high

120,350
people employed in the tech sector in 2016.

90,000+
LinkedIn members in New Zealand with IT skills.

23,946
IT and digital workers in just 39 Government agencies.

14,000
new jobs created by the tech sector in 2016.

72,000
IT Services related jobs in all sectors has grown to exceed this.

$82,000
More jobs posted for ICT roles than any other role, median salary now.

Supply of digitally skilled workers is low

Only **14,220**
computer science and information technology students studying in 2016.

3%
annual increase in student numbers.

11%
annual increase in software programmer jobs.

Only **5,090**
computer science and information technology graduates in 2015.

Only **36%**
of computer science and information technology students were FEMALE in 2016.

Only **5,500**
technology visas granted over the past 12 months.

Only **8%**
of computer science and information technology students were MAORI in 2016.

Demand is forecast to grow

120 tech firms expect to create more than

3,200
new digitally skilled roles over next two years.

More than

1,200
extra software developers will be needed over next two years by those 120 tech firms alone.

Highest demand is forecast for:

MACHINE LEARNING
SOFTWARE DEVELOPMENT
DATA ANALYSTS
SOFTWARE ARCHITECTS

= SKILLS GAP

Source: Digital Skills For a Digital Nation, New Zealand Digital Skills Forum, 2017

Making our mark offshore: the history of New Zealand Trade and Enterprise

As part of the economic and public management reforms of the late 1980s and 1990s, most government subsidies and incentives for economic development were removed, on the understanding that the market would allocate resources most efficiently. Support remained in place to assist exporting firms to access international markets through Trade New Zealand.

The Labour Government of 1999 established Industry New Zealand to support the development of sectoral and regional economic activity. Industry New Zealand focused on domestic economic development, with Trade NZ supporting successful domestic firms to take on global markets.

In 2003, these bodies were merged to form New Zealand Trade and Enterprise (NZTE).

NZTE is now the government's international business development agency, helping companies to grow internationally for the benefit of New Zealand. It increases New Zealand companies' international success by helping them boost their global reach and build capability. For further information, see page 54.

EPIC Innovation centre is an innovative shared services space that focuses on technology and collaboration in Christchurch. Source: NZ Story

Industry transformation plans

NGĀ MAHERE PANONI AHUMAHI

A central element of our industry policy is developing Industry Transformation Plans, prepared in consultation with all the key players and covering all elements necessary for transitioning that sector to a more productive, sustainable and inclusive future.

Singapore is using Industry Transformation Maps to drive improvements in productivity, to address the challenges and opportunities created by the 4th industrial revolution. We agree with that approach and are advancing a similar strategy. Our first Industry Transformation Plan is the Construction Sector Accord, developed in partnership with the construction sector.

Nobody knows a business or sector better than those that work in it. So when it comes to successful and enduring strategy development and delivery, the best approach is for the government, business and workers to agree on a common vision for the future and what needs to be done to realise it.

Business owners and workers, including unions, have the best understanding of the current state of their sector and where the opportunities and challenges lie.

Bodies such as the Prime Minister's Business Advisory Council and Future of Work Tripartite Forum have a vital role to play in taking an economy-wide perspective when considering sector-specific strategies.

The Crown's partnership with Māori is also crucial to realising the full potential of our sectors. A number of Māori businesses are at the forefront of transformational change, spanning generations and embedded within a commitment to kaitiakitanga and manaakitanga – key elements for successfully delivering on the Government's vision for a more productive, sustainable and inclusive economy.

Industry Transformation Plans will be sector led and government supported. They will describe an agreed vision for the future state of the sector and outline the actions required to realise this vision, including investment, innovation and better skills development. They will exploit synergies that exist across industries as well as within them. They will build from the existing suite of support measures available to industries, including funding and regulatory interventions, leveraging what is working and scaling back what is not.

They will be living documents that can adapt through economic and political cycles.

Each sector will require its own mix of actions. These could start in the science and early-stage business development area, where new ideas and innovation are developed. They may address finance, including where government can act to support investments being made, especially in early-stage venture funding. We will need to work with growing and mature businesses alike to support investment in R&D and the diffusion of technology, to lift productivity, shift from volume to value and develop new markets.

We will be supported by the work done by NZTE and the Ministry of Foreign Affairs and Trade to drive inward and outward investment, opening new markets and the doors to trade across the world.

We can only get the balance right by working together – business, workers, iwi, and local and central government. Ensuring we take an inclusive approach as our economy transitions, as well as bringing everyone with us, will be important as we work with industry.

In addition to the Construction Sector Accord, the government already has work underway in a number of sectors, including tourism, as outlined in Table 1.

Taking a partnership-led approach, the Government will initially focus on four other priority sectors for new Industry Transformation Plans: food and beverage, agritech, digital technology, and forestry and wood processing.

Key component parts of Industry Transformation Plans will include:

- A discussion of historical productivity in the sector;
- Assessments of the opportunities and risks from increasing digitalisation;
- Assessments of the opportunities and risks from the future of work, and skills training needs in the sector;
- Decarbonisation pathways;
- Ways to increase exports;
- Assessments of capital and labour constraints;
- Opportunities to collaborate with other sectors; and
- An investment attraction strategy.

Over time, and with the lessons learned from these four priority sectors, Industry Transformation Plans will be progressed in other sectors.

CONSTRUCTION SECTOR ACCORD

The Construction Accord sets out the way the government and industry will partner to deliver a transformed construction sector and completes the first phase of a two-phased approach. The Accord sets out priority work areas and some high-level commitments to action for transformation.

In the next phase, the sector will collaborate on a wider basis to develop a more detailed construction sector transformation plan to meet the challenges and achieve the outcomes outlined in the Accord.

FOOD AND BEVERAGE

The food and beverage sector makes an important contribution to the New Zealand economy, accounting for 32 per cent of our total manufacturing output. Food and beverage manufacturing employs around 93,000 New Zealanders.

Productivity grew by 3.2 per cent in 2018, but declined overall by a compound annual growth rate of -0.5 per cent in the five years to 2018.

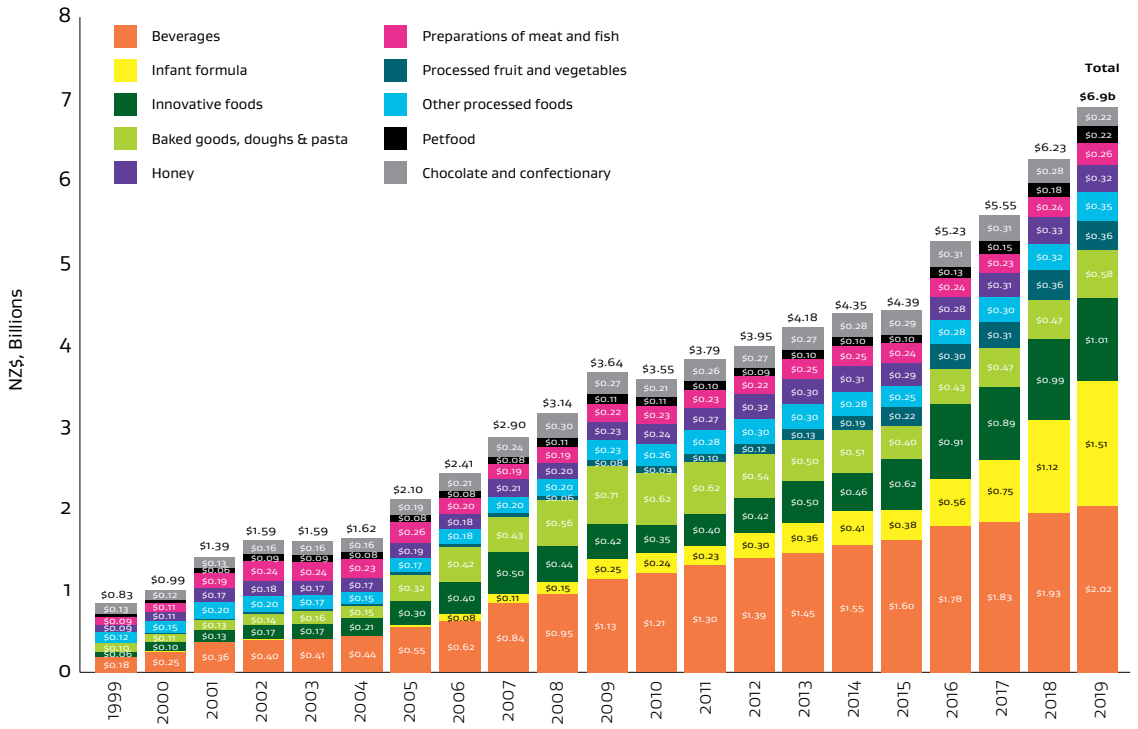
Poor productivity in this sector is at least in part due to the dominance within the sector of commodities such as milk powder, meat and butter within the sector, although the share of these commodities in New Zealand's exports has declined because of the growth in exports of value-added foods and beverages.

Historically, the sector has been structured around the production of these commodities. To improve productivity, we need to move more purposefully from volume to value.

The Primary Sector Council, established by the Minister of Agriculture in April 2018, is providing strategic leadership to enable the Food and Fibre sector to respond to challenges and opportunities arising from consumer expectations, new technologies and environmental pressures. It has been tasked with creating a vision for the primary sector and to identify the capabilities the New Zealand Food and Fibre sector will need to achieve the vision. The outcomes from this process will be a key input into the Food and Beverage Industry Transformation Plan.

The sector is committed to increasing the share of value-added food and beverage products that New Zealand produces. Investment by the sector over the past 10 years has been focused on producing value-added products such as nutraceuticals (food that provides medicinal or health benefits), infant formula, packaged consumer products and beverages. Value-added food and beverage products, including wine, recorded a compound annual growth rate of 11 per cent in the 20 years to April 2019.

Figure 11: Value-added food and beverage exports



Source: Statistics NZ

The government is committed to partnering with the food and beverage sector to:

- drive innovation in the sector to enable the shift from volume to value and to improve productivity
- triple the value of value-added food and beverage exports from New Zealand to NZ$21 billion by 2035
- decarbonise heat used in industrial processes (process heat), to enable more sustainable production[9]
- establish New Zealand as the leading location for food innovation and manufacturing in the Asia-Pacific region.

The government will work with industry, workers and Māori to determine the best path forwards for achieving these goals. This will include supporting the sector to address barriers such as access to skilled workers, access to new plant and technologies, and enabling change in the sector.

We will focus on coordinating an enhanced value-added food and beverage ecosystem, spanning science institutions, universities, Institutes of Technology and Polytechnics, manufacturers and adjacent sources of innovation and related services.

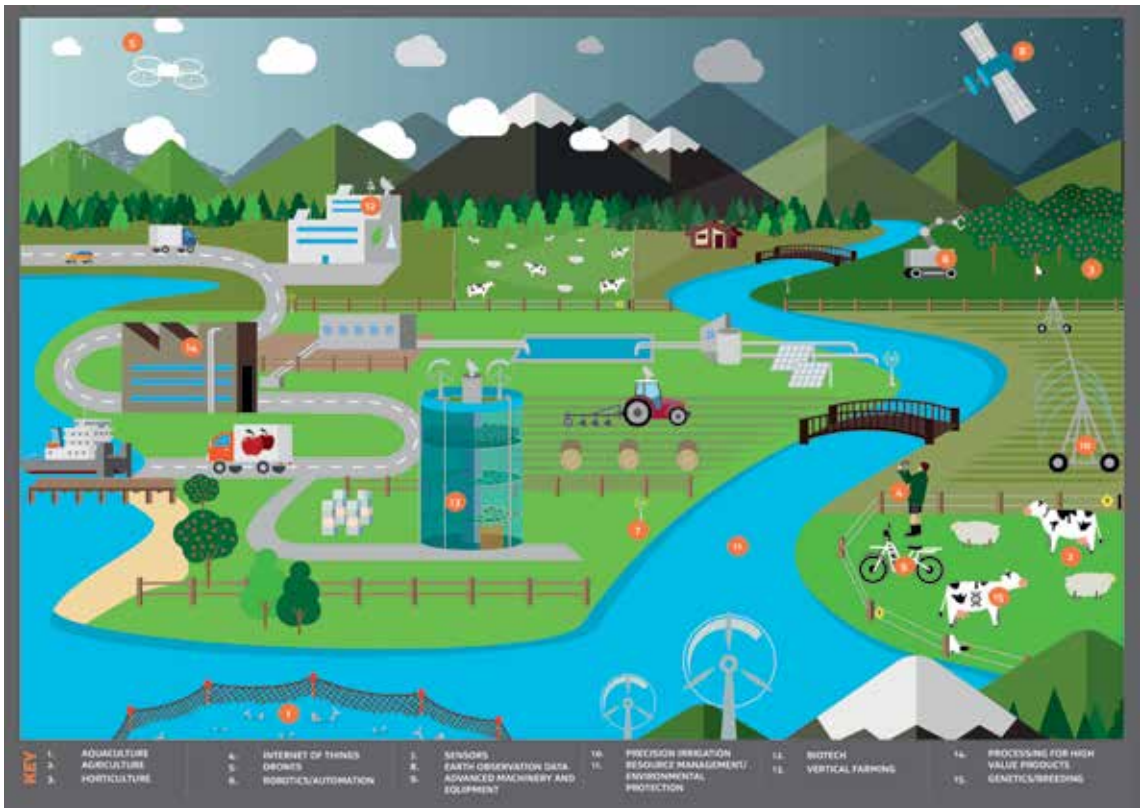
Much of this ecosystem is currently supported through the Food Innovation Network (NZFIN), which comprises the FoodBowl, FoodWaikato, NZFIN – Hawke's Bay, the FoodPilot, FoodSouth and FoodSouth – Otago. Government is aware of proposals for new food hubs and value-added food strategies in regions such as Taranaki, Marlborough and Northland.

Other PGF initiatives and funding available through the Ministry for Primary Industries' Sustainable Food & Fibre Futures programme will support projects that will create more value from the food and fibre industries.

We will also collaborate and partner with the industry to develop initiatives that support workforce upskilling, capability building and the development of career transition pathways where needed.

9 Currently, 60 per cent of New Zealand's process heat is supplied using fossil fuels, mainly gas and coal. www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/low-emissions-economy/process-heat-in-new-zealand/

Figure 12: Examples of agritech



AGRITECH

The agritech sector spans a wide range of products and services including genetics, precision agriculture and horticulture, information and communications technology, and machinery and equipment, including robotics. The sector is critically important to New Zealand as a developer and supplier of inputs and production systems to the primary sector. The Prime Minister's Business Advisory Council has recommended a special focus on automation in horticulture.

Crucially, the agritech sector can drive productivity improvements in our primary sector and will also be central to creating a more sustainable economy. Agritech can contribute to land management that is more efficient, higher-quality produce and better environmental outcomes, including improved water quality and reduced methane, nitrous oxide and CO_2 emissions.

A significant proportion of New Zealand's R&D-intensive, high- and medium-high technology firms are within the agritech sector, including Gallaghers, Scott Technology, Robotics Plus, Tru-test and Waikato Milking Systems.

Agritech exports are estimated at around NZ$1.5 billion annually. However, exports have been flat for a decade and the uptake of this technology across the primary sector and related manufacturing sectors has been low.

The sector lacks a coordinated supporting ecosystem and has weak international linkages. This is inhibiting New Zealand's ability to maximise significant export opportunities.

The government is working with industry body Agritech New Zealand and other industry parties to develop a draft agritech strategy and action plan. This strategy will provide the foundation for a future agritech Industry Transformation Plan.

The strategy will aim to:

- grow the sector and enable production that is more sustainable
- increase agritech exports
- drive innovation and uptake of agritech across the primary sector and related manufacturing sectors.

Work on this plan will include defining the agritech sector better, establishing an evidence base for action, setting targets for the sector and monitoring progress towards them.

DIGITAL TECHNOLOGY

Digital technologies impact all sectors of the economy. Increasing uptake will improve productivity and create value, including from the use of data. Digital technologies underpin a number of actions the government is taking to support the ongoing development of our technology sector and industries using technology. To improve productivity in the New Zealand economy, we need better diffusion of digital technologies by small and medium-sized businesses.

Opportunities are also presenting within the digital sector itself for more coordinated action between the government and industry. These include:

- continuing to work with the IoT Alliance and the AI Forum to drive uptake of these technologies
- implementing the Industry 4.0 Demonstration Network programme to increase uptake of Industry 4.0 technologies and processes across manufacturing sectors, improving productivity and competitiveness, with budget funding of $6 million over four years
- coordinating, developing and rolling out a National Digital Infrastructure Model to generate value from data for all aspects of the economy – eg infrastructure management and development
- supporting New Zealand digital technology firms by providing a level playing field for New Zealand firms to compete for government business
- working through the Digital Skills Forum to ensure the digital technology sector, and the industries that rely on digital technology workers, can access the tech talent needed to support the growth of these sectors and the economy more generally.

Our Industry Transformation Plan for the digital technology sector will bring together these diverse strands of work into a coherent strategy to ensure New Zealand business are well placed to take advantage of rapid advances in technology, including through having access to the tech talent necessary to support growth in New Zealand's ICT export industry.

FORESTRY AND WOOD PROCESSING

In 2018, around half of New Zealand's total forestry harvest was exported. These exports almost entirely comprised lower quality industrial A- to K- grade logs. The export of logs is partly driven by high demand and prices from China, and partly by the way our domestic wood-processing sector is configured. Much of the current structure of the sector is based on past decisions to serve the domestic market with traditional products.

A 2018 study[10] found there are opportunities for new primary and secondary wood-processing activities in New Zealand, based on developing new products for export. There is potential for the sector to be an ongoing source of renewable and sustainable resources, including plant fibre, chemicals and bio-energy, at the heart of a circular,[11] bio-based, carbon-neutral economy. International developments in this area (eg in Finland) suggest putting the wood sector at the heart of a circular bioeconomy. While this could be a serious proposition for New Zealand, comprehensive research would be required to determine whether it is viable here. Other opportunities could lie in value-added intellectual property changing the way we produce seedlings or grow and harvest trees; the way we use foreign management technology; and our end-use timber products.

10 Forest Economic Advisors Spotlight Series for MBIE 2018/19.

11 A circular economy is an alternative to the traditional linear economic model of take-make-use-dispose. The circular economy aims to keep resources in use for as long as possible, extract the maximum value from them while in use, then recover and regenerate products and materials at the end of each service life. See www.mfe.govt.nz/waste/circular-economy

Opportunities to develop new products face obstacles, including market-distorting practices in other countries. Regional infrastructure is also constraining growth in the sector, including electricity grid capacity in some regions. Additional constraints are certainty of supply of logs for processing, labour and the costs of transport to markets.

New Zealand needs an expanded and profitable forestry and wood-processing sector to fulfil the Government's economic, climate change and water quality objectives.

The government is committed to partnering with the forestry and wood-processing sector to:

- promote investment in primary and secondary wood processing focused on market-ready, value-added products
- address trade-distorting tariffs and other such practices in other countries
- maximise regional, economic and environmental benefits
- identify the opportunities to develop the forestry and wood-processing sector through the completion of a long-term Forestry Strategy. This strategy is expected to cover a broad range of considerations of the role of forests in the New Zealand economy, with respect to the environment (eg landowners integrating trees onto farms) and across the value chain.

Māori have extensive interests across the forestry value chain. The Crown–Māori partnership can deliver mutual benefits around economic development, employment and investment, as well as meeting sustainability goals.

Government action in other sectors

We already have industry transformation initiatives underway in other sectors, as outlined in the table below. This activity has similar objectives to the proposed Industry Transformation Plans in our four priority sectors and may form part of future Industry Transformation Plans. ■

Table 1: Other industry transformation initiatives

Sector	Objective	Action
Tourism	To enrich New Zealand through productive, sustainable and inclusive tourism growth.	Implement The Aotearoa New Zealand Government Tourism Strategy. This sets out five goals for tourism in New Zealand and the way the government will partner with the tourism sector to achieve these goals: › Tourism supports thriving and sustainable regions. › Tourism sector productivity improves. › Aotearoa New Zealand delivers exceptional visitor experiences. › Tourism protects, restores and champions Aotearoa New Zealand's natural environment, culture and historic heritage. › New Zealanders' lives are improved by tourism.

Creative industries	To grow New Zealand's creative sector to improve social and economic outcomes, within creative industries themselves and across New Zealand more broadly.	The government will partner with industry body WeCreate on the implementation of key recommendations from its action plan. The government has existing work underway to transform the Creative Industries, including: › supporting the screen industry's development of a 10-year strategy › introducing measures to ensure our creative professionals can have sustainable careers › initiatives to enhance the international potential of contemporary popular New Zealand music › reviewing our copyright protection regime.
Aerospace	To establish New Zealand as the regional centre for the development of space and autonomous air transport (drone) development.	MBIE is leading the development of a government space strategy. *Autonomous Aircraft Taking Flight: An Aviation System for the Automated Age*, sets out a vision and direction for a multi-year programme of work to integrate drones into the aviation and wider transport system.
Renewable energy	To grow development, production and use of renewable energy resources as a cornerstone of the sustainable low-emissions economy.	To develop and implement policies to drive the production and use of renewable energy resources, focusing on two pillars: completion and implementation of the Green Hydrogen Strategy; and switching energy sources for process heat away from fossil fuels, particularly coal, to biomass or electricity, particularly in food and beverage manufacturing (eg spray drying in the dairy industry).
Health technologies	To grow the sector as a provider of health technologies within the New Zealand health system and for export.	Better coordinate business development across the sector and advance the Health Research Strategy, particularly the innovative ideas and commercial opportunities action area. Potentially pilot a Health Incucelerator[12] model, embedded within District Health Boards in the medium term.

12 Incubator and accelerator combined.

The next steps

NGĀ MAHI KA WHAI AKE

Over the next year, the government will work intensively with industry in our four focus sectors to develop Industry Transformation Plans.

Groups such as the Future of Work Tripartite Forum, the Business Advisory Council and the Primary Sector Council will help to guide the process strategically.

We will set out timeframes for developing Industry Transformation Plans for the next five sectors, taking into account work already underway, such as the New Zealand-Aotearoa Government Tourism Strategy.

Recognising the considerable potential of the sector for New Zealand, the Agritech Transformation Plan will be the next to be developed.

Our Industry Transformation Plans will complement the government's soon-to-be released Research, Science and Innovation Strategy, which will position us at the leading edge of technologies. These advances will facilitate the development of new industries in New Zealand, some of which may seem inconceivable today.

New Zealand companies are developing autonomous air transport.
Source: NZTE

Conclusion

KUPU WHAKAKAPI

A PRODUCTIVE, SUSTAINABLE AND INCLUSIVE ECONOMY

To be a successful nation, government, business owners, workers, and regions all need to work together. True partnership is a keystone of a just transition and is fundamental to growing and sharing New Zealand's prosperity more fairly in the digital age.

This document has outlined specific initiatives that Government has implemented and will continue to work to develop. By working together, we can do even better to meet our goals for the New Zealand economy. While New Zealand's economic foundations are sound, we and the rest of the world face significant challenges. We always will.

New Zealand's productivity problems have been well canvased. Both diffusion of technology and the development of innovative new products and services are inhibited by low per capita investment in our productive businesses.

Finding ways to address this is a key part of our work programme. Recent initiatives like the R&D tax credit, ring-fencing of losses and extending the brightline test are intended to weight investment towards the productive sectors and to lift economic performance. In some ways it's simple. We want to grow our productive sectors and reduce speculative investment. To do this we need to apply more financial capital and more people to the task and, as the saying goes, people will follow the money.

The world is in the midst of a technological revolution born of the confluence of affordable computer power, mobile positioning systems, sensors, robotics, big data, the IoT, Artificial Intelligence and genetics.

We all know the digitalisation of many parts of the economy creates challenges, which we are dealing with under the banner of 'the future of work'. The flip side of that challenge is the enormous opportunity to improve the efficiency of existing methods of production or to commercialise the new products and services born of this revolution.

New Zealand needs to chase down as many of these commercial opportunities as we can and harness the jobs and the value. By moving from volume to value, leveraging opportunities in adjacent sectors and backing emerging sectors, we aim to build an economy that is more productive, more sustainable and more inclusive. Only by achieving all three will we be able to make sure that growth benefits everyone. ■

CASE STUDY 1

Growth and Innovation Framework: the GIF that keeps on giving

Soul Machines

Artificial Intelligence company Soul Machines was launched in November 2016 by Dr Mark Sagar (who won Oscars for his work in creating computer-generated faces for characters on Avatar and King Kong) and serial entrepreneur Greg Cross.

Soul Machines is a deep Artificial Intelligence Science and Research company focused on autonomous animation as a key technology in the development of Artificial General Intelligence. Soul Machines' Soul Platform™ is a Digital Brain™ that combines neural networks and biologically inspired models of the human brain to allow its realistic digital humans to synthesise human behaviour in real time.

Soul Machines' digital humans and autonomous characters can be deployed across a number of different industry sectors including financial services, healthcare, education, software, e-commerce and entertainment. Global brands such as Mercedes Benz, Autodesk and Proctor and Gamble have implemented Soul Machines across a wide range of uses.

Vesper Marine

In the ICT sector, Vesper Marine brought an IT solution to the America's Cup when it developed a marine safety system that uses Automatic Identification System (AIS) technology to mark the edge of the race course with virtual buoys.

Vesper Marine's virtual boundary was used to corral the spectator fleet at both the 2013 and 2017 America's Cup regattas in San Francisco and Bermuda, as well as during the 2017–18 Volvo Ocean race. If the weather changes and the course must be moved, the virtual markers are simply moved along with it. Vesper Marine's AIS transponders contain world-leading technology and are now sold in over 30 countries. Vesper Marine was supported by a project grant and a growth grant from Callaghan Innovation to develop their technology.

Revolution Fibres

Revolution Fibres is a leading biotech firm that has created products used in everything from sound control and fishing rods to Formula 1 cars and anti-allergy bedding. The company recently collaborated with fishing company Sanford to produce an anti-wrinkle treatment made from discarded hoki skins. By electrospinning liquid collagen extracted from fish skins into nanofibre, the company has created its flagship actiVLayr face masks. Callaghan Innovation has supported Revolution Fibres with project and student grants, as well as by providing wide-ranging advisory support. ■

CASE STUDY 2

Telco reforms: bringing New Zealand to the digital cutting edge

A more digitally enabled economy and the associated technology revolution are diversifying and deepening the value of New Zealand's economic and export base, as well as improving the long-term productivity and wellbeing of New Zealanders.

More than $15 billion of private sector investment in telecommunications infrastructure over the last decade has put in place a strong foundation for the country's digital future. Digital healthcare, precision agriculture and integrated smart cities are now presenting as real commercial opportunities for New Zealand with wider co-benefits, such as land use that is more effective and better access to healthcare.

From the structural separation of Telecom, through to the roll-out of ultra-fast broadband, the range of interventions and regulatory changes by successive governments in the telecommunications sector has underpinned these developments. These include:

- the unbundling of the copper local loop, allowing effective competition and innovation in copper services and competitive mobile telecommunications
- the structural separation of Telecom to create a regulated monopoly of lines and competition at the retail level
- investment in a major upgrade of telecommunications infrastructure, which is delivering improved broadband coverage throughout New Zealand through three programmes – Ultra-Fast Broadband, the Rural Broadband Initiative and the Mobile Blackspot Fund
- the passing of the Telecommunications (New Regulatory Framework) Amendment Act to enable the stable and predictable regulation of fibre networks, providing certainty to both providers and consumers.

Better regulation and more investment has resulted in a rapid deployment of mobile technology and its increased uptake by business. Companies such as Xero and Vista Entertainment rely on this connectivity to deliver their cutting-edge technologies to the rest of the world.

By 2022, 99.8 per cent of New Zealanders will have access to broadband infrastructure and 87 per cent of New Zealanders will have access to ultra-fast broadband. This will place New Zealand in the top five countries in the OECD for the proportion of homes and businesses that can access fibre.

However, considerable disparities in digital uptake remain between rural and urban communities, and small and large businesses. The government has a key role to play in encouraging digital uptake, so that regional New Zealand is well placed to take advantage of the opportunities that technological development presents.

Our businesses (tech sector and others) need connectivity to help them grow. The expansion of the ultra-fast broadband programme will ensure this. We are also gearing up to roll out 5G in 2020. 5G will not just bring faster broadband speeds and connection times. It will change the way we do things, bringing new possibilities to our firms working with emerging technologies like the IoT, virtual reality experiences and driverless cars. ■

CASE STUDY 3

TIN200 export success

New Zealand's technology sector is a significant part of our wider economy. It is estimated that the sector grew by more than $1 billion in 2018, according to the Technology Investment Network (TIN).[13]

The continued growth of the sector will add value to our economy and exports, as well as creating new high-value jobs. Digitally based businesses are not limited by New Zealand's geographic isolation. They are able to scale into large international markets more easily, and their growth is not constrained by the availability of physical resources.

The TIN top 200 New Zealand tech companies are attracting substantial investment from all over the world and driving growth in diverse global markets. Fintech, agritech, digital media and healthcare have been among the best performers. New Zealand also has a solid start-up and accelerator ecosystem for new tech companies. NZTE has a strong focus on growing New Zealand's tech sector exports, with 43 per cent of all NZTE tech customers experiencing growth of more than 40 per cent.

There is still much to be done. Significant disruption is expected in the coming years. New technologies, such as augmented and virtual reality, the IoT and Artificial Intelligence hold significant opportunities, as well as challenges that will need to be managed.

In their 2017 report *Accelerating a Connected New Zealand*, the New Zealand IoT Alliance estimated a potential net benefit for the New Zealand economy over the next 10 years of just under $2.2 billion from IoT application in key areas such as transport and logistics, dairy farming, tourism and complex manufacturing.

Likewise, in their 2018 report *Artificial Intelligence: Shaping a Future New Zealand*, the AI Forum estimated that Artificial Intelligence could be used instead of human labour in a growing range of manual or repetitive tasks, enabling that same labour to be redeployed onto new, higher-value tasks. The report's analysis found that through this labour conversion alone, Artificial Intelligence could increase New Zealand GDP by between $23 billion and $54 billion by 2035 across 18 industry groups.

Effective partnerships between government and industry will be critical for maintaining confidence in digital participation in the face of technological advances, new ways of delivering services and the new risks emerging from cyber-attacks and data collection.

We need to focus on creating and attracting the right types of skills, so that people and businesses are confident and able to use new digital technologies. This will involve building a pipeline of New Zealanders with digital skills, re-skilling and up-skilling our existing workforce, and bridging the gap between education and employment. ■

13 TIN 2009 Investors Guide.

CASE STUDY 4

Growing the Māori Economy

The Māori economy is a critical part of our future economic success. The Māori economy is broadly defined as privately and collectively owned businesses that acknowledge their genealogical links to Māori ancestors.

Prior to the arrival of European settlers, through to the late 1850s, economic activity among Māori was strong and they were actively trading both domestically and internationally. Between 1840 and 1930, the amount of land occupied and controlled by Māori had been reduced to only 5 per cent.

In the 1930s, government schemes were introduced, aiming to raise the productivity of the remaining lands still held by Māori.

The establishment of the Waitangi Tribunal in 1975 sought to investigate breaches of the Treaty of Waitangi. The process was then accelerated through the Office of Treaty Settlements.

In the past 30 years, through settlements with government, Māori authorities and enterprises have negotiated a total of almost $2 billion in assets and financial redress. Through astute management, the value of these assets has grown at an average 10 per cent per annum since settlement.[1]

To date, Māori economic growth has centred on sectors with strong links to natural resources, land and culture. These include the agri-sector, forestry and fishing, property, construction and infrastructure, tourism, and technology and innovation.

Collectively, Māori own $13 billion in primary sector assets, which is approximately 10 per cent of the total New Zealand agriculture, forestry and fishing asset base. Māori control 50 per cent of New Zealand's fishing quota and approximately 30 to 40 per cent of the land that has forests on it. Although the forestry rights for the trees on that land are often held by corporate/foreign interests, many Māori groups wish to take over the forest ownership progressively.

There is an estimated 1.4 million hectares of registered Māori land owned by Māori authorities, enterprises and individuals – plus additional privately owned land. A significant proportion of this land is yet to be developed to meet its full potential.

Māori participation in fast-growing sectors such as biotechnology, health ICT, high-tech manufacturing, agritech and fintech is increasing.

Globally, there is increasing interest in the visibility of business practices relating to sustainability, environmental wellbeing, and social outcomes. Māori enterprises tend to operate with values that are closely aligned to these global shifts in attitudes, including whanaungatanga, manaakitanga and kaitiakitanga. NZTE has a Māori strategy to support these developments and Te Pora Māori, its specialist Māori Business Group, enhances NZTE's engagement with the Māori economy. ■

CASE STUDY 5

Supporting start-ups and innovation: New Zealand Venture Investment Fund

The New Zealand Venture Investment Fund (NZVIF) was established in 2002 in response to a lack of supporting infrastructure and funding options available in the early stage capital market.

Its objectives were to:

- accelerate development of the venture capital industry by increasing the level of early-stage investment activity in the New Zealand market
- develop a larger pool of people in New Zealand's venture capital market with skills and expertise in early-stage management
- facilitate commercialisation of innovations from the Crown Research Institutes, universities and the private sector
- get more New Zealand businesses on paths to global success by increasing their access to international experts, networks and market knowledge.

Since its inception, NZVIF has invested over $223 million into 287 companies incorporated in New Zealand through partnerships with venture capital funds and angel networks. Those companies have raised a further $2.4 billion from private investors, with 54 per cent from international investors, and earned $5.6 billion in revenue and $3.9 billion in export earnings. Software, biotech and technology hardware companies have all benefited from early stage investment from NZVIF.

The pool of people in New Zealand's capital market with skills and expertise in early-stage investment has also grown, with flow-on effects on the number of venture capital deals being made in New Zealand. New investors, from angels to a small number of KiwiSaver Fund Managers, are taking renewed interest in aggregating capital into venture funds. A recent example is the establishment of Icehouse Ventures in May 2019, which aims to accelerate the growth and development of Kiwi entrepreneurs who have global aspirations.

This growth notwithstanding, New Zealand's venture capital market has yet to reach its full potential. Venture capital markets typically take 20 to 30 years to mature. Further investment is required to build a vibrant and self-sustaining New Zealand early-stage investment ecosystem that is investing in globally ambitious companies. Such an ecosystem is critical for setting the stage for emerging sectors to realise their full market potential. The 2019 Budget committed $300 million of government support for Series A and Series B capital rounds. ■

CASE STUDY 6

Making our mark offshore: the history of New Zealand Trade and Enterprise

As part of the economic and public management reforms of the late 1980s and 1990s, most government subsidies and incentives for economic development were removed, on the understanding that the market would allocate resources most efficiently. Support remained in place to assist exporting firms to access international markets through Trade New Zealand.

The Labour Government of 1999 established Industry New Zealand to support the development of sectoral and regional economic activity. Industry New Zealand focused on domestic economic development, with Trade NZ supporting successful domestic firms to take on global markets.

In 2003, recognising a need to enhance coordination and a more seamless service delivery, the government merged Industry New Zealand and Trade NZ into a new agency, New Zealand Trade and Enterprise (NZTE).

In its early years, NZTE had a wide brief, with responsibility for developing and implementing trade, industry and regional development policies, in partnership with industry, businesses, iwi, central and local government, and relevant community groups.

Various reviews of NZTE activity identified that the agency was 'inch-deep and mile-wide' and that this was not achieving the economic improvement envisaged. The government agreed to focus NZTE in a more targeted way to help capable New Zealand firms to succeed internationally.

NZTE is now the government's international business development agency, supporting companies to grow internationally for the benefit of New Zealand. It increases New Zealand companies' international success by helping them boost their global reach and build capability. This includes:

- using connections and government credibility on behalf of businesses and applying local in-market knowledge to help companies enter and grow in international markets
- linking businesses with services designed to improve efficiency and operations, spark innovation, refine strategy, enhance leadership and access capital – thereby helping them to build the capability they need to be successful.

An example of NZTE's value add is its work with Vista Entertainment Solutions, a world leader in cinema management software, to help Vista break into the Japanese market. Research by NZTE had indicated that one of the major Japanese movie theatre operators was at the end of their software depreciation cycle. NZTE helped Vista to develop a relationship with this company and position itself as a trusted leader in the cinema industry, able to commit to Japan over the long term. ■

New Zealand Government

LSE 4672 JUN19