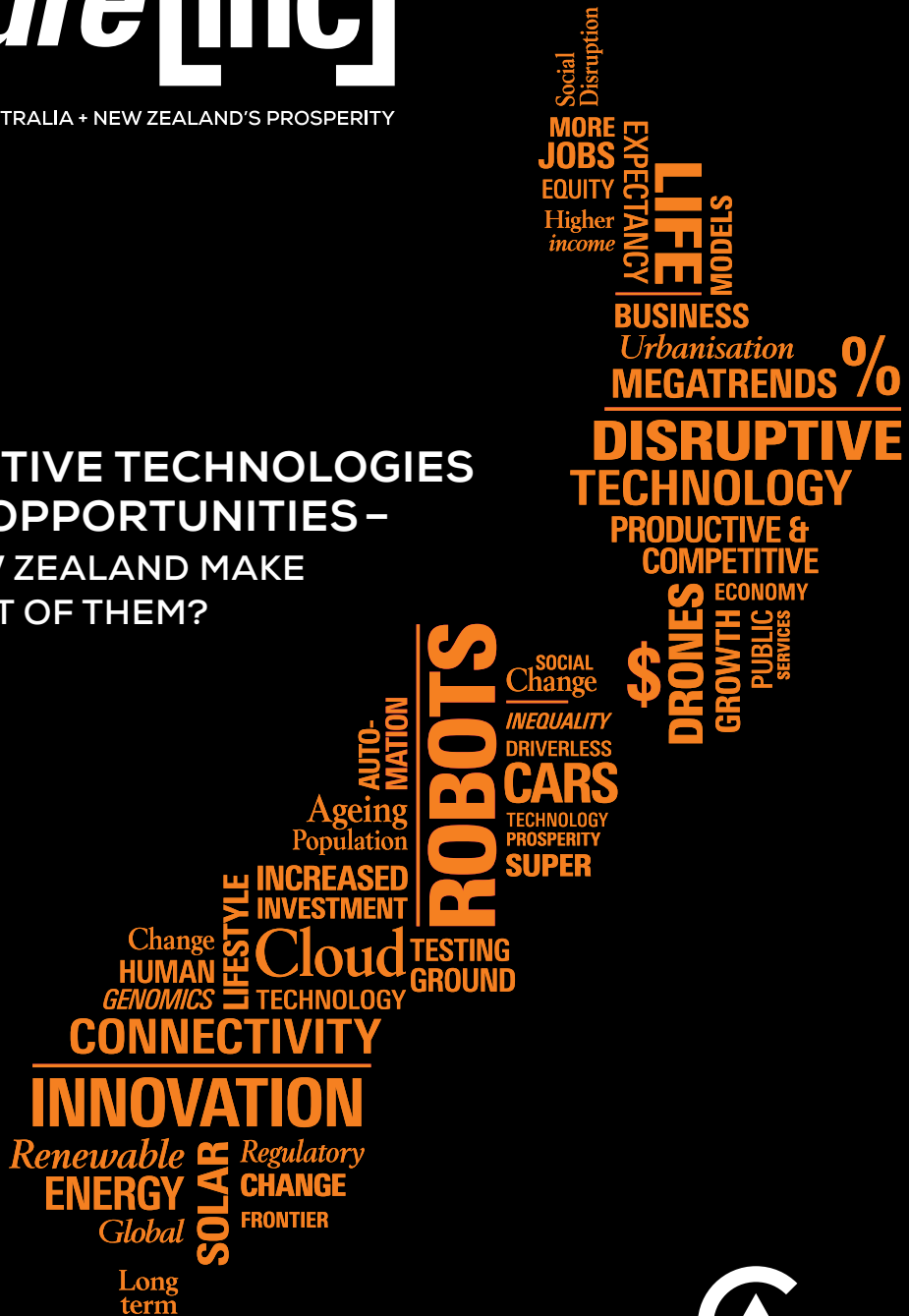


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A PLAN FOR AUSTRALIA + NEW ZEALAND'S PROSPERITY

DISRUPTIVE TECHNOLOGIES
RISKS, OPPORTUNITIES –
CAN NEW ZEALAND MAKE
THE MOST OF THEM?





CHARTERED ACCOUNTANTS
AUSTRALIA + NEW ZEALAND



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A PLAN FOR AUSTRALIA + NEW ZEALAND'S PROSPERITY

While we anticipate a future complete with robots and sprightly centenarians, one of the most fundamental shifts is already upon us. Technological change is gathering pace at a speed traditional businesses are scrambling to keep up with. Technology is changing the structure of the New Zealand economy and our role within the global economy faster than ever before.

There is a growing impetus for New Zealand businesses to adapt to minimise the disruptive effects of technology. Current business models won't be sustainable, and the need for change is becoming urgent. Public debate on the appropriate role of technology in New Zealand's economy and society is needed to ensure we address these issues as a nation.

In this paper we consider the impact technological disruption may bring to New Zealand and the extent to which we are prepared to take advantage of this disruption. For professionals, such as Chartered Accountants, to be truly valued we need to understand the risks and opportunities associated with disruptive technologies, challenge existing paradigms and use this knowledge to make informed decisions on the best way to navigate this sea of change.

Welcome to the conversation.



Fred Hutchings
President, Chartered Accountants
Australia and New Zealand



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AUSTRALIA + NEW ZEALAND

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885,000 (46%)

NEW ZEALAND JOBS AT RISK OF AUTOMATION IN THE NEXT TWO DECADES

24/7, 365 days

EXPECTATIONS OF CONNECTIVITY FOR MOST YOUNG NEW ZEALANDERS

\$1.4 trillion

ECONOMIC IMPACT DRIVERLESS
CARS ARE EXPECTED TO HAVE

3

ROBOTS EMPLOYED
AS CLEANERS AT
AUCKLAND AIRPORT



CONTENTS

06

SUMMARY

07

INTRODUCTION

08

THE FLEXIBILITY OF
OUR ECONOMY WILL
DETERMINE HOW WELL
WE CAN RESPOND

15

WHY THE COMING
TECHNOLOGY
TRANSITION WILL
BE DISRUPTIVE

20

RISKS AND
OPPORTUNITIES

29

FUTURE FORECAST –
INDUSTRY SPOTLIGHT
OF TECHNOLOGICAL
CHANGE IN NEW
ZEALAND

43

CALL TO ACTION

48

REFERENCES

Disruptive technologies, which create new markets and displace existing ones, are the new normal, and given New Zealand's relatively healthy economy and flexible regulatory environment, we appear to be well placed to evolve and prosper.

SUMMARY

We are a nation of enthusiastic adopters. We embrace technological change and its associated benefits. But any rapid change brings associated trade-offs and risks as well as benefits. It is these trade-offs and risks that must be subject to transparent public debate.

The pace at which technology is transforming our lives is exponential. Entire industries are being disrupted as new business models emerge. Regulators, businesses and individuals alike must adapt or be left behind.

Our legal and regulatory sectors must act to both protect society and foster innovation. They must modify their frameworks to accommodate technological advances.

The job market is changing and will continue to change. Some jobs will disappear. Some will be replaced by different roles that emerge from the relevant technology. Research suggests that roles requiring a low skill level are the most likely to be automated, and that the resulting job loss is likely to be most severe in regional centres. Studies suggest that jobs

requiring 'soft skills', such as creative and social intelligence, are at a relatively low risk of being automated.

In this paper, we explore various industries where technological change is set to significantly disrupt the status quo. Driverless cars, solar power and longer lives – all made possible by technological advancement.

Our small island nation is home to numerous disruptive technology companies. According to the CEO of one such company, Rocket Lab, New Zealand is the best place in the world to launch a satellite! These businesses are thriving despite low levels of governmental investment in innovation, by the standards of the developed world.

As stakeholders in our country's future, we must be aware of the impact disruptive technologies are having on our lives: good and bad.

In the final section of the paper, we present a series of suggestions that aim to challenge policy makers, businesses and individuals to mindfully embrace technological innovation.

Disruptive technologies have arguably changed our lives for the better. The world we now inhabit is more globally interconnected, convenient, and efficient than ever before.

INTRODUCTION

From the manner in which we communicate, to how wars are fought and the way that we work. The world has changed and there is no going back.

However, despite immense benefits to society, disruptive technologies bring about social, economic and environmental costs such as job obsolescence, and raise ethical issues such as the acceptability of certain medical innovations.

In this paper we explore the benefits and costs to society of disruptive technologies, and seek to promote public debate on each. We do this to ensure that we are consciously shaping our future, as the pace of technological change accelerates.

The **PACE OF CHANGE IS UNPRECEDENTED.**

While it took 50 years for electricity to reach 25% of homes in the United States (US), the internet reached 75% of US homes in only 15 years.

THE FLEXIBILITY OF OUR ECONOMY WILL DETERMINE HOW WELL WE CAN RESPOND

01 HOW FLEXIBLE IS OUR
ECONOMY?

02 HOW WELL PLACED IS NEW
ZEALAND TO MANAGE
TECHNOLOGICAL DISRUPTION?

03 PUBLIC DEBATE REQUIRED ON
HOW WE SHOULD HARNESS
THE POWER OF TECHNOLOGY



01

HOW FLEXIBLE IS OUR ECONOMY?

New Zealand appears to be well placed to adjust to disruptive technologies, as a result of our relatively flexible regulatory environment, moderate ageing trends and resilient economic environment, as discussed below.

- **Relatively light regulation** – New Zealand is ranked second only to Singapore, in World Bank global comparisons of the ease of starting up and doing business.¹
- **Comparatively low deficit** – Compared to most OECD countries, New Zealand's fiscal balance is only mildly in deficit and our total government debt represents only 38% of GDP, which is low by international standards.²

- **Resilience** – Ranked an impressive third in 2014, in 2012 New Zealand was rated first in the Forbes 2012 Best Countries for Business list. Forbes commented that 'New Zealand's economy is closely tied to Australia's, and both held up better than most during the global financial crisis'.³
- **Younger than most** – While New Zealand's population is ageing, the impact is quite moderate compared to many OECD countries, owing to both relatively high net migration and fertility rates. The 'fiscal tsunami' that is feared due to the ageing population is much less of a risk in New Zealand than other OECD countries.⁴

Opportunities exist to improve the strength and flexibility of our economy. This will enable New Zealand to capitalise on the opportunities made possible, whilst successfully managing the associated risks and challenges of disruptive technologies.

Our 20th century **REGULATORY SETTINGS NEED MODERNISING** to keep pace with 21st century technological change.



02

HOW WELL PLACED IS NEW ZEALAND TO MANAGE TECHNOLOGICAL DISRUPTION?

New Zealand's ability to manage technological change depends on the extent to which we adapt to the changes fuelled by the digital economy.

New Zealanders are enthusiastic technology adopters. For example, take-up of smart phones has been very quick, and internet usage across all regions, ages and genders is now close to universal. As illustrated in Figure 1, overall, New Zealand household internet penetration is over 90%, more than double the current global average and marginally higher than other developed economies such as Australia, Japan and South Korea. Rural broadband provision

Several **CAREER CHANGES** may be required over a persons' working life given the **PACE OF TECHNOLOGICAL CHANGE**.

also compares favourably to other countries, such as Singapore, Australia and the United Kingdom (UK). Continued investment in rural technological infrastructure will be important to ensure that the regional divide does not intensify.

The pattern of globalisation is also a very beneficial tailwind for New Zealand - the world is coming to us, as an increasing share of global economic activity takes place in Asia. The opportunities for trade are clear. Exports and tourism will increasingly focus on Asian emerging economic powerhouses.

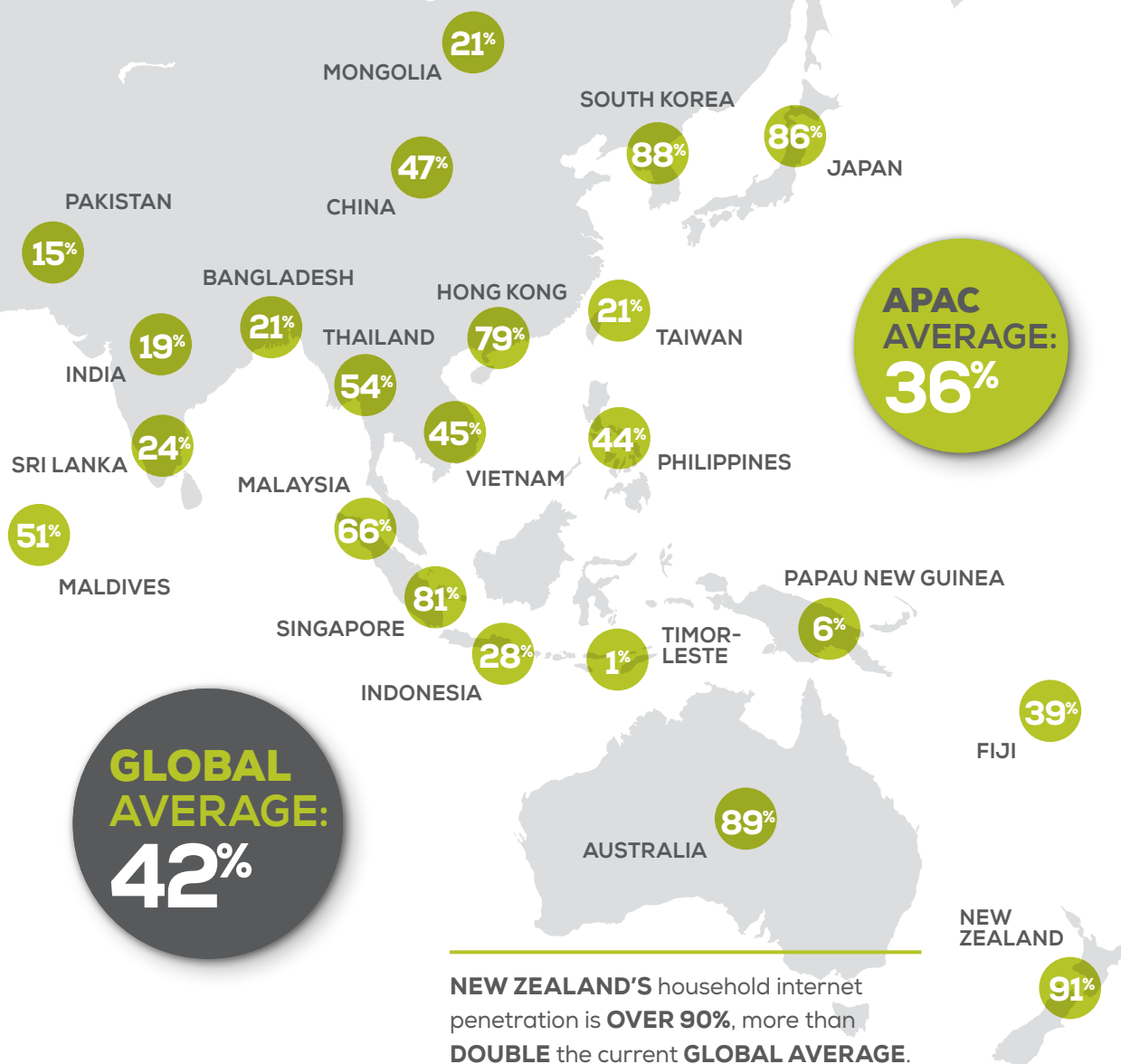
While familiarity with technology is important, the ability of people to win the race against technology will be contingent on opportunities for re-training and up-skilling.

The increasing pace of technological progress will likely cause higher job turnover, and a higher level of 'frictional unemployment'. This suggests that, more than ever before, New Zealanders need to be prepared for changing occupations during the course of their careers. This may not be unwelcome in itself as new technologies and longer life-spans imply increased opportunities to change careers.

FIGURE 1

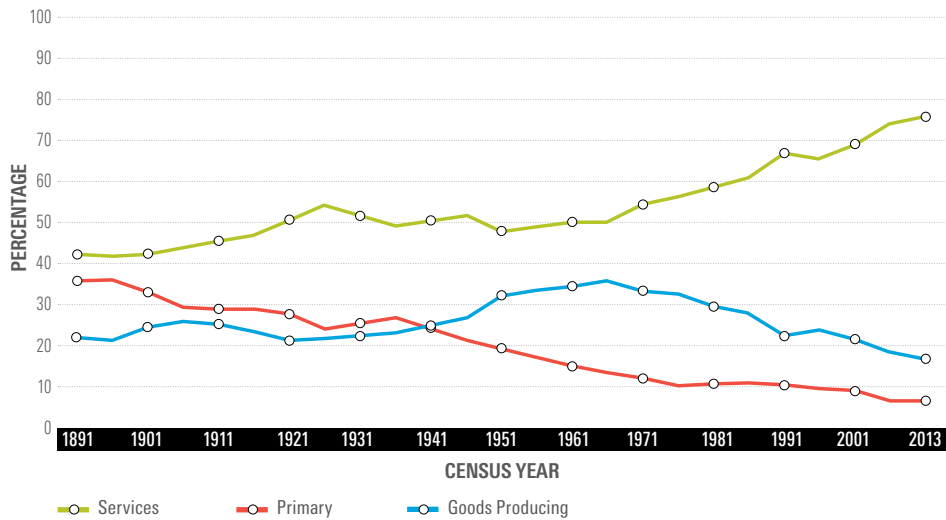
APAC INTERNET USE

NATIONAL INTERNET PENETRATION FIGURES (MARCH 2015)



SOURCE: WeAreSocial, Singapore (US Census Bureau, Internet World Stats, CNNIC, IAMA)

FIGURE 2: EMPLOYMENT BY INDUSTRY SECTOR



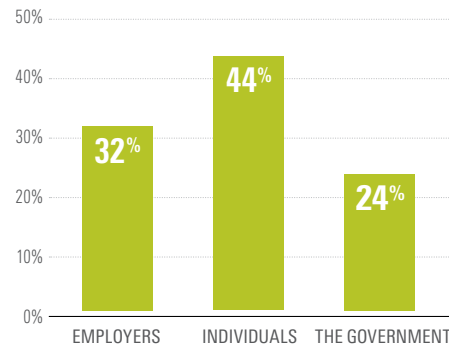
SOURCE: Adapted from Statistics New Zealand 1891–2013 census data⁵

New Zealand will also need to address the **THREAT THAT DISRUPTIVE TECHNOLOGY POSES TO THE SERVICE SECTOR**, which now **EMPLOYS THE MAJORITY** of New Zealanders.

We conducted a survey of 2,300 New Zealanders in order to get a view on their awareness of, and attitudes to, technological change. To cope with the accelerating risk of job turnover, New Zealanders need to be prepared to adjust, especially those working in the service sector which, as illustrated in Figure 2, employs almost 80% of New Zealanders.

We asked these New Zealanders who they thought should bear the cost of training and up-skilling – employers, individuals or the government. As depicted in Figure 3 below, the vast majority (around 75%) consider the cost of training to be the responsibility of the employer or individual. The minority (around 25%) consider the cost of up-skilling to be the government's responsibility. These results suggest that New Zealanders are agile and recognise the need to be responsible for managing their own career prospects.

FIGURE 3: WHO SHOULD BEAR RESPONSIBILITY WHEN TECHNOLOGIES PUT JOBS AT RISK?



SOURCE: NZIER, Colmar Brunton survey commissioned by Chartered Accountants ANZ, July 2015

We also asked survey participants about the extent to which they think their jobs are at risk from technological change over the coming decade. Irrespective of occupation category, survey results suggest that people perceive a low to moderate degree of risk. Our modelling suggests that a number of occupational types have a much higher risk of job obsolescence than that perceived by our survey respondents. This finding is discussed in more detail later in the paper.

Although New Zealanders may be prepared to accept the responsibility to re-train or up-skill, their awareness of the need to do so is lower than what may be required.



03

PUBLIC DEBATE REQUIRED ON HOW WE SHOULD HARNESS THE POWER OF TECHNOLOGY

Whilst embracing technological advancement with enthusiasm, we must ensure that technology is not carelessly woven unchecked into the fabric of our lives.

Historically, New Zealanders have been proactive in debating the risks of new scientific developments, as in the case of nuclear power, offshore mining and genetically engineered crops. Are the potential impacts of these emerging technologies tangible enough to prompt us to question them?

Is there a tipping point, a moment of critical mass when it will be too late to wind back these rapidly emerging technologies – when technology controls us, rather than the other way around?

‘The **HUMAN SPIRIT MUST PREVAIL** over technology.’ – Albert Einstein

An appropriate regulatory framework must be developed to encourage constructive business innovation. New Zealand needs adequate research and development investment to enable collaborative, progressive and considered technological advancements for the benefit of our economy and society.

We also need to ask ourselves why we employ technologies. To make our lives easier? In what way and for whom?

We urge you, as business leaders, to be at the forefront of change in asking these questions and prompting intelligent debate in New Zealand. There will be important trade offs to be made, and these decisions should be made inclusively. Public debate will help to ensure that appropriate regulatory settings are created to encourage and stimulate innovation, while maintaining the integrity of our values and culture for future generations.

WHY THE COMING TECHNOLOGY TRANSITION WILL BE DISRUPTIVE

01 INCREASING PACE OF CHANGE

02 WHAT THE EXPERTS THINK ABOUT JOB CREATION AND DESTRUCTION

03 24/7 CONNECTIVITY - THE FUTURE IS ALREADY HERE



01

INCREASING PACE OF CHANGE

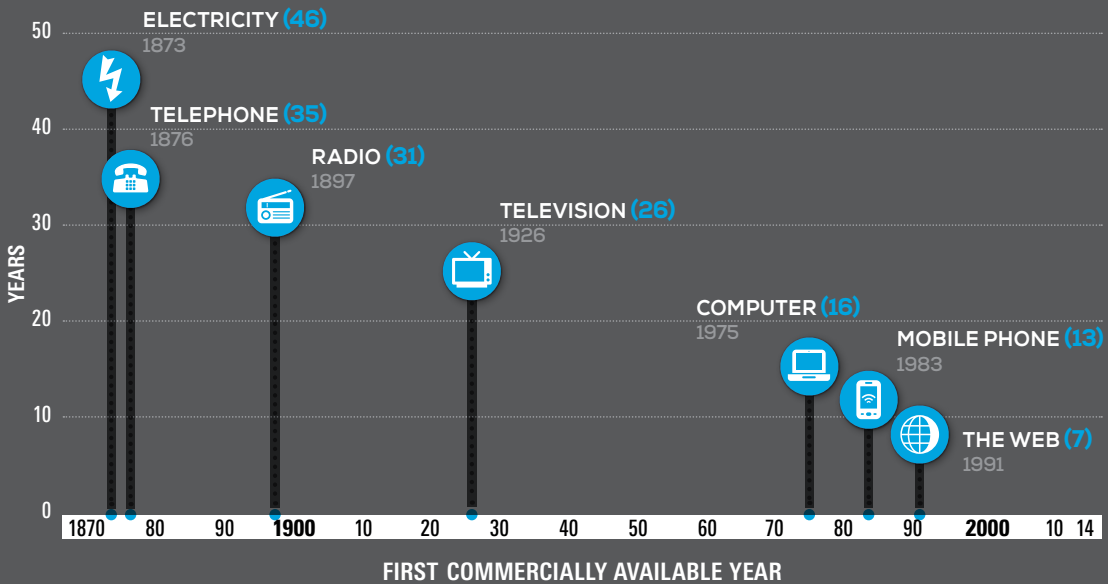
McKinsey & Company estimate that the current ratio of change is ten times that of the Industrial Revolution. They also say change is happening at 300 times the scale and with roughly 3,000 times the impact.⁶ These changes are propelled by the world's

growing population. In addition, increased global connectivity, means innovations are being rapidly diffused and adopted across the globe. Figure 4 illustrates the increasing pace at which technology has been adopted in the United States since 1870. It is not unreasonable to assume that the adoption of technology in New Zealand has followed a similar trend.

FIGURE 4

THE INCREASING PACE OF CHANGE

TECHNOLOGY ADOPTION – YEARS UNTIL USED BY 25% OF AMERICAN POPULATION



SOURCE: Singularity.com⁷

02

WHAT THE EXPERTS THINK ABOUT JOB CREATION AND DESTRUCTION

The speed of technological and social change is increasing. This raises the divisive question: could the costs of change outweigh the benefits for extended periods? In a 2014 survey of 1,896 experts conducted in the US⁸, around half envision a future where robots and digital agents displace significant numbers of blue and white collar jobs. The other half expect that technology will create more jobs than it displaces. The survey identified key themes with reasons to be hopeful and reasons to be concerned:

REASONS TO BE HOPEFUL

- While advances in technology may displace certain types of jobs, historically they have also resulted in net job increases
- We adapt to changes by inventing entirely new types of work, and by taking advantage of uniquely human capabilities
- Technology will continue to free us from day-to-day drudgery, and allow us to define our relationship with 'work' in a more positive and socially beneficial way
- Ultimately, as a society we control our own destiny through the choices we make.

REASONS TO BE CONCERNED

- So far automation has impacted most on blue-collared employment. However, the coming wave of innovation threatens to upend white-collar work as well
- Certain highly skilled workers will prosper in this new environment but far more may be displaced into lower paying service industry jobs at best, or permanent unemployment at worst
- Many educational systems may not be adequately preparing us for the work of the future, and some political and economic institutions appear to be poorly equipped to adjust.

The coming wave of innovation **THREATENS TO UPEND WHITE-COLLAR WORK.**



03

24/7 CONNECTIVITY – THE FUTURE IS ALREADY HERE


An important element of technological change is mobile connectivity – the ability of people to stay in touch with business, family and friends 24/7. In just 16 years the mobile phone has become ubiquitous in New Zealand. This is also true for the rest of the developed, and much of the developing world. The immediate connectivity of people has enabled innovative entrepreneurs to develop

disruptive new business models, which have changed the way many now do business. The revolutionary power of companies, such as Airbnb and Uber, allow consumers to take part in the ‘sharing economy’, which bypasses conventional providers of goods and services.

The sharing economy effectively connects people who have certain goods and services with those who don’t, and makes it viable for anyone to advertise and sell goods and services that were once only provided by full-time businesses.

CASE STUDY

AIRBNB



Airbnb operates via an enormous network of private individuals willing to rent out their rooms or homes to accommodation seekers. Conceived in 2008 by a trio of men who decided to rent out an air mattress on their floor to help pay the rent, the company is now worth over US\$20 billion, more than

almost every hotel chain in the world, and it does not own even a pillow. Airbnb is experiencing explosive growth. In the summer of 2010, 47,000 people stayed with Airbnb hosts, while in the northern summer of 2015, 17 million guests used the service.⁹

While Uber and Airbnb connect people to each other, another technology is expanding exponentially and is set to change the way we work, commute, communicate and collaborate. The Internet of Things (IoT) describes another phenomenon of hyperconnectivity in which inanimate objects are equipped with the ability to transfer data - without human or computer input. It is anticipated that every object will be uniquely identifiable and create a melding of the digital and physical worlds.

We can see examples of this technology already, when our smart phone gives us a real time arrival for a bus, but this technology has the potential for much more. The IoT will generate entirely new job roles and titles

and while it is difficult to predict exactly how this will look, new professions will likely include medical robot designers, grid modernisation managers and privacy protection engineers.

The IoT technology will monitor our health, energy consumption, decongest traffic through intelligent design, keep a close tab on our productivity, and further reduce the need to go to an office to work. It will produce mega data that enables complete operational efficiency and eliminate downtime.

The IoT is expected to generate an unprecedented competitive advantage. It is likely that those businesses who fail to see the urgency of adopting this technology will be left behind.

CASE STUDY

UBER



While traditional taxi companies must adhere to the rules and monitoring policies required by transport providers the world over, Uber has taken advantage of a regulatory gap in the industry and taken urban transport by storm. Conceptualised by co-founder Garrett Camp, it was initiated in 2009 from frustrations at being unable to find a taxi on the streets of San Francisco.

Connecting 'drivers with riders' via a smart phone app, Uber operates in 60 countries and provides over one million rides every day. Part chauffeur service,

part tech company, Uber has been steeped in controversy, with strong opposition expressed by conventional taxi drivers. It continues to expand however, and its active driver base has grown from zero in mid-2012 to over 160,000 at the end of 2014. Uber is currently worth US\$40 billion.¹⁰

Uber is facing legal action all over the world. But while it is being banned in some cities, it continues to thrive in many others, and is a clear illustration of how technology can disrupt an industry at the click of an app.

RISKS AND OPPORTUNITIES

01 JOBS AT RISK –
INTERNATIONAL RESEARCH

02 WHICH JOBS AND INDUSTRY
SECTORS FACE MOST CHANGE
IN NEW ZEALAND?

03 HOW DO THE RISKS FALL
ACROSS THE COUNTRY?

04 CAN INNOVATION SAVE
THE DAY?



01

JOBS AT RISK – INTERNATIONAL RESEARCH

A recent US study¹¹ by Frey and Osborne of the Oxford Martin Programme, suggests that almost half of American jobs could be vulnerable to automation over the coming two decades. The study estimated the susceptibility of jobs to computerisation across 702 different occupations by categorising jobs into high, medium and low risk occupations, depending on their probability of computerisation.

Key findings were:

- Around 47% of total US employment is in the high risk category – jobs expected to be automated relatively soon, perhaps over the next 20 years
- Most workers in transportation and logistics, together with the bulk of office and administrative support workers, and labour in production occupations, are at high risk
- A substantial proportion of employment in service occupations, where most US job growth has occurred in recent decades, are highly susceptible to computerisation
- Jobs most at risk tend to attract lower wages and require lower levels of education.

The study concludes that as technology progresses, computerisation is predicted to have the most significant impact on lowly skilled and lowly paid occupations. As workers in those occupations are displaced, they must focus on the development of their soft skills, including creative and social intelligence.

LOW-SKILLED WORKERS will look to move into roles that are less **SUSCEPTIBLE TO COMPUTERISATION**, for example, jobs requiring creative and social intelligence.



02

WHICH JOBS AND INDUSTRY SECTORS, FACE THE MOST CHANGE IN NEW ZEALAND?

We applied Frey and Osborne's¹² estimate of job automation to New Zealand employment data. We were interested in whether we would get similar results to the US, and where those impacts might fall across the country. We found 46% of the New Zealand work force faces a high risk of computerisation, similar to the US figure. This may reflect that developed economies employment industry profiles are similar.

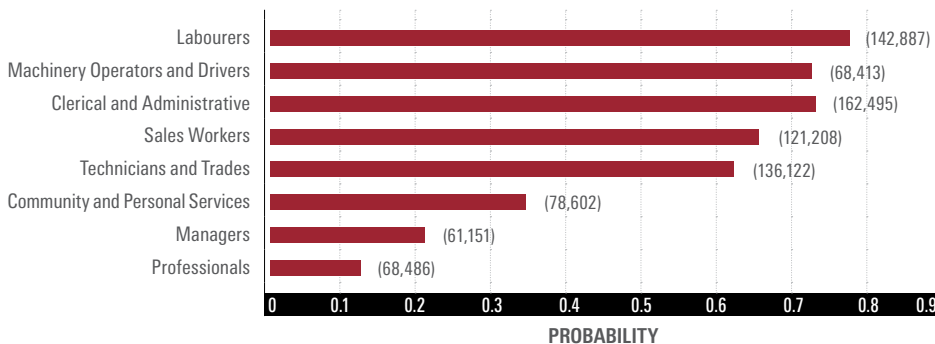
Nearly 50% of all jobs in New Zealand could be at risk of computerisation and automation.

Figure 5 profiles the categories of employment which could be at high risk of automation in New Zealand, and records the number of people potentially affected in each category. Around 75% of labouring jobs have a high-risk or probability of automation, while at the other extreme around 12% of professional roles are at risk of automation. These differences reflect the degree to which jobs that are routine in nature, can be easily replicated by robotics and automation. Our modelling does not explicitly consider other challenges to occupations such as those created when new business models are developed.

It is also important to note that our job computerisation model is only concerned with labour supply, and not with the demand for labour or competition. It is unlikely that the manufacturing employment decline observed in New Zealand is due simply to automation.

FIGURE 5: EMPLOYMENT AT HIGH RISK OF AUTOMATION BY OCCUPATION

(Numbers in brackets represent the number of jobs at high risk of automation)



SOURCE: Adapted from NZIER, Statistics New Zealand¹³, based on Frey and Osborne¹⁴

Increasing foreign competition, and the global shift of manufacturing to China, in particular, may also have played a significant role. Similarly, the growth in education and training no doubt in part reflects increasing demand by New Zealanders and foreign students for higher levels of education.

New Zealand has retained its relatively stable and high employment rate, despite substantial automation over recent decades. Consider the example of bank machines, which have replaced many thousands of

bank tellers who used to manually count and dispense cash.

Automation and technological developments can also create new occupations. Pew Research compared the list of occupations in the US used in 1999 to those used today for national statistical purposes¹⁵. They found that approximately 500,000 people work in occupations today that did not exist in 1999 such as network specialists, network architects, information security analysts and web developers.



CASE STUDY

ACCOUNTANTS AT RISK

We conducted detailed analysis based on the above model, predicting job loss due to automation within the accounting profession. This analysis found that all but two roles within the accounting profession (corporate treasurers and secretaries) are at high risk of automation. Such findings reinforce the need to continue to reposition the profession as trusted strategic business advisors, who can offer significantly more to businesses than pure accounts processing and financial statement preparation. While the number of New Zealanders working as accountants has been increasing (by almost 6% between 2012 and 2014)¹⁶ this trend is set to reverse in the coming decade as automation takes hold. This prediction is shown in Figure 6. Such a stark prediction may not be dissimilar to predictions for the 'paperless' office – forecasts based on

critical assumptions which may be flawed in some way. Nevertheless it is definitely a 'wake up' call to the profession to adapt their offerings to continue to stay relevant and employed. As business leaders, accountants must continue to develop a broader range of skills to ensure that their role in the changing economy is retained.

As businesses endeavour to maximise the benefits of 'big data', data analysts are the number one professional service occupation predicted to flourish as a result of disruptive technologies. The ability of many professions, including accounting, to survive will depend on their ability to successfully combine a range of skill-sets, including technical knowledge, critical business thinking, strategic insight and relationship management.

New Zealand has had a similar experience to that of the US, in the creation of entirely new occupations. These jobs tend to be concentrated in technology related sectors, which helps to explain why New Zealand's technology sector is flourishing.

Large technology multi-nationals are established, and home grown champions such as Datacom, Xero, FNZ and Gameloft, have shown we are able to develop and market globally valued products and services.

Xero topped the Forbes magazine '100 most innovative growth companies' list in June 2014, an encouraging sign for New Zealand's ability to successfully produce innovative companies.

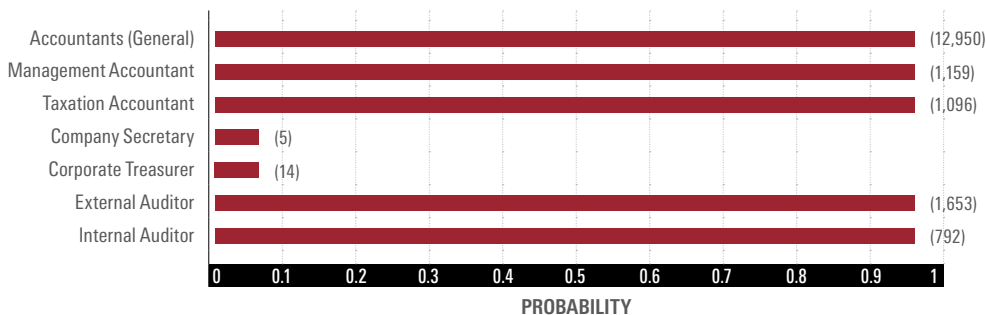
Another impressive example of the ability of New Zealand businesses to push the

global technology frontier, is the case of the Auckland-based, US-controlled company, Rocket Lab. Rocket Lab has developed a dramatically lower-cost launch technology called the Electron to send satellites into low earth orbits. It is early days for the company, but with the backing of NASA and Lockheed Martin, the potential for New Zealand to create a viable aerospace industry is very real. In the words of founder Peter Beck:

"Our vision at Rocket Lab, is to make space commercially viable and more accessible than ever before, doing what the Ford Model T did for consumer automobiles. This technology will really open space for business. We're currently considering a shortlist of regions as potential locations for a space port, and encourage any region interested to get in touch with us now."¹⁹

FIGURE 6: NUMBER OF ACCOUNTANTS AT HIGH RISK OF AUTOMATION BY ROLE (BASED ON NEW ZEALAND CENSUS DATA)

(Numbers in brackets represent the number of accountants at high risk of automation)



SOURCE: Adapted from NZIER, Statistics New Zealand¹⁷, based on Frey and Osborne¹⁸



CASE STUDY

NEW ZEALAND POST

New Zealand Post has been impacted by disruptive technologies as letter mail is replaced by electronic communication. In November 2013, New Zealand Post Group launched a refreshed five-year strategy called 'Delivering our Future'.

It revolves around streamlining mail (letter and parcel) operations in response to falling letter volumes and increasing parcel volumes as online purchasing grows. As labour is New Zealand Post's largest cost, employee numbers are forecast to reduce by around 20% between 2014 and 2018. In order to prepare employees for change, New Zealand Post have established a 'Future Zone' initiative primarily for staff whose jobs are changing or will cease to exist.

New Zealand Post has been pro-active in changing their business model, seeking an amendment to the Deed of Understanding with the government which allowed them to reduce the standard mail delivery schedule. It has also collaborated with new partners, such as Australia Post, positioning the combined entities as one integrated 'Australasian' parcel destination. As an integral part of 'Delivering our Future', New Zealand Post has developed an e-commerce platform, strengthened its banking and retail arms, and is trialling an 'integrated delivery agent' vehicle that will enable the delivery of both letters and parcels.²⁰



03

HOW DO THE RISKS FALL ACROSS THE COUNTRY?

We would expect automation to disproportionately impact New Zealand’s regional economies given their focus on primary industries. As a result, we may see the continuation of government efforts and policies focused on regional adjustment and development, such as further investment in the Regional Growth Plan and Rural Broadband Initiative.

Our expectations were confirmed when we applied Frey and Osborne’s estimate of US job

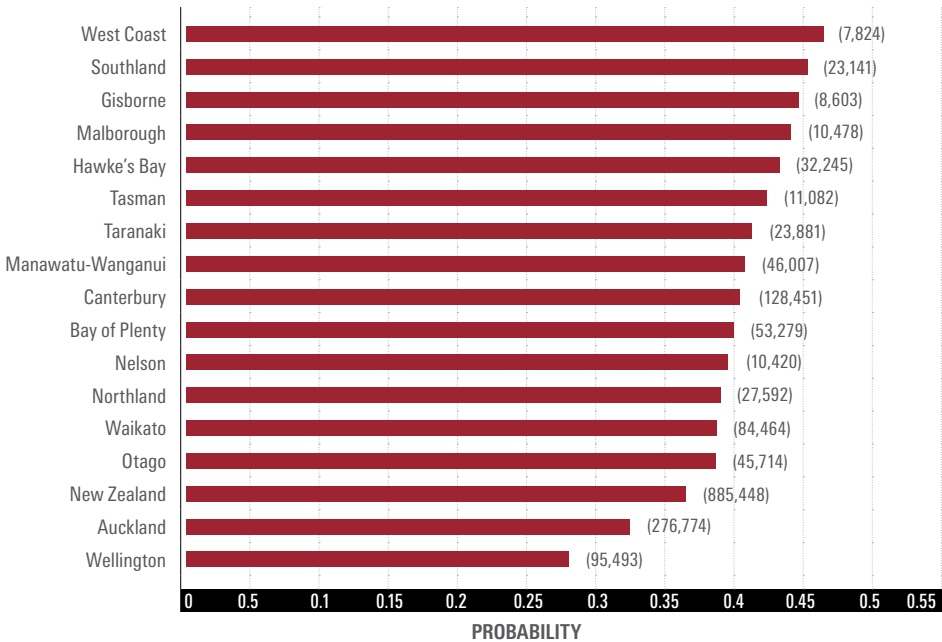
automation to New Zealand employment data. We found that New Zealand’s regional work-force faces a greater risk of computerisation than the New Zealand average. We also found that the risk for Auckland and Wellington was noticeably lower than that for other regions. This is illustrated in Figure 7 below.

“The Government “owes it” to the West Coast to come up with a regional development strategy that would create new jobs in the region.’

– Andrew Little, Leader of the Opposition²¹

FIGURE 7: JOBS AT HIGH RISK OF AUTOMATION – REGIONAL IMPACT

(Numbers in brackets represent the number of jobs at high risk of automation)



SOURCE: NZIER, Statistics New Zealand²²

04

CAN INNOVATION SAVE THE DAY?

In order for New Zealand to reap the opportunities presented by emerging technologies, businesses will need to be innovative and collaborative. As business leaders, we need to encourage our organisations to be 'thoughtful integrators' and to partner with non-traditional players. An example is the recent collaboration between Meridian Energy and Xero. On 1 September 2015, Meridian and Xero joined forces to offer customers the opportunity to have their electricity data invoices automatically fed into their Xero accounts. This partnership seeks to save Kiwi businesses time, energy, and paper, and further positions both companies as 'thoughtful integrators'.

It is vital that New Zealand continues to push the boundaries of what is possible and test out new ideas. Given the pace of technological change, speed to market is essential.

'Ambitious and driven people tend to be the **INNOVATORS AND THE GLOBAL DISRUPTORS**; the new age job creators. They are the people who can **GIVE OUR ECONOMY AN EDGE** in a digital age where distance is no impediment to wealth creation.' – Hon. J. B. Hockey, former Australian Treasurer²³

So while investment in innovation research is increasing, more can be done.

Government has been increasing its investment in support of innovation. Funding to enable enhanced innovation for businesses, and research science and technology providers, nearly doubled between 2013/14 and 2014/15²⁴. Funding to support science and innovation has now surpassed \$1 billion (increasing from \$897m in 2014/15 to \$1.09b in 2015/16)²⁵. In addition, government announced its intention to develop regional science institutes as part of Budget 2015. These institutes will be instrumental in creating an effective research and testing base in regional New Zealand.

Callaghan Innovation, one of the main benefactors of government investment in innovation, considers that businesses which stay ahead of global competition through innovating and successfully commercialising their ideas, are more likely to improve their productivity, grow their export revenue, and employ more people in higher-wage work. While growing, New Zealand business innovation remains low by the standards of developed economies.²⁶



A number of bodies, including the New Zealand Hi-Tech Trust and the New Zealand Innovation Council, have been established recently to publicly reward innovation. The New Zealand Stock Exchange, NZX, established a new market in 2014, designed specifically to target small to mid-sized businesses whose growth potential may be constrained by a lack of expansion funding. The new market, NXT, provides a platform from which businesses can achieve their growth potential. Crowd funding platforms and peer to peer lending companies, such as Harmony, are also making it easier for new businesses to access the much needed funds to 'start up'. Access to funding is no longer a significant barrier for innovative enterprises.

The Kiwi Landing Pad offers New Zealand technology companies either short or long-term residence at their office in San Francisco. It provides tenants with access to a wealth of experience and enables them to create invaluable networks in the US technology, business and investment community.²⁷ Access to international connections are no longer a barrier. New Zealand Trade and Enterprise (NZTE) is a key enabler in this space.

'New Zealand is the best place in the world to launch a satellite.' – Peter Beck, Founder and CEO Rocket Lab²⁸

New Zealand also has a unique global position and geography that makes it the ideal place to set up boutique businesses.

FUTURE FORECAST – INDUSTRY SPOTLIGHT ON TECHNOLOGICAL CHANGES

01 SMART CARS WILL RESHAPE
THE FUTURE SOON

02 SHINING A LIGHT
ON THE GREEN GRID

03 MANUFACTURING
IMMORTALITY



FUTURE FORECAST

01

THREE INDUSTRY SPOTLIGHTS

We explore three industries to illustrate some of the business and social transformations that are emerging as a result of new technologies. We include responses to our survey of 2,300 New Zealanders on each area of innovation.

- **Smart cars** focuses on the economic, business and social disruption which will come once autonomous vehicles start to appear on roads
- **Energy transformation** focuses on how quickly solar power generation will be adopted in New Zealand and the potential impact on the electricity industry
- **Radical extension of life** focuses on a more speculative area of innovation. We explore more deeply held social attitudes towards technological changes.

SMART CARS WILL RESHAPE THE FUTURE SOON

Google's self-driving car has started revolutionising the world of transport. Four US states, plus Washington DC, have passed legislation allowing driverless cars. Later this year, automated taxi pods will start running on the streets of England's Milton Keynes, offering rides around the town. The UK government is updating the highway code to take account of driverless cars.

Within a decade we will likely share motorways with driverless trucks.

Steve McNamara, head of the Licensed Taxi Drivers Association, told the BBC that driverless cars didn't threaten his job.

'Autonomous vehicles will need primary legislation changes to operate on UK roads, the technology is in its infancy and untried and tested in busy urban environments, it ain't happening for many a year. In reality it is doubtful if autonomous cars could ever work alongside conventionally driven vehicles.'²⁹

Regulation will play a major role in determining the speed of uptake of driverless cars across the world.

Regulation pending, the introduction of driverless cars means that car ownership may become an outdated concept. In order to retain their relevance, car companies are starting to adapt and broaden their offerings. For example BMW have partnered with JustPark which finds the nearest available parking space for drivers. A similar

product, Parkable, has just been released in New Zealand by innovators driven by disrupting legacy markets with ground breaking technology.

We are already seeing a number of models of cars on the market with 'semi-autonomous' driving features. These include forward collision avoidance systems such as autonomous braking (when drivers fail to do so), lane keeping (helping the driver to avoid crossing the centre line), headlights that automatically adjust to light conditions, and smart cruise control that automatically keeps a cars following distance fixed.

Recently there have been announcements introducing 'level 3' autonomous vehicle technology to the market – driving functions are sufficiently automated that the driver can safely engage in other activities. Examples include:

- Mercedes-Benz Intelligent drive packages (available in its S-Class car) which allow drivers to let the car steer, brake and accelerate in traffic moving at less than 60Kph
- By 2016, Mercedes plans to introduce 'Autobahn Pilot', which allows hands-free highway driving with autonomous overtaking of other vehicles

- By 2020, GM, Mercedes-Benz, Audi, Nissan, BMW, Renault, Tesla and Google all expect to sell vehicles that can drive themselves at least part of the time
- In November 2015, Volvo will start testing driverless cars in South Australia with further regional test sites sought; Volvo's managing director Kevin McCann commented: 'The trials in South Australia this November will be the first of many trials nationally, with discussions underway in a number of jurisdictions. ARRB Group is calling for additional states, territories and partners to support this important national research initiative. We're seeking technology and automotive industry partners to assist us in Australia's driverless vehicle innovation.'³⁰

There is an opportunity for New Zealand to market the West Coast, or other regional towns suffering from job loss due to automation, as testing grounds for driverless cars and other technologies.

- In 2015, Freightliner unveiled the world's first road-legal, self-driving big rig – the Inspiration Truck.

Within 10 years, commuters are likely to find themselves being passed by not only driverless cars, but also driverless trucks on motorways, assuming no regulatory barriers are introduced in New Zealand that might stop their adoption.

Driverless vehicles have **ENORMOUS DISRUPTIVE POWER**. They may destroy or reshape public transport systems, accelerate urban sprawl, and destroy many jobs.



THE POTENTIAL BENEFITS AND DRAWBACKS

Most experts agree that, although driverless cars will never be crash-proof, they are much safer as they minimise human error. Relatively primitive Electronic Stability Control (ESC) technology, introduced around 2000 in many cars, demonstrates the safety gains afforded by technology. The Highway Loss Data

Institute (HLDI) estimates that ESC lowers the risk of a fatal single-vehicle crash by about half and the risk of a fatal rollover by as much as 80%³¹.

The Rand Corporation extensively investigated the benefits and drawbacks of the self-driving vehicles³². We summarise their conclusions and other research we have undertaken in Table 1.

TABLE 1: BENEFITS AND DRAWBACKS OF SMART AND DRIVERLESS TECHNOLOGIES

BENEFITS	DRAWBACKS
Fewer vehicle crashes , as many crashes are caused by driver error	
Increased mobility of the young, the elderly, and the disabled	Urban sprawl is accelerated as the cost of travel is much lower and occupants spend time in other activities
Decreased congestion from more efficient traffic flow – driverless vehicles could increase road capacity by between 50% – 250%	Because the technology would decrease the cost of driving and increase car use there is a risk that, congestion might increase, rather than decrease in some areas
Productivity and fun vehicle occupants could spend travel time engaged in other activities	Obsolete occupations – public transit, taxi driving, crash repair, and automobile insurance
Space used for parking could be repurposed mobile driverless cars mean fewer parking spaces are needed, and spatially concentrated parking is not required	Public transport at risk – the ease and convenience of driverless cars may compete with public transport use

SOURCE: Based on Rand Corporation 2015³³

These are wide ranging social and economic impacts. The conclusion that driverless technologies will make some occupations obsolete is in line with our estimates of jobs at risk – the transport, postal and warehousing sectors have the highest risk of job losses. But there are far more wide ranging impacts than job losses. Lowering the cost of travel and increasing its convenience could lead to more urban sprawl and adversely impact on public transport. Lower road accidents could also impact on the insurance industry and even increase life expectancy. Driverless cars are also likely to benefit the ageing population, providing mobility while removing the necessity to drive.

GOOD BYE TO PUBLIC TRANSPORT AND A RETHINK FOR URBAN PLANNERS?

The International Transport Forum (ITF), a division of the OECD, recently modelled the use of self-driving cars in Lisbon and found that shared 'taxibots' could reduce the number of cars required by 80 to 90%, while substantially increasing the distance travelled. As a result, it is conceivable that a fleet of self-driving vehicles could 'completely eliminate the need for traditional public transport' even in lower take-up scenarios³⁴.

As a recent article³⁵ pointed out, transport policy has tended to view public transport networks as a fixed entity around which urban structures and individuals are expected to

arrange themselves. Driverless vehicles offer the prospect of transport systems (which may well involve significant public provision) that better suit people's needs.

The impact of autonomous 'public' transport using small driverless vehicles may be transformative – passengers can travel whenever they want, 24/7, to exactly where they want to be. The 'last mile' of walking in the dark from rail or bus stops to their home may become a thing of the past. Given this potential, the merits of investing billions of dollars more in public transport systems in Auckland is less clear – stranded asset risks are possible.

BUT NEW ZEALANDERS ARE NOT SO CONVINCED OF THE BENEFITS...

Driverless vehicles have enormous disruptive power. They may destroy or reshape public transport systems, accelerate urban sprawl, and destroy many jobs including bus drivers, taxi drivers, traffic police and truck drivers. Yet potentially they bring enormous social benefits. Reductions in road deaths and injuries, the freeing up of parking space and on-demand travel convenience without the need for an expensive chauffeur to name just a few.

As illustrated in Figure 8, the majority of New Zealanders (74%) think people will buy and use driverless cars, however only around half (51%) believe that the introduction of



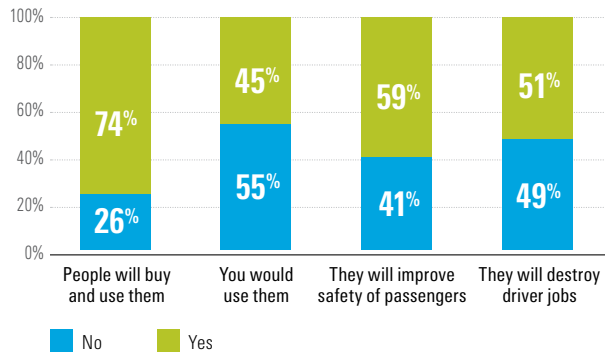
driverless cars will destroy the jobs of drivers. Only a small majority believe they will increase the safety of passengers (59%). Also, while the majority of New Zealanders see other people using driverless vehicles, they are less inclined to see themselves using the cars (45%). Overall, given the infancy of the technology, we think this result bodes well for rapid uptake of driverless vehicles in New Zealand.

There are many opportunities to use driverless vehicles, such as transferring passengers between the airport or cruise ship and the CBD. Driverless vehicles have been used to shuttle passengers from Heathrow airport to the parking lot since 2011.

We asked New Zealanders who they thought would be liable when things go wrong. While driverless vehicles will have a substantially lower crash rate than human drivers, this does not mean crashes won't occasionally happen due to, for example, faulty software. Responses to this question are reasonably evenly spread as shown in Figure 9, with the exception of the 31% who believe that the software supplier should be held liable, well above the 22% who thought liability should rest with the person in the car.

These results signal that a number of important regulatory issues will need to be addressed before New Zealand is able to market itself as a testing ground for driverless vehicles.

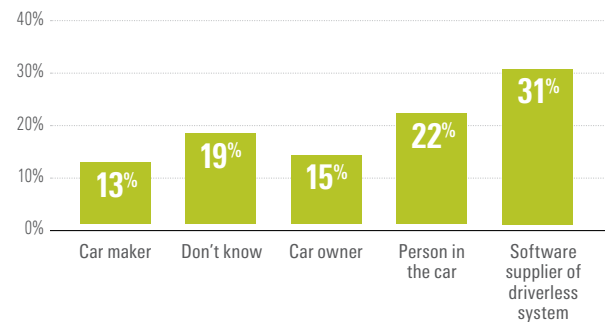
FIGURE 8: WOULD YOU BUY A DRIVERLESS CAR?
(Results weighted by age, gender and region)



SOURCE: NZIER, Colmar Brunton survey commissioned by Chartered Accountants ANZ, July 2015

FIGURE 9: WHO SHOULD BE LIABLE FOR THE COSTS OF THE ACCIDENT IN A DRIVERLESS CAR?

(Results weighted by age, gender and region)



SOURCE: NZIER, Colmar Brunton survey commissioned by Chartered Accountants ANZ, July 2015

02

SHINING A LIGHT ON THE GREEN GRID

The silicon chip has revolutionised the way we do business, how we shop, even how we meet our future partners. Now the same material has the potential to revolutionise the electricity sector.

‘Over the last 135 years electricity has transformed the way we work, live and play,’ says Richard Wills, Flick Electric Co., GM Strategic Relationships and Channels.³⁶

Sustainability is a key consideration driving the uptake of renewable energy. Indeed the classic energy trilemma (security, affordability and sustainability) is continually challenged, with sustainability gaining significant ground over security of supply and affordability. The upcoming inter-governmental climate change summit in Paris is anticipated to place additional pressure on governments to adopt renewable energy. Combined with the reducing costs of renewable technologies, widespread adoption of renewable energy is imminent. Solar and wind energy generation are already emerging forces in the New Zealand energy market.

A recent survey conducted by PwC³⁷ found that 97% of respondents expect a medium or high amount of disruption in their main home market by 2020.

Disruption in the energy sector has led to significant job losses in New Zealand and many more are signalled to follow. In August 2015, Genesis Energy announced that the Huntly Power Station would close its two remaining coal burning plants by December 2018. In the same month the Prime Minister announced Solid Energy was being placed into administration. The global fall in coal prices was cited as one of the main factors contributing to the demise of Solid Energy.

ROLE OF ELECTRICITY IN THE NEW ZEALAND ECONOMY

The energy sector is a key enabler of technological change with many new technologies being powered by, or enabled through, the dramatic increase in access to electricity. Indeed the disruptive force of internet connectivity is made possible by the energy sector. Imagine a world with no electricity. We would certainly have a very different society and economy. The Auckland electricity blackouts of 2014 brought parts of the city to a standstill. Electricity will continue to play an increasingly important role in the New Zealand economy as we adopt new technology, powered by electricity, such as driverless cars, smart cities, smart homes and smart community infrastructure.

New Zealand’s decision to deregulate its electricity market has led to home grown companies, like Catapult, developing leading-edge technology for the electricity sector which are now succeeding in a global market.³⁸



HOW DOES TECHNOLOGICAL CHANGE AND INNOVATION EFFECT THE ENERGY INDUSTRY?

Technological change in the electricity sector has opened up opportunities for non-traditional players, such as companies with a technology, telecoms or engineering focus, to enter the market.

The New Zealand government is also playing a role in disrupting the electricity industry, using technology to improve pricing transparency with the roll-out of the 'What's My Number?' campaign. The campaign is forcing electricity providers to offer competitive prices. As at 30 September 2015, the campaign website estimated that \$202m of potential savings had been identified.³⁹

CASE STUDY

NEW ENERGY RETAILER – FLICK ELECTRIC CO.

New energy retailers, such as Flick Electric Co., have been seizing the opportunities created by emerging technologies. Flick was founded by two young New Zealanders who combined their knowledge of the electricity industry with experience in

setting up innovative businesses. Flick uses new technology to improve the transparency of electricity retail, making it easier for customers to take control of their electricity consumption and pricing.

'Flick was born out of our **FRUSTRATION WITH THE TRADITIONAL ELECTRICITY RETAILING MODEL**. We're built from the ground up to help our customers get the best out of New Zealand's excellent electricity generation system. **GAME ON.**' – Steve O'Connor, Flick Chief Executive⁴⁰





CASE STUDY

SOLAR ENERGY

We now explore the growing popularity of solar electricity generation, looking at both the economic realities of solar generation and New Zealanders attitudes towards solar uptake.

To give a brief explanation of the technology, solar photovoltaic (PV) cells convert solar energy into electricity using layers of a semi conducting material (crystalline silicon). The price of this technology has fallen dramatically over the last few decades, from about US\$77/watt in 1977 to US\$0.74/watt in 2013⁴¹. Recent analysis by Deutsche Bank placed the current cost at between US\$0.13 and US\$0.23/watt which is well below the retail price of electricity in many markets.

As a renewable energy, solar appeals to countries, businesses and individuals from a sustainability perspective. While not yet economic, awe-inspiring inventions, such as solar powered roads and sports grounds, may be a reality soon.

New modes of transport have been created using solar energy, such as the Hyperloop, a reduced-pressure tube in which pods powered by solar energy can travel at extremely high-speeds.⁴²

IMPACT OF SUBSIDIES

Over the last decade, global installed solar capacity has grown by nearly 50% per annum, reaching 180 Gigawatts (GW) in 2014. The early growth was focussed in Europe, and more recently in China, Japan, Australia and the United States. This growth was driven by generous subsidies provided to encourage renewable energy generation as part of efforts to meet national targets for the reduction of greenhouse gas emissions. In recent years, solar PV subsidies have

been cut-back globally as PV prices have fallen to levels increasingly competitive with thermal (coal and gas) generation sources. Much of New Zealand's electricity generation is already renewable and, so far, the economics have favoured wind and geothermal energy generation.

SOLAR INVESTMENT BECOMING ECONOMIC SOON...IN MOST PLACES

We looked at when solar panels are likely to become economic in New Zealand. At current prices, solar PV panels are uneconomic for New Zealanders, even with the 'hidden subsidy' paid to solar installers.⁴³ In sunnier regions, such as Northland, Marlborough and Central Otago, solar PV is more competitive. Regions which have high electricity charges are also more attractive solar prospects. It comes as no surprise that Kerikeri is the most attractive solar prospect, but the number two slot is occupied by Balclutha, not a sunny region but one with very high electricity charges. With traditional jobs in Balclutha at high risk of automation, installation of solar PV panels could provide much needed employment for the region.

Solar PV is likely to become more competitive as breakthroughs in the cost of storing electricity speed up the uptake of solar and other renewable energy sources.

WILL NEW ZEALANDERS ADOPT SOLAR EN MASSE?

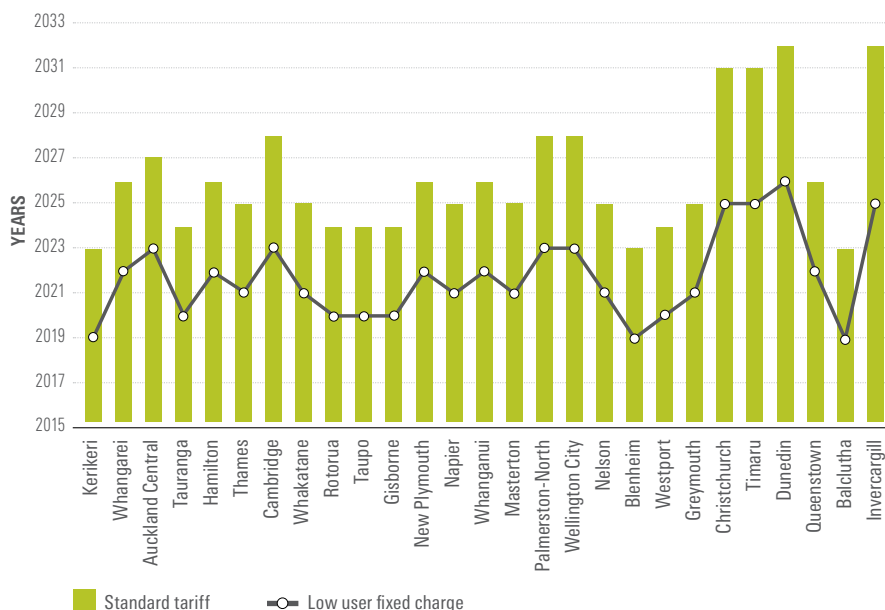
Colmar Brunton surveyed individuals on their appetite for installing solar PV. Around 73% would buy or lease panels if the cost was the same or substantially less than the potential savings on their

Continued 

CASE STUDY Continued

FIGURE 10: NUMBER OF YEARS BEFORE SOLAR PV BECOMES ECONOMIC

(Assume 2% annual (real) growth in tariffs, 5% annual decline in solar cost, \$3500/kW current solar cost)



SOURCE: NZIER Solar PV and Storage model 2015

power bills. However, the survey also suggests consumers are reluctant to pay a significant sum up-front. The largest group of respondents, 43%, would buy panels only if the payback period was five years or less. This is unlikely for panels with an expected life of at least 20 years. Only 5% are willing to buy panels with a realistic payback expectation of 15 years plus. This shows that finance and contractual lease arrangements will be a primary consideration for potential purchasers.

FURTHER DISRUPTION TO THE ELECTRICITY BUSINESS...

By combining these survey results with the forecast solar cost model we have

generated a residential uptake scenario which is depicted in Figure 10 above. During the 2020s, most regions become economic for solar given our cost assumptions, which results in the sort of exponential growth we have already seen overseas. We can also estimate the savings consumers make on their power bills, which by 2030 is around \$700 million per annum.

This means that by 2040, electricity and network companies would have seen a cumulative \$10 billion eroded from their current revenue base.⁴⁴

03

MANUFACTURING IMMORTALITY

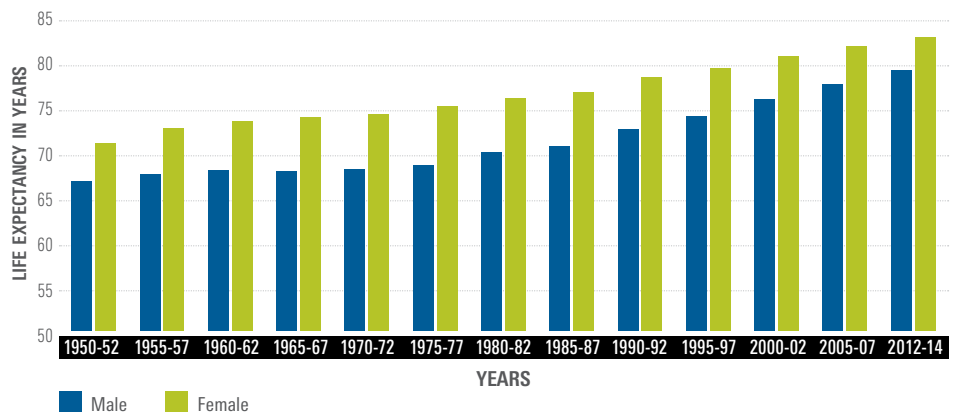
Life spans have been extending progressively since 1840 by an average of around three months a year in most developed countries⁴⁵. This is despite world wars, influenza pandemics and other diseases such as cancer. This increasing life expectancy shows no signs of slowing and may switch gear and rapidly accelerate with recent biotech and other medical research advances. The advances in life expectancy have been driven by a host of developments including lower infant mortality, better sanitation and finding successful treatments for age-related ailments such as heart disease.

NEW ZEALAND'S EXPERIENCE – THUMBS UP FOR MEN

The escalation in New Zealander's life expectancy between 1950 and 2014 is shown in Figure 11. The average life expectancy for men and women has increased by 12 years over the period, gaining a steady 2.3 months of life expectancy a year (i.e. less than the three months a year increase experienced by developed countries since 1840). Women still live longer than men but the gap in life expectancy has substantially narrowed over the period. Male life expectancy was 6.5 years lower than women in 1977, whereas the difference is now only 3.7 years.

Global life-spans have been extending by 3 months a year for the last 150 years – there are no signs of stopping.

FIGURE 11: LIFE EXPECTANCY



SOURCE: Statistics New Zealand⁴⁶

INVESTING IN BEATING THE GRIM REAPER

The race to find ways to extend life is on. What has recently changed is that ageing itself is now seen by many as a 'disease'. A recent article⁴⁷ points out that as recently as a generation ago it would have seemed implausible to suggest that there could be a cure for ageing. But now a host of research centres, universities, business start-ups and investors have come to the party. Google has invested in a spin-off known as Calico, aimed at combating 'ageing and associated diseases'.

The February 2015 cover of *Time* magazine pictured a baby with the statement 'This Baby Could Live to be 142 Years Old'. Research is uncovering promising ways to extend life at an extraordinary pace, and many potential treatments are being explored by entrepreneurs.

Research is uncovering promising ways to **EXTEND LIFE AT AN EXTRAORDINARY PACE**, and many potential treatments are being explored by entrepreneurs.

One of the most promising compounds being tested is rapamycin, which seems to slow ageing and its damage. In studies conducted to date, organs in old rodents have been rejuvenated and their life expectancy extended by around 20%.

If such an approach could work on humans, it could extend the average life expectancy in New Zealand from 82 to 98.

Robots have for years been helping doctors perform surgery – at Guy's and St Thomas' hospital in London, UK, for example, robots assist doctors with keyhole kidney surgery. Speed is a crucial factor in the success of such operations and the robots are able to sew blood vessels connecting donor kidneys far more quickly than humans.⁴⁸

DEATH DEFYING DILEMMAS

New Zealand's population is ageing. The number of people aged 65 and over has doubled since 1980, and is likely to double again by 2036. This change in population structure will increase financial pressure on health services and the national superannuation system.

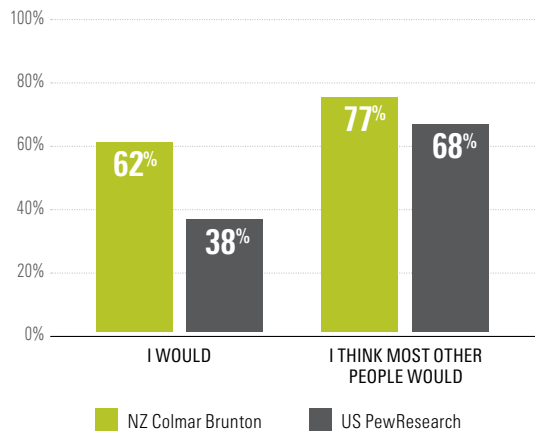
The potential social and financial impacts of the average lifespan increasing by 20% are immense. Many people may choose to continue to work if they are in good health. They may continue to earn good incomes and accrue wealth, and take government superannuation which, on current policy settings, is not income-tested. The less fortunate may need to live on the lower incomes offered by national super for an extended period.

We asked New Zealanders about whether the eligibility of national superannuation should be increased if people live longer, healthier lives. The majority (62%) thought the age of eligibility should be increased to take account of population ageing.

It is important that as the average life expectancy increases, mature-age people are provided with re-training and opportunities to up-skill, to enable them to continue to find meaningful work if they wish to remain employed.

Initiatives such as SeniorNet, which 'brings older adults and technology together in a friendly, fun and stress-free way'⁵⁰ are providing mature-age people with the skills they need to continue to participate in the workforce.

FIGURE 12: WHO WANTS TO LIVE DECADES LONGER?
(Results weighted by age, gender and region)



SOURCE: Adapted from NZIER, Colmar Brunton survey commissioned by Chartered Accountants ANZ, July 2015, and Pew Research Centre survey.⁴⁹

WHAT DO NEW ZEALANDERS THINK ABOUT LIVING LONGER?

Assuming a significant number of the 65+ age group keep working on good incomes, then income inequality will increase in New Zealand and differences in wealth accumulation will widen even further.

We first asked New Zealanders whether they, personally, would choose to undergo medical treatments to slow the aging process and live decades longer. As shown in Figure 12, the majority (62%) of New Zealanders said 'yes', compared to only 38% of Americans. New Zealanders seem to be more open than



Americans to extending their lifespan by decades, perhaps a reflection on differences in New Zealand and US social support systems for the elderly. However, roughly two-thirds of respondents in both countries (77% in New Zealand and 68% in the US) thought that most other people would choose to live decades longer by undergoing medical treatments to slow the aging process.

We asked people about a range of social and economic issues potentially associated with an ageing society and found that:

- The attitudes of Americans and New Zealanders were broadly similar with only the minority believing the economy would be more productive
- The vast majority of New Zealanders and Americans expect longer life would strain natural resources
- The most marked difference between Americans and New Zealanders was that the majority of New Zealanders said everybody should get access to treatments to extend life (80%), compared to a minority of Americans (44%)
- Americans were also more convinced that only the wealthy would have access to treatments (66%), than New Zealanders (53%).

These differences may reflect the fact that cost and access to health services is fairly uniform in New Zealand, whereas in the US a 'user pays' model is more prevalent.

LIVING LONGER ONLY AN OPTION FOR THE RICH

While our survey respondents would like everyone to be able to benefit from medical advances, the economic reality is quite different.

It is important that the government is pro-active in ensuring that appropriate regulatory controls are in place to address the issues brought about by artificially enhanced life spans.

CALL TO ACTION

01 POLICY MAKERS

02 BUSINESSES

03 INDIVIDUALS



Having explored the impact that technological change might bring to New Zealand, we consider there are good reasons to be positive. New Zealand's ability to make the most of technological change is strong. Our survey results suggest that as a nation our agility, and our reasonable awareness of technological change, will enable us to adapt and thrive. New Zealand's policy settings are also conducive to a flexible, dynamic economy.

Successful home grown companies such as Xero, FNZ, Gameloft and Rocket Lab show that we are not just fast adopters of technology – we are also able to push the frontier of technological change and create globally competitive new products and services.

However, this conclusion does not mean we should be complacent. The scale of change from automation, and related changes in business models, is projected to be significant. Given the pace of change, it is important that we start preparing our nation for the challenges presented by technological change now. We need to be pro-active and take innovative approaches to guide ourselves and our organisations through the sea of

automation. In navigating this sea, we must be mindful of the purposes for which we are employing technology, to ensure that we don't lose sight of the essence of being human along the way.

While we can be positive about the long run, short-term downside employment and business risks are apparent. There are also potentially regional elements to these risks to which policy makers and businesses need to be attuned, and consider how they can reap the opportunities and minimise the adjustment costs. As business leaders we are well placed to guide our organisations through the period of significant change that lies ahead.

The following pages of this paper contain key steps designed to promote public debate amongst policy makers, businesses and individuals, surrounding the potential challenges arising from technological change and how they can be addressed.

It is imperative that we are mindful of the purposes for which we are employing technology, to ensure that we **DON'T LOSE SIGHT OF THE ESSENCE OF BEING HUMAN** along the way.

01

POLICY MAKERS

STAKEHOLDER CALL TO ACTION

1 What's the right level of technology?

Initiate public debate on the appropriate role of technology in New Zealand society, with a view to creating guiding principles on the introduction and adoption of technology.

2 How do we raise awareness of the jobs at risk?

Create a dynamic register of jobs and sectors at most risk of technological disruption based on academic research, and offshore and local experience. Share register with businesses, unions and other stakeholders.

3 Is education keeping pace?

Consider whether the education system is equipping both children and adults with the skills needed to meet technological changes. The ability to quickly adapt and continuously up-skill will be lifetime assets. Be wary of supporting occupational specific skills.

4 Are present regulatory settings appropriate?

Examine the extent to which present regulatory settings unnecessarily encumber technology uptake. Be proactive in adjusting settings in response to new business models and to seize the opportunities presented by technology, whether or not they have reached New Zealand's shores.

5 Will public assets become redundant?

Assess how government infrastructure spending needs to change in the face of emerging technological disruption, particularly in transport networks where there is a risk that some investments, such as public transport, will be stranded as driverless technologies evolve.

6 Should the superannuation age increase?

Consider whether the current age and structure of superannuation will continue to be appropriate given increased life spans driven by technology.

7 How should we address regional issues?

Boost regional economic development through investment, increased migration and considering innovative policies, such as promoting certain regions as potential testing sites.

02

BUSINESSES

STAKEHOLDER CALL TO ACTION

1 Is your business strategy fit for today's world?

Regularly consider how business strategy, growth targets, and investment plans may be affected by technological shifts. The risk of stranded assets is relevant for many businesses as well as government. This may require longer strategic planning horizons.

2 Does your digital strategy deliver?

Adopt a comprehensive digital strategy that takes into consideration how the digital economy will affect all employees, product and service offerings and delivery models. Consciously develop the power of your online brand.

3 Are your team up-skilling?

Develop a plan for employees to prepare for the impact of technological change and encourage on the job training and up-skilling throughout employees careers.

4 Are you experimenting?

Be fast adopters – experiment with new technologies that can deliver the same, or better, outcomes for customers.

5 Have you enhanced the key 'human' elements?

Enhance the key elements of your business that utilise human interaction, such as developing networks and enhancing customer experience.

6 Are you ready to take on the world?

Be prepared to go global with commercialisation of new technologies and business models. As part of this, seek outside capital and business support when needed.

7 Have you automated your business processes?

Prepare for automation by digitising, streamlining and automating business processes and incorporating new technologies wherever appropriate.

03

INDIVIDUALS

STAKEHOLDER CALL TO ACTION

1 Do you know what lies ahead?

Actively build awareness of the technological changes affecting your occupation. Understand the implications for future careers.

2 Is retraining an option?

Be ready to re-invest in training several times in your career and proactively pursue retraining opportunities if you find yourself in a 'sunset' occupation. Seek to broaden your skill set and develop skills in areas less likely to be automated.

3 Are you a fast adopter?

Be fast adopters – realise the increased consumption choices, cost savings, and potential income sources that new technologies can bring.

4 Are you thinking outside the box?

Avoid being constrained by perceptions of traditional gender roles in your career choices – some low skilled occupations often dominated by men are considered to be most at risk of job displacement. Men currently in these occupations may wish to consider training in areas traditionally viewed as more female professions, such as teaching, social work and healthcare.

5 Get involved!

Engage in the public debate around the appropriate role of technology in our society.



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