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BUSINESS ADVISORY COUNCIL

A FUTURE THAT WORKS:

HARNESSING AUTOMATION FOR A MORE PRODUCTIVE AND SKILLED NEW ZEALAND

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FOREWORD BY CHAIR OF BAC

HE AHA TE MEA NUI O TE AO?
What is the most important thing in the world?

HE TANGATA, HE TANGATA, HE TANGATA!
It is the people, it is the people, it is the people.

At the first meeting of the Prime Minister's Business Advisory Council in November last year, a focus on people, their working future and skills took priority. This reflects our shared understanding and experience from our own organisations, that people are the most valuable asset any business, or indeed any nation, has.

As business leaders we are acutely aware of the need to innovate and change to compete and thrive. We are also aware of the major global forces influencing the world economy, especially automation and its impact on the future of work. This wave of automation, which is increasingly known as the fourth industrial revolution, will unleash unimaginable change on our society and our working lives: where we work, what we work on and the way we work are all set to transform. The Prime Minister's Business Advisory Council believes Aotearoa New Zealand faces unprecedented opportunities and challenges as automation and innovation change our working lives. This demands that the three big actors – government, business and communities – collaborate like never before. Collaboration is key as each actor plays a different role and has unique skills and advantages to deliver a stronger and better society. However, existing information, many government systems and agencies and many business models are not currently geared-up for this future. The country requires a deliberate strategy with bold initiatives between government and business to harness the opportunity and to ensure that large parts of our society are not left behind in the global wave of transformation.

It is also clear that any national strategy must be long-term and be supported by all parts of the political spectrum. Systems level reform, at times radical and challenging to our current 'business as usual' approach needs to occur if we are to take automation seriously. Ultimately, we will all get the businesses and country we deserve and armed with our current knowledge, doing nothing or not enough, is a choice.

It is therefore my privilege on behalf of the Prime Minister's Business Advisory Council to deliver this report, making it available as a public good for all Kiwis. Its analyses and recommendations provoke new conversations, encourage a greater sense of urgency and provide practical and tangible suggestions to capture benefits and protect the vulnerable. It is critical business, community, public sector and political leaders raise our collective literacy, engage and wrestle with the issues around the automation transformation. Doing so is the only way we will happen to our future rather than it happen to us.

I wish to thank McKinsey & Company with whom we have partnered in creating this report and who have gifted New Zealand a great step forward in the automation conversation through this work. I also wish to acknowledge the business leaders who are members of the Council, and others whose skills we draw on, who give their time and insights freely to serve our wider national interest. Finally, our thanks to the Government for asking these hard questions and being open to our advice. A significant opportunity lies ahead of us. If we take the right decisions, we will capture the benefits of that opportunity; confidently, while ensuring we look after each other in the process.New Zealand has demonstrated kaitiaki many times in our past as we have attempted to solve our economic, social and environmental challenges. Automation presents us with another moment to lead the world in our response to significant global change.

Our hope is that this work contributes to Aotearoa confidently grasping that opportunity.

NĀ TŌU ROUROU, NĀ TŌKU ROUROU KA ORA TE IWI
Through collaboration we can all thrive

CHRISTOPHER LUXON
Chair of the Prime Minister's Business Advisory Council
Chief Executive Officer – Air New Zealand

PREFACE

New Zealand has already put considerable thought into the future of work. Back in 2014, the New Zealand Labour Party established a Future of Work Commission to develop the vision, direction, and policies to enable New Zealanders to confidently face the changing nature of work and have sustainable, fulfilling and well-paid employment in the coming decades.[1] The programme published a report in 2016 containing 63 recommendations across six workstreams for policies and actions that would support New Zealand during anticipated changes to the way we work.[2] The report incorporated some estimates of job displacement from research published by Chartered Accountants Australia and New Zealand, with the assistance of the New Zealand Institute of Economic Research, in October 2015.[3] More recently in 2017, the Artificial Intelligence Forum of New Zealand (AI Forum) was founded as a not-for-profit, non-government organisation aiming to promote the economic opportunities raised by AI, while also working to ensure that society can adapt to the rapid and far-reaching changes that AI technology will bring.[4] The Forum has several publications, including a recent research report investigating AI's potential impacts on New Zealand's economy and society.[5] Additionally, various other businesses and organisations have been exploring and forming views on the topic.

This report aims to build on this body of research and work by:

- Estimating the potential impact of automation on economic outcomes in New Zealand, such as net job impacts, improvement in productivity and economic growth
- Looking at not only the potential impact of automation, but the likely impact based on modelled adoption under several scenarios (early, mid-point or late)
- Estimating—down to a regional level, and by sector and occupation—which jobs are vulnerable to disruption because of automation, as well as the potential upside in terms of jobs created
- Considering the skill and qualification shifts required in the workforce to meet future labour market demands
- Estimating the potential impact of automation on unemployment and income inequality
- Sharing our views on what it will take for both the private and public sectors to capture the opportunities from automation, while ensuring that the resulting benefits are broadly shared.

[1] http://www.futureofwork.nz/
[2] Future of Work Commission, "The future of work", 2016.
[3] Chartered Accounts of Australia and New Zealand, "Disruptive technologies: risks, opportunities—can New Zealand make the most of them?", October 2015.
[4] https://aiforum.org.nz/about/
[5] Artificial Intelligence Forum of New Zealand, "Artificial intelligence: shaping a future New Zealand", May 2018.

Ultimately, we are seeking to answer two questions we face as a nation:

- How can New Zealand rapidly leverage automation technologies to boost productivity?
- How can New Zealand prepare and support displaced, continuing and future workers through the transition?

In seeking to answer these questions, the opportunities and challenges of automation for New Zealand are set out in detail in the following pages. It is, however, worth noting some key messages here.

Automation offers the small and medium enterprises that make up 97 percent of New Zealand enterprises the chance to shed the limitations of their size and resources and turbo-charge their productivity, reach and impact. By 2030, thousands of working Kiwis, perhaps one in every three adult workers, will need to reskill to change occupation in order to adapt and keep pace with the coming wave of transformation. That is some 60,000 New Zealanders retraining every year in order to remain employed.

The risk of doing nothing or acting with insufficient urgency is real; if that risk eventuates Kiwi families will be negatively impacted. In such a scenario, inequality, already at the forefront of our national conscience and conversation, could rise to exceed the level seen in the US.

It is in this context that the overarching theme of the report becomes clear. Any solution requires the collaboration of stakeholders from across sectors. This includes business, iwi, not-for-profits and not only the government of the day, but a broad range of supporters from across the political spectrum. This coalition of support, somewhat depoliticised, is required in order to implement a long-term national strategy that exists beyond electoral or business cycles.

□ □ □

We partnered with McKinsey & Company, in collaboration with the McKinsey Global Institute (McKinsey's business and economics research arm), to develop the fact base and write the report. In doing so, we leveraged methodologies, data and research from the McKinsey Global Institute, as well as McKinsey's extensive, global research and work in workforce transitions.

McKinsey & Company leadership and core team included Andrew Grant, David Pralong, Laurent Kinet, Jasper van Halder, Sev Thomassian and Diana Ivanov. McKinsey Global Institute automation specialists included Gurneet Singh Dandona and Alok Singh. Certain parts of this report have been derived from the report by McKinsey & Company 'Australia's automation opportunity: Reigniting productivity and inclusive income growth', and we wish to thank the authors and contributors of that report.

We hope that this report inspires conversation and a tangible call to action for every New Zealander, as well as our businesses, not-for-profits, unions, educational institutions and the public sector, on how we can work together and ensure we all share in the growth and opportunity automation can bring to the place we call home.

CONTENTS

EXECUTIVE SUMMARY

Automation technologies—which span advanced robotics, machine learning and AI—have already started to transform the New Zealand workplace, and soon they will reach scale. These technologies present our nation with enormous opportunity to restore momentum in productivity. However, at the same time, there will be new challenges to overcome. This report examines how automation may affect New Zealand and what can be done to secure the benefits and navigate the challenges. It does this in three parts:

1. Productivity imperative and automation: where we explore our nation's productivity imperative and the coming age of automation

2. Automation opportunities and challenges: where we describe both the three main benefits automation could offer and the three main difficulties that may arise

3. Recommendations: where we offer 12 recommendations on what businesses and government can do, and the importance of reskilling, to secure the benefits and overcome the challenges.

The prospect of automation can be daunting for both workers and employers, and both groups may find themselves wanting to delay its impact. Yet, both groups stand to lose significantly if New Zealand becomes a laggard in this transition. Conversely, both groups will benefit significantly from accelerating the transition, if it is supported by the right social framework, especially through education, training and retraining. In this regard, the future of work will align the interests of all groups, and collaboration is key to capturing the benefits and mitigating the risks of a speedy transition while ensuring no New Zealander is left behind.

The summary of the key findings is set out below.

1. PRODUCTIVITY IMPERATIVE AND AUTOMATION

- **New Zealand has a productivity problem.** Our labour productivity growth is roughly one-third lower than the OECD average[6], and has been steadily declining over the years. Between 2006 and 2016, the average annual productivity growth rate was just 0.9 percent, which was 0.4 percentage points lower than the previous decade, and 0.6 percentage points lower than two decades earlier (Exhibit 1).

- **The automation wave is well on the way.** Automation technologies have the potential to change workplaces. Overall, this technological disruption is predicted to be 10 times the pace and 300 times the scale of the industrial revolution.[7] Automation will increase the amount we can produce, the way we work and the jobs we work in.

- **Automation may solve the productivity puzzle.** For New Zealand, the critical upside of automation is productivity growth. As consumers demand change and new markets are

[6] OECD New Zealand Economic Survey 2017, Figure 1.2 (Labour productivity growth across 20 OECD countries for which data is available).
[7] Richard Dobbs, James Manyika, and Jonathan Woetzel, No ordinary disruption: the four global forces breaking the all the trends, McKinsey & Company 2015.

created, innovators can increase exports of automation-era products and services. In previous decades, New Zealand has lost production and routine jobs to low-cost countries, replacing them with higher-value jobs. Since automation lends itself to the displacement of tasks rather than the elimination of whole jobs, the automation era will create more collaborative and cognitive jobs that involve more complex interactions and judgement[8]—if New Zealand can help its workforce transition to those skills then it can expect to see the productivity growth rewards.

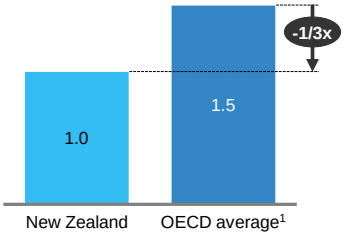
- **The impact of automation on jobs in NZ will depend on the pace and extent of automation adoption.** The research examined multiple factors that would affect the pace and extent of automation, resulting in three scenarios for automation potential (i.e. what can technically be automated based on currently available technologies) and automation adoption (i.e. what we believe will be automated, taking into consideration financial, regulatory, and political and social constraints). These three scenarios are: an early scenario, a mid-point scenario, and a late scenario. Currently, 40 percent of all work activities can be automated based on available technologies. This will rise to 60 percent by 2030 in the mid-point scenario. However, the entire 60 percent potential will not be automated. We estimate that 21 percent of workplace activities will be automated by 2030 under the mid-point estimate, which could rise to 41 percent in an early adoption scenario.

EXHIBIT 1

New Zealand's labour productivity growth is low and declining

NZ's labour productivity growth is **1/3x lower than other OECD** countries[1]

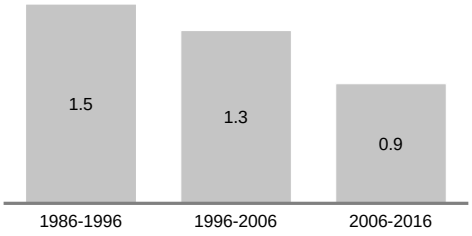
Productivity growth, annual average, 1995-2015



Out of 20 OECD countries, NZ has the **fourth lowest** productivity growth rate[1]

NZ's labour productivity growth has been **decreasing over the past few decades**

Productivity growth, CAGR, percent



The **productivity growth gap vs other high-income OECD countries has remained fairly stable**, because they experienced a similar productivity growth decrease

1 Based on OECD analysis in OECD New Zealand Economic Survey 2017, Figure 1.2 (Labour productivity growth across 20 OECD countries for which data is available)

SOURCE: OECD Economic Survey New Zealand 2017, Figure 1.2 (left), Oxford Economics; NZ Productivity Commission: 'Can the Kiwi fly? Achieving productivity lift-off in New Zealand', Chart 2 (right)

2. AUTOMATION OPPORTUNITIES AND CHALLENGES

Automation is an inevitability that holds enormous potential for New Zealand, but that does not mean that its full benefits are guaranteed. The extent to which increased productivity and

[8] McKinsey, 'Compete to prosper: Improving Australia's global competitiveness', July 2014.

other benefits will be achieved depends on the speed of automation adoption relative to international competition. Automation also comes with its challenges, but New Zealand has faced and overcome many challenges before. This change will also be manageable if correctly navigated. Accordingly, we cover the three main opportunities and challenges of automation for New Zealand.

Opportunity 1 – Automation could help solve the productivity problem

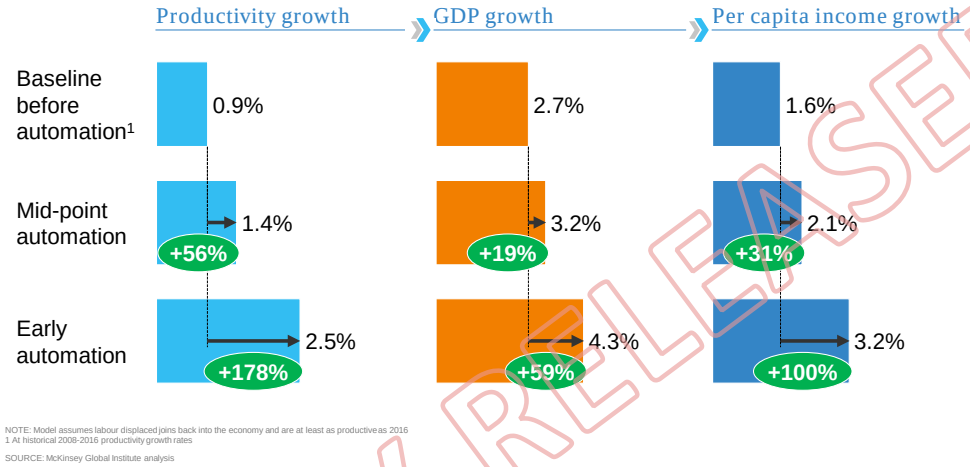
- **Early automation adoption could turbocharge productivity.** McKinsey analysis suggests early adoption boosts productivity significantly more than mid-point adoption—2.5 percent between 2016 and 2030 for early adoption (GDP growth of 4.3 percent), compared to 1.4 percent in a mid-point adoption scenario (GDP growth of 3.2 percent) (Exhibit 2).
- **In turn, this will boost economic and social outcomes.** To put these productivity growth numbers into context, automation could lift the value of New Zealand's GDP over the decade to 2030 by $133 billion to $436 billion[9] in aggregate (equivalent to $13 billion to $44 billion per annum) and give each person additional income of $25,000 to $83,000 in aggregate over that period (equivalent to $2,500 to $8,300 per annum), based on mid-point and early adoption scenarios.[10] Strong job outcomes, however, are necessary to maximise the opportunity to grow GDP, incomes and living standards through automation, and ensure the benefits are widely shared such that no New Zealander is left behind. The various actions that each group of stakeholders can take to maximise whole-of-country prosperity are explored in the recommendations section.
- **SMEs have a chance to shine.** Previously, SMEs have been handicapped as technology-driven productivity improvements have been out of reach due to the large investment costs and complex integration efforts required, but this is changing with automation technologies, which can be applied at small scale.

[9] All dollar amounts in this report are in NZD, except where stated otherwise.
[10] Based on expected increase to real GDP per capita.

EXHIBIT 1

Automation can provide a major boost to New Zealand's future economic prosperity

Projected real growth rate (compound annual growth rate) by automation scenario, 2016-2030



NOTE: Model assumes labour displaced joins back into the economy and are at least as productive as 2016
1 At historical 2008-2016 productivity growth rates

SOURCE: McKinsey Global Institute analysis

Opportunity 2 – Automation can improve our international competitiveness

- **Automation can increase our international competitiveness.** For example, New Zealand is less productive than the US overall, being at 68 percent of the US's labour productivity when taking all industries into account, but it can close the gap to 73 percent through earlier automation adoption, or widen it in the case of later adoption to 40 percent of the US's productivity. Automation potential and adoption is higher in the US, where 43 percent of existing workforce activities could already be automated with today's technologies, compared to 40 percent in New Zealand. This is because a higher proportion of work activity in the US involves repetitive, highly automatable activities, compared to New Zealand.

- **The outcome is even more stark in certain sectors.** For example, New Zealand's labour productivity in manufacturing is only 54 percent of the US equivalent. Faster adoption could close that gap to 83 percent, whilst slower adoption risks plunging that to just 29 percent of the US's level. Other sectors where early or late adoption will make the biggest difference to New Zealand's international competitiveness are agriculture, transportation and warehousing.

Opportunity 3 – New jobs will be created and existing jobs will be more interesting

- **An additional 200,000 net jobs will be created by 2030.** Although adoption of automation will reduce the workforce by 700,000 jobs in aggregate by 2030, these reductions will be offset by the creation of 900,000 new jobs in aggregate over the same period.[11] Of these new jobs, almost 700,000 (~80 percent) could come from new sources of demand and the faster economic growth that goes along with higher productivity, while

[11] Employment growth forecasts are based on the impact of automation in addition to the 1.8% long-term employment growth forecast 'Medium to long-term employment projections: looking ahead to 2026', Ministry of Business, Innovation and Employment, March 2018.

200,000 (~20 percent) could come from entirely new specialist roles that do not currently exist. Automation also has important implications for the quality of jobs, eliminating many dangerous, routine and manual activities, and allowing people more time to use their specialised skills in more engaging ways. Similarly, there may be a need to embrace various forms of work (full-time, part-time, contracting, and independent workers in the gig economy) as job types change.

- **Employment growth will be widespread across regions.** Nearly all regions are expected to experience net job creation by 2030, with Auckland and Wellington best off, while West Coast and Southland are expected to see a decrease in employment (Exhibit 3). What differentiates regions, and the extent to which they are expected to adopt automation, is their occupation and industry mix.

- **Sectors will experience varying levels of net job creation** (Exhibit 4). The sector mix of the job market is expected to shift in favour of specialised, service-based sectors, with three sectors expected to create the most jobs by 2030: healthcare (82,000 net jobs), accommodation and food services (34,000 net jobs), and professional, scientific and technical services (31,000 net jobs). Total net job creation numbers are a function of both a sector's automation adoption by 2030, and its current share of New Zealand's workforce.

- **Most operations-based sectors are expected to be the highest adopters of automation.** Ten sectors are expected to see net job displacement by 2030, with four main sectors being the most heavily affected and accounting for over 70 percent of the net job displacement by those ten sectors: i) manufacturing (38,000 jobs displaced), ii) administrative, support and government (38,000 jobs displaced), iii) transportation and warehousing (32,000 jobs displaced), and iv) agriculture, forestry, fishing and hunting (25,000 jobs displaced). Thus, these sectors have the greatest opportunity to embrace adoption.

EXHIBIT 2

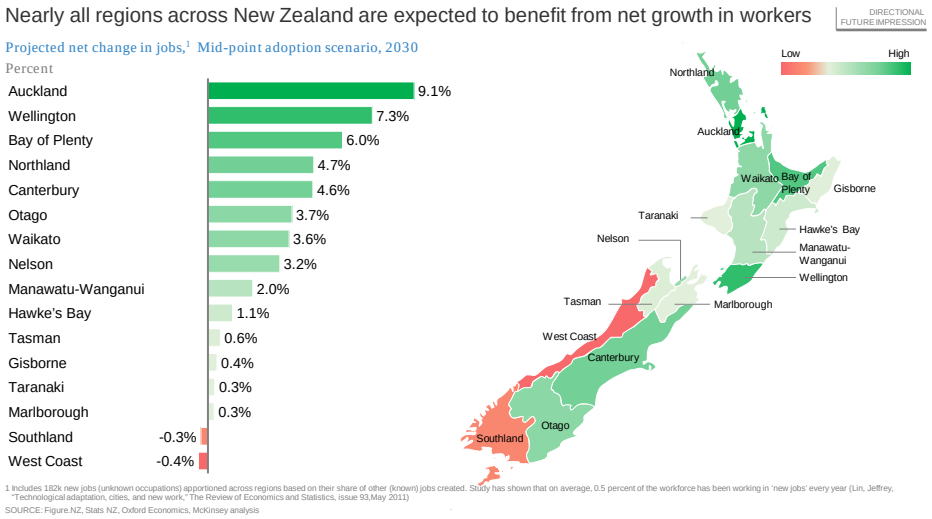
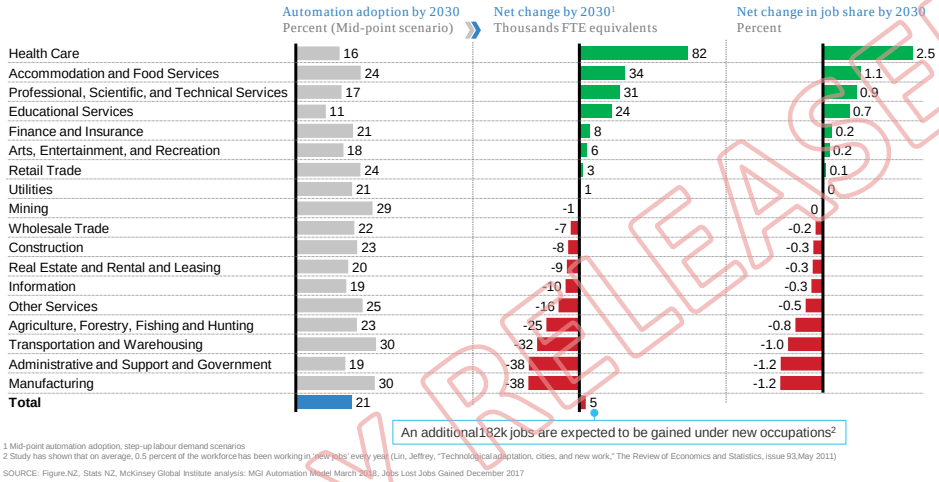


EXHIBIT 3

Net, there will be more jobs available, but in different industries



Challenge 1 – Automation will change the skills required in the workplace

- **The nature of work itself is changing.** As automation fundamentally alters the activities we perform at work, it also changes the skills we need. The research points to four types of work activities that will see an increase in demand: working with machines (technology skills), applying expertise (cognitive skills), interacting with stakeholders (collaboration skills), and managing and developing people (emotional skills) (Exhibit 5). By contrast, the need for people to perform physical, predictable and routine tasks will shrink.

- **The perception that automation driven changes will affect largely manual work is incorrect.** The precise changes in skillsets required will vary substantially by occupation and sector (Exhibit 6). It would be wrong, however, to assume that only lower-skilled occupations will be affected. Many high-skilled jobs will change as diagnostic and data functions will be performed faster and more efficiently by machines.

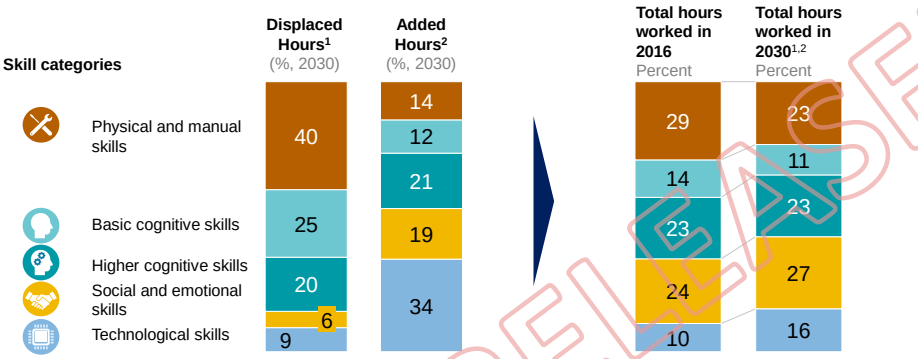
- **Automation is lifting required skill levels faster than we produce graduates.** If current graduation and work patterns continue, the nation could face an overall shortage of 130,000 university graduates to fill available jobs by 2030, split roughly into 40 percent postgraduates and 60 percent undergraduates.

- **In response to this, changes will be needed in both the design and delivery of education, including vocational training.** The core challenge in education, however, is not just with formal education; there are also challenges associated with how the broader education system, including vocational training, has been designed, and with its responsiveness to the skills being demanded by employers.

EXHIBIT 4

Demand for technological, social and emotional, and higher cognitive skills are expected to increase significantly in New Zealand

Evolution in skill categories
Share of hours worked, percent

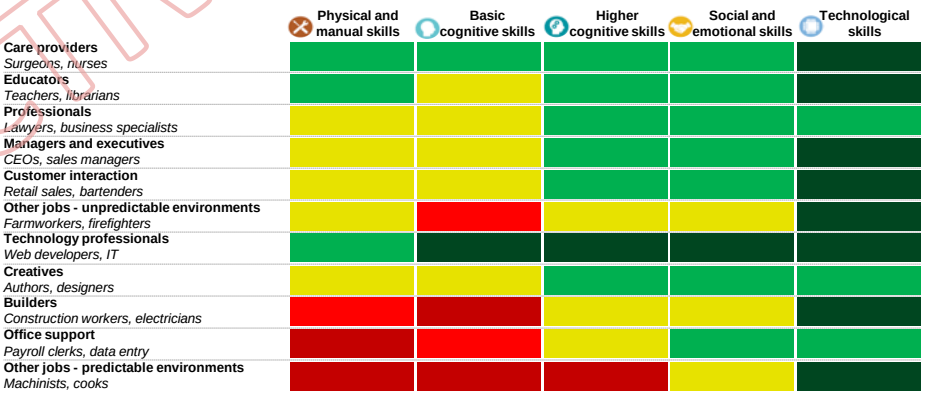


NOTE: Based on difference between hours worked per skill in 2016 and modeled hours worked in 2030 in Step-up scenario and midpoint automation. For practical purpose, the numbers for Australia is based on the 2030 Step-up demand , after automation from Jobs Lost Jobs Gained Model only. while other countries are based on Skills Model, where additional levers were also applied. Hence, cross comparison should be considered directional .
1 Midpoint automation adoption 2 Step-up demand scenario
3 The change in hours worked refers to the difference in total hours worked in a certain skill category in 2016 compared to 2030 projections. The percentage difference is not referring to the change from 2016 to 2030 of the percentage that a skill category makes up of total hours worked
SOURCE: Figure.NZ, Stats NZ, Oxford Economics; MGI Skills Model; McKinsey Global Institute analysis

EXHIBIT 5

All jobs categories will require a greater amount of technological skills, followed by social and emotional skills

Skill shifts by occupation categories
Percentage difference in hours worked (2016-2030)



1 Based on difference between hours workers per skill in 2016 and modelled hours worked in 2030 in Step-up labour demand scenario and midpoint automation
SOURCE: Figure.NZ, Stats NZ, Oxford Economics; MGI Skills Model; McKinsey Global Institute analysis

Challenge 2 – Unemployment may rise during the transition period to full automation adoption

- **New Zealand may well see a bump in unemployment during the transition period.** This is likely to occur when automation adoption displaces jobs, but individuals have not been retrained for new jobs. If the rate of re-employment within one year is around 61 percent, a low of the last 30 years experienced in the early 1990s, it would bump the overall peak unemployment rate as high as 5.3 percent in the mid-point automation adoption scenario, and up to 6.1 percent in the early automation adoption scenario (Exhibit 7). If the re-employment rate is around New Zealand's long-term re-employment rate of 74 percent, the unemployment rate would rise as high as 4.6 percent in the mid-point automation adoption scenario, and up to 4.8 percent in the early automation

adoption scenario. These peak unemployment scenarios are based on the current relatively low unemployment rate environment, with the unemployment rate at 4.0 and 4.3 percent during September and December 2018 quarters, respectively. Future demand and supply shifts could change the outcome of the unemployment scenarios.

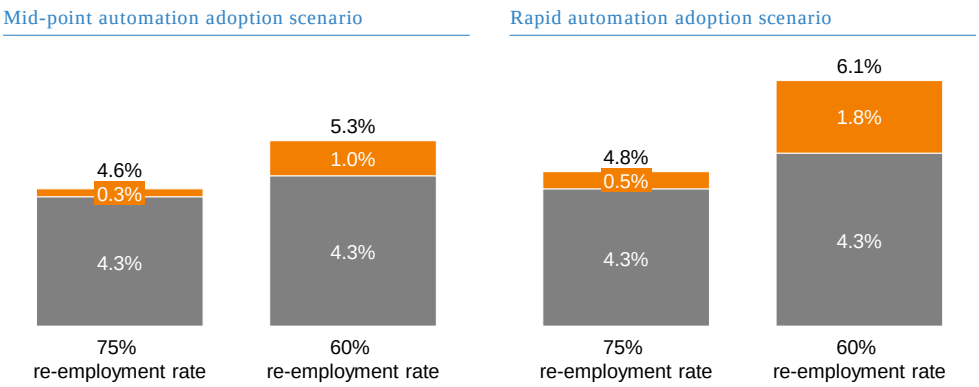
- **Some occupations will be impacted much more than others.** Overall, job displacement will be highest in administrative or generalist occupations that involve predictable physical tasks or repetitive data collection and processing. Secretaries, receptionists, research and legal assistants, and payroll and data entry workers, for example, are highly vulnerable (Exhibit 8).

- **As a result, a significant part of the labour force will need to retrain to gain re-employment.** While the impacts of automation over the next 50 to 100 years are hard to fathom, the economy is likely to return to full employment in the medium term (i.e. by 2030), as it has always done following structural shocks. However, there is no doubt that workers who are displaced will find this period challenging. The World Economic Forum estimates that by 2022, no less than 54 percent of workers will require significant reskilling and upskilling, with 19 percent requiring training of 6 months or longer.[12] Some may be able to find similar jobs in other companies or sectors, but many will need to retrain and transition to completely new occupations in order to find work. McKinsey analysis suggests that, in a rapid adoption scenario, an average of over 60,000 workers per year will need to upgrade their qualifications to change occupations altogether, totalling to over 900,000 workers by 2030 (or almost 1 in 3 workers in the workforce). In a mid-point adoption scenario, this is expected to be closer to 1 in 10 workers.

EXHIBIT 6

Peak unemployment

Scenarios for peak impact on unemployment by automation adoption and re-employment rate[1] within one year; percent in 2025



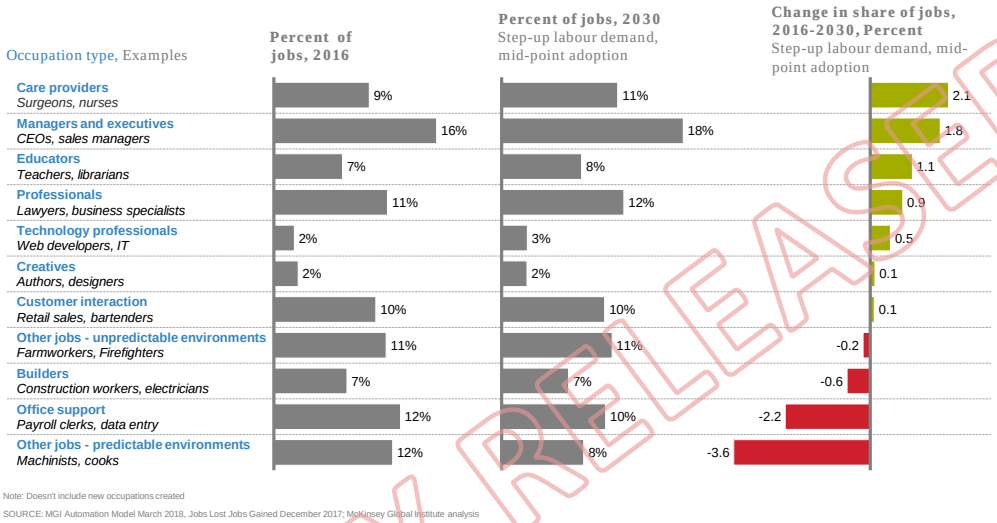
1 Over long term, 74% of unemployed persons in New Zealand have been re-employed within one year (proxied using % of people unemployed for > 1 year). The lowest rates recorded are around 61% during the recession in the early 1990s

SOURCE: Stats NZ as at February 2019; McKinsey Global Institute Global Growth Model

[12] World Economic Forum, "The future of jobs report", 2018.

EXHIBIT 7

Overall occupation mix is expected to shift in favour of specialised occupations



Note: Doesn't include new occupations created

SOURCE: MGI Automation Model March 2018, Jobs Lost Jobs Gained December 2017; McKinsey Global Institute analysis

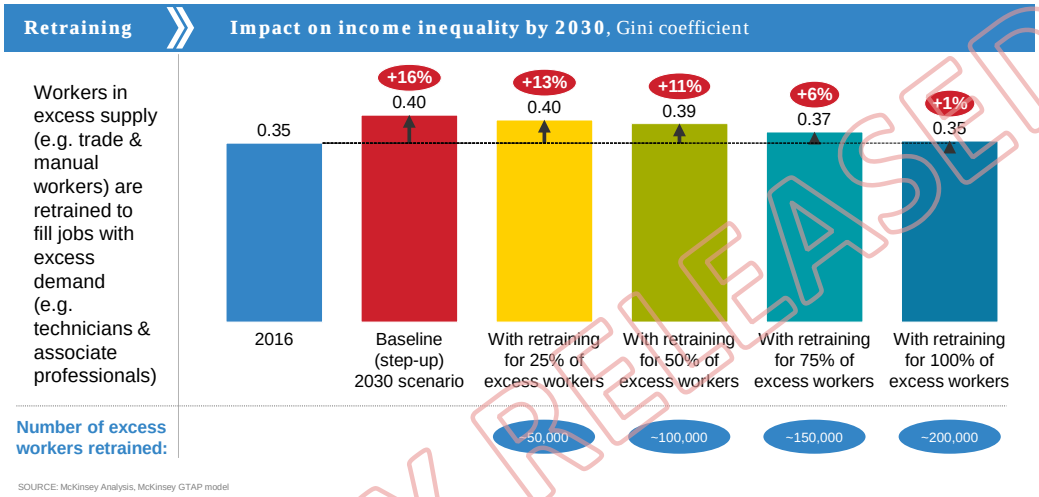
Challenge 3 – Automation could widen income inequality

- **Wages will favour those with future relevant skills.** Workers who can perform cognitive, collaborative and digital work—the skillset relevant in the automation age and being in short supply—will likely enjoy strong wage growth. However, an oversupply of those who can perform routine or physical work will drive wages down.
- **This is expected to affect overall income inequality.** If workers are not effectively retrained, creating large imbalances between supply and demand, the resulting changes in wages would drive up New Zealand's Gini coefficient from 0.35 to 0.40—an increase of 16 percent by 2030.[13] This would put New Zealand's level of income inequality higher than what prevails in the US today (a Gini coefficient of 0.39).
- **However, retraining could temper automation's impact on income inequality.** McKinsey examined various scenarios that would allow surplus lower-skilled workers to qualify for higher-skilled and higher-paid roles such as technicians or associate professionals (Exhibit 9). They estimate that if three quarters of these workers upgrade their skills (around 150,000 people), the impact on income inequality could be reduced by more than half.

[13] The Gini coefficient is based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality.

EXHIBIT 8

Effective policies to retain and upskill excess workers and redeploy them to unfilled high-skill jobs could reduce the impact on income inequality



SOURCE: McKinsey Analysis, McKinsey GTAP model

Solutions will be needed for New Zealand to navigate these challenges and to achieve the full potential benefits of automation: turbocharged productivity growth, increased international competitiveness and more jobs created than displaced. These solutions require a combined stakeholder approach—no one stakeholder has the ability to deliver all benefits and overcome all challenges on their own.

We propose a list of 12 potential recommendations across business and government specifically. Additionally, we also list thought starters for the education sector and individuals, because we all have a role to play in harnessing automation for a more productive and skilled New Zealand.

3. RECOMMENDATIONS

To capture the benefits of automation, and successfully navigate its challenges, both business and government will need to act, and above all, collaborate. In this report we make 12 specific recommendations with the intent of providing a tangible call to action for every business and the public sector on how we can work together and ensure that every New Zealander shares in the growth and opportunity automation can bring.

<table>
<tr><th colspan="2">Skills, Retraining and Education</th></tr>
<tr><th>Challenge</th><th>Recommendation</th></tr>
<tr><td>Significant numbers of Kiwis need to be retrained and reskilled every year to close the anticipated skills gap and mitigate the risks posed by automation.</td><td>New Zealand private and public sector employers need to be at the forefront of this transformation, adopting impactful and best-practice retraining strategies.

1. Kiwi employers should pledge to double their investment in annual employee training, re-training and upskilling and publicly report on this investment as a credible signal of leadership in ensuring Kiwis are well prepared for the Future of Work.

2. Board directors should ask the following of their organisations:

– What is the organisation’s strategy to at least double the rate of real productivity growth using automation technologies?

– What is the organisation’s human capital strategy to train, retrain, upskill and empower its people to thrive in the Future of Work?

– How will the organisation change or enhance its culture, behaviours and operating models to ensure it delivers the benefits of automation?</td></tr>
<tr><td>The Future of Work quickly becomes the Future of Education, and New Zealand needs to deliver scalable and effective ways to teach the key competencies demanded by future labour markets; cognitive skills, social and emotional skills and most significantly, technological skills.</td><td>The education system, including content and delivery methods, needs recreating to prioritise training in Future of Work skills, specifically technology skills.

3. A national digital and technology curriculum should be developed and made compulsory, at appropriate levels in the education system.

4. A “National Digital Certificate” should be created as a scalable way for businesses to retrain employees in the technology skills needed for most future roles.</td></tr>
</table>

A scalable mechanism is needed to encourage and require Kiwis to take personal responsibility to reskill throughout their lives. This will become just as important as saving for retirement.	5. **A "KiwiSaver for Skills" should be established by creating citizen directed Lifetime Learning Accounts** for individuals to tap into throughout their careers to acquire new skills or pursue higher education.
Understand and Target Māori and Youth Challenges in the Future of Work	
Challenge	**Recommendations**
Māori and youth are especially vulnerable to the potential impacts of automation. New policies and bold initiatives are needed to address this and must be based on robust evidence.	6. **Government should commission a similar Future of Work report focusing on Māori and the impact of automation** to inform targeted recommendations. It should include insights on youth unemployment, which for Māori currently sits above 20%.
Mitigate Risks by Overhauling and Recreating Institutions	
Challenge	**Recommendations**
Positive and negative consequences will vary across regions with some parts of the country being particularly hard-hit if no mitigating actions are taken. Our current welfare system needs to experiment and modernise to reflect this new reality and we need powerful interventions and new mechanisms to support work transitions.	7. **The "Work and Income New Zealand (WINZ) of the future" should be piloted by trialing a Mobility Centre model that:** – **Can deploy to regions** prioritised because they will be more negatively impacted by automation than other regions; – **Acts as a sophisticated jobs information market place**, careers and qualifications matching and brokering service; – **Is authorised to implement risk sharing schemes** with training providers if their training does not result in employment for a displaced worker (the risk currently sits 100% with the individual); and – **Provides targeted, case managed and individualised support** so that a single view of a customer can be developed for a displaced worker, allowing the full suite

	of government schemes to be made available. **An initial pilot should be rolled-out in Southland** given its vulnerability to automation, strong education sector and population size.
The potential for significant numbers of Kiwis, including youth, to be unemployed is real. Our agencies and policies, in their present form, are ill equipped to respond to this.	**8. There should be social welfare reform including, but not limited to:** – Setting policy that requires anyone under a certain age (and who meets fair and reasonable criteria) be in work or in training; a pure unemployment benefit is not an option. – Allowing other beneficiaries to concurrently access full-time training.
Assessing and undertaking needed reform requires a shift from a business as usual approach, the ability to operate across government and access to political and fiscal levers.	9. **A dedicated Future of Work Unit within the Treasury should be established** with direct, high-level political support that is responsible for the delivery of initiatives, new systems set-up and the introduction of schemes at the right time, in the right places, for the right people.
Government Leading by Example	
Challenge	**Recommendations**
The public sector has the largest workforce in New Zealand. In many cases it is heavily process, task and systems driven and therefore holds significant levers to lead a positive response to capturing automation's benefits.	10. **Specific services (at both the central and local government level) where automation is appropriate should be identified and tangible, world-class improvement targets should be set** on outcomes and metrics that matter most to citizens (e.g. passport processing has been an example of this).
Targeted SME and Sector "Surge Support"	
Challenge	**Recommendations**
SMEs and sectors that provide New Zealand with a comparative advantage hold the key to harnessing the benefits of automation by	11. **High-performing, or high-potential sectors (which have self-selected) should be surged** with support and targeted investment and incentives to achieve scale through automation (for example, accelerated

solving a large part of our productivity problem. Despite SMEs making up 97% of Kiwi businesses, there is no Provincial Growth Fund equivalent for SMEs and many struggle to scale and adopt the technology needed to supercharge their businesses. There is a strong correlation between SMEs that use three or more Apps to run their businesses and 30% more profitability.	depreciation on innovative technology assets, R&D tax credits). 12. **A "SME in a Box"** scheme should be created, which outlines clear, user friendly steps towards greater productivity in SMEs, including: – Encouraging and specifically recommending App and technology use through loans, grants or investment to enable adoption and associated training. – Partnering with book-keepers, banks and other service providers to SMEs as a vehicle to roll-out this scheme.

1. PRODUCTIVITY IMPERATIVE AND AUTOMATION

NEW ZEALAND'S PRODUCTIVITY PROBLEM

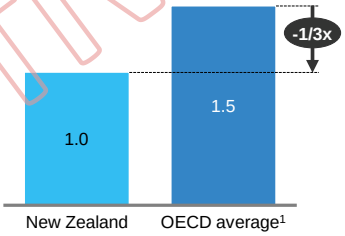
New Zealand has a long-standing productivity problem. Our labour productivity growth is roughly one-third lower than the OECD average[14], and has been steadily declining over the years.[15] Between 2006 and 2016, the average annual productivity growth rate was just 0.9 percent, which was 0.4 percentage points lower than the previous decade, and 0.6 percentage points lower than two decades earlier (Exhibit 10).

EXHIBIT 9

New Zealand's labour productivity growth is low and declining

NZ's labour productivity growth is **1/3x lower than other OECD** countries[1]

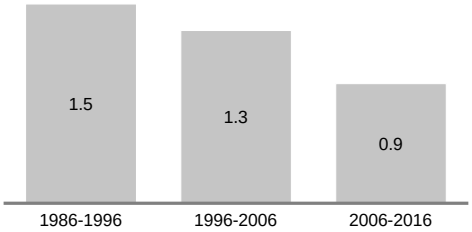
Productivity growth, annual average, 1995-2015



Out of 20 OECD countries, NZ has the **fourth lowest** productivity growth rate[1]

NZ's labour productivity growth has been **decreasing over the past few decades**

Productivity growth, CAGR, percent



The **productivity growth gap vs other high-income OECD countries has remained fairly stable**, because they experienced a similar productivity growth decrease

1 Based on OECD analysis in OECD New Zealand Economic Survey 2017, Figure 1.2 (Labour productivity growth across 20 OECD countries for which data is available)

SOURCE: OECD Economic Survey New Zealand 2017, Figure 1.2 (left), Oxford Economics; NZ Productivity Commission: 'Can the Kiwi fly? Achieving productivity lift-off in New Zealand', Chart 2 (right)

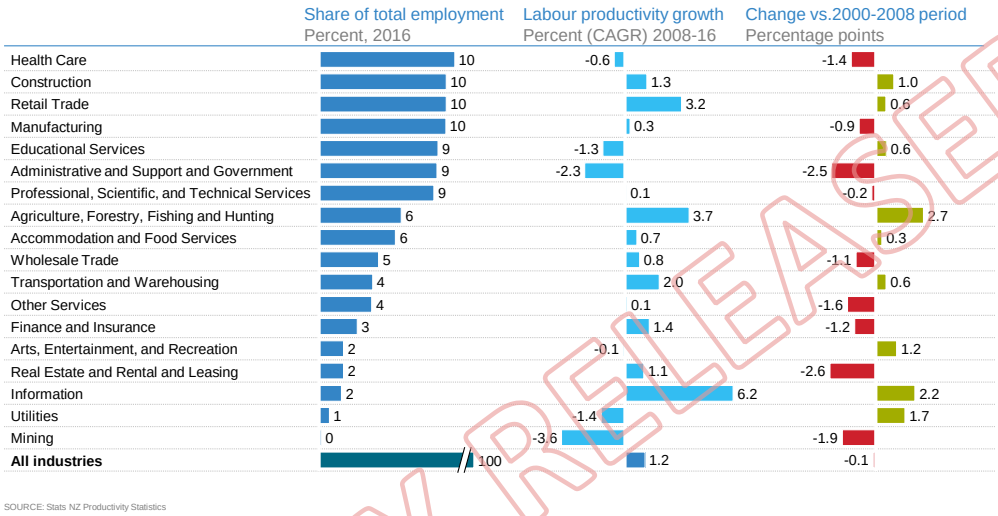
Since the global financial crisis in 2008, half of all sectors have had less productivity growth than in the equivalent preceding time period (Exhibit 11). This is largely due to a widespread fall in multi-factor productivity (MFP) growth across all sectors in the wake of the global financial crisis, with the exception of the agriculture, forestry, fishing and hunting sector.

[14] Based on OECD analysis in OECD New Zealand Economic Survey 2017, Figure 1.2 (Labour productivity growth across 20 OECD countries for which data is available).

[15] Declining productivity growth is also a problem across other high-income OECD countries. This has resulted in a fairly stable productivity level gap between NZ and other high-income OECD countries. See NZ Productivity Commission: 'Can the Kiwi fly? Achieving productivity lift-off in New Zealand', Chart 2: http://www.csls.ca/ipm/34/Conway.pdf

EXHIBIT 10

The recent slowdown in productivity growth has been broad-based across sectors



SOURCE: Stats NZ Productivity Statistics

If New Zealand does not lift its productivity growth, our economic growth will decline unless further offset by employment growth. The result could be stagnation of per capita GDP growth and strain on the nation's social fabric. The OECD looked into this lacklustre performance and attributed it to our lack of international connections, agglomeration economies of scale, weak competitive pressures, low rates of capital investment, and meagre research and development activity.[16] Various governments in New Zealand have been working to address labour productivity through measures such as the Business Growth Agenda in 2012-2017, increased investment in infrastructure (including high speed broadband) and a strong ICT strategy with clear targets to enable better public services. However, and this may be surprising, it is automation that promises to be the real unlock for New Zealand to accelerate its productivity growth.

THE AUTOMATION WAVE IS WELL ON ITS WAY

Automation technologies—which span advanced robotics, machine learning and AI—are going to change workplaces. Globally, the McKinsey Global Institute has found that AI alone may deliver the equivalent of US$13 trillion in additional economic activity by 2030, or about 16 percent more than would otherwise be achieved.[17] This additional wealth is added because machines can outperform humans in many areas, which has implications for jobs and for the future of work.

Digital technologies have appeared in accelerating waves, from the first computers through to the latest smartphones and cloud computing. Automation, artificial intelligence and machine learning are not new, but the unprecedented scale and pace of disruption is changing our world faster than ever before. Overall, this technological disruption is predicted to occur at 10

[16] OECD Economic Surveys: New Zealand, July 2017.
[17] *Notes from the AI frontier: Modelling the impact of AI on the world economy*, McKinsey Global Institute, 2018.

times the pace and 300 times the scale of the industrial revolution.[18] Computing power is increasing exponentially, with ubiquitous connectivity and torrents of data being created—over 90 percent of the world's data today has been created in the last 2 years.[19] Through the use of this data, automation will increase the amount of output we can produce, the way we work and the jobs we work in.

In the past, computers completed rigidly defined tasks for which they were specifically programmed. Today, machines can guide themselves: setting a strategy for learning and utilising past data to understand future patterns without being reprogrammed. This artificial intelligence (AI) is already applied across an impressively broad range of scenarios. While they are not yet able to 'think' in the way we do, machines are starting to do things that once only humans could, and they are doing it better. Until recently, games such as chess and Go were considered the ultimate challenges: even the fastest computers could not spin through possibilities fast enough to beat an intuitive Grand Master. Now, programs simply learn from their past and present 'opponents'—and can take on thousands in a second—to tilt the playing board in their favour.[20] At the same time, the game of chess has never been more popular.[21] What has played out on the gameboard is now about to play out at every New Zealand workplace. This creates unique, contemporary opportunities and challenges for New Zealand. We will need to adapt faster to change than we ever have before and, in the process, not leave anyone behind.

A fourth revolution may solve the productivity puzzle

To explore the implications of this disruption on the global future workforce, McKinsey & Company mapped the capabilities of this 'deep learning' against more than 400 specific work activities and identified a wealth of practical applications, across myriad scenarios. AI-driven algorithms can look ahead to optimise logistics, or schedule maintenance to reduce downtime and operating costs while extending the life of capital assets. For example, in aviation, AI has been used to extend the life of planes beyond what was previously possible using traditional analytic techniques by combining plane model data, maintenance history, IoT sensor data (such as anomaly detection on engine vibration data), and images and videos of engine conditions.[22] Consumer industries will tend to see more marketing AI applications as increasingly frequent digital interactions with customers generate larger data sets for AI techniques to tap into.[23]

Further, AI or machine learning can then be combined with cyber-connected objects (the Internet of Things) and robotics to create an integrated cyber-physical world. For example, Autogrow, an Auckland based AgTech company, is at the cutting edge with its integrated,

[18] Richard Dobbs, James Manyika, and Jonathan Woetzel, No ordinary disruption: the four global forces breaking the all the trends, McKinsey & Company, 2015.
[19] 10 Key Marketing Trends For 2017, IBM Marketing Cloud.
[20] For a useful overview of AI technologies and use cases, see the following publications: *The age of analytics: Competing in a data-driven world,* December 2016; and 'What's now and next in analytics, AI, and automation,' McKinsey Global Institute, May 2017.
[21] https://www.bloomberg.com/opinion/articles/2018-11-13/world-chess-championship-2018-is-made-for-the-internet.
[22] Notes from the AI frontier: Applications and value of deep learning, McKinsey Global Institute, April 2018.
[23] Notes from the AI frontier: Applications and value of deep learning, McKinsey Global Institute, April 2018.

automated crop management solutions. It has recently partnered with Amazon's Alexa, with the aim of being the first provider in the world to allow commercial growers to 'speak' to their systems and use an avatar to remotely check on and manage their crops. The next step would then be to use AI to proactively self-correct any identified issues.[24]

For organisations investing in automation technologies, the benefits are many—and often that is more a bi-product than an objective. They can optimise how industrial plants use energy and raw materials, or help managers coordinate large, complex construction projects more seamlessly. AI can also lead to entirely new offerings. Amazon's recommendation engine and the Alexa virtual assistant for the home give consumers an expanded range of choices, often with higher quality and at lower prices, whilst giving those companies access to new revenue streams.

For New Zealand, the upside of automation is in productivity growth. As consumer demands change and new markets are created, innovators can increase exports of automation-era products and services. In previous decades, New Zealand has lost production and routine jobs to low-cost countries, replacing them with higher-value jobs. The automation era will create more collaborative and cognitive jobs that involve more complex interactions and judgement[25]—if New Zealand can help its workforce transition to those skills, then it can expect to see the productivity growth rewards.

Today AI is where mobile technologies were 15 years ago: much more growth and competitive reshuffling is still to come. However, New Zealand companies that remain wedded to their traditional business models and operations may pay a heavy price. Public-sector organisations will also need to release their highly cognitive workforce from more routine tasks and allow them to meet the rising service expectations of their citizen customers. Citizens, workers, and society as a whole stand to benefit from access to higher quality private and public services, improved quality of life (for example, health incomes), and the potential for higher wages for more skilled work. A fourth and most powerful economic revolution awaits[26]—we further explore automation's ability to boost productivity and other benefits in the following chapter.

Tasks not jobs

Despite growing fears, automation lends itself to the displacement of tasks rather than the elimination of whole jobs. Only a few occupations are fully automatable by adopting current technologies, however many other occupations are partially automatable. McKinsey Global Institute (MGI) research examined more than 2,000 work activities in more than 800 occupations globally, estimating both the time spent on them and feasibility of automating them—using just existing technologies.

[24] https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12149496.
[25] McKinsey, 'Compete to prosper: Improving Australia's global competitiveness', July 2014.
[26] The first industrial revolution was the 18th century shift from rural to urban societies. The second, in the lead up to World War I, saw the twin breakthroughs of electricity and the internal combustion engine. The third is the first digital revolution of the 1980s onwards, with the personal computer, the internet and related technologies. See 'The Fourth Industrial Revolution: what it means and how to respond', World Economic Forum, 2018.

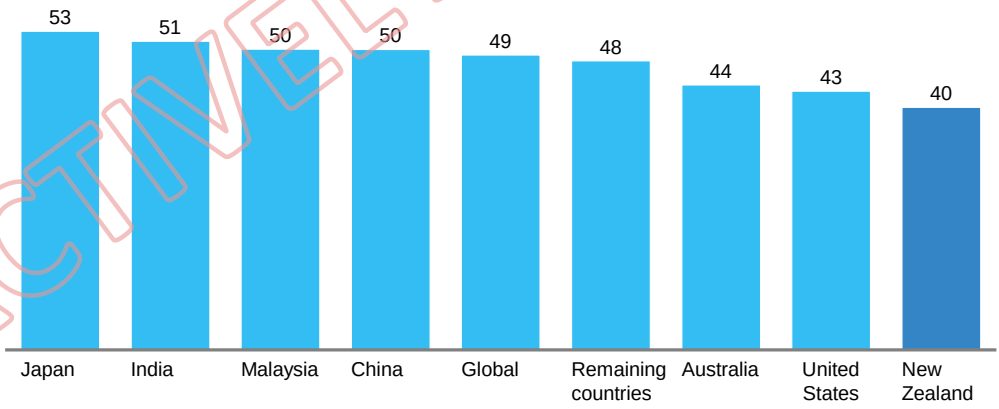
For New Zealand, MGI analysis shows that only 1.6 percent of occupations can be fully automated, and thus replaced outright. However, the analysis also found that in 60 percent of jobs, about one-third of their component activities could be automated based on currently available technologies.[27] This means that companies would need fewer workers across that portion of the job, and the balance of tasks could be combined, redefined and enhanced.[28]

Further, McKinsey found that 40 percent of existing workforce activities could already be automated with today's technologies, which is relatively lower than Australia (44 percent), the US (43 percent) and the global average (49 percent) (Exhibit 12).[29] While New Zealand's automation potential is significant, it is relatively lower than other western countries as its workforce spends less time on repetitive activities (45 percent), which are highly automatable (Exhibit 13). Highly automatable activities include predictable physical tasks, data processing and data collection, which are prevalent in occupations such as production workers, payroll officers and mortgage originators.

EXHIBIT 11

New Zealand has a significant automation potential of 40%, although it is relatively lower than other countries

Automation potential based on demonstrated technology, 2016, Percent[1]



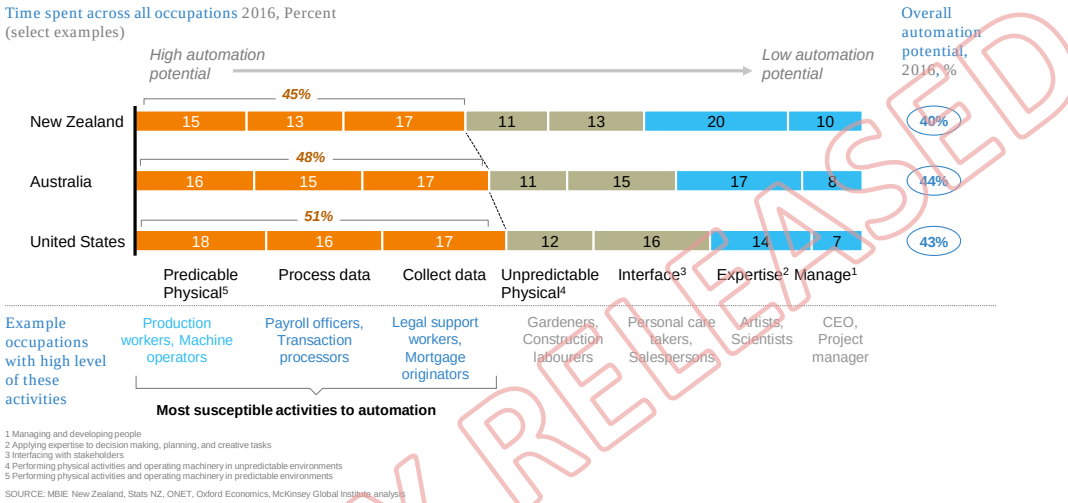
1 We define automation potential according to the work activities that can be automated by adapting currently demonstrated technology

SOURCE: Stats NZ, Figures.NZ, MBIE New Zealand, ONET, Oxford Economics, McKinsey Global Institute analysis

[27] See A future that works: Automation, employment, and productivity, McKinsey Global Institute, January 2017, and Jobs lost, jobs gained: Workforce transitions in a time of automation, McKinsey Global Institute, December 2017.
[28] As a baseline for discussion, we directly map percentages of activities within an occupation that can potentially be automated to the percentage of jobs within that occupation that could be lost.
[29] Specialised work refers to work that requires personal interactions or the application of specialist skills that are highly sensitive to changing stimuli (i.e. not routinised), are cross-functional, or require significant creativity. For example, teaching, nursing, and sales are considered specialised work occupations.

EXHIBIT 12

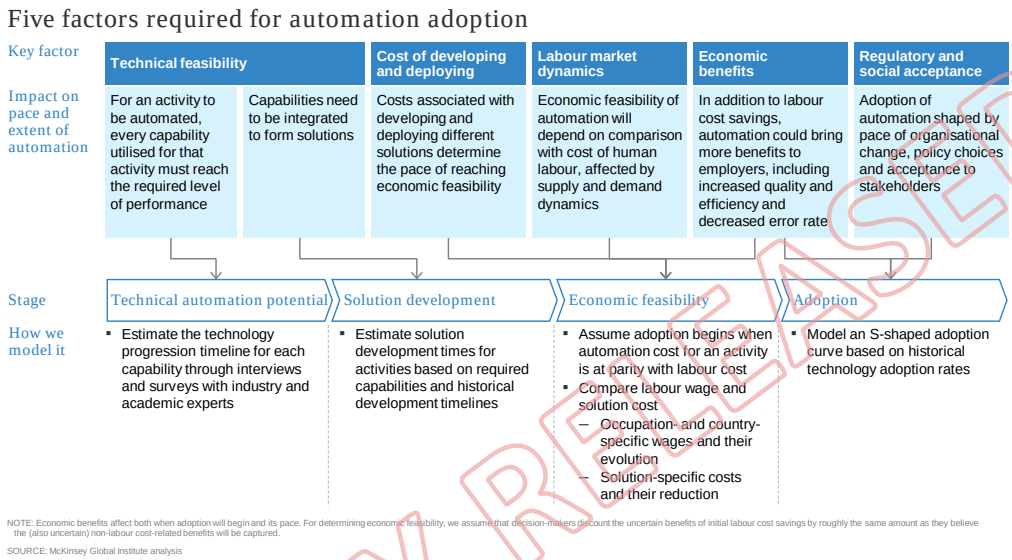
This share of repetitive activity is relatively low compared to other countries, resulting in New Zealand's lower automation potential



The impact of automation on jobs in NZ

The McKinsey Global Institute research examined multiple factors that would affect the pace and extent of automation (Exhibit 14), resulting in three scenarios for automation potential (i.e. what can technically be automated because the technology currently exists) and adoption (i.e. what we believe will actually get automated, taking into account financial, regulatory and political and social constraints). These are: a late (or slow) scenario; an early (or rapid) scenario; and a mid-point scenario, which is the average of the late and early scenarios. For early adoption to happen, technologies and solutions would need to be developed at an accelerated speed, requiring both the public and private sectors to invest significantly in research and development (R&D), technology development and technology deployment. That would require investment in developing the technologies themselves, as well as investment in digitally enabled infrastructure. Likely barriers to adoption, such as outdated or complex regulation, would also need to be overcome quickly, requiring a high degree of support and consensus across society.

EXHIBIT 13



McKinsey New Zealand has applied these same methodologies to examine the impact for New Zealand and found that this 40 percent automation potential could rise to 60 percent by 2030 in the mid-point scenario, and to as high as 79 percent in the rapid scenario. Despite this, only 21 percent of workplace activities are expected to be automated by 2030 under the mid-point estimate. Although it may be technically feasible for organisations to automate a wide range of tasks, they will not do so overnight. Doing so is a complex equation that incorporates the costs of the systems and the transition, the relative cost of labour, the strength of the business case, customer acceptance, and industry regulations.

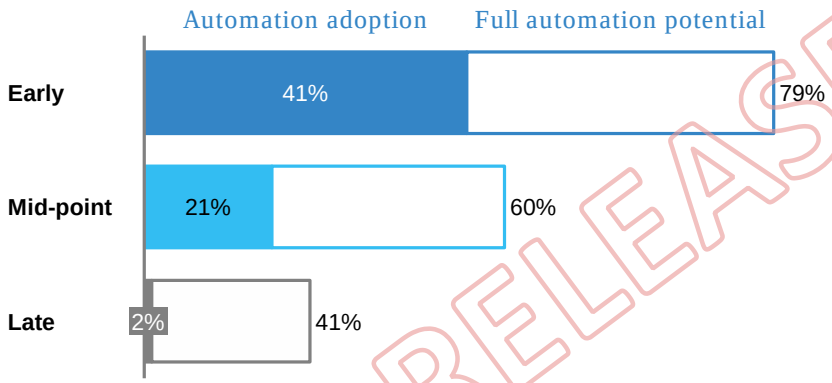
For instance, if retail stores automate the checkout process, they may choose to eliminate some checkout staff—but they could also opt to redeploy their checkout staff to help customers with questions about products, delivering a better customer experience. Likewise, as call centres introduce more automation technologies, employees may only be needed to handle difficult customer service questions, allowing workers to be redeployed to serve customers more comprehensively than they have scope to do now—ultimately resulting in more satisfied customers. The important point here is these shifts will not necessarily lead to workforce reductions, but rather could lead to better use of staff.

McKinsey ran multiple scenarios on how rapidly and widely automation technologies could be adopted across the New Zealand economy. This was a bottom-up analysis, based on tasks in each occupation and industry. The mid-point scenario estimates that approximately one-third of the total automation potential will be realised by 2030. Activities that together account for 21 percent of the hours put in by New Zealand's workforce today would be handled by machines. This share could be as low as 2 percent in a late, or slow, adoption scenario, or as high as 41 percent if automation adoption happens quickly (Exhibit 15).

EXHIBIT 14

Our mid-point scenario estimates that 21 percent of work will be automated by 2030

Scenarios for automation potential and adoption for New Zealand by 2030;
Percent of time spent on work activities



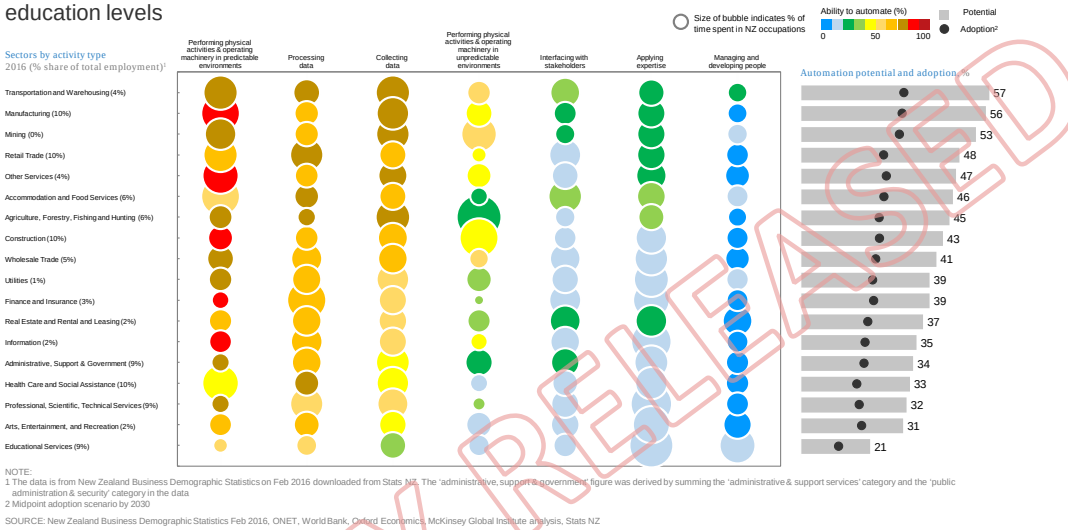
SOURCE: McKinsey Global Institute (MGI)

When considering the speed of automation at the mid-point scenario, measured as the percentage of FTE hours expected to be automated by 2030, analysis suggests that New Zealand could adopt automation relatively quickly (to achieve a 21 percent automated workforce) compared with the global average (of 19 percent in the same scenario). This is because New Zealand workplaces pay relatively high wages and salaries for routine work, making it attractive for organisations to automate part or all of those jobs. It is for this reason, coupled with having an industry-heavy economy, that Japan and Germany are expected to automate faster in the timeframe (28 percent and 26 percent, respectively), with Japan also driven by its rapidly ageing workforce. Both Australia and the US are also expected to automate faster than New Zealand (each at 25 percent).

Not surprisingly, the automation opportunity varies significantly by sector (Exhibit 16). Three sectors—transportation and warehousing, manufacturing, and mining—will experience significant automation as their work time is dominated by performing predictable physical activities and collecting data—both highly automatable activities. At the other end of the automation scale, educational services, healthcare and professional services will experience the least automation as more time is spent on managing and developing people, and applying expertise, where the ability to automate is relatively low.

EXHIBIT 15

Automation potential varies across industries depending on mix of work activity types and education levels



NOTE:
1 The data is from New Zealand Business Demographic Statistics on Feb 2016 downloaded from Stats NZ. The 'administrative, support & government' figure was derived by summing the 'administrative & support services' category and the 'public administration & security' category in the data
2 Midpoint adoption scenario by 2030

SOURCE: New Zealand Business Demographic Statistics Feb 2016, ONET, World Bank, Oxford Economics, McKinsey Global Institute analysis, Stats NZ

□ □ □

The next chapter looks further at the opportunities and challenges automation will deliver for New Zealand, and the effects on New Zealand's various sectors, occupations and regions. Chapter 3 considers what government and business could do to seize the automation opportunities, mitigate the challenges, and transition the workforce into the future.

2. AUTOMATION OPPORTUNITIES AND CHALLENGES

As set out in Chapter 1, New Zealand's productivity growth has been declining. While overall GDP growth has been offset, to some extent, by employment growth, New Zealand needs to re-boot productivity—the main driver of quality growth—in order to deliver greater prosperity for the country. However, while automation is an inevitability that holds enormous potential for New Zealand, that does not mean that its full benefits are guaranteed. The extent to which it can boost productivity will depend on how fast New Zealand chooses to adopt automation.

Automation also brings challenges. Automation will change the workplace in New Zealand as we know it—with required skills shifts and changing educational requirements, as well as significant job churn as jobs are both displaced and created. At a societal level, automation could widen income inequality, unless mitigated through sufficient, well managed, and timely retraining of displaced workers.

Accordingly, before looking at what public and private sector can do to mitigate the risks, in this chapter we explore the three main opportunities and challenges of automation for New Zealand:

- Opportunity 1 – Automation could help solve the productivity problem
- Opportunity 2 – Automation can increase international competitiveness
- Opportunity 3 – Automation will change jobs
- Challenge 1 – Automation will change the skills required in the workplace
- Challenge 2 – Unemployment may rise during the automation transition period
- Challenge 3 – Automation could widen income inequality

THE OPPORTUNITIES

OPPORTUNITY 1 – AUTOMATION COULD HELP SOLVE THE PRODUCTIVITY PROBLEM

Automation could go very far in solving New Zealand's productivity imperative. New automation technologies are related to all four levers that an economy can pull to boost its productivity: investing in capital assets, investing in human capital, boosting competition and entrepreneurship, and investing in innovation and technology. New Zealand should have strategies for all four of these levers, and they should each incorporate the promise of automation. The innovative technologies automation and machine learning offer are specifically designed to increase quality and output, with greater efficiency. They create incentives for greater cognitive and collaborative human skills, and opportunities for

entrepreneurs to take on incumbents and for incumbents to take on international competition. With all this on the table, it is imperative to move early.

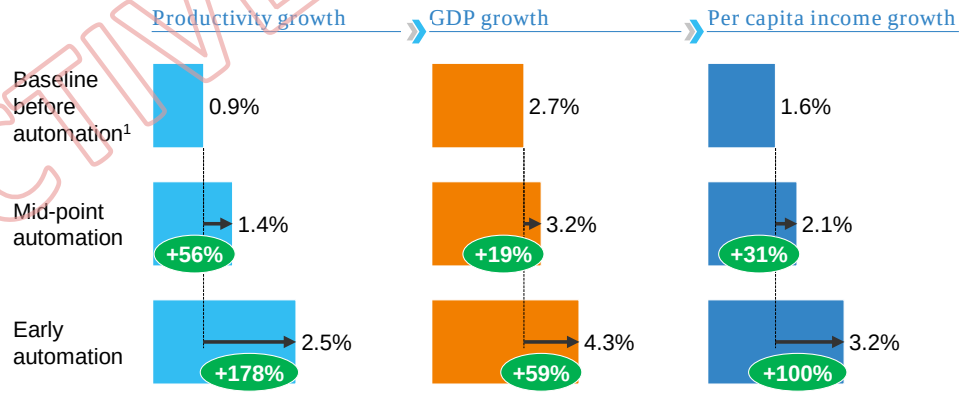
McKinsey analysis suggests early adoption boosts productivity significantly more than mid-point adoption. Automation may support productivity growth of 1.4 percent between 2016 and 2030 in a mid-point adoption scenario, however the early adoption scenario tips that to as much as 2.5 percent (Exhibit 17). Under the mid-point adoption scenario, this would take New Zealand's productivity growth to 27 percent above the baseline before automation of 1.1 percent, and 93 percent of the 1.5 percent achieved during the high productivity growth years of 1986 to 1996. The early adoption scenario is even more promising; early adoption would increase New Zealand's baseline productivity by approximately 2.5 times, which is 1.8 times higher than the productivity achieved from 1986 to 1996.

An increase in productivity growth from automation would significantly increase GDP growth. The baseline GDP growth of 2.7 percent could increase to 3.2 percent in the mid-point scenario (a fifth higher than the baseline scenario) or 4.3 percent if automation is rapidly adopted (about 60 percent higher than the baseline).

EXHIBIT 16

Automation can provide a major boost to New Zealand's future economic prosperity

Projected real growth rate (compound annual growth rate) by automation scenario, 2016-2030



NOTE: Model assumes labour displaced joins back into the economy and are at least as productive as 2016
1 At historical 2008-2016 productivity growth rates

SOURCE: McKinsey Global Institute analysis

To put these productivity growth numbers into context, these estimates suggest that automation could lift the value of New Zealand's annual economic activity or GDP by around $23 billion by 2030 in the mid-point adoption scenario, and by around $75 billion in the early adoption scenario—about 7 to 22 percent more than would be achieved otherwise. It could increase average New Zealand incomes by $4,000 to $14,000 per year, about 7 to 22 percent more than would otherwise be achieved.

Over a decade these numbers add up: automation could cumulatively add $133 billion to $436 billion to the New Zealand economy between 2021 and 2030, and give each person additional income of $25,000 to $83,000 over that period. Comparing the two scenarios, early automation adoption offers approximately three times the economic benefits compared to the mid-point scenario. That is, the additional value of pursuing early adoption over mid-point adoption could be worth $303 billion to the economy over a decade, and about $58,000 for

each New Zealander. If New Zealand shuns automation, it needs to be aware that it is forgoing these potential upsides as well.

Strong job outcomes, however, are necessary to maximise the opportunity to grow GDP, incomes and living standards through automation, and ensure the continuation of businesses' social licence to operate. Periods of high unemployment have second-order effects, such as slowing demand for consumption-based services, that impact many businesses. The expected impact on jobs, skill requirements and unemployment are explored later in this chapter, while the next chapter (Chapter 3) recommends actions that can be taken by all stakeholders to ensure the benefits of automation are broadly shared.

Box 1. SMEs have a chance to shine

As New Zealand is a nation of small-to-medium enterprises—with 73 percent of businesses employing less than 20 people, and only 4 percent employing over 100 people[30]—automation solutions could bridge the historic productivity gap they have faced compared to bigger or global competitors. Previously, SMEs have been handicapped as technology-driven productivity improvements, such as those delivered by Enterprise Resource Planning (ERP) systems, have been out of reach due to the large investment costs and complex integration efforts required. This is changing with automation technologies, which can be applied at small scale. Cloud based analytics solutions, for example, work as well for a 10-person company as for a 10,000-person company. Similarly, the previous barriers preventing SMEs from adopting ERP systems have been removed—companies such as Kradle, an Australian-based start-up, have developed cost effective software-as-a-service ERP solutions that are web-based and specifically targeted towards SMEs.[31]

OPPORTUNITY 2 – AUTOMATION CAN INCREASE INTERNATIONAL COMPETITIVENESS

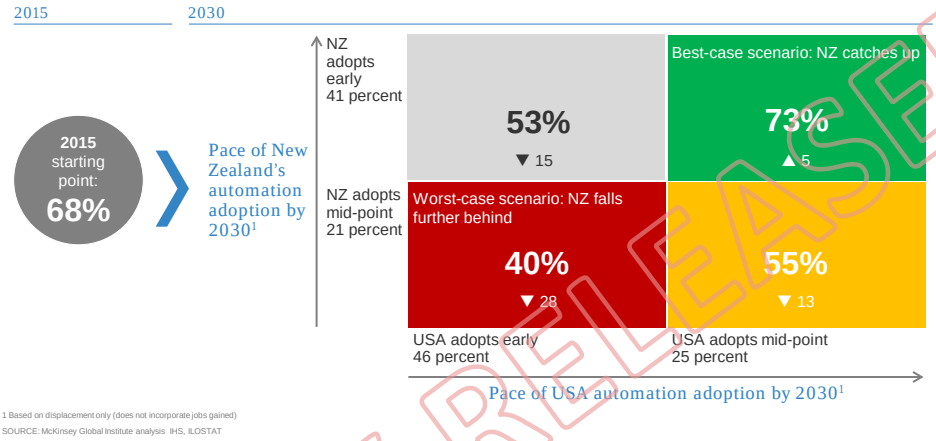
An additional benefit of automation is the potential it offers for New Zealand sectors to also catch up to international competitors. New Zealand is less productive than the US overall, with New Zealand's labour productivity being 68 percent of the US's labour productivity when taking all industries into account (Exhibit 18). New Zealand has the opportunity to narrow the overall gap to 73 percent through early automation adoption. The gap will further widen if New Zealand adopts automation at the same pace as the US (to 55 percent of the US's productivity) due to the different sector concentrations between the countries, and it will widen even further (to 40 percent of the US's productivity) if the US outpaces New Zealand in automation adoption. This international comparison is another example of the benefit of adopting automation early.

[30] Business Operations Survey 2017, Statistics New Zealand.
[31] https://istart.co.nz/nz-news-items/kradle-new-erp-available-smes/

EXHIBIT 17

The extent to which automation improves the relative competitive position of New Zealand's sectors will depend on the relative speed of automation adoption

New Zealand labour productivity as a percent of USA level



1 Based on displacement only (does not incorporate jobs gained)

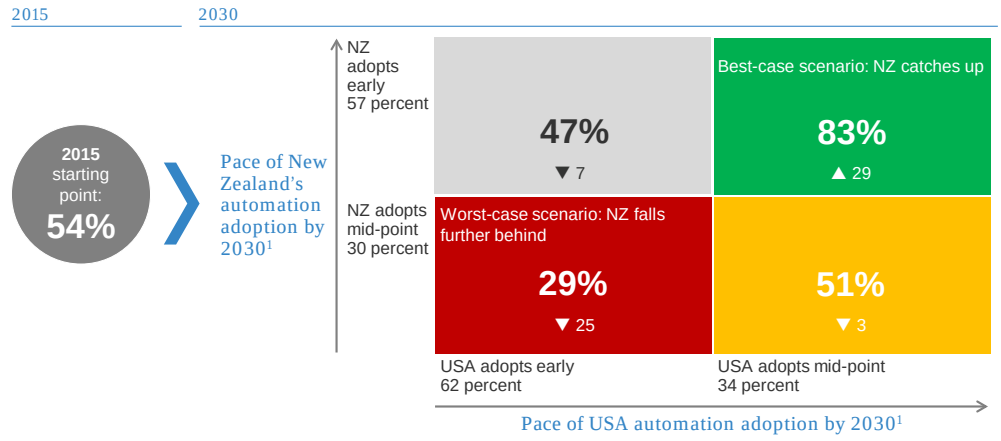
SOURCE: McKinsey Global Institute analysis IHS, ILOSTAT

While some New Zealand sectors, such as agriculture, are ahead of their international peers in terms of labour productivity, others are lagging. New Zealand's labour productivity in manufacturing is only 54 percent of the US equivalent (Exhibit 19), making it hard for New Zealand to compete. Faster adoption of automation could allow New Zealand manufacturers to close that gap to just 83 percent. Slower adoption risks seeing our relative manufacturing productivity plunge to just 29 percent of the US's level. Other sectors where the choice between early or late adoption will make the biggest difference to New Zealand's international competitiveness, as either an additional boost or to catch up, transportation and warehousing.

EXHIBIT 18

The extent to which automation improves the relative competitive position of New Zealand's Manufacturing sector will depend on the relative speed of automation adoption

New Zealand Manufacturing labour productivity as a percent of USA level



1 Based on displacement only (does not incorporate jobs gained)

SOURCE: McKinsey Global Institute analysis IHS, ILOSTAT

OPPORTUNITY 3 – AUTOMATION WILL CHANGE JOBS

Historically, major economic change has both destroyed and created jobs. The Industrial Revolution made agriculture more efficient and reduced the agricultural workforce, but it also generated countless new jobs in manufacturing. Similarly, the decline of manufacturing in advanced economies led to a boom in service industry jobs. There is every reason to think that a similar process will unfold with the automation revolution.

Even with automation, the demand for work and workers could increase as economies grow, partly fuelled by productivity growth enabled by technological progress. Rising incomes and consumption, increasing healthcare for aging societies, investment in infrastructure and energy, and other trends will create demand for work that could help offset the displacement of workers. Additional investments in infrastructure and construction, beneficial in their own right, could be needed to reduce the risk of job shortages in some advanced economies.[32]

While some workers will be at risk of job displacement, McKinsey analysis suggests that by 2030, the net result of jobs lost and gained is a net job creation of approximately 200,000. Automation also has important implications for the quality of jobs, eliminating many dangerous, routine and manual activities, and allowing people more time to use their specialised skills. On top of this, the nature of employment may change, as more and more workers consider contracting or independent work. In 2016, 20 to 30 percent of the working age population in the US and EU-15 engaged in independent work, with 70 percent choosing it as a preferred option rather than out of necessity and reporting high satisfaction with their work lives.[33] NZ should embrace these new labour models, so long as workers are not materially disadvantaged. While NZ could opt for implementing automation slowly to keep lower value-add jobs, or hindering the adoption of variations on traditional employment, this may hurt the nation's productivity and prosperity in the long run, especially when other countries charge ahead.

Of the almost 900,000 new jobs created by 2030, almost 700,000 (79 percent) of these jobs could come from new sources of demand and the faster economic growth that goes along with higher productivity, while the remaining 200,000 (21 percent) could come from entirely new specialist roles that do not currently exist (Exhibit 20). This is not surprising: one-third of new jobs created in the US in the past 25 years did not exist at the start of that period, and 70 percent of these were linked to technology.[34] Just as it would have been impossible to imagine web developers and social media marketers 50 years ago, it may be hard for us to envision today the new types of digital specialists who will be working to keep autonomous systems running with optimal efficiency. The market for edge computing experts and 3D printing engineers will grow. Other new jobs will focus more on helping people live in an automated world, such as fitness commitment counsellors to combat the effects of increasingly sedentary work lives, or virtual data brokers to help individuals keep their personal information safe and accessible.[35]

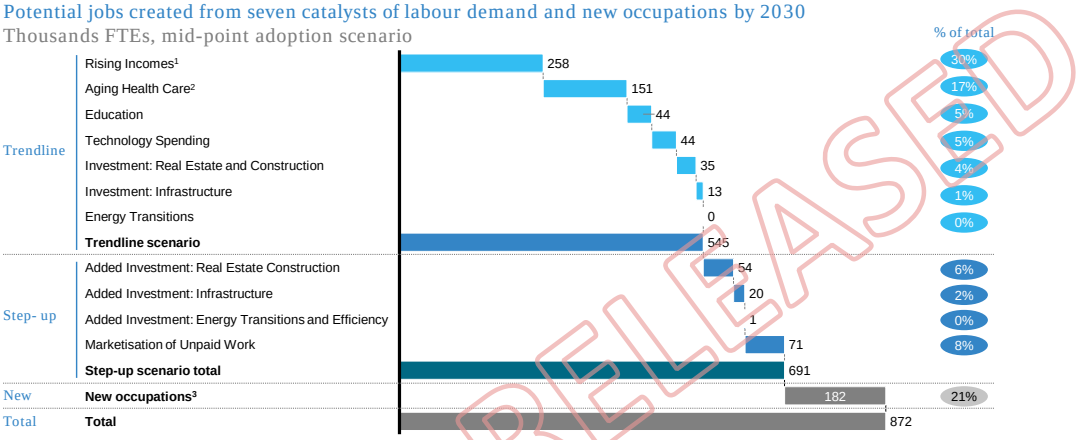
[32] McKinsey Global Institute, 'Jobs lost, jobs gained: workforce transitions in a time of automation', December 2017.
[33] McKinsey Global Institute, 'Independent work: choice, necessity and the gig economy', October 2016.
[34] Jeffrey Lin, "Technological adaptation, cities, and new work," Review of Economics and Statistics, 93: 2, May 2011.
[35] For more, see https://www.cognizant.com/whitepapers/21-jobs-of-the-future-a-guide-to-getting-and-staying-employed-over-the-next-10-years-codex3049.pdf.

EXHIBIT 19

Rising consumer incomes and ageing health care are expected to be the largest sources of job creation

Potential jobs created from seven catalysts of labour demand and new occupations by 2030

Thousands FTEs, mid-point adoption scenario



1 Excludes jobs created by ageing and healthcare
2 Includes jobs created from increased income
3 Study has shown that on average, 0.5 percent of the workforce has been working in 'new jobs' every year (Lin, Jeffrey, "Technological adaptation, cities, and new work," The Review of Economics and Statistics, issue 93.May 2011)

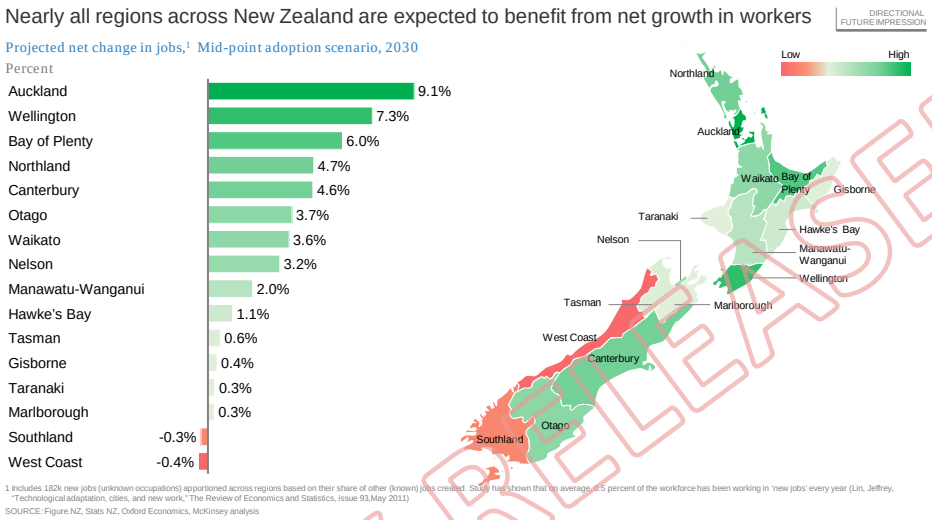
SOURCE: MBIE New Zealand, ONET, Stats NZ, Oxford Economics, McKinsey Global Institute analysis: MGI Automation Model March 2018, Jobs Lost Jobs Gained December 2017

While automation will lead to job creation, there will also be job displacement. The 21 and 41 percent automation adoption rates under the mid-point and early adoption scenarios translate to around 700,000 or 1.3 million full-time equivalent positions displaced over the next decade, respectively. While automation won't lead to mass unemployment, the real challenge is addressing the potential spike in the unemployment rate during the transition and to minimise long-term unemployment for individuals, which has devastating consequences for affected households, communities and for society as a whole. The unemployment challenges during the transition period are addressed in Chapter 2 and the potential solutions to minimising long-term unemployment in Chapter 3.

Employment growth will be widespread

Nearly all regions across New Zealand are expected to experience net job creation by 2030 (Exhibit 21). Auckland and Wellington are expected to be best off, with a 9.1 and 7.3 percent in net change in jobs, respectively, while only West Coast and Southland are expected to see a decrease in employment (-0.4 and -0.3 percent, respectively).

EXHIBIT 20

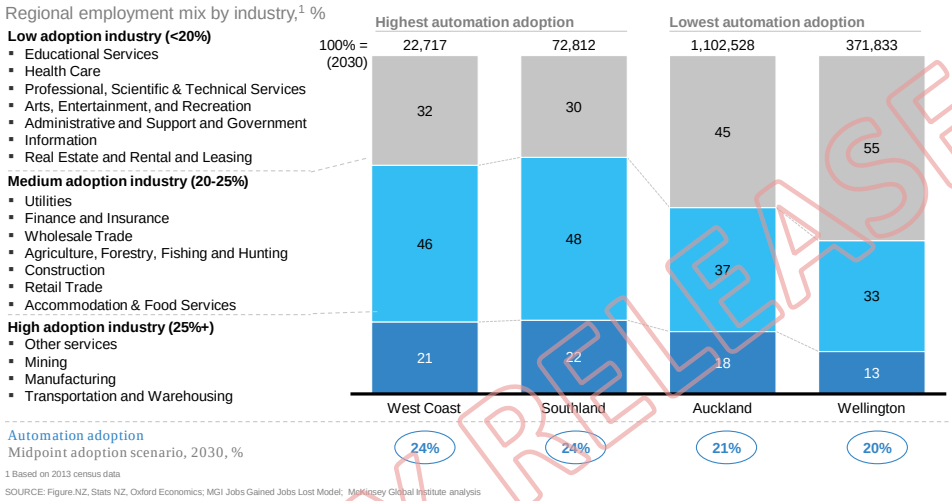


What differentiates regions, and the extent to which they are expected to adopt automation, is their occupation and industry mix**.** The West Coast and Southland have a higher proportion of their workforce employed in medium-to-high automation adoption industries, while Wellington and Auckland employ a relatively higher proportion of workers in low automation adoption industries (Exhibit 22).

Agriculture, for example—a medium automation adoption industry—employs a much higher proportion of West Coast and Southland workers than in Auckland or Wellington. Dairy farming is the top income generator in these regions, accounting for 14.8 percent of Southland's economy and 13.4 percent of the West Coast economy. Out of Southland's 57,000 total workers, nearly 3,000 work in the dairy industry (Fonterra's Edendale site, for example, employs over 600 people) and approximately 1,600 work in forestry. Auckland and Wellington, on the other hand, over-index on work in professional services and administrative, support and government sectors—both low automation adoption industries.

EXHIBIT 21

Regional differences are driven by industry mix



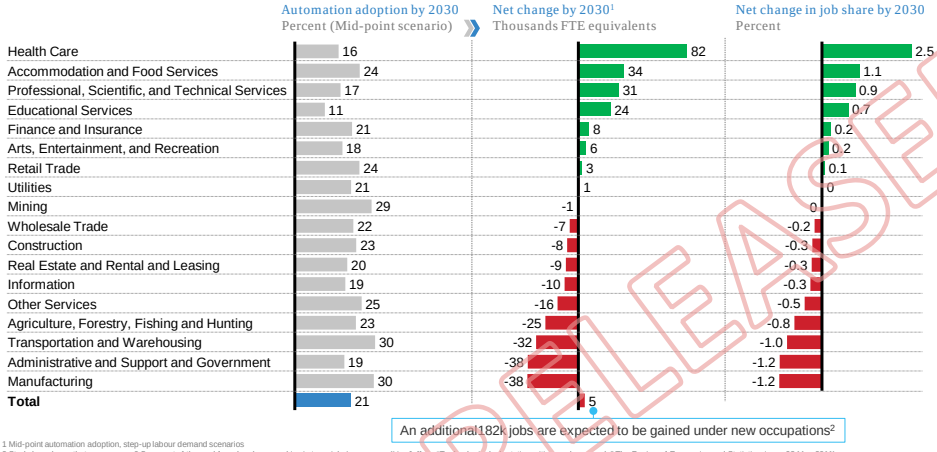
Sectors will experience varying levels of net job creation

The sector mix of the job market is expected to shift in favour of specialised, service-based sectors. Eight sectors are expected to create more jobs than they displace by 2030. Of these, three sectors will account for almost 80 percent of the net job creation by the eight sectors: healthcare (82,000 net jobs), accommodation and food services (34,000 net jobs), and professional, scientific and technical services (31,000 net jobs) (Exhibit 23), resulting in a 2.5 percent, 1.1 percent and 0.9 percent increase in share of total jobs for each of those sectors, respectively. Total net job creation numbers are a function of both a sector's automation adoption by 2030 and its current proportion of New Zealand's workforce. When considering the net impact of automation within sectors, two of the three sectors remain the same for the lowest levels of expected automation adoption: educational services (11 percent), healthcare (16 percent) and professional, scientific and technical services (17 percent).

Most operations-based sectors are expected to adopt higher levels of automation than their service-based counterparts. Ten sectors are expected to see net job displacement by 2030, with four of New Zealand's main sectors being the most heavily affected and accounting for over 70 percent of the net job displacement by those ten sectors: i) manufacturing (38,000 jobs displaced); ii) administrative, support and government (38,000 jobs displaced); iii) transportation and warehousing (32,000 jobs displaced); and iv) agriculture, forestry, fishing and hunting (25,000 jobs displaced). This results in a -1.2 percent, -1.2 percent, -1.0 percent and -0.8 percent change in share of total jobs for each of those sectors, respectively. Two of these sectors are also expected to be the highest adopters of automation across the economy: manufacturing (30 percent) and transportation and warehousing (30 percent), with mining (29 percent) following closely behind. The implications of automation on the skills shift required in the workplace and the potential impact on unemployment during the transition period are covered in more detail under Challenges 1 and 2.

EXHIBIT 22

Net, there will be more jobs available, but in different industries



1 Mid-point automation adoption, step-up labour demand scenarios
2 Study has shown that on average, 0.5 percent of the workforce has been working in 'new jobs' every year (Lin, Jeffrey, "Technological adaptation, cities, and new work," The Review of Economics and Statistics, issue 93,May 2011)

SOURCE: Figure.NZ, Stats NZ, McKinsey Global Institute analysis: MGI Automation Model March 2018, Jobs Lost Jobs Gained December 2017

THE CHALLENGES:

CHALLENGE 1 – AUTOMATION WILL CHANGE THE SKILLS REQUIRED IN THE WORKPLACE

The nature of work itself is also changing, as automation fundamentally alters the activities we perform at work, and therefore the skills we need. This will affect both the type of generalist skills and the level of specialist skills needed. Both may affect how our education system works to prepare the workers of the future.

The skills shift

As mentioned, some occupations will be impacted much more than others. Research points to four types of work activities that will see an increase in demand: working with machines (technology skills), applying expertise (cognitive skills), interacting with stakeholders (collaboration skills), and managing and developing people (emotional skills) (Exhibit 24). The rapid shift in skills required is already happening. The World Economic Forum estimates that even within the next 3 years, no less than 54 percent of workers will require significant reskilling and upskilling, with 19 percent requiring training of 6 months or longer.[36]

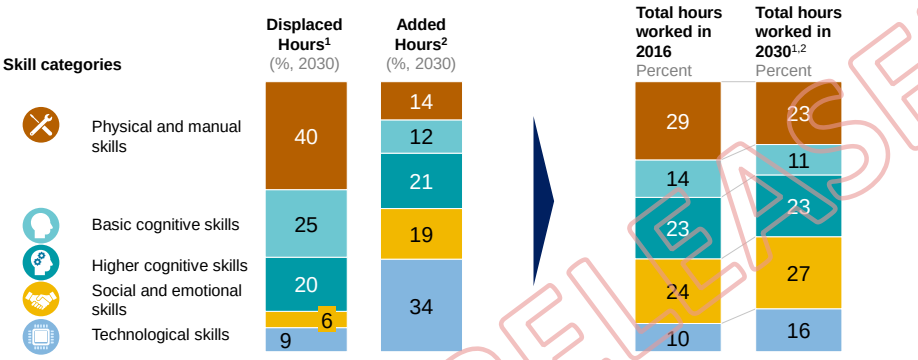
First there is the need to work with technology: farmers, firefighters, sales managers, builders, and others, will all rely heavily on machines that will collect data and take specific physical actions. These workers will need the cognitive skills to identify patterns, detect problems and prescribe courses of action. They will need collaborative and emotional skills to work in and create more effective teams, maintain productive and social workplaces, and engage with an ever-wider pool of customers. In the mid-point scenario, workers will spend more time using technology (16 percent of hours worked in 2030, compared to 10 percent in 2016), and more time in personal interactions that require collaboration and emotional skills (such as leadership, management or teaching) (Exhibit 24). By contrast, the need for people to perform physical and routine tasks will shrink.

[36] World Economic Forum, “The future of jobs report”, 2018.

EXHIBIT 23

Demand for technological, social and emotional, and higher cognitive skills are expected to increase significantly in New Zealand

Evolution in skill categories
Share of hours worked, percent



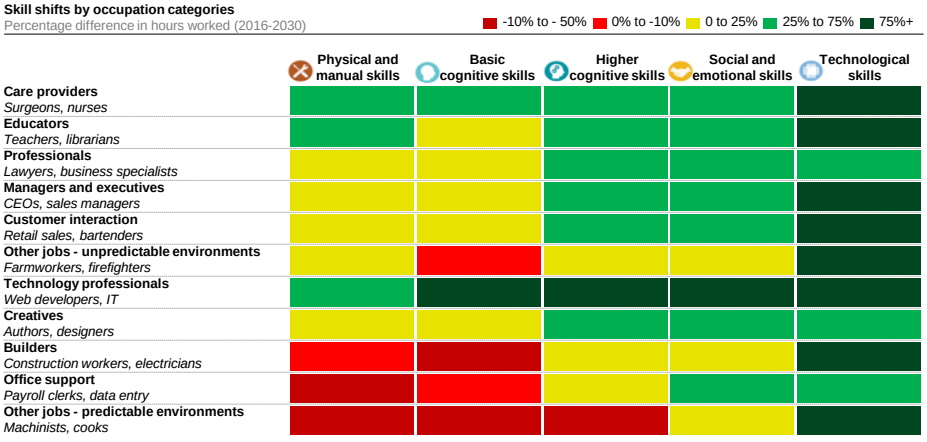
NOTE: Based on difference between hours worked per skill in 2016 and modeled hours worked in 2030 in Step-up scenario and midpoint automation. For practical purpose, the numbers for Australia is based on the 2030 Step-up demand , after automation from Jobs Lost Jobs Gained Model only. while other countries are based on Skills Model, where additional levers were also applied. Hence, cross comparison should be considered directional .
1 Midpoint automation adoption 2 Step-up demand scenario
3 The change in hours worked refers to the difference in total hours worked in a certain skill category in 2016 compared to 2030 projections. The percentage difference is not referring to the change from 2016 to 2030 of the percentage that a skill category makes up of total hours worked
SOURCE: Figure.NZ, Stats NZ, Oxford Economics; MGI Skills Model; McKinsey Global Institute analysis

The perception that automation driven changes will affect largely manual or lower-skilled work is incorrect; the precise changes in skillsets required will vary substantially by occupation and sector: see Exhibit 25. To illustrate this variation, workers across New Zealand's large and growing service sector may have access to automated information gathering, but will need to upskill in technology and emotional skills. For example, in education automation and AI can enable more digital content, interactive and personalised learning, and virtual learning and support. The result will be increased demand for teachers and instructors with basic digital skills and the ability to work with people with advanced IT and programming knowledge, as well as for new types of teaching methods.

EXHIBIT 24

All jobs categories will require a greater amount of technological skills, followed by social and emotional skills

Skill shifts by occupation categories
Percentage difference in hours worked (2016-2030)



1 Based on difference between hours workers per skill in 2016 and modelled hours worked in 2030 in Step-up labour demand scenario and midpoint automation
SOURCE: Figure.NZ, Stats NZ, Oxford Economics; MGI Skills Model; McKinsey Global Institute analysis

Further, many high-skilled jobs will change as diagnostic and data functions will be performed faster and more efficiently by machines. Already today, 13 percent of a surgeon's job (by

time) is automatable, including activities such as instrument sterilisation and analysing patient data. This is also the case for 23 percent of a lawyer's time; tasks like legal research and document preparation rely heavily on mechanical and replicable data research. Automation will therefore alter the very nature of these professions. A surgeon in the automation era will spend much more time using 'soft' skills, including cognitive skills and emotional skills, while the requirement for physical and technology skills will decline sharply. This will have significant repercussions for how universities train doctors, what aptitudes they seek out in applicants, how patients value their doctors, and how employers assess job applicants.[37]

[37] McKinsey Global Institute internal analysis, 2018.

Box 2: Skills shift in agriculture, manufacturing and the public sector

Manufacturing

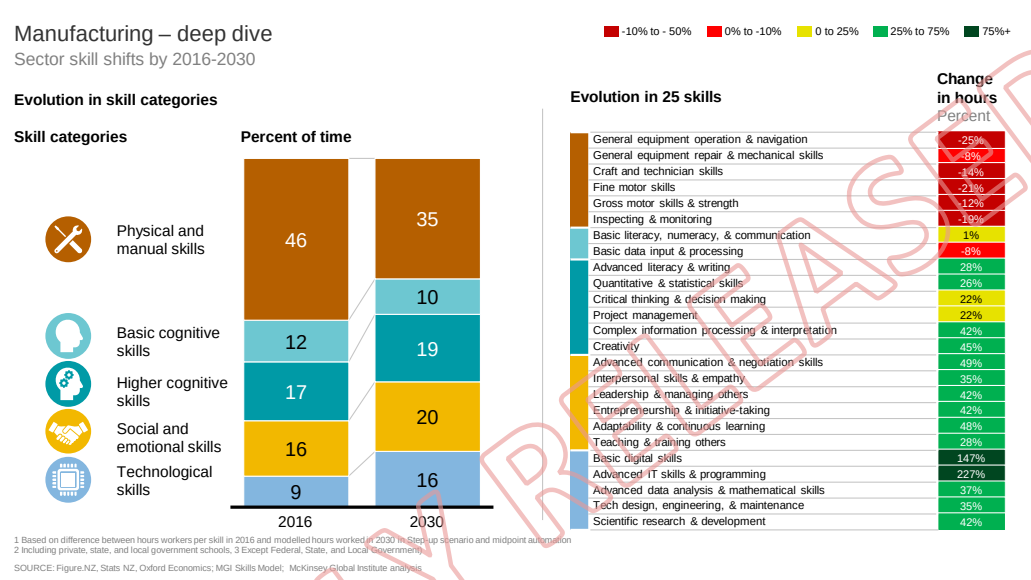
The manufacturing industry is a significant contributor to New Zealand's economy, accounting for 11 percent of its GDP and employing 10 percent of its total workforce. It has a pivotal opportunity to embrace automation, particularly given that doing so could go a long way towards offsetting its recent low labour productivity growth (0.3 percent per annum from 2008 to 2016) and low international competitiveness (currently at 54 percent of US manufacturing productivity, see Exhibit 19).

The positive impact of automation in manufacturing could be profound. In a joint research collaboration, the World Economic Forum and McKinsey & Company identified 16 leading factories that achieved significant financial and operational benefits from deploying the latest technology at scale[38]. One example is Rold, an Italian company of 250 FTE that produces door locks for washing machines. Rold has increased productivity by 11 percent by adopting automation technologies, such as advanced data infrastructure and digital dashboards displaying real-time machine data on the shop floor, machine stoppages and performance deviations that are automatically escalated to production managers, and digital labs testing and applying new production technologies for rapid prototyping.

In New Zealand, several companies are already well progressed. TCI, one of the largest plastic injection moulding companies in New Zealand, use Universal Robots industrial robotic arms, which only take a few minutes to program, to perform labelling and assembly tasks. This has resulted in higher levels of quality assurance and reduced costs, and allows TCI to use freed up staff on more complex tasks.[39] Another example is Energia Potior's EnPot technology, a result of research from the Light Metals Research Centre at the University of Auckland. EnPot consists of a series of heat exchanges for aluminium smelters that enable energy use to be adjusted in response to electricity price fluctuations, and better leverage renewable sources.[40] Smelter operators are able to turn energy consumption up or down by up to 30 percent (as compared to 5 percent previously) to take advantage of off-peak power prices, while accommodating the intermittency associated with renewable power supply.[41] In the future, manufacturing workers will spend less time using physical and manual skills (decreasing from almost half of total time, to just over one-third), with the largest decrease coming from equipment operation as robots replace manual, repetitive tasks (Exhibit B1). At the same time, work time will shift in favour of a higher focus on technological skills: the expected time spent using technological skills will almost double (from 9 percent of hours worked, to 16 percent) with the biggest increase coming from advanced IT skills and programming and other digital skills.

[38] World Economic Forum and McKinsey & Company, "Fourth industrial revolution: beacons of technology and innovation in manufacturing", January 2019.
[39] https://www.universal-robots.com/case-stories/tci-new-zealand/
[40] Ministry of Business, Innovation & Employment, *New Zealand Sectors Report Series: Beyond Commodities: Manufacturing into the future*, New Zealand Government, 2018.
[41] https://www.energiapotior.com/

EXHIBIT B1



Agriculture

Agriculture, forestry, fishing and hunting is one of New Zealand's key sectors. Despite comprising only 5 percent of GDP and 6 percent of employment,[42] the sector plays a critical role in New Zealand's export activity and is responsible for generating input for value chains in other key sectors, such as manufacturing (food and beverage), wholesale trade, and transport, postal and warehousing. Primary industries account for over 70 percent of New Zealand's merchandise exports, [43] with an estimated 85 to 90 percent of our dairy, meat, fruit and vegetable produce being exported every year.[44] Labour productivity in agriculture is one of the highest of New Zealand's sectors (see Exhibit 11), yet it has been experiencing a shortage of skilled staff over the last few years as a result of tougher immigration regulations and competition for labour with other well-paid industries, such as construction and road building.[45]

One of the benefits of technology and automation could be mitigating the impact of such shortages in future, where automation could perform some of the more menial work, such as operating machinery in predictable environments, collecting data, and processing data.

Numerous automation technologies are already in use within the agriculture sector to improve the efficiency, quality and reliability of output. These include autonomous drones for real-time land mapping, surveying and monitoring, autonomous tractors, automated grain/food processing, semi-autonomous crop care and pollination, and automated dairy milking, manufacturing, and herd management systems. The Agrobot, for example, is a

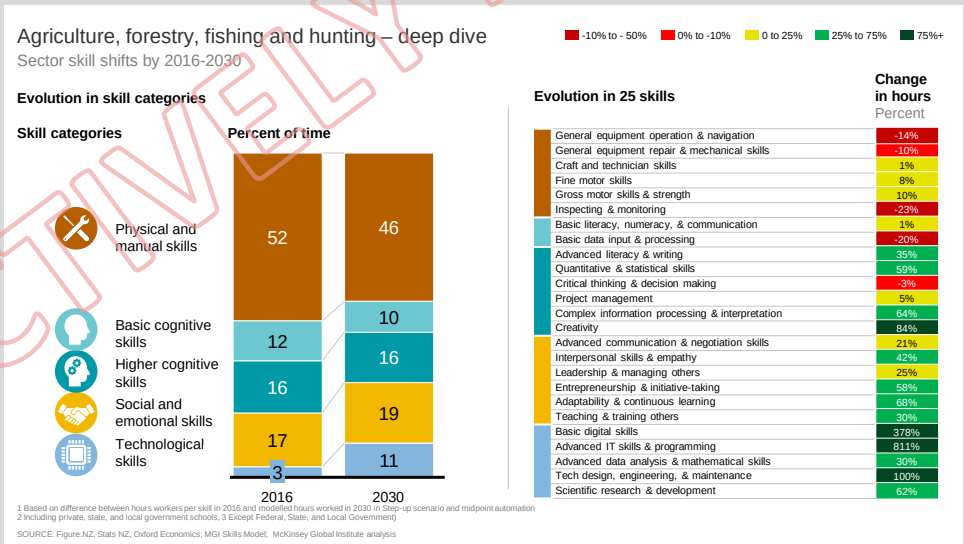
[42] Based on ANZSIC categorisation, Statistics New Zealand, as at 2016.
[43] Ministry for Primary Industries: https://www.mpi.govt.nz/exporting/overview/growing-exports/
[44] https://www.export.gov/article?id=New-Zealand-Agriculture-Sector
[45] https://www.stuff.co.nz/business/farming/102231279/primary-sector-industries-in-hunt-for-workers-as-shortfall-looms

strawberry harvester with 3D sensors that analyses fruit health before harvesting, moving and packaging.

New Zealand start-ups are already making a prominent mark on the AgTech industry. Robotics Plus, for example, is a Tauranga-based company building robotics solutions for the industry. Two of their recent projects include the QuadDuster, an assistive kiwifruit pollination system, and a robotic apple packaging solution that aims to speed up the packaging process while ensuring optimal handling and orientation.

Such fast-paced change is anticipated to change the nature of work, and skills used, in agriculture. Agriculture workers are anticipated to spend slightly less time using physical and manual skills in future compared to today (from 52 percent of work hours to 46 percent), and significantly more time on technological skills (Exhibit B2). Within technical skills, advanced IT skills and programming are expected to undertake the largest relative increase in hours.

EXHIBIT B2



Public sector

The administrative and support sector (including public administration and safety) accounts for 6 percent of GDP, and 9 percent of total employment. The public service, local government and other government entities employ ~150,000 people across New Zealand. There is significant potential for automation in the public sector; as has been seen in the private sector, technology adoption and digital transformation can improve efficiency, productivity and citizen satisfaction.

Automation can enable governments to do more with less. They can enhance their services, automate and improve the accuracy of back office processes, better store and use data, and scale efficiently as demand grows, without comprising the quality of their service.

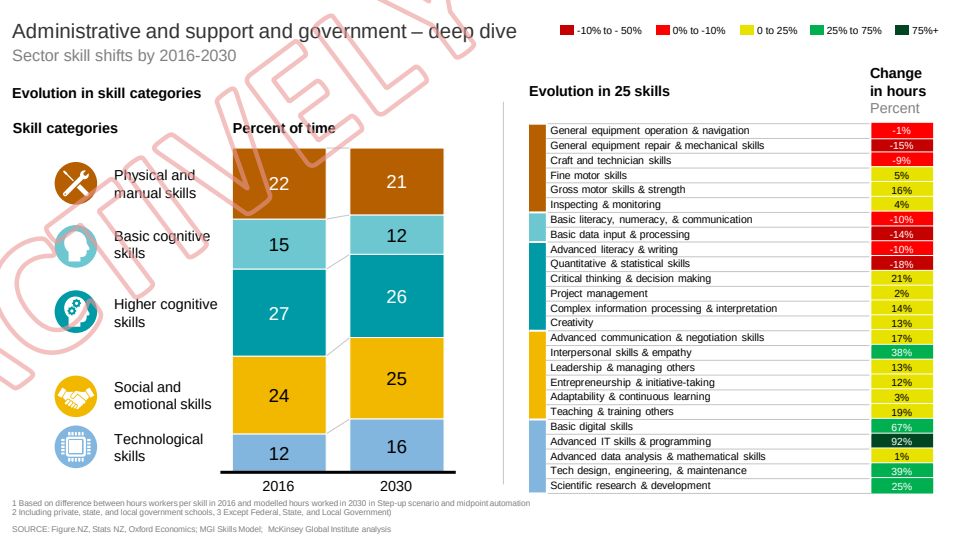
The University of Adelaide in Australia, for example, used a Chatbot last year to deal with

student enquiries relating to certain components of admission.
Over 2,000 students managed to skip what would have otherwise been an hours-long phone queue to have their query resolved in around 3 minutes.[46]

New Zealand's very own ICT Strategy aims to enable better public services and agency digital transformation through several levers, including the use of emerging technologies and data and analytics.

The anticipated skills shift for public sector employees is less apparent than in previously examined industries, as a relatively lower portion of time (22 percent) is spent on physical and manual skills today. Automation is more likely to impact public sector workers by freeing up time spent today using basic cognitive skills, such as basic computation and data input or processing, in favour of more time spent on technological skills (expected to shift from 12 percent of hours worked to 16 percent of hours worked by 2030, see Exhibit B3).

EXHIBIT B3



[46] https://www.forbes.com/sites/oracle/2018/10/01/university-of-adelaide-builds-a-chatbot-to-solve-one-very-hard-problem/#15c041674e17

Graduates' skills versus labour market needs

By 2030, much of New Zealand's workforce will be people who are currently students in our education system. It is therefore critical to ensure that universities and vocational education and training (VET) institutes equip enough graduates with skills that employers can further develop for an increasingly technology-driven workplace. A supply-demand mismatch may occur both in the nature and the level of subject disciplines being pursued.

To shed light on any possible mismatch, McKinsey looked at education trends over the past 15 years, the current levels of graduates by field of study, the current employment rates among those graduates (a signal of current demand) and projected needs of the labour market (a signal of future demand). Some mismatch between what students choose to study and what employers need is bound to occur, of course, as young people pursue both a vocation and their interests. But the analysis highlights as many reasons for concern as for optimism.

Looking at the total volume of graduates needed, we see that automation and digitisation are lifting the level of skills needed in the job market faster than New Zealand currently produces graduates. If current graduation and work patterns continue—barring the wholesale irrelevance of the formal tertiary education sector as some think tanks and futurists have predicted[47]—New Zealand could face an overall shortage of 130,000 university graduates to fill available jobs by 2030, split roughly 40 percent postgraduates and 60 percent undergraduates (Exhibit 26).

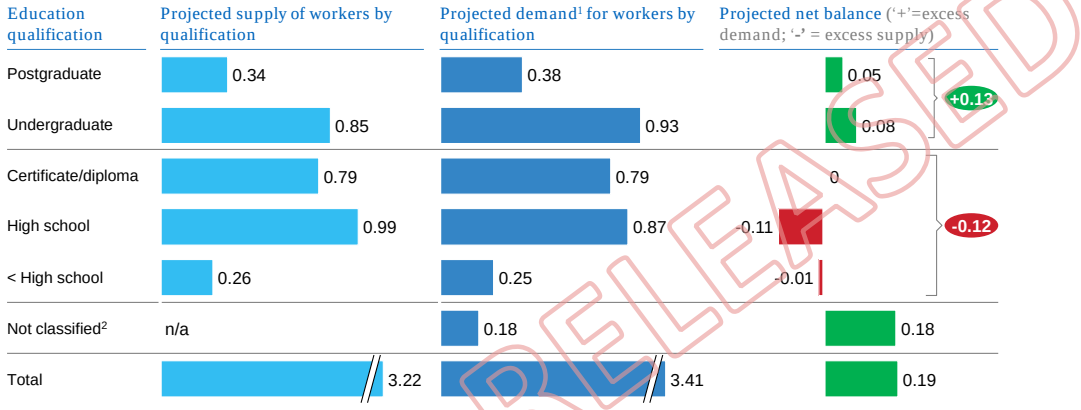
In response to this, changes will be needed in both the design and delivery of education. It may be that new subject disciplines need to be included in the courses that are projected to be in demand. For example, in the fields of health, education or IT, the introduction of subjects in collaborative and/or emotional skills could be imbedded in those courses of study. Similarly, it may be that more humanities courses should incorporate the skills to understand digital processes and possibilities. As such, undergraduate degrees may look very different to today's, and all stakeholders will need to encourage more young people to continue their education after high school. These efforts to better align study and work prospects are taken up in Chapter 3.

[47] See, for example, *Here's How Higher Education Dies* (2018), The Atlantic; or *How Google and Coursera may upend the traditional college degree* (2015), Brookings.

EXHIBIT 25

More students will require university degrees

Projected change (mid-point adoption scenario[1]) in worker supply and demand, by education qualification; millions of jobs, 2030



Note: Mid-point of earliest and latest automation adoption in the 'step-up' scenario
1 Mid-point automation scenario, step-up labour demand scenario.
2 New occupations created by automation and technological change.

SOURCE: MGI Automation Model March 2018, Jobs Lost Jobs Gained December 2017; McKinsey Global Institute analysis

The core challenge in education is not just with formal education; there are also challenges associated with how the broader education system has been designed, and with its responsiveness to the skills being demanded by employers. For example, there are opportunities to improve career planning, advice and coaching; to increase flexibility by funding transferable, stackable modules and short courses rather than only entire degrees; to provide greater recognition and formal credits for educational achievements, including skills evaluations of non-formal activities; and to provide greater access to networks, so that people can be more easily matched with opportunities.

CHALLENGE 2 – UNEMPLOYMENT MAY SPIKE DURING THE TRANSITION PERIOD

While the impact of automation should be offset by broader job growth over the coming decade, New Zealand may well see a bump in unemployment during the transition period—that is, when automation adoption displaces jobs, but individuals have not been retrained for new jobs. The relatively high number of displaced workers, approximately 700,000 under the mid-point adoption scenario and 1.3 million under the early adoption scenario, does carry the risk of higher fluctuation in the unemployment rate. The challenge is to minimise long-term unemployment for individuals, which has negative consequences for the households and communities affected and for society as a whole.

Slowing down the pace of automation might reduce short-term disruption to the labour market, but it may also lead to a decline in global competitiveness, productivity and income growth that could be hard to reverse as other countries get ahead.

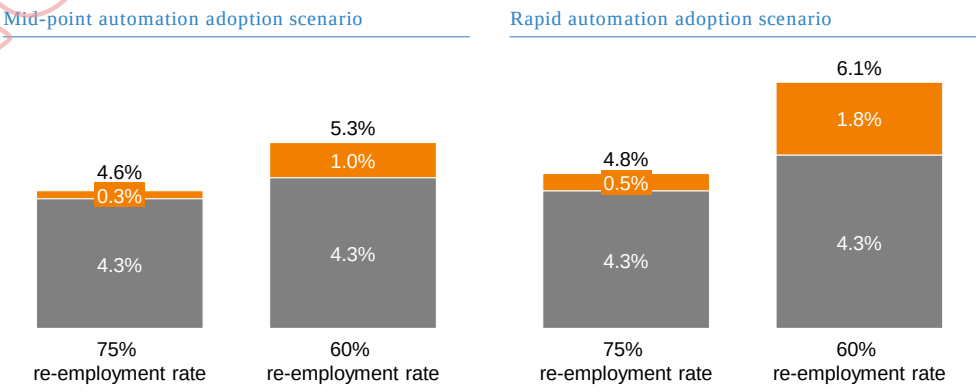
Historically, almost three-quarters of unemployed New Zealanders find new jobs within a year, which is well above the OECD average and close to that of Australia and the US.[48] If this historical re-employment percentage holds, automation would have a relatively small impact on the unemployment rate in the mid-point adoption scenario, potentially causing it to rise to 4.6 percent, or up to 4.8 percent in the early automation adoption scenario. However, if automation structurally lowers the rate of re-employment or contributes to a recession by, for example, reducing consumer confidence or purchasing power, the result could cause significant pain. If the rate of re-employment within one year falls down to around the 61 percent mark, a low of the last 30 years experienced in the early 1990s, it would bump the overall unemployment rate as high as 5.3 percent in the mid-point automation adoption scenario, and up to 6.1 percent in the early automation adoption scenario (Exhibit 27). These peak unemployment scenarios are based on the current environment of relatively low unemployment, with the unemployment rate at 4.0 and 4.3 percent during September and December 2018 quarters, respectively. Future demand and supply shifts could change the outcome of the unemployment scenarios.

Higher unemployment has second-order effects, such as slowing demand for consumption-based services and increases in skills-based labour shortages, which impact all businesses. At the individual worker level, layoffs can have an ongoing impact on workers' mental health, self-esteem and financial circumstances,[49] all of which may render them less resilient in the face of future workforce changes. Furthermore, residents with low incomes have limited ability to invest in training. Relevant interventions are addressed in Chapter 3.

EXHIBIT 26

Peak unemployment

Scenarios for peak impact on unemployment by automation adoption and re-employment rate[1] within one year; percent in 2025



1 Over long term, 74% of unemployed persons in New Zealand have been re-employed within one year (proxied using % of people unemployed for > 1 year). The lowest rates recorded are around 61% during the recession in the early 1990s

SOURCE: Stats NZ as at February 2019; McKinsey Global Institute Global Growth Model

[48] That rate peaked at 84 percent in 2009 and 2010, with a low of 61 percent in 1993 and 1994, and a long-term average of approximately 74 percent over the last three decades. If a recession hits, however, the re-employment rate could again trend towards the 61 percent low of the last three decades. *Household Labour Force Survey*, 1987-2018, OECD and Statistics New Zealand, and, *Back to Work: New Zealand*, OECD, 2016.

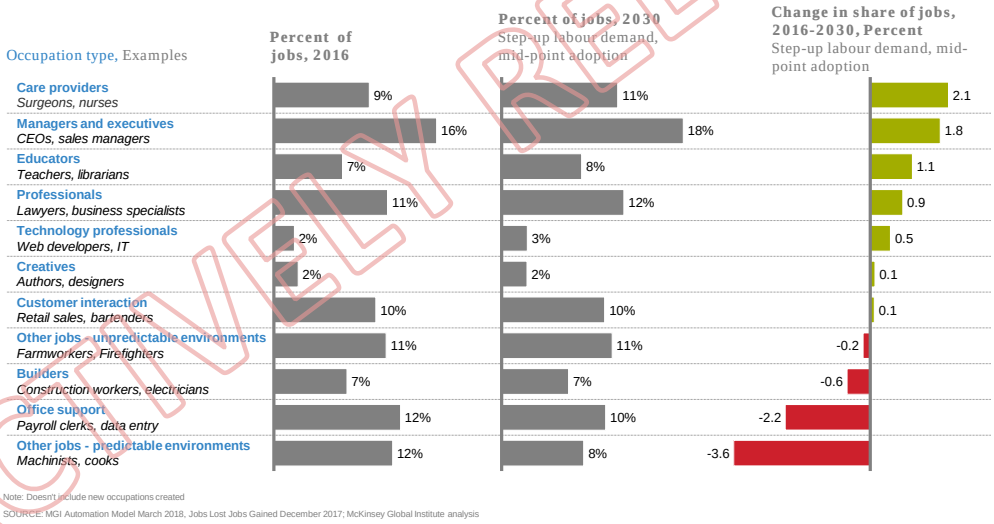
[49] See, for example, Silvia Mendolia, The Impact of Job Loss on Mental Health, UNSW School of Economics, January 2009.

A significant part of the labour force will need to change their occupation, much of which will involve retraining

Some occupations will be impacted much more than others. Overall, job displacement will be highest in administrative or generalist occupations that involve predictable physical tasks or repetitive data collection and processing. Secretaries, receptionists, research and legal assistants, and payroll and data entry workers, for example, are highly vulnerable. Demand will hold steadier for occupations that require personal interactions or application of specialist or technology skills, such as teaching, nursing, sales, and computer programming (Exhibit 28).

EXHIBIT 27

Overall occupation mix is expected to shift in favour of specialised occupations



Note: Doesn't include new occupations created
SOURCE: MGI Automation Model March 2018, Jobs Lost Jobs Gained December 2017; McKinsey Global Institute analysis

As a result, a significant part of the labour force will need to retrain to gain re-employment. While the impacts of automation over the next 50 to 100 years are hard to fathom, the economy is likely to stabilise in the medium term (i.e. by 2030), as it has always done following structural shocks. However, there is no doubt that workers who are displaced, or at risk of displacement, will find this period challenging. Some may be able to find similar jobs in other companies or sectors, but many will need to retrain and transition to completely new occupations in order to find work. McKinsey analysis suggests that in a rapid adoption scenario, an average of over 60,000 workers per year will need to upgrade their qualifications to change occupations altogether, totalling to over 900,000 workers by 2030 (or almost 1 in 3 workers in the workforce). In a mid-point adoption scenario, this number is expected to be closer to 1 in 10.

CHALLENGE 3 – AUTOMATION COULD WIDEN INCOME INEQUALITY

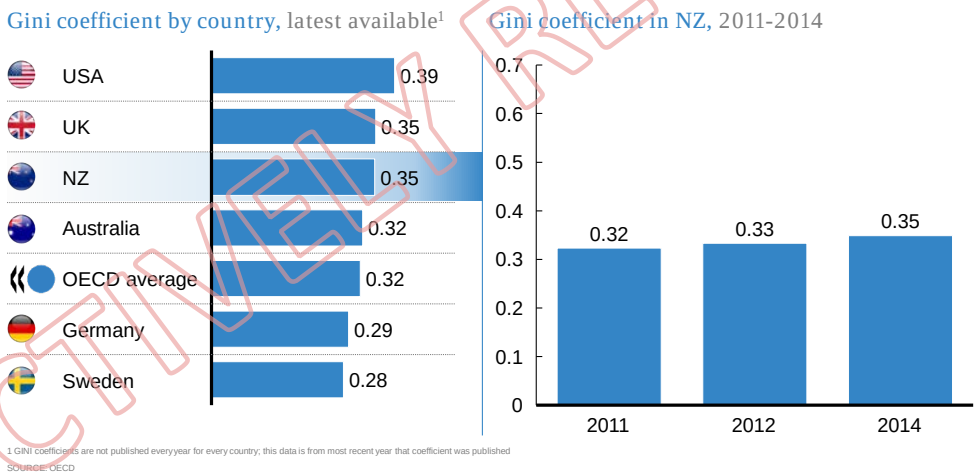
A certain degree of inequality is present in any market-oriented economy. People have different skills and abilities, they make different choices in life, and they do not all have equal access to the same opportunities. However, significant sustained inequality may become an issue to the stability of society.

Traditionally, New Zealand's gap between high- and low-income earners has been moderate, but it has increased in recent years (Exhibit 29).[50] Its Gini coefficient has trended up from 0.32 in 2011 to 0.35 in 2014, which places New Zealand above the OECD average and Australia (at 0.32), but in line with the UK, and below the US (0.39).[51]

A Roy Morgan poll in March 2018 found that the single issue of greatest concern to New Zealanders was poverty and the gap between rich and poor, which was mentioned by over 20 percent of those polled, more than twice the second-placed response.[52] Income inequality may be driven by disparities in skills and qualifications, age and regional opportunities, which may be exacerbated in the age of automation.

EXHIBIT 28

Income inequality in New Zealand is higher than the OECD average and has been increasing over time



1 GINI coefficients are not published every year for every country; this data is from most recent year that coefficient was published
SOURCE: OECD

Wages will favour those with future relevant skills

Rising demand for some specialised skills and falling demand for administrative and physical work could lead to a divergence in wage trends. By 2030, McKinsey analysis projects a shortage of around 163,000 professionals (12 percent below demand) and 33,000 service and retail workers (6 percent below demand). At the same time, there could be a surplus of around 134,000 trade and manual workers and 63,000 administrative workers.

These supply-and-demand forces would be reflected in pay cheques. Workers who can perform cognitive, collaborative and digital work—the skillset relevant in the automation age,

[50] OECD data shows an increase in New Zealand's Gini coefficient from 2011 to 2014. However, we acknowledge that there are competing views over New Zealand's longer-term income inequality trend. For example, see Bryan Perry, Ministry of Social Development, Household incomes in New Zealand: Trends in indicators of inequality and hardship 1982 to 2017, October 2017: which shows New Zealand's Gini coefficient increased from the middle of the 1980s to the early 1990s, but has subsequently been fairly stable.

[51] The Gini coefficient is based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality.

[52] http://www.roymorgan.com/findings/7534-roy-morgan-problems-facing%20new-zealand-february-2018-201803152343

which will be in short supply—will likely enjoy strong wage growth. However, an oversupply of those who can perform routine or physical work will drive wages down. The average wages associated with the latter types of work are already sharply lower than what the average manager or technicians earns today—and automation could widen this gap.

McKinsey created a high-level general equilibrium model to indicate the potential magnitude of wage divergence, based on the impact of automation on supply and demand dynamics for five major occupational groups over time: i) managers and professionals, ii) technicians and associate professionals, iii) service and retail workers, iv) administrative workers, and v) trade and manual workers (Exhibit 30).[53] This model is only a theoretical indication of the potential impact on income inequality.[54]

The simulation indicates that the wages of managers and professionals would rise by 11 percent and those of service and retail workers would rise by 5 percent. In contrast, the wages of administrative workers, and trade and manual workers, would fall by 15 percent.

Automation could lead to a divergence in future wages growth: managers, professionals and specialists could see their wages rise, while administrative, retail and trade workers could see their wages fall.

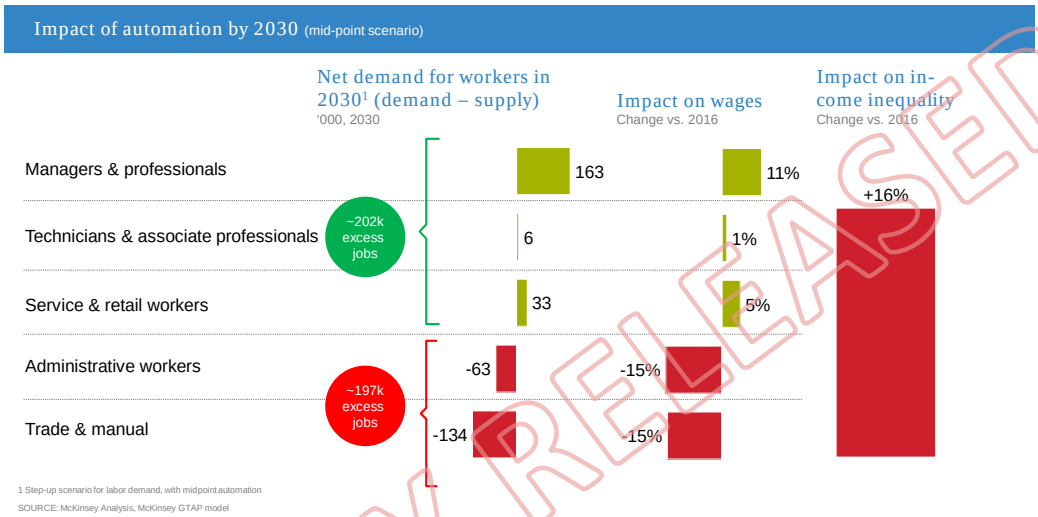
These estimates should be viewed as the high end of wage effects, since labour costs directly affect the attractiveness of automation. If administrative workers are not expensive to hire, companies have weaker incentives to invest in automating administrative tasks. This dampens job losses and the oversupply of these workers, eventually stopping the cycle of falling wages.

[53] McKinsey Global Institute employed a static version of McKinsey's Global Trade Analysis Project (GTAP) computable general equilibrium model. Wage rates were indexed to equilibrium wage rates and wage deviations for each scenario were reported by labour category. First order deviations from the equilibrium wage rate occur in a general equilibrium model as a result of elasticities of the demand for labour, the supply of labour, and the substitution of labour. Second order effects are also accounted for as, for example, bundles of production and consumption fluctuate given new costs of production and consumption prices.

[54] The model does not take into account regulatory factors such as minimum wages and assumes that the entire impact of demand-supply mismatches will manifest in wage changes rather than job losses. This means that the wage effects on inequality are likely to be slightly overstated.

EXHIBIT 29

Automation could increase income inequality because of a divergence in labour demand and wages



Income inequality will depend on retraining

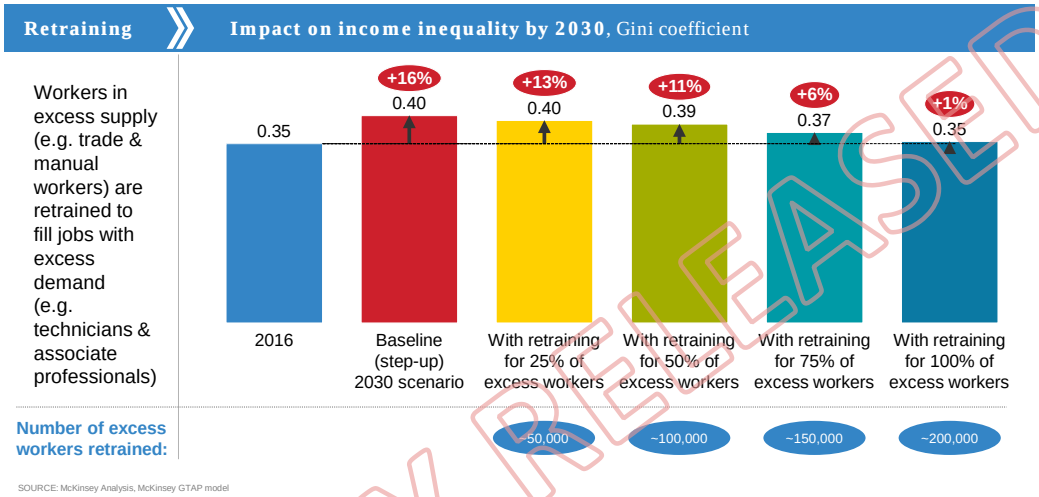
The wage trends expected for the five occupational groups would affect overall income inequality. If workers are not effectively retrained, creating large imbalances between supply and demand, the resulting changes in wages would drive up New Zealand's Gini coefficient from 0.35 to 0.40—an increase of 16 percent by 2030.[55] This would put New Zealand's level of income inequality higher than what prevails in the US today (a Gini coefficient of 0.39).

Ensuring that the workforce has the right skills for the automation age requires retraining. To illustrate how retraining could temper automation's impact on income inequality, McKinsey examined various scenarios that would allow the roughly 200,000 surplus lower-skilled workers to qualify for higher-skilled and higher-paid roles such as technicians or associate professionals (Exhibit 31). If three quarters of these workers (approximately 150,000) upgrade their skills, the impact on income inequality could be reduced by more than half. With training, the downward pressure on pay for administrative workers, and trade and manual workers, would see their wages decline by 5 percent rather than 15 percent. As a result, the 2030 Gini coefficient would stand at 0.37 in 2030 rather than 0.40 if no retraining was offered. If all 200,000 of the displaced workers in these categories can be retrained, income inequality would not increase at all. For governments, the clear implication is that the short-term cost of retraining would be more than offset by the longer-term gains of fewer unemployed workers relying on welfare, and a more equal society.

[55] This model estimates impact on Gini in two steps. First, it estimates the wage changes from supply-demand mismatches. Second, it applies the new wages to the current occupational split of the workforce. This means it does not take into account potential impacts on Gini from the number of workers in certain occupations, or indeed any changes in unemployment rate.

EXHIBIT 30

Effective policies to retain and upskill excess workers and redeploy them to unfilled high-skill jobs could reduce the impact on income inequality



SOURCE: McKinsey Analysis, McKinsey GTAP model

Outer suburbs and regional communities will be most challenged

Some areas that will be more affected by automation than most are concentrated in outer suburban and regional communities. This is perhaps where the greatest risk of increased inequality for New Zealand exists because the ability of those communities to respond to the automation impact may be lower than elsewhere. If we believe that people need higher levels of education to develop the digital, cognitive and communication skills needed for the automation age—in any sector—then we should be concerned about areas which have low education levels, previous experiences of job losses, and socioeconomic conditions that have limited their opportunity to develop the needed skills.

The first hurdle is that regions heavily dependent on a few sectors present workers displaced by automation with few alternative local job options. Since sector concentration also implies similar experiences and skills among the workforce, job losses would potentially leave many people with similar skillsets competing for fewer jobs. For example, the agriculture, forestry fishing and hunting sector accounts for between 15 to 19 percent of jobs in the West Coast, Gisborne, Marlborough and Tasman regions. If a major employer in the area were to close due to automation, residents with similar skillsets would be left to compete for fewer jobs.

If displaced workers then seek to find work in other sectors or locations, they may find that their level of education does not meet the criteria for the new positions. There is a clear shortfall in the average levels of education in at-risk areas. On average, 62 percent of people who live in Auckland hold a NCEA Level 1 certificate or higher, but this is heavily biased towards inner-city areas. Outer suburban or rural areas such as Otara or Wellsford, where only 38 and 43 percent of respective residents hold an NCEA Level 1 certificate or higher, may have a tougher time finding new jobs or further developing the needed skills.

With few local job options, residents would need to look further afield—and here they may face further challenges. Rural areas tend to be less connected both in terms of transportation infrastructure and digital links, making it harder for residents to either commute to work or

take advantage of the remote-working opportunities that technology offers. For example, in Canterbury, residents of Geraldine would face a commute of approximately 2–3 hours if they wanted to work in Christchurch. And while larger townships within the Southland and Otago region have 4G internet connection, some of the region lacks high-speed internet coverage. Small towns within remote areas of the Bay of Plenty and Gisborne are similarly disadvantaged.

Contrast these areas with central Auckland, which boasts a diversified economy and a highly educated population. Here, 57 percent of workers are professionals or managers, and work in sectors relatively immune to automation, such as professional services, financial services, healthcare, and education. No single sector contributes more than 11 percent of employment, so that if there is a tight job market in one sector, there will be options in others.

□ □ □

Automation technologies will create new possibilities for productivity growth, but they will also usher in some labour market disruption. Ensuring people are at work (albeit not necessarily in the same occupation they have always been in), is necessary to maximise the opportunity to grow economic and social outcomes, and ensure no New Zealander is left behind. The challenge for policy makers and their partners in business, education and the social sector is to keep an acceptable opportunity gap between places like central Auckland and regional New Zealand. Governments around the world are looking at these challenges knowing that they may need a new era of collaboration and effective policy. While New Zealand is at the frontier of national thought leadership in this space, it could advance that frontier much further. This is our focus in the next chapter.

3. RECOMMENDATIONS

The prospect of automation can be daunting for both workers and employers, and both groups may find themselves wanting to delay its impact. Yet, both groups stand to lose significantly if New Zealand becomes a laggard in this transition. Conversely, both groups will benefit significantly from accelerating the transition if it is supported by the right social framework, especially through education, training and retraining. In this regard, the future of work will align the interests of all groups, and collaboration is key to capturing the benefits and mitigating the risks of a speedy transition, while ensuring no New Zealander is left behind.

All stakeholders in the New Zealand economy need to collaborate on a joint national action plan if automation is to overcome two challenges:

- How can New Zealand rapidly leverage automation technologies to boost productivity?
- How can New Zealand prepare and support displaced, continuing and future workers through the transition?

This chapter offers selected themes for government and business for navigating these twin challenges and concludes with 12 specific recommendations derived from those themes with the intent of advancing discussion across New Zealand about its automation future.

Combined theme 1. Invest in training, retraining and reskilling

Businesses and government can help mitigate the impacts of automation by investing in, and supporting, the training, retraining, and reskilling of workers:

- Businesses can prioritise retraining before recruitment, and pledge significant investment in annual worker training, retraining and upskilling to close the anticipated skills gap
- Government can encourage disclosure in their annual reports of investment in annual worker training, retraining and upskilling, and incentivise investment in retraining

What business can do

Prioritise retraining before recruitment

In the process of adopting automation, it is discrete activities and roles that become redundant, rather than people. Organisations often fall into the trap of letting employees go when their roles disappear and hiring new workers for emerging positions. A smarter and more cost-effective approach is to equip existing staff—who may have many years of experience with systems, products, customers and culture—with the necessary skills for the new roles. For example, organisations could set targets to move a proportion of staff from back-office roles into positions in customer service that rely on interpersonal skills. In doing so, organisations could avoid losing 'corporate memory' and a large slice of morale among retained workers, as well as the risks, costs and pressures of recruiting new employees or hiring temporary contractors. One company famously asked its workers 'whether their job could be better done by a robot' and promised retraining 'for another role at the firm' for those who said 'yes'.[56]

The mandate for increased investment in retraining is already here, with no less than 54 percent of workers anticipated to need significant reskilling and upskilling within the next 3 years, and 19 percent requiring training of 6 months or longer.[57] A business's employment brand, and broader brand, benefits from looking after its people and the wider community, and society is looking at businesses to take the lead on retraining. In addition, if a significant number of workers are not proactively retrained, the resulting risk of displacement and increase in unemployment will negatively impact businesses through slowing demand for consumption-based services, social upheaval, and an increase in skills-based labour shortages.

Where reskilling is an option, choosing to do so (as opposed to 'firing and hiring') has a strong business case. While reskilling comes at a cost, the 'fire and hire' alternative comes with redundancy cost, recruitment cost, risk of cultural mismatch, a potentially higher salary expectation, and longer time for onboarding (at lower productivity). Initial McKinsey analysis suggests that releasing and recruiting costs approximately 2.5 times more over a 3-year period than retraining an existing employee, taking into account redundancy cost, recruitment cost, and salary expectations alone. Where reskilling is not appropriate, however, companies

[56] *Insurer asks its 16,000 staff: could a robot do your job?*, The Sunday Times, 2019.
[57] The future of jobs report, World Economic Forum, 2018.

should consider recruitment, including high-skilled overseas recruitment, to initially import talent and subsequently build talent and capability internally.

In a recent study, 75 percent of executives reported that retraining would provide at least half the solution to their companies' current skills mismatches, and 64 percent stated that the main reason for investing in retraining was to increase employee productivity.[58] Most employees can carry their line expertise into an adjacent field through a 'domino reskilling model'. For example, when AT&T reduced its physical store footprint, it found that the skills of store managers largely mirrored those of 'scrum masters' who lead agile teams, so it retrained many displaced store managers into those roles. In another example, a regional Italian bank reskilled and redeployed nearly ~10,000 employees who were being displaced by a combination of technology changes and strategic shifts. The bank, subject to regulation which barred layoffs, successfully reskilled and redeployed ~9,500 employees over a 5-year period and saw employee satisfaction rise from 70 percent to 80 percent over the course of the program.

Retraining programs provide an opportunity to partner with innovative educational institutions and can be extended to new recruits. Such bespoke training programs may also result in a certification that advances careers and serves as a drawcard for recruits. The retraining programs may draw on the same remote and digital technologies that will be used increasingly in the workplace, and cost less to deliver. They may also form part of lifelong learning platforms (such as Degreed, an education technology solution) to build skills and certify expertise. One conglomerate in the Middle East has created a technology academy that every employee must attend, with the aim of making all 40,000 of its workers proficient in digital analytics. Such initiatives develop in-house expertise, foster a common understanding of market opportunities, and promote loyalty among employees.

Another form of partnership could be between companies in similar industries or regions who team up to solve their reskilling and redeployment requirements. Businesses with complementary skills gaps could arrange for rotations, secondments and placement opportunities to enable on-the-job retraining, or co-ordinate cost-effective retraining at scale. Similarly, businesses within the same region requiring a similar skill-set could work together to redeploy freed up labour across their respective needs, to ensure workers are utilised effectively and continue to be excited with variety in their roles.

None of these initiatives can be completed overnight. A European technology company took 3 years to reskill one-third of its existing workforce (placing 1,000 employees a year into new roles), and its experience can be considered typical. Its programs had to cover both hard competencies to work with machine learning, IoT and cloud computing, and soft skills such as coaching and working in an agile environment.

[58] *Retraining and reskilling workers in the age of automation*, McKinsey Quarterly, January 2018. Another report showed that only 16 percent of digital strategies succeed, and that the top reason for failure (cited by respondents) was a lack of the right employee capabilities and mindsets. See: *Unlocking success in digital transformations*, McKinsey & Company, October 2018.

Pledge investment in training and retraining

New Zealand employers may consider making meaningful investments in worker retraining and upskilling. For example, in a 'Pledge to America's Workers' campaign, 200 organisations have committed to creating over 6.5 million working opportunities in the US through mechanisms such as apprenticeships, work-based learning and continuing education. In separate initiatives, Google has pledged US$1 billion towards retraining the global workforce (not just its own); the Walmart Foundation has pledged US$100 million in workforce development and reskilling; and Lockheed Martin has pledged US$50 million in support of science, technology, engineering and maths (STEM) scholarships, and a further $US100 million to expand employee training and educational opportunities.

A New Zealand variant could propose that companies acknowledge their employees, customers and New Zealand's wellbeing as a whole, and pledge significant investment in annual worker training, retraining and upskilling to close the anticipated skills gap.

What government can do

Encourage disclosure by companies

To keep businesses honest, as well as to increase the public's trust in companies' undertakings, the government could encourage disclosure by companies in their annual reports of their investment in annual worker training, retraining and upskilling. The report could also include disclosure on the quantifiable impact of their efforts. This investment and outcome reporting would also provide a rich source of data on investment effectiveness, allowing governments and organisations to better shape policy and programs.

Incentivise investment in retraining

Taking as inspiration the government's new research and development tax incentive scheme,[59] a similar structure could be introduced as an additional lever to encourage business investment in workforce training. In the US, for example, several states including Connecticut, Georgia, and Virginia, are providing tax credits ranging from 5 to 50 percent for businesses investing in worker training.[60] The scheme could take a variety of shapes and forms. For example, it could be an increase in the business deduction allowed for training (similar to Austria from 2000 to 2016, where 120 percent of training expenditure could be deducted for tax purposes), a percentage tax credit on overall spend, or a tax credit for any increases in spend relative to the prior year or a base year.

The government could also consider providing tax breaks for people who decide to study while they work. In Australia, for example, workers who study and incur self-education expenses may be eligible for tax deductions if their employment and the chosen course of study have a sufficient connection. If a similar model were to be adopted, it should be sufficiently broad, to ensure it captures the fast-changing nature of work and wide-reaching need for reskilling and change of occupations.

[59] https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/r-d-tax-incentive/
[60] Workforce training tax credit: promoting employer investments in the workforce, Aspen Institute, August 2018.

Box 3. What individuals can do

The onus to develop future workplace skills does not lie solely with businesses and/or the government: individuals should be proactively taking responsibility for their journeys to ensure they are ready for the transition technology will bring to the workplace. For example:

- Individuals should proactively assess their current skill base, inform themselves about the anticipated skills required in future, and perform their own skills gap assessment
- Individuals should then aim to understand how they could go about closing any skills gap through relevant education and training programs on offer
- While government and businesses may financially contribute to an individual's education and training, individuals should be prepared to self-fund (either partially, or fully) their own training and education as an investment in their future. To do this, they could consider saving into their own education and retraining accounts to be used in the near- to long-term, much the same way they would think about saving for future holidays or retirement.

Combined theme 2. Arrange a cohesive, collaborative multi-partnership effort to deliver a national action plan, including in regional areas that will be impacted by automation

Businesses, the public sector, and the not-for-profit sector will all have a unique role to play in ensuring all New Zealanders flourish in the new age of automation. To ensure efforts and resources are coordinated effectively and driven towards a coherent national action plan, these stakeholders should work together.

A core component of a national action plan should involve leveraging New Zealand's industry strengths to ensure no industry, or region, is left behind. This can be through the incentivisation of cross-company collaboration and innovation that creates jobs in regions at risk of high unemployment or disruption from automation. The government is already focusing on regions through initiatives such as the Sector Workforce Engagement Programme (SWEP) and the new Provincial Growth Fund (PGF). SWEP is a cross-government initiative that aims to improve businesses' access to labour in industries such as horticulture, dairy, construction, and more, by growing the skills and capability of working people in specific regions. Since its pilot in 2016, 950 New Zealanders have been employed through SWEP initiatives, 3,000 have been supported into recognised training whilst employed, and 50 have started apprenticeships.[61]

[61] https://www.growregions.govt.nz/about-us/sector-workforce-engagement-programme/, Ministry of Business, Innovation and Employment.

Business theme 1. Invest early in automation technology to maximise productivity benefits and open-up new business opportunities

Businesses could accelerate their investments in automation technology: those that invest early and introduce it explicitly into their strategy stand to gain the most benefits in productivity improvement, customer satisfaction, and in some cases new business opportunities. To do so, they should take a long-term view on the returns on this investment and the upfront costs of the transition.

Automation presents endless strategic opportunities. These opportunities could promote business expansions, improve customer outcomes or tackle internal efficiencies. For example, a 2017 report by MIT Technology Review and Genesys found that 91 percent of top companies (such as Alibaba and Lexus) use AI to boost customer service and improve branding. Similarly, over 90 percent of companies with world-leading brand recognition and high levels of customer satisfaction use AI solutions to increase customer satisfaction, compared to 42 percent of companies in their fields overall.[62]

91 percent of top companies such as Alibaba, and Lexus use AI to boost customer service and improve branding. Similarly, over 90 percent of companies with world-leading brand recognition and high levels of customer satisfaction use AI solutions to increase customer satisfaction, compared to 42 percent of companies in their fields overall.

New Zealand businesses and sectors that invest early in automation technology stand to gain the most. As detailed in Chapter 2, New Zealand could move from 68 percent to 73 percent of the level of the US's labour productivity through a more rapid uptake of automation. Similarly, New Zealand's manufacturing sector could significantly catch up to its American competitors by adopting automation earlier, potentially moving from 54 percent of the US' productivity to 83 percent. These businesses do not need to be large—automation benefits can be captured by all companies, regardless of the size of their balance sheet. In the past technology-driven productivity improvements were only affordable for large companies. However, automation technologies can be applied cost-effectively to smaller scale businesses—cloud-based solutions, for example, are as cost-effective and work as well for a 10-person company as for a 10,000-person company.

Automation can also spur new business opportunities. drones and unmanned aerial vehicles are able to quickly map, inspect or transport in places that are difficult to reach and are

[62] *91% of top companies use AI to boost customer service, improve branding*, TechRepublic, October 11, 2017.

already used to spray crops, perform land surveying and inspect oil rigs.[63] Innovations in one company can also lead to opportunities for others. Medallia has developed an automated customer feedback platform which PayPal has enabled contact centre employees to tag the root cause of issues, reduce customer pain points by 50 percent and increase transaction volume by more than USD 2 billion.[64] Automation can also deliver fast movers an irresistible advantage: Amazon is expected to open 3,000 Amazon Go stores by 2021, featuring a smartphone-led shopping experience with AI-enabled 'Just Walk Out' checkouts.[65] In New Zealand, businesses should continue to experiment. Flirtey, a drone delivery company, partnered with Domino's Pizza to complete the world's first commercial pizza delivery by drone to a customer in Auckland, and aims to extend its service to medical and other retail deliveries.[66]

Finally, in setting automation strategies, companies are investing in the future, which means that ultimate returns on initial costs may be delivered in the longer term. Adopting this longer-term focus may be challenging[67] but it will pay off, with 'long-term' companies outperforming their 'short-term' peers, on average, in terms of revenue, earnings, economic profit and job creation.[68] A longer-term focus also allows a company or agency to pay due attention to the organisational challenges in their transition to the automation age.

Business theme 2. Build the organisation of the future with the right size, shape, skills and culture to deliver the strategy

Chapter 2 discussed how the automation wave will affect employment, changing roles and skills shifts throughout New Zealand. This national picture is mirrored in individual organisations. Private companies will need to build a future organisation of the right size, shape, skills and culture to deliver their automation strategies.

In doing so, it will not be sustainable for companies or agencies to simply retrench one set of people and hire another. Certainly, workers with the most in-demand skills will tend to gravitate towards the earlier technology adopters. However, that 'talent' also wants to work in a culture that respects and develops people—the most valuable asset—with retrenchment as a last resort. Forward-thinking organisations are concluding that their resilience is strengthened by developing the skills of their existing employees and so are supporting them to transition to new roles within the organisation, removing fear of retrenchment from the equation.

[63] *Drones predicted to give British economy a £42bn lift by 2030*, The Guardian, May 29, 2018.
[64] www.medallia.com
[65] www.amazon.com
[66] https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=11749185
[67] Taking a longer-term view requires determination, as shown by a survey of 1,000 board members and C-suite executives around the world, which found that almost two-thirds of respondents said the pressure to demonstrate short-term financial performance had increased over the previous five years. See *Focusing capital on the long term*, McKinsey & Co., December 2013.
[68] *Where companies with a long-term view outperform their peers*, McKinsey Global Institute, February 2017.

Forward-thinking organisations are concluding that their resilience is strengthened by developing the skills of their existing employees and so are supporting them to transition to new roles within the organisation.

Building a future-ready workforce requires a focus on both the '**what**' and the '**how**' elements: **what** an organisation needs to do to get the right talent and skills in place, and **how** the organisation can build a culture that brings out the best in that talent (Exhibit 32).

Building the 'what': the right skills in the right place

The possibilities of automation will force public agencies and private firms to rethink the roles and skills they need. This involves three basic steps:

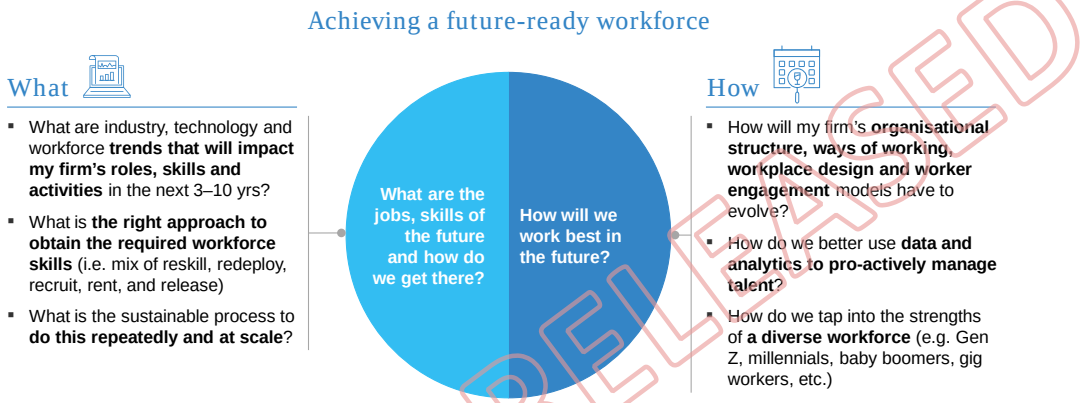
- **Diagnose any gaps between today's workforce and future roles and skills.** Most organisations spend significant time and resources developing their strategic plan and significantly less time identifying the future roles and skills required to deliver that plan. Analysing the people implications of a strategic agenda often reveals that the intended results will not materialise unless the right people decisions are made early on. A granular diagnostic, down to the individual role level, is needed to give real-time insights into current and future skills of the workforce and to identify skills gaps that will need to be closed.

- **Design robust plans to close future skills gaps.** A portfolio of initiatives is needed that goes beyond traditional 'hiring and firing'. The '**5R**' levers to close skills gaps start with **reskilling** and **redeploying** existing employees, then **recruiting** externals either permanently or in the short term, and **renting** workers through contracting or activating freelancers in the gig economy. If it has too many people, a company or agency will need to plan for the **release** of employees, including providing retraining, education and transition support to prepare their workers for an external career (see proposal B4). Some organisations may have to recruit entire teams, partner with other complementary organisations, and/or pursue acquisitions and joint ventures that help them close their talent gaps. The best companies build their workforce strategies into their annual strategy processes to arrive at a joint financial and people plan.

- **Implement plans through rapid and disciplined execution—a future workforce centre of excellence.** The most effective talent transitions are governed by a dedicated, cross-functional 'future workforce centre of excellence' that includes both senior human resources and line managers. Its roles are to drive (re)skilling programs, create learning pathways, access the latest external thinking, resolve roadblocks and help management make quick and clear decisions when trade-offs are needed. Each subject area should have a business lead who is accountable for achieving results and ensuring targets are met.

EXHIBIT 31

Designing the Future of Work: The **what** and the **how**



Business theme 3. Adopt an agile way of working

As discussed in Chapter 1, automation will displace work activities but not necessarily entire jobs. Recent McKinsey analysis shows that the key to capturing the productivity benefits of automation is effectively redeploying the resulting freed-up time.[69] Accordingly, organisations must ensure that they establish the right work environment and mechanisms to do so.

This is perhaps best done through new ways of spurring 'agility' in the workplace, such as Agile itself, 'no-collar' jobs, and internal task-sharing economy models. As the term suggests, agility enables a company or agency to react quickly to changing market demand and dynamics. It typically depends on cross-functional teams that can innovate new solutions and diagnose and remove roadblocks. It requires a shift from traditional, internally-focused line reporting models to one of digitally enabled collaboration, both internally and with external partners.

Agile shows significant promise, having been successfully deployed in several Australasian companies to create a more productive, flexible and engaged workforce. Spark New Zealand has become the first fully agile telecommunications operator in the world. In just under six months, Spark established over 100 cross-functional teams or 'squads', organised into 18 'tribes'. Over 2,000 employees were transitioned through over 100 distinct agile trainings. Teams are self-managed, removing the need for multiple middle management layers. Roles are no longer rigid; team members can switch roles or even teams every few weeks to meet changing needs. Early signs indicate that impact has been quick and impressive: the company is on track to achieve substantial gains in customer satisfaction, employee engagement, productivity and—most importantly—time to market.

[69] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, 2017.

Agile shows significant promise, having been successfully deployed in several Australasian companies to create a more productive, flexible and engaged workforce.

While certain businesses have chosen to deploy agile at scale, others could choose to adapt agile principles in a tailored manner or at a smaller scale. They could apply an agile way-of-working to certain business units only, or other select parts of the business.

Business theme 4. Support displaced workers towards a career beyond the organisation

While employers should begin by seeking to retrain and redeploy people whose roles have been made redundant, some workers will have to leave the organisation. Rather than leave these workers to be supported by the open market and the government, employers could take steps to prepare them for a new career.

For organisations that support their workers to embark on the next stage of their professional journey, the benefits are immediate and reputational. The immediate benefit is that the organisation has signalled how much it values its people, and that it understands the impact of displacement (or the fear of being displaced) by automation. Without the hearts and minds of its workforce, a business or public agency has very little chance of a successful transition to the automation age. This approach is highly likely to reflect a healthy organisational culture, which helps to attract staff with in-demand skills; and is equally likely to contribute to a strong organisational reputation, which may attract funding and partnerships. Further, apart from these advantages, the support of displaced workers could become a new limb of corporate social responsibility in future, much like green initiatives, fair trade, and charitable giving have become commonplace.

Without the hearts and minds of its workforce, a business or public agency has very little chance of a successful transition to the automation age.

Workplace retraining programs could offer modules in applicable marketplace skills, certification of skills and, where applicable, training on how to set up a business or transition to the gig economy. Organisations could fund specialists to provide these services. For example, in Australia, the Transition Hub is a partnership between the UTS business school and WeWork that supports companies as they transition people out of their organisation by offering performance coaches, personal brand specialists, psychologists, financial advisors, mentors and recruiters. Businesses could also subsidise their own employees' education efforts, even if in an unrelated field. The Starbucks Foundation offers full tuition coverage for eligible Starbucks baristas to earn their bachelor's degree through Arizona State University

online,[70] and Amazon pre-pays college up to 95 percent of tuition and fees towards a certificate or diploma in qualified fields of study, leading to in-demand jobs, whether or not the individual plans to stay on with Amazon.[71] Additionally, online resources are already available to all workers, such as Grow with Google, which provides free training and tools to support growing skills, careers and businesses.[72]

Sweden has a different approach, through a system for retraining mid-career workers using private sector 'job-security councils'. Employers pay into these councils, which provide financial support and job counselling to laid-off workers, with the aim of helping them get back to work as soon as possible. Over 85 percent of displaced workers find a new job within a year. Personal counsellors help workers with their resumes and steer them into classes in their fields or other fields. These job-security councils are more effective than similar government-administered initiatives as they have more ample financial resources and can intervene more quickly after layoff.[73]

Government theme 1. Government to lead by example

The New Zealand Government has the opportunity to lead by example, and set clear, tangible, world-class improvement targets for the public sector, on outcomes and service-delivery metrics that matter most to citizens and can be achieved through automation technology. If there are relevant performance benchmarks that show what can be achieved for customers with automation, those benchmarks should become the target, even if they seem ambitious. If a target can only be reached by engaging with available technologies, it is the right target and should be pursued over a reasonable timeframe.

If there are relevant performance benchmarks that show what can be achieved for customers with automation, those benchmarks should become the target, even if they seem more ambitious than is possible.

In the public sector, aggressive customer-centric targets could help to drive highly appreciated outcomes. For example, facial recognition or thumbprint identification could significantly reduce service times at hospital admission desks and in government agencies by eliminating the need to fill out lengthy identity forms. Tele-health services could increase doctors' outreach, particularly in rural areas. Targets may need to be set or approved by government to guide the operational plans of agencies, but publicly sharing progress towards targets on an annual basis could promote transparency and accountability.

[70] https://edplus.asu.edu/what-we-do/starbucks-college-achievement-plan
[71] https://www.amazoncareerchoice.com/home
[72] https://grow.google/
[73] Alana Semuels, "What if getting laid off wasn't something to be afraid of?" The Atlantic, October 25, 2017; Back to work: Sweden, OECD, 2015.

Automation can also do things more efficiently behind the scenes, freeing up time for more customer engagement. At the Ministry of Social Development, automation technology could help to ensure that customer details are automatically updated, increasing payment accuracy and improving the citizen and worker experience. At the IRD, automated technology could provide a fuller view of taxpayers' financial activities and ensure they pay their taxes in full.

In parallel, to support the clear priority of digitisation and automation, the government could establish an independent information mechanism that can collect data, drive research and establish and maintain a credible fact base on automation in New Zealand. A robust evidence base is an essential component of good policy-making around technology adoption. A useful example is the European Union's (EU) Digital Economy and Society Index (DESI), which measures 30 indicators of digital adoption and performance for member states, as well as the EU overall. The World Bank has also launched the Digital Adoption Index to monitor technology use by various nations' citizens, businesses and governments. Oxford Economics introduced a similar tracker last year, known as the Digital Society Index. New Zealand currently has no such measure.

Box 4. Singapore's digital and automation mechanism

Singapore serves as a good example of integrating the government's digital goals into a single office that spans business, government and society. In 2017, the country established the Smart Nation and Digital Government Office (SNDGO) to lead 'smart nation' project planning. The SNDGO is built on three pillars: digital economy, which encourages technology adoption and innovation (for example, by offering support for local digital businesses and small- and medium-sized enterprises (SMEs) undergoing technological transformation); digital government, which raises digital capabilities in the public sector, runs public-sector digital transformations and co-creates digital public services with citizens and businesses; and digital society, which fosters digital literacy, expands and enhances access to digital infrastructure, and promotes digital inclusion and adoption. The office has been driving programs within each of these pillars across the government and is partnering with educational institutions and industry to foster technological advancement in each area.

Government theme 2. Use policy to enable nation-wide automation adoption, including incentivising automation growth for SMEs and select sectors

Policy is the backbone that could be used to transition our nation into a more prosperous future in the wake of automation. This could include creating a Mobility Centre, enacting regulation and policy conducive to encouraging automation adoption and ease of doing business, selecting globally leading industries for targeted automation growth through incentives and policy, and introducing a SME Automation and Future Skills Securitisation Fund.

Create a Mobility Centre

New Zealand will need to innovate to make sure it has the right institutions that are fit-for-purpose to support the needs of the workforce in the future. One critical need will be

matching workers' skills to open jobs, or understanding what reskilling is required if displacement occurs. To tackle this challenge and facilitate mobility in the labour market, the government could create a Mobility Centre that matches displaced workers with jobs.

A Mobility Centre could perform four functions:

- Create a central information marketplace to give transparency on supply and demand for skills and jobs, expected income levels, and the effectiveness of retraining and reskilling efforts
- Determine the skills certification and credentialing required for future jobs, and cater to specific individual needs. The former would allow skill credentials to be more portable across sectors, and the latter would allow the prioritisation of workers' specific needs where possible. For example, a priority of not physically relocating could suggest retraining in a field of work that can be performed remotely
- Share risk with displaced workers. This could be done through safety nets or investment clawbacks for workers that invested in their own retraining for jobs suggested by the Mobility Centre, if work does not eventuate within a certain period of time
- Create tracking mechanisms to measure and monitor the impact of retraining. The use of unified statistics could create the requisite transparency to better shape future policy based on empirical evidence.

The importance of giving individuals transparency on relevant reskilling cannot be overemphasised, as exemplified by the closure of the General Motors plant in Janesville, Wisconsin in 2008, where such transparency did not exist.[74] As a result, some of those who retrained ended up worse off than those who did not. In fact, by 2011, a higher proportion of the workers who did not retrain after layoffs had a job (72 percent), compared to those who went back to school in an effort to reskill (61 percent). A Mobility Centre could give displaced workers transparency on what retraining they should pursue, so that workers retrain for jobs in demand in the future, and not for jobs of the past.

Germany has successfully deployed a network of labour market services consisting of over 700 agencies and branch offices nationwide to deliver lifelong learning and occupational counselling. An online self-exploratory tool allows for the identification of peoples' strengths and hidden talents. It then offers users recommendations based on professional development options that are suitable to personal strengths and interests, as well as future opportunities. This continuously supports the life-long counseling efforts (online and offline) of the labour agencies that broadly reach over 40 million people.

One way to set up the Mobility Centre would be to convene a dedicated working group from academia, technology, unions, business, policy makers and education for three months to collaboratively develop and refine a nation-wide solution roadmap, while also counselling government on automation opportunities and challenges.

[74] Amy Goldstein, 'Janesville: an American story', Simon & Schuster, 2017.

Enact regulation and policy conducive to encouraging automation adoption and ease of doing business

In parallel, government will need to rethink needlessly obstructive regulation while protecting societal concerns. Legal frameworks will need to adapt to reflect a new reality of digitisation and automation. The right regulatory frameworks and conditions need to exist to encourage and enable investment in, and the development of, new technology. Outdated personal data legislation, for example, may be preventing innovative solutions and business models for the healthcare or social sectors. As technology continues to evolve, increasingly complex and ambiguous legal issues will arise, which will require quick regulatory iteration. Similarly, as new labour models become increasingly popular (such as the gig economy), there may be a need to rethink the bounds of the traditional employer-worker relationship.

Select globally leading industries for targeted automation growth through incentives and policy

While developing incentives and policy levers, the government could consider attributing an enhanced focus to industries where New Zealand stands to gain significant competitive advantage from the rapid adoption of automation. Agriculture and tourism, for example, are two important industries where New Zealand already stands out at a global scale. Investing in automation solutions to improve the efficiency, productivity, and quality of output could catapult New Zealand even further up the global ranks.

In Chapter 2, we briefly explored agriculture's importance to New Zealand's economy, specifically exports, and the various applications of AgTech (for example, automated harvesting, fruit picking and grading) that could address current labour shortages. New Zealand companies are already emerging as leaders in this space, and this is something to continue to build on through targeted policy and incentives (for example, an AgTech investment fund, or enhanced R&D credits).

Tourism is another key sector of New Zealand's economy, directly contributing 6 percent of GDP, with indirect contribution amounting to an additional 4 percent. Workers in the tourism industry account for 8 percent of New Zealand's workforce, and international tourism expenditure contributes 21 percent to New Zealand's total exports of goods and services.[75] The use cases of technology and automation in travel and tourism are also rapidly evolving. They include digitised and automated travel bookings, automated check-in, automated security and baggage handling at airports, and even automated customer service through chatbots or robots. Hotels in Japan and California, for example, already have robots welcoming and assisting guests during their stay. Fingerprint or face recognition is an existing technology that, when integrated at scale, could get rid of the need for hotel keys altogether. In the competitive tourism market, New Zealand cannot afford to be complacent on innovation. Creating a unique, differentiated experience for tourists, as well as using the latest technologies to promote tourism, is a way to future-proof New Zealand's strong foothold in the tourism sector. Again, targeted policy incentives could be used for the tourism industry.

[75] Tourism Satellite Account 2016, Statistics New Zealand.

Introduce a SME Automation and Future Skills Securitisation Fund

New Zealand is a nation of small-to-medium sized enterprises. As discussed in Box 1, SMEs have a chance to shine in the age of automation, as automation technologies can be applied at small scale. SMEs will usually require bank loans to make investments in automation and they often have greater difficulty in attaining business loans than larger enterprises. The Australian Government has recently announced an Australian Business Securitisation Fund—to give SMEs bank-issued, government-backed loans—to make it easier for SMEs to borrow for investment purposes. New Zealand could adopt a similar, more targeted, fund—a SME Automation and Future Skills Securitisation Fund—to give our SMEs better access to loans for the specific purpose of automation adoption and retraining the workforce.

Government theme 3. Strengthen education for lifelong learning, with dedicated upskilling pathways for older workers

The skills New Zealand workers need at work will change significantly as a result of automation. To prepare for this, these new and different skills can be embedded in education courses now, rather than added when New Zealand is in the midst of job disruption. Accordingly, the New Zealand Government could establish citizen-directed 'lifetime learning accounts' and conduct educational reform.

The skills people need at work will change significantly as a result of automation. These skills should be embedded in education now.

Establish citizen-directed 'lifetime learning accounts'

Education and training are lifelong pursuits and are essential for people to enter the workforce, find and retain jobs, and continue to grow throughout their careers. Yet many New Zealanders complete their education in their 20s and work for 35 to 40 years without much additional formal education. As workplace technologies and employer needs evolve, New Zealanders may need a different approach: lifelong training focused on skills development. While valuable at any time, this could better prepare people for the automation disruption, particularly older workers.

As workplace technologies and employer needs evolve, New Zealand may need a different approach: lifelong training for adults focused on skills development.

To financially support this approach, 'lifetime learning accounts' could be stablished. Singapore's SkillsFuture program, for example, establishes an account for each adult citizen over the age of 25, which they can tap into throughout their career to acquire new skills or

pursue higher education. The account can be used to cover the cost of around 25,000 pre-approved courses offered by a range of providers (including overseas Massive Open Online Courses, or MOOCs), including assessment and certification fees.[76] France offers a similar program, financed through employer contributions of 1 percent of total payroll costs (or 0.55 percent for firms with fewer than ten employees).[77] The US Congress is considering introducing a similar program, to be co-financed by matching employer and employee contributions (with an option for governments to also match contributions), up to an established cap.[78] In each of these cases, the fund follows the account holder throughout their life such that when they shift workplaces, their new employer contributes to the same fund. The New Zealand government could consider introducing such programs, similar to existing superannuation accounts, to help fund education and upskilling throughout a person's life as technology advances.

Encouraging displaced workers to keep participating in the labour market will be critical, especially workers whose jobs are displaced within a decade or so of their retirement. Many older workers lack the resources or the appetite to retrain, especially where it comes at a large out-of-pocket cost, but nevertheless, will have to reskill to avoid the prospect of unemployment or a significant reduction in pay, responsibilities, and job quality. Here, government support and incentives become critical, not only to repay these workers for their years of service and taxes, but also to maintain their health and community engagement, so as to avoid higher future costs to the taxpayer. The government could also combine assistance for older workers with support for SMEs. In Germany, for example, the Federal Labour Office funds job-related training programs for workers aged 50 and over who are employed by SMEs. These programs have been correlated with an increased share of older workers in training and higher employment rates for those aged 45 to 54.[79]

Conduct educational reform to better align lifelong learning foundations, study and work prospects

The changing nature of work has led businesses, students and governments globally to demand up-to-date skills-based curricula, with student-centred teaching integrated with work experience and technology, and course structures that include both short courses and modular certifications. Generally, the rate of progress has been slow and job-related outcomes need to be improved. The rapid and pervasive change inflicted by digital progress is affecting nearly all forms of established human activity, and therefore compels the reconsideration of incumbent education systems for lifelong learning, starting from early childhood education to upskilling as a worker approaches retirement.

To date, there has been little focus on what the changing future of work could mean for early childhood education and the subsequent compulsory school years. International research has

[76] www.MySkillsFuture.sg
[77] *France: Employers obligation to provide skill development plans or training,* European Monitoring Centre on Change.
[78] Skills Investment Act of 2019, United States Congress.
[79] Hila Zboralski-Avidan, *Further training for older workers: A solution for an ageing labour force?* (PhD dissertation).

highlighted the importance of the first 5 years of a child's life as the core period for the development of critical thinking and non-cognitive executive function (such as empathy and attention), as well as psychological resilience. These attributes will be critical to ensuring sound mental wellbeing in an environment which will rapidly change over a lifetime due to technological advancement. This calls for a systematic review and monitoring of existing early childhood education to promote the desired outcomes.[80]

It is also important to continue to adapt years one to 13 to better align with future needs and the anticipated shift in skills that will be required in the workplace: that is, a stronger focus on technological skills, advanced IT skills and programming, and advanced cognitive and social skills. New Zealand schools have already begun to innovate in this space: since 2005, Onehunga High School pioneered Construction School, merging traditional and vocational education with great success.[81] This has expanded to include support for additional specific pathways, such as a Services Academy run in conjunction with the New Zealand Defence Force, a Health Science Academy through partnership with various District Health Boards, and a Business School.[82] Meanwhile, Albany Senior High School has been incorporating impact projects—highly structured, project-based learning experiences—into their curriculum.[83] The current review of the NCEA curriculum is a good opportunity to align high school learning outcomes to be relevant to the workplace of the future.

In the tertiary landscape, there is an opportunity to introduce more modular, skills-oriented learning pathways to facilitate lifelong learning journeys that are portable between sectors. The University of Melbourne in Australia, for example, is exploring the introduction of 'micro-credentials' that certify students' partial completion of work towards a degree. In 2017, they partnered with Learning Machine, a US company associated with the Massachusetts Institute of Technology, to pilot a micro-credentialing system based on a blockchain platform.

Despite these efforts, there is still a considerable way to go. Universities and vocational educators need leaders who can communicate the need to modernise course design and delivery as well as drive its implementation. Teachers need new skills to make the best use of technology through enhanced coursework, personalised materials and learning experiences, and interactive simulations. These are not easy transitions for established institutions. New Zealand has, however, recently announced a critical step in the right direction through the intended reform of vocational education. The purpose of the proposed reform of vocational education is to enable a strong, unified, healthy and sustainable vocational education system that delivers the skills that learners, employers and communities need to be successful. Importantly, employers are being consulted to inform curricula and are offered representation through new Industry Skills Bodies. Governance will be centralised through a single New Zealand Institute of Skills & Technology to expedite improvements, yet will stay close to

[80] Understanding wellbeing in the context of rapid digital and associated transformations, International Network for Government Science Advice (INGSA), August 2018.
[81] http://www.onehungahigh.school.nz/curriculum/pathways/building-and-construction/
[82] http://www.onehungahigh.school.nz/curriculum/pathways/
[83] http://www.ashs.school.nz/curriculum/impact-projects/equine-education

regions to understand their local skills and development strategies by establishing Regional Leadership Groups.[84]

Government theme 4. Launch pilots of new social welfare concepts

Despite the best efforts of governments, employers, and the education system, there will inevitably be workers who, through little fault of their own, find themselves displaced by automation and who struggle to upskill and find meaningful re-employment. This has always been the case, and it will remain so in the age of automation. If worker displacement through automation significantly pushes up unemployment rates, there could be additional pressure on New Zealand's existing social welfare structures.

While accelerating reforms in training and education is a key part of the equation, a more immediate reform option could be to extend the safety net to encompass all types of work, not just traditional, full-time employment. At present, for example, workers compensation is not available (at least not efficiently) for independent contractors, and there is no capacity to continue accruing long service leave between different types of jobs or across different jobs.

New Zealand should explore new ideas that could be incorporated into future reforms. Governments and researchers, for example, are already exploring new concepts to tackle income inequality.

Another option is to consider new ideas that could be incorporated into future reforms, in case the speed of automation adoption is faster than anticipated. Governments and researchers are already exploring new concepts to tackle income inequality, such as wage insurance; the universal basic income (UBI), to guarantee a minimum living wage for all citizens; salary supplements, to encourage labour force participation (some modelled on the earned income tax credits in the US); minimum wage increases; and even a mandated distribution of capital when its returns exceed those to labour by an agreed margin.

Evidence on many of these policy ideas is as yet limited or mixed. Wage insurance, for example, is intended to encourage displaced workers to take potentially lower paying positions by topping up their incomes. People who cannot find a new job with equal or better pay receive government funded top-ups for specified periods (such as one year), capped at a particular amount (for example, $10,000). The Brookings Institution has advocated for wage insurance in the US on multiple occasions.[85] To date, however, there has been too little analysis to assess its track record. Wage insurance does have an advantage over other

[84] Employers factsheet: reform of vocational education, February 2018: https://conversation.education.govt.nz/assets/RoVE/Employers-factsheet-Reform-of-Vocational-Education.pdf

[85] *Earnings insurance for Germany*, Brookings, July 25, 2002; *Wage insurance: A potentially bipartisan way to help the middle class*, Brookings, February 24, 2015; *Four cures for automation anxiety*, Brookings, June 21, 2018; *What is this 'wage insurance' Obama's talking about*, The Atlantic, January 14, 2016.

suggestions such as UBI, because it is a more targeted initiative and therefore less costly to taxpayers. There is also insufficient data on overseas pilots of UBI to assess its efficacy. Finland ran a 2-year UBI pilot from 2017 to 2018, with an aim to promote more active workforce participation and provide a stronger incentive to work. Initial findings from the program, where participants were given €560 per month, showed positive effects on health and stress but no improvement in work status or likelihood to find work. A broader investigation will be published in 2020, looking into the drivers of the results and the dynamics at play.[86] Y-Combinator, a US seed accelerator, will start a basic income study this year. It will randomly select individuals across two US states to participate in the study, half will receive $1,000 a month for up to 5 years; the rest will serve as a control group for comparison.[87]

In Denmark, employers and governments work with unions to maintain the country's 'flexicurity system', a golden triangle which combines active labour market policies with flexible rules for hiring and firing (~25 percent of Danes switch jobs every year), and high levels of benefits for unemployed individuals (up to 90 percent for the lowest paid workers). The active labour market support includes job counselling, including career guidance, training or education to all unemployed individuals, and offers all workers access to numerous vocational training programs.[88]

Accordingly, the New Zealand Government may need to pilot its own interventions to develop a deeper understanding of their potential, and to convince the public of the value of expanding worker transition support. This could provide public agencies with the necessary evidence base to implement an innovative idea if existing welfare models come under strain. To enable a fair comparison between different interventions, the government could leverage advanced analytics and automation technologies.

Specific recommendations

Based on the themes described above, we propose a list of 12 specific recommendations across business and government. These recommendations will result in positive societal impacts if they are delivered through a combined stakeholder approach—no one stakeholder has the ability to deliver all benefits and overcome all challenges on their own.

Skills, Retraining and Education	
Challenge	**Recommendation**
Significant numbers of Kiwis need to be retrained and reskilled every year to close the anticipated skills gap and mitigate the risks posed by automation.	New Zealand private and public sector employers need to be at the forefront of this transformation, adopting impactful and best-practice retraining strategies. **1. Kiwi employers should pledge to double their investment in annual employee**

[86] https://www.weforum.org/agenda/2019/02/the-results-finlands-universal-basic-income-experiment-are-in-is-it-working/
[87] https://basicincome.ycr.org/
[88] McKinsey Global Institute, 'Jobs lost, jobs gained: workforce transitions in a time of automation', December 2017.

	training, re-training and upskilling and publicly report on this investment as a credible signal of leadership in ensuring Kiwis are well prepared for the Future of Work. 2. **Board directors should ask the following of their organisations:** – What is the organisation's strategy to at least double the rate of real productivity growth using automation technologies? – What is the organisation's human capital strategy to train, retrain, upskill and empower its people to thrive in the Future of Work? – How will the organisation change or enhance its culture, behaviours and operating models to ensure it delivers the benefits of automation?
The Future of Work quickly becomes the Future of Education, and New Zealand needs to deliver scalable and effective ways to teach the key competencies demanded by future labour markets; cognitive skills, social and emotional skills and most significantly, technological skills.	The education system, including content and delivery methods, needs recreating to prioritise training in Future of Work skills, specifically technology skills. 3. **A national digital and technology curriculum should be developed and made compulsory,** at appropriate levels in the education system. 4. **A "National Digital Certificate" should be created** as a scalable way for businesses to retrain employees in the technology skills needed for most future roles.
A scalable mechanism is needed to encourage and require Kiwis to take personal responsibility to reskill throughout their lives. This will become just as important as saving for retirement.	5. **A "KiwiSaver for Skills" should be established by creating citizen directed Lifetime Learning Accounts** for individuals to tap into throughout their careers to acquire new skills or pursue higher education.
Understand and Target Māori and Youth Challenges in the Future of Work	
Challenge	**Recommendations**
Māori and youth are especially vulnerable to the potential impacts of automation. New policies and bold initiatives are needed to address this and must be based on robust evidence.	6. **Government should commission a similar Future of Work report focusing on Māori and the impact of automation** to inform targeted recommendations. It should include insights on youth unemployment, which for Māori currently sits above 20%.

Mitigate Risks by Overhauling and Recreating Institutions	
Challenge	**Recommendations**
Positive and negative consequences will vary across regions with some parts of the country being particularly hard-hit if no mitigating actions are taken. Our current welfare system needs to experiment and modernise to reflect this new reality and we need powerful interventions and new mechanisms to support work transitions.	**7. The "Work and Income New Zealand (WINZ) of the future" should be piloted by trialing a Mobility Centre model that:** – **Can deploy to regions** prioritised because they will be more negatively impacted by automation than other regions; – **Acts as a sophisticated jobs information market place**, careers and qualifications matching and brokering service; – **Is authorised to implement risk sharing schemes** with training providers if their training does not result in employment for a displaced worker (the risk currently sits 100% with the individual); and – **Provides targeted, case managed and individualised support** so that a single view of a customer can be developed for a displaced worker, allowing the full suite of government schemes to be made available. **An initial pilot should be rolled-out in Southland** given its vulnerability to automation, strong education sector and population size.
The potential for significant numbers of Kiwis, including youth, to be unemployed is real. Our agencies and policies, in their present form, are ill equipped to respond to this.	**8. There should be social welfare reform including, but not limited to:** – Setting policy that requires anyone under a certain age (and who meets fair and reasonable criteria) be in work or in training; a pure unemployment benefit is not an option. – Allowing other beneficiaries to concurrently access full-time training.

Assessing and undertaking needed reform requires a shift from a business as usual approach, the ability to operate across government and access to political and fiscal levers.	9. **A dedicated Future of Work Unit within the Treasury should be established** with direct, high-level political support that is responsible for the delivery of initiatives, new systems set-up and the introduction of schemes at the right time, in the right places, for the right people.
Government Leading by Example	
Challenge	**Recommendations**
The public sector has the largest workforce in New Zealand. In many cases it is heavily process, task and systems driven and therefore holds significant levers to lead a positive response to capturing automation's benefits.	10. **Specific services (at both the central and local government level) where automation is appropriate should be identified and tangible, world-class improvement targets should be set** on outcomes and metrics that matter most to citizens (e.g. passport processing has been an example of this).
Targeted SME and Sector "Surge Support"	
Challenge	**Recommendations**
SMEs and sectors that provide New Zealand with a comparative advantage hold the key to harnessing the benefits of automation by solving a large part of our productivity problem. Despite SMEs making up 97% of Kiwi businesses, there is no Provincial Growth Fund equivalent for SMEs and many struggle to scale and adopt the technology needed to supercharge their businesses. There is a strong correlation between SMEs that use three or more Apps to run their businesses and 30% more profitability.	11. **High-performing, or high-potential sectors (which have self-selected) should be surged** with support and targeted investment and incentives to achieve scale through automation (for example, accelerated depreciation on innovative technology assets, R&D tax credits). 12. **A "SME in a Box"** scheme should be created, which outlines clear, user friendly steps towards greater productivity in SMEs, including: – Encouraging and specifically recommending App and technology use through loans, grants or investment to enable adoption and associated training. – Partnering with book-keepers, banks and other service providers to SMEs as a vehicle to roll-out this scheme.

□ □ □

We are experiencing history in the making. Over the coming years, due to the rapid evolution and deployment of new technologies, the very nature of how we work, interact and live as a nation will fundamentally change. This prompts everyone—individuals, businesses, government, unions, education institutions, not-for-profits—to take initiative and stay nimble when it comes to seizing the many opportunities, and circumventing the challenges, that automation is expected to present. Managing this type of transition is what New Zealand does well. New Zealand has resiliently overcome, and flourished, during periods of stress in the past, such as the 'turbulent transition' and deregulation of the 1970s and 80s,[89] more recently the global financial crisis, and now it has the opportunity to show its adaptability once more.

Realising the opportunities of automation and navigating its challenges is not something that the government, a single firm or a single individual can do alone. New Zealand needs a clear strategy, the right skills, effective collaboration at all levels, and the determination to take action when needed. Through a coherent, collaborative national approach that ensures we are future-ready and leave no one behind, automation could indeed be the solution to a long-standing productivity problem and propel New Zealand into a new era of prosperity.

[89] Reserve Bank of New Zealand, *The Reserve Bank and New Zealand's Economic History*, 2007.

APPENDIX 1: MCKINSEY GLOBAL INSTITUTE METHODOLOGY

This report draws on the methodology and findings from the January 2017 McKinsey Global Institute (MGI) report, *A Future that Works: Automation, Employment and Productivity*; and the December 2017 report, *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation.* A full methodology of that work is detailed in the reports' technical appendices. This is a brief summary of this methodology and how it was applied to produce the findings in this report.

What the model does:

- This research develops a set of scenarios (necessarily incomplete) to serve as a guide as we anticipate and prepare for the future of work. This research is by no means the final word on this topic, and ongoing research is required.
- These scenarios seek to address some of the questions most frequently raised in public debate. Will there be enough work in the future to maintain full employment, and if so what will that work be? Which occupations will thrive, and which ones will wither? What are the potential implications for skills and wages as machines perform some or all of the activities that humans do now?
- To answer these questions, MGI analysed scenarios for the net impact of automation and future labour demand, which further depict changes in employment, sectors and skills. MGI examined both the potential labour market disruptions from automation and some potential sources of new labour demand that will create jobs.
- MGI findings look into trends that may serve as catalysts of future labour demand and could create demand jobs by 2030. These trends include caring for others in ageing societies; raising energy efficiency and meeting climate challenges; producing goods and services for the expanding consuming class, especially in developing countries; and investing in the technology, infrastructure and buildings needed in all countries.
- MGI analysis offers a static view of the potential labour demand that could be created from the seven trends. It does not factor in supply-demand dynamics and feedback from factors such as changes in wage levels.
- Sizing methodology varies by trend. However, MGI capture direct and indirect jobs that could be created from each of the seven catalysts, take into consideration the decline in hours worked per person, and factor in globalisation of work.
- For three of the seven trends—investment in infrastructure, investment in buildings and investment in renewable energy and energy efficiency—MGI examined two scenarios: a 'trendline' scenario, in which spending follows the observed trends across countries; and a 'step-up' scenario, in which labour demand increases as a result of societal and policy choices. For a fourth trend—the increasing shift to market of services that were long done

without remuneration—MGI only examined a step-up scenario that assumes rising female participation in the workforce.

- MGI found that a growing and dynamic economy—in part fuelled by technology itself and its contributions to productivity—would create jobs. These jobs would result from growth in current occupations due to demand, and the creation of new types of occupation that may not have existed before, as has happened historically.
- None of this will happen by itself—it will require businesses and governments to seize opportunities to boost job creation, and labour markets to function well.

What the model does not do:

- The model is not intended to produce forecasts.
- MGI has not made assumptions in its modelling about sector trends, such as the growth of e-commerce in retailing, or the impact of fiscal constraints on public-sector employment.
- MGI does not model changes in work structure, such as the growth of the gig economy, or activities within an occupation that could change as a result of technological innovation.
- MGI analysis of wage trends is based on current average wages for each occupation in each country. Wages are not modelled over time by occupation based on the dynamics of labour supply and demand.
- MGI does not model changing skill requirements for occupations or analyse the 'skill bias' of automation technologies—that is, whether they will enable high-skill workers at the expense of low-skill workers, or vice versa. They are not the cause for the approach, but they can be an effect.

WORK HOURS THAT COULD BE AUTOMATED

The technical potential for automation of the global economy and projected adoption rates are determined by an analysis of the underlying work activities for each occupation, covering 46 countries. This analysis uses databases published by institutions including the World Bank and the US Bureau of Labour Statistics 2014 O*Net database to break down around 800 occupations into more than 2,000 activities, and it determines the performance capabilities needed for each activity based on the way humans currently perform it. The report further breaks down activity into 18 capabilities and assesses their technical automation potential. This framework is informed by academic research, internal expertise and industry experts. The report focuses on 2016-30 and therefore takes the automation adoption percentage through to 2030.

MGI use these findings to size the number of jobs that could be automated by 2030. MGI assume that each hour of work that could be automated will result in proportional job loss. For example, if 10 percent of current work activity hours in an occupation will be automated, then 10 percent of jobs in that occupation will be displaced. It is unclear if this assumption is conservative or aggressive. Based on what has been observed historically, it is expected in

many cases that the result of activity automation will be a redistribution of efforts to other existing or new activities. However, it is also possible that with automation, existing work processes could be radically overhauled and reduced in complexity, reducing labour demand even further beyond the automation potential of current activities. MGI have not modelled these countervailing effects.

Jobs lost = (1 – weighted automation potential) × 2030 labour force

To calculate the work hours automated in 2030, MGI multiply the automation adoption percentage by the size of the labour force in 2030. In doing this, MGI assume that the occupation mix of the economy and the underlying work activities in each occupation in 2030 are the same as today. This is a conservative assumption, because in reality MGI would expect that jobs will not be added back with the same occupation mix, and that new jobs will be added in less automatable sectors.

To estimate the size of the 2030 labour force, MGI use population projections from the United Nations, labour force participation projections from the International Labour Organisation and the natural unemployment rate for OECD countries. For countries outside the OECD, MGI use the maximum unemployment rate from either 2007 or 2012 to adjust for the effects of the 2008 Global Financial Crisis on unemployment.

LABOUR DEMAND DRIVERS

The work examines the labour demand created by seven catalysts. MGI selected these seven catalysts from a shortlist of 20, after conducting high-level sizing calculations to estimate their potential to create labour demand by 2030. The seven catalysts are: rising incomes, healthcare and ageing, development and deployment of new technology, infrastructure investment, residential and commercial buildings, energy transitions and efficiency, and marketisation of currently unpaid work. Detailed descriptions of these catalysts and the calculation approach can be found in the technical appendix of the 2017 report, *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation.*

MGI capture direct and indirect jobs that could be created from each catalyst, take into account the decline in hours worked per person, and factor in globalisation of work. The model offers a static view of the potential labour demand that could be created from the seven drivers and does not factor in supply-demand dynamics and feedback from factors such as changes in wage levels. It estimates potential labour demand; whether this potential is captured will depend on the choices and investments made by businesses, policymakers and workers. Beyond the seven drivers, the scenarios do not take into account any sources of labour demand that could play an important role in determining the future of work. MGI do not model entirely new industries and occupations that could exist in the future, in part enabled by technology. (Studies have shown that, on average, 0.5 percent of the workforce have been working in ‘new jobs’ per year in the past couple of decades.) MGI do not take into account sectoral shifts in industries that are not directly related to automation, such as the rise of e-commerce in retail. MGI also do not model changes in work structure, such as the growth of the ‘gig’ economy, or activities within an occupation that could change as a result of technological innovation.

APPENDIX 2: INEQUALITY METHODOLOGY

In this report, McKinsey Global Institute (MGI) analysed several scenarios regarding the potential impact of automation trends and reskilling responses on inequality levels in New Zealand.

MGI used a static version of McKinsey's Global Trade Analysis Project (GTAP) computable general equilibrium model with GTAP_v9 dataset. The model was structured using New Zealand and 'Rest of World' as regions, with five labour categories (in descending order by wage):

- Managers and professionals
- Technicians and associate professionals
- Service and retail workers
- Administrative workers and clerks
- Agriculture, trade and manual workers.

MGI began with a labour market in equilibrium, with labour supply equal to labour demand, and deviated from this equilibrium by adjusting the labour demand according to six scenarios that vary based on degree of reskilling (ranging from 25 percent to 100 percent). Labour supply was held constant for comparison between scenarios.

Wage rates were indexed to equilibrium wage rates, and wage deviations for each scenario were reported by labour category. First-order deviations from the equilibrium wage rate occur in a general equilibrium model as a result of elasticities in the demand for labour, the supply of labour and the substitution of labour. Second-order effects are also accounted for—for example, as bundles of production and consumption fluctuate given new costs of production and consumption prices.

MGI also calculated a 'Synthetic Gini coefficient'. MGI began by ordering labour categories based on 2016 wages. MGI then calculated the area under the Lorenz Curve using labour category employment instead of percent of population and the wage bill for income. MGI assumed equitable distribution of income within labour categories, so changes to this synthetic Gini are a result of changes to labour categories, rather than changes within.

APPENDIX 3: SKILLS GAP METHODOLOGY

In this report, MGI estimated the potential size of the 'skills gap' in the New Zealand workforce in 2030. For the purpose of this report, the skills gap is the gap between the types and levels of qualification that employers are looking for, and the types and levels of qualification that New Zealanders are graduating with.

To conduct this analysis, MGI built a model drawing upon data from the National Centre for Vocational Education Research (government-funded students' database, 2010 and 2016) and the Department of Education and Training (higher education statistics, 2010 and 2016 student data). Future employer demand was calculated using the McKinsey Global Institute model.

Future worker supply analysis focused on graduate completions only (assuming companies will only hire students who have graduated). The total number of completions included 100 percent of government-funded completions, 100 percent of domestic completions for higher education and 29 percent of international completions for higher education (considering only the share of international students who have been granted work visas in recent times). In 2016, 32,414 graduate work and post-study work visas were granted, out of a total of 110,383 overseas higher education students who completed their degree.

The total number of completions in 2030 was forecast based on expected population growth (using the same 2016-2030 compound annual growth rate).

Based on 2016 completion share by field of education and qualification level, and based on 2003-16 trends, MGI then computed the 2030 completion share by field of education and qualification level. By applying these shares to the total number of completions forecast in 2030, MGI determined the number of completions in 2030 by field of education and qualification level.

Finally, to compute the projected gap in employment by 2030 in terms of supply versus demand, MGI compared the projected share of 2016-30 cumulative graduate supply from education with the projected share of 2016-30 jobs gained (i.e. demand).

APPENDIX 4: NET JOBS BY REGION METHODOLOGY

In this report, jobs gained by region were estimated based on McKinsey Global Institute's (MGI) jobs lost, jobs gained methodology (see Appendix 1). This methodology was applied both at the national level and at the regional level for New Zealand, as detailed below. The analysis is indicative only.

In MGI's models, 2016 employment (2.5 million FTE) is broken down into ~800 granular occupations and scaled consistently to 2030 employment (3.2 million FTE), using the Ministry of Business, Innovation and Employment's 1.8 percent CAGR long-term employment growth forecast.

Displaced jobs at a regional level were modelled by MGI using the methodology described in Appendix 1, based on the 2016 baseline employment by region.

For jobs gained, MGI projected a national number at this detailed occupation level in 2030, but not at a regional level. This equated to 0.7 million jobs gained in known occupations, and an additional 0.2 million jobs gained in new occupations that do not exist yet.

To estimate regional jobs gained, McKinsey first apportioned national jobs gained at a granular occupation level, and then scaled to account for anticipated varied regional growth from migration and new investment.

Initial apportionment of national jobs gained to regions involved taking forecast 2030 baseline employment by region at the 800 granular occupation level, removing jobs displaced due to automation, and arriving at retained jobs by region. Against each of the 800 occupations, the national jobs gained in that occupation were apportioned across the regions, based on their individual share of retained jobs in that occupation in 2030. Each region's initial job gained was the sum of its jobs gained apportionment across its 800 occupations. The estimated new occupations (0.2 million) were then apportioned and added to regions in the same way, resulting in total jobs gained of 0.9 million across New Zealand.

McKinsey then scaled this number to account for regional supply and demand drivers (i.e. migration and new investment). Historical regional employment growth was used as a proxy indicator for future regional employment growth, as estimated regional employment forecasts were not available. To arrive at an adjusted regional cut, the regional totals were scaled by indexing regions' historical growth as against New Zealand's overall historical growth rate for that same period.

Finally, net jobs were calculated by adding these scaled job gains to MGI estimated jobs displaced by region.