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Technological change and the future of work

Technology adoption by firms

Technological change and the
future of work

Draft report 5

January 2020

The New Zealand Productivity Commission

Te Kōmihana Whai Hua o Aotearoa¹

The Commission – an independent Crown entity – completes in-depth inquiries on topics selected by the Government, carries out productivity-related research and promotes understanding of productivity issues. The Commission aims to provide insightful, well-informed and accessible advice that leads to the best possible improvement in the wellbeing of New Zealanders. The New Zealand Productivity Commission Act 2010 guides and binds the Commission.

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About this inquiry

This inquiry explores the impacts of new and changing technology on the quantity and nature of work. It builds on research and modelling carried out by governments, academics and other organisations in New Zealand and throughout the world. It aims to answer two main questions:

- What are the current and likely future impacts of technological change and disruption on the future of work, the workforce, labour markets, productivity and wellbeing?
- How can the Government better position New Zealand and New Zealanders to take advantage of innovation and technological change in terms of productivity, labour-market participation and the nature of work?

The inquiry has released five draft reports

The five draft reports address different aspects of this inquiry's terms of reference.²

Report 1 – September 2019 ***New Zealand, technology and productivity***

- Defining technology, technological change and disruption
- What factors affect technology adoption and diffusion?
- What are the labour-market effects of technology diffusion to date?
- What might future technology adoption and labour market change look like?
- Preparing for an uncertain future

Report 2 – November 2019 ***Employment, labour markets and income***

- How has technology affected NZ's labour market?
- Are digital platforms and gig jobs changing the nature of work?
- How well do employment laws balance protections and flexibility?
- How can income support for displaced workers be improved?
- Can the Government better support those affected by labour-market change?
- What might improve NZ's technology adoption rates, and its labour market?

Report 3 – December 2019 ***Training New Zealand's workforce***

- How well does NZ's training and skills system support people in work to retrain and acquire new skills over time?
- What changes would make the system more responsive to the needs of a dynamic labour market?

Report 4 – January 2020 ***Educating New Zealand's future workforce***

- How well does the NZ education system prepare people for future uncertainty?
- Does the national curriculum help or hinder?
- How well does the system promote flexibility and adaptability in students?
- Are there attributes of the system that close off student options too early?

Report 5 – January 2020 ***Technology adoption by firms***

- What motivates firms to adopt new technologies?
- How do markets for land, labour, capital and other inputs affect technology adoption by firms? What else influences firm decision making?
- Firm and labour dynamics in a competitive business environment
- How can governments better encourage technology uptake by firms – and hence productivity growth?

Register your interest

The Commission seeks your help in gathering ideas, opinions and information to ensure this inquiry is well informed and relevant. The Commission will keep registered participants informed as the inquiry progresses. You can register for updates at www.productivity.govt.nz/have-your-say/subscribe, or by emailing your contact details to info@productivity.govt.nz.

² See the inquiry's [issues paper](#) or [draft report 1](#) for the terms of reference, or visit www.productivity.govt.nz/assets/Documents/8170d4518e/Terms-of-reference_Technology-disruption-and-the-future-of-work.pdf.

Make a submission by 17 February 2020

The Commission is interested in hearing comment, feedback and other evidence on the draft reports, and is conscious that different people and groups will have differing levels of interest in each of them. The Commission therefore welcomes separate submissions on each of the reports, submissions that respond to cross-cutting themes in multiple reports, or a single submission that covers all five. Please pick the format and approach that suits you best.

The **due date for submissions** on the five draft reports is Monday, **17 February 2020**.

Anyone can make a submission. Your submission may be written or in electronic or audio format. A submission may be a short note on one issue or a substantial response covering multiple issues. Please provide relevant facts, figures, data, examples and documents where possible to support your views. Multiple, identical submissions will not carry more weight than the merits of your arguments. Your submission may incorporate relevant material provided to other reviews or inquiries.

Your submission should include your name and contact details and the details of any organisation you represent. The Commission will not accept submissions that, in its opinion, contain inappropriate or defamatory content.

Sending in your submission

Please make your submission via www.productivity.govt.nz/have-your-say/make-a-submission. The Commission appreciates receiving submissions in PDF format.

What the Commission will do with submissions

The Commission wants to have as much information as possible on the public record. Submissions will become publicly available documents on the Commission's website. This will occur shortly after receipt, unless your submission is marked "in confidence" or you wish to delay its release for a short time. Please contact the Commission before submitting "in confidence" material.

Other ways you can participate

The Commission welcomes feedback about this inquiry. Please email your feedback to info@productivity.govt.nz or contact the Commission to arrange a meeting with inquiry staff.

The inquiry team is running a blog on technological change and future of work topics. Individual staff members post regularly at www.productivity.govt.nz/futureworknzblog/. You can subscribe at www.productivity.govt.nz/have-your-say/subscribe. Comments and guest posts welcome.

Final report in March 2020

The Commission will deliver a **final report to the Government in March 2020** bringing together themes, findings, recommendations and participant feedback from the draft reports.

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Key

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Finding

Overview

This inquiry deals with the questions of how technology affects the economy and employment, and how New Zealand can best position itself for future technological progress. Earlier draft reports have focused on the nature and scale of technological change and on policies to help workers better adjust to the impacts of this change. A major finding is that there is no sign of an imminent technological “disruption” to work, and that New Zealand, if it is to enjoy higher productivity and income growth, needs more technology adoption and diffusion, not less.

This report deals with the policies to encourage technological adoption. Decisions about whether and how to adopt technology are taken by individual firms. Many factors influence these decisions, but three important drivers are relative prices, risks and rewards. Changes in relative prices, for either inputs (including labour and capital) or for the outputs of a firm’s production, may encourage a firm to adopt technology to improve its production processes or to develop new goods and services. Perceived higher rewards (such as greater profits or market share) will tend to encourage technology adoption; while higher perceived risks or uncertainty will discourage it. The level of management capability within a firm affects how well it identifies new opportunities to use technology and how successful any technology adoption effort is likely to be.

Government policies and services affect firms’ relative prices, risks and rewards, often with positive effects, but sometimes in unexpected, undesirable or unintended ways. A dynamic, flexible and competitive business environment, underpinned by supportive policies, is important for technology adoption and productivity growth.

The entry of new firms seeking market share or producing new goods and services, the exit of weaker firms, and the movement of resources from low- to higher-performing firms – called “reallocation” – are central to the process of productivity growth. Yet capital does not appear to be moving towards New Zealand’s most productive firms. As capital is needed to adopt new technology, this could indicate slow rates of technology adoption by those firms, and an impaired process of reallocation.

New Zealand’s small domestic markets and geographic distance from large markets creates barriers to productivity growth. Small size and distance limit competitive pressures in many markets; reduce firm scale and specialisation; and hamper flows of ideas and technology into New Zealand.

Protecting and extending business environment dynamism should be a priority of any government seeking to encourage technology adoption.

- The business environment should be kept open to flows of goods, services, capital, data and ideas. This helps to offset the constraints on technology adoption created by New Zealand’s size and distance. New Zealand’s policy settings generally support openness now, but this needs to be maintained.
- Adoption of technology can be a complicated and high-risk undertaking for firms. Having the flexibility to easily reorganise production, can reduce these costs and risks. Policies that make it hard for a firm to reverse a decision (eg, laying off staff who were hired in expectation of growth that does not ultimately occur) can discourage firms taking the risk of adopting new technology.
- Government policies that support workers in the event of job loss, rather than protecting jobs or failing firms, can support the beneficial reallocation of resources.
- Decision makers should be conscious of:
 - unintended consequences (eg, foreign investment rules that make it harder for local firms to develop land for housing);
 - spillovers from other policy areas that affect the business environment (eg, land use regulation that has effects on labour mobility); and
 - the benefits of policy stability.

- There is a place for interventions targeting specific types or groups of firms, but such interventions should be designed with an appreciation of the likely economy-wide productivity effects. Interventions should not discourage the entry of new firms, the exit of poorly performing ones, or the reallocation of resources to better performing firms

There are some specific areas where government action could help remove barriers to, or increase the rewards for, technology adoption. This report presents some examples:

- Higher emissions prices would encourage investments in carbon-reducing technologies.
- A stronger national innovation system would enable firms to better identify and adopt productivity-enhancing technologies.
- A review of the limits on the use of genetic modification technologies would help ensure regulation keeps pace with technological change and evolving knowledge.
- A review of New Zealand's competition and consumer protection statutes is needed to make them fit for the digital age.
- Accelerating open banking and consumer data rights regulatory reforms could create new markets, opportunities and rewards for technology adoption.
- Adopting less restrictive land-use regulation could increase employment opportunities for workers and the supply of labour for firms.

This is the last draft report of the *Technological Change and the Future of Work* inquiry. The inquiry will deliver its final report to the Government in March 2020.

1 Technological change and the future of work – the story so far

Key points

- This report – the last of five draft reports – focuses on firms.
 - Firm decisions have a direct influence on labour markets, technology adoption and productivity.
 - Adoption of technology can improve a firm's productivity. But this is only one source of a nation's productivity growth. Reallocation of resources through the entry of new firms, the growth of successful firms and the exit of poorly performing firms is important.
 - Government policies and actions and investments can affect firm decisions about the adoption of technology both directly and indirectly by affecting the relative prices, and the risks and rewards that firms face.
- The inquiry's previous draft reports have concluded:
 - Over the past few decades New Zealand has seen substantial change to both the workforce and to firms' demand for labour; and it has adapted to that change without consequences that might qualify as "disruption". The New Zealand labour market is dynamic and appears well placed to adjust to future technological change over the next decade or so without disruption.
 - Despite the high-profile emergence of some digital-platform-mediated gig work, there is scant evidence in New Zealand of an increasing trend to more platform-mediated work, casual work, self-employment, contracting or of workers holding multiple jobs.
 - Any expansion of platform-mediated work does not appear to be at the expense of traditional employment arrangements. Most workers undertake platform-mediated work for short periods, and for supplementary income, rather than as a main job.
 - Better income security for displaced workers might contribute to greater acceptance of technology adoption and to better matching of people's skills to jobs.
 - Having a dynamic, flexible labour market minimises the consequences of job displacement, by offering opportunities for people to quickly find new jobs suited to their skills and preferences. Income protection measures can cushion the financial shock of job loss.
 - Job protections such as mandatory redundancy pay or minimum notice periods can discourage labour-market mobility and skill redeployment, and they favour workers who have these protections over those that do not.
 - Firms investing in new technologies require complementary skills, which depends in large part on having a high-performing education and training system for working-age adults. Training systems need to be responsive to demand as it emerges.
 - An education system for the future of work should empower people to learn new skills and knowledge throughout life and help people make well-informed choices and avoid closing off viable options inadvertently, unnecessarily or too early.
- There is not too much technological change and adoption in New Zealand; there is too little. This report considers general principles and specific actions for the Government to better position New Zealand firms to take advantage of technological change.

1.1 New Zealand, technology and productivity

The inquiry's first draft report, *New Zealand, technology and productivity* (2019b) examined concerns based on recent predictions that modern economies, including New Zealand, face significant labour-market disruption from emerging technologies. It noted that widespread and large-scale technological change over the past two-and-a-half centuries has not reduced the centrality of work to society, or the overall quantity of work and employment. Emerging technologies, particularly artificial intelligence, robots, software bots and autonomous vehicles, have not had significant effects on labour markets to date.

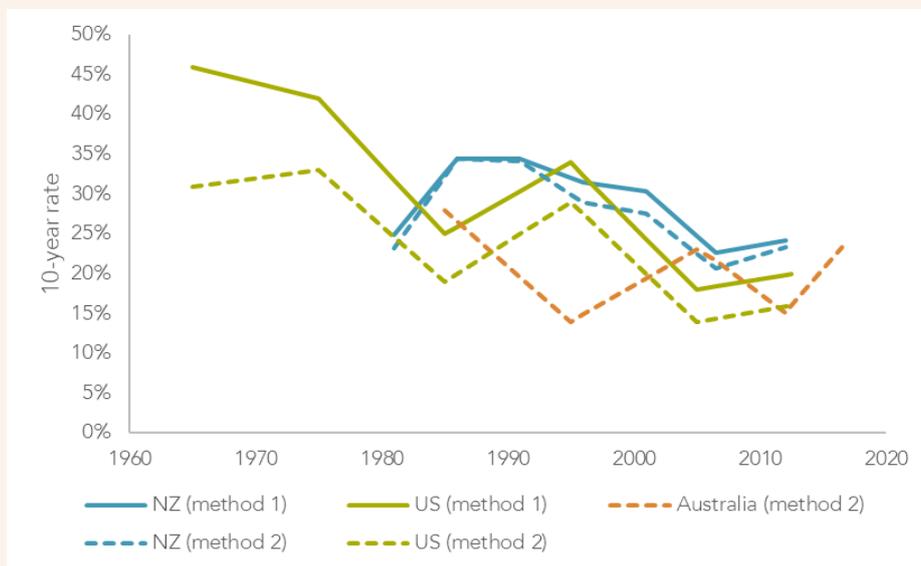
This does not mean that the New Zealand labour market is static. Over the past few decades there has been substantial change to both the workforce and to firms' demand for labour; and New Zealand has adapted to that change without consequences that might qualify as "disruption". There is no reason to expect that technological change in the next decade or so will not be within the capacity of New Zealand's well-functioning labour market to absorb.

Over the long run, change in the numbers of people in specific occupations is the best available measure of long-run labour-market change. Box 1.1 presents new data on occupational churn in New Zealand with comparisons against Australia and the United States.

Box 1.1 Update: Occupational churn

NZPC (2019b) reported occupational churn data over 175 years for the United States, showing that churn has been at historically low levels. Data for Australia covering a shorter period showed a similar trend (Office of the Chief Economist, 2018). Figure 1.1 presents the results of a Productivity Commission project undertaken by Dave Maré of Motu Economic and Public Policy Research.

Figure 1.1 Occupational churn, New Zealand, Australia and the United States, 1960s–2010s



Source: Maré (2019).

Notes:

1. 10-year occupational churn rate, plotted at the midpoint of the decade (or part-decade, where data is only available for a shorter period).
2. Maré uses the term "occupational drift", which is a better description of the underlying dynamics. This report uses "occupational churn" for consistency with the inquiry's earlier draft reports.
3. Maré used harmonised ANZSCO06 occupational coding at level 4. His methodology is consistent with "method 1" and "method 2" described in Atkinson and Wu (2017). The Office of the Chief Economist's (2018) methodology is consistent with method 2.
4. Maré's data included New Zealand Census 2018. This data was rated as "moderate quality". Just over 20% of data was derived by statistical imputation (Stats NZ, 2019). The 2013 census had a higher response rate and did not use statistical imputation. For this reason, the most recent datapoint should be treated with caution.

F1.1

The rate of worker movement between occupations has slowed over recent decades in New Zealand, Australia and the United States. This is consistent with other evidence that labour market and business dynamism has declined.

NZPC (2019b) concluded that New Zealanders need to embrace technology as a path to higher levels of community wellbeing, not to treat technology as a threat. More and faster technology adoption will improve New Zealanders' living standards and broader wellbeing. Embracing technology implies supporting people who are less able to adjust, preparing young people for the future, and setting policies and institutions that encourage the creation and uptake of new knowledge, skills, processes, goods and services by firms.

1.2 Employment, labour markets and income

The second draft report *Employment, labour markets and income* (NZPC, 2019a) examined the recent performance of New Zealand's labour market and opportunities for improvement that might both encourage technology adoption and better support people who face significant adjustment costs from labour-market change.

New Zealand's labour market is dynamic. It has low unemployment and high rates of labour market participation. Just over one in five workers change jobs each year. Despite the high-profile emergence of some platform-mediated gig work, there is scant evidence in New Zealand of an increasing trend to more digital-platform-mediated work, casual work, self-employment, contracting or of workers holding multiple jobs. Any expansion of platform-mediated work does not appear to be at the expense of traditional employment arrangements. Most workers undertake platform-mediated work for short periods, and for supplementary income, rather than as a main job.

NZPC (2019a) postulated that better support for displaced workers might contribute to a populace more accepting of technology adoption, and contribute to better matching of people's skills to jobs.

Having a dynamic, flexible labour market minimises the consequences of job displacement, by offering opportunities for people to quickly find new jobs suited to their skills and preferences. Income protection measures can cushion the financial shock of job loss. However, NZPC (2019a) considered that there was a case for improving the system of income protection in the event of job loss, through mechanisms such as portable individual redundancy accounts, government-mandated unemployment insurance, or tweaks to the benefits/tax system.

NZPC (2019a) looked at "Flexicurity", a model common in Northern European countries. Flexicurity eases shocks to people's incomes while they look for a new job, and offers labour-market flexibility to firms and training to workers.

In contrast to income protection, job protections such as mandatory redundancy pay or minimum notice periods can discourage labour-market mobility and skill redeployment, and they favour workers who have these protections over those that do not.³

Given the complexity of the existing welfare and tax systems, and the likelihood of significant fiscal implications of any changes, NZPC (2019a) did not recommend specific policy changes. However, the Commission undertook to do further analysis of replacement income rates in New Zealand. Box 1.2 presents a preview.

³ Redundancy pay and extended notice periods increase the costs of firm restructure, and so discourage firm-initiated labour mobility. Also, the anticipation of redundancy payments can reduce worker-initiated mobility.

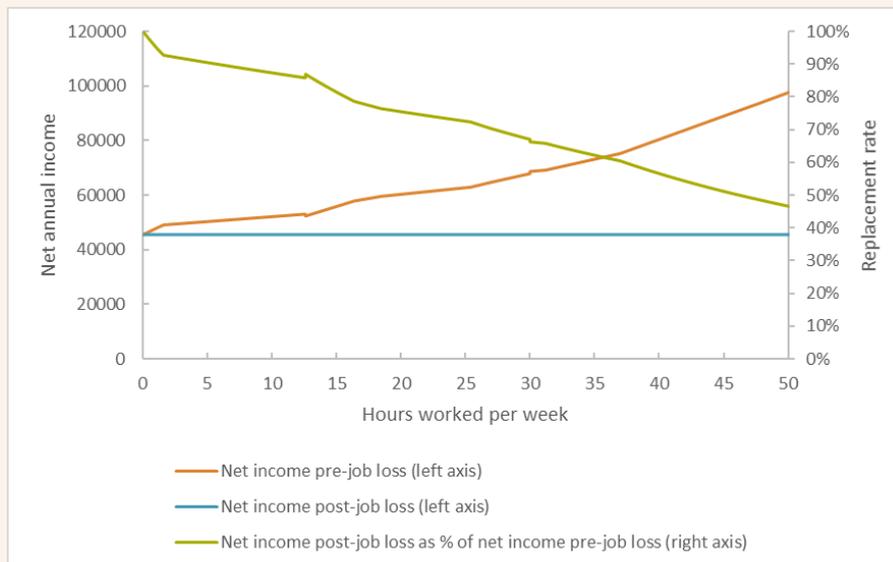
Box 1.2 Preview: Analysis of replacement income in New Zealand

Mok and Nolan (forthcoming) model income protection through New Zealand's tax and benefit system. Using the Treasury's non-behavioural microsimulation model, they estimate changes to the incomes of different family types after a job loss. This involves detailed modelling of families' incomes after taxation and the receipt of assistance ("net income"), at varying hours of work.

In practice, these calculations are highly complex. Net income is the result of the interaction of wages, income tax, main welfare benefits, and supplementary welfare assistance. It further varies based on civil status, the number and ages of children, the number of income earners in the family, and childcare and accommodation costs.

As an illustration, Figure 1.2 shows the net income of a single income couple earning \$50 per hour, with a new-born child, living in Auckland and paying rent of \$560 a week. The current system is more generous to families with children than to individuals and families without children.

Figure 1.2 Net income for a single income couple, working 0–50 hours, and replacement rate following job loss



Source: Mok and Nolan (forthcoming).

Notes:

1. Net income includes all main benefits and other payments such as Best Start, Winter Energy, Independent Earner Tax Credit and Accommodation Supplement.
2. The information supporting this graph has been provided by The New Zealand Treasury. Any analysis and conclusions are solely those of the authors.

For a family in work, the orange line shows their net income (after tax and benefits) at varying hours of work. Their net income following job loss (blue line), would be approximately \$46 000, regardless of the hours previously worked. The green line shows their post-job loss net income as a proportion of their pre-job loss income. This is the income replacement rate. All else equal, a family facing a higher replacement rate will suffer less of a financial shock from job loss.

One standard for unemployment insurance is to provide a 50% replacement rate (ie, the net income when out of work is 50% of the net income when in work). This family's replacement rate is above 50% if they previously worked less than 47 hours. At a lower wage rate, a 50% replacement rate would occur at a higher number of hours worked. A family with two or more children would have a higher replacement rate. Replacement rates are significantly lower for singles and couples without children.

Mok and Nolan (forthcoming) will present income replacement rates for a variety of representative households.

1.3 Training New Zealand's workforce

The third draft report *Training New Zealand's workforce* (NZPC, 2019c) considered work-related education and training for people in the workforce and for those soon to join it. This included training in people's workplaces, on-campus at a tertiary education provider, and through online or distance learning.

Each year large numbers of people join or leave the workforce or change jobs but people already in the New Zealand workforce will likely make up half the workforce in 2040. Inwards and outwards migration are responsible for numerically larger effects on the size and composition of New Zealand's workforce than the output of the school system.

Firms investing in technology need staff with complementary skills, the supply of which depends in large part on having a high-performing education and training system for working-age adults. Just as it is impossible to predict with any degree of accuracy how technology adoption will play out in New Zealand (NZPC, 2019b), it is also hard to predict what types of learning or retraining will be needed. Training systems need to be responsive to demand as it emerges. Making New Zealand's education and training system more responsive in the face of technological change means that the system will need to be more flexible. And that in turn involves reconsidering barriers that restrict participation, and restrictions on the types of education, training and credentials offered.

The report made recommendations to reduce barriers to workforce education and training, including widening access to student loans, easing constraints on the delivery of micro-credentials, and ensuring new migrants' eligibility to undertake government-funded vocational education. Government-funded work-based education and training should be available to all people in the workforce, and to volunteers, rather than be restricted to those who meet the legal definition of an "employee".

1.4 Educating New Zealand's future workforce

The fourth draft report *Educating New Zealand's future workforce* (NZPC, 2020) looked at how the New Zealand education system could better prepare young learners for a world of work.

Desirable characteristics of an education system for the future of work are its ability to empower people to learn new skills and knowledge throughout life; and help them make well-informed choices and avoid closing off viable options inadvertently, unnecessarily or too early. To do this the education system needs to provide a strong foundation of core skills, have a well-implemented and coherent curriculum, well-guided and clear learning and career pathways, and facilitate learners being able to keep their options open and change course.

An education system that is itself able to learn and adapt to changing circumstances is likely to be better at supporting successful approaches and initiatives and dropping those that are less successful.

There are opportunities for improvement to be made in the current reforms to the education system. NZPC (2020) identified opportunities to improve the promotion of innovation and good practice across the education system; support better curriculum implementation; remove constraints on students' ability to pursue relevant learning and career pathways; improve students' ability to switch in tertiary education; and address digital inclusion for young people.

1.5 This report: Technology adoption by firms

The Commission's previous draft reports, summarised briefly above, focused on the labour market consequences of technology, and how well education and training assists people to develop skills for current and future labour markets. This report focuses on firms. That's because decisions about technology adoption and hiring staff are made at the firm level.

Firms face a complex set of decisions about what inputs to use, how to organise themselves internally and what complementary investments are needed to successfully adopt technology. Chapter 2 looks at the role and importance of management capability in the successful adoption of technology. It also acknowledges

the ways in which government policies directly and indirectly affect relative prices and the perceived risks and rewards that firms face in making decisions about adopting new technology.

Adoption of new technology can help a firm be more productive. Yet, as explained in Chapter 3, this is only part of the story about how technology raises productivity across an economy. Firms operate in a dynamic environment – successful firms grow at the expense of less-productive firms, new firms enter the market and others exit. Chapter 3 looks at how these dynamic processes contribute to economy-wide productivity.

Questions guiding this inquiry include how the Government can “better position New Zealand and New Zealanders to take advantage of innovation and technological change” and “best encourage technology innovation and uptake”.⁴ Earlier draft reports have focused on steps the Government can take to better position current and future *workers* for greater technological change. Chapter 4 lays out some principles to guide policies for promoting *firm* innovation and technological adoption and highlights specific areas where government action would be helpful.

This report concludes the series of draft reports for this inquiry into *Technological change and the future of work*. The Government has asked the Commission to further investigate the role firms play in shaping aggregate productivity performance through the diffusion of technology, as part of a new inquiry into *Maximising the economic contribution of New Zealand's Frontier firms*.⁵

⁴ See the terms of reference for this inquiry at https://www.productivity.govt.nz/assets/Documents/8170d4518e/Terms-of-reference_Technology-disruption-and-the-future-of-work.pdf.

⁵ See the terms of reference at www.productivity.govt.nz/assets/Documents/3df076d434/Terms-of-reference_Maximising-the-economic-contribution-of-New-Zealands-frontier-firms.pdf.

2 Firms' decision making, technology adoption and productivity

Key points

- Decisions about technology adoption and hiring are made at the firm level.
- Firms attempt to balance their costs and risks with rewards and opportunities. This requires decisions about:
 - the inputs to use;
 - the outputs to produce;
 - which customers to pursue;
 - how to organise internally; and
 - which production processes to adopt.

In dynamic markets, prices and circumstances change so firms are making these business decisions repeatedly.

- A firm's management capability is an important factor in the successful adoption of technology. Firms face a complex set of decisions, which create significant management challenges.
- Competition, and connections with high-performing firms, both contribute to raising management capability.
- A wide range of government policies can affect technology adoption by firms, by changing relative prices and by altering the risks and rewards of new technology. Such policies have both anticipated and unanticipated effects on technology adoption and productivity.

If successful, adoption of new technology can help a firm be more productive. Firms' decisions have a direct influence on work and the labour market, technology adoption and productivity. This chapter focuses on firms, their decisions and the factors that affect those decisions.

2.1 The nature and types of firm decisions

Firms face decisions on what to produce, which customers to pursue, and which inputs and technology to use. Substantial productivity gains from new technology may require re-engineering of business models and production processes; and development of new markets or expansion of existing ones (NZPC, 2014). These decisions interact with each other in ways that create significant management challenges (Box 2.1).

Successful firms make these sorts of decisions repeatedly, for instance in response to changes in market conditions and availability of new technology. Teece (2019) pointed to the importance for firms of dynamic capabilities. These help "firms differentiate themselves through learning, entrepreneurship, innovation, and astute decision making" (p. 3). Teece broke dynamic capabilities into

(1) identification and assessment of threats, opportunities and customer needs ... (2) mobilization of resources to address fresh opportunities while capturing value from doing so ... and (3) ongoing organizational renewal. (2019, p. 10)

Teece noted that dynamic capabilities reside in individual managers and in an "organization's values, culture and collective ability to quickly implement a new business model or other changes" (p. 10).

Box 2.1 Automating the nuts and bolts – or not?

Michael, a New Zealander, set up an online nuts and bolts distribution company with his business partner, based in Brisbane. A “one-stop-shop” for big construction and manufacturing jobs’ must supply a wide variety of nuts and bolts. Michael has more than 14 000 product lines (SKUs). He employs 15 full- and part-time staff, mainly processing orders, packaging them up, checking they are accurate, and sending them out.

Picking and sorting tasks are likely more readily automatable than other tasks, like driving (NZPC, 2019b). So, would Michael automate his business? As it happens there is a machine that can help process an order and find the different product lines. In fact, it can recognise many more SKUs than Michael currently supplies.

The machine would reduce picking areas, increase pick rate and allow more stock per square metre. Even so, it would take more than just raising the capital to buy the machine. The machine is tall, so Michael would have to alter the current mezzanine floor. And the stock would need to be positioned according to its popularity.

He would have to make other complementary investments as well. The major change would be to the company’s IT systems to integrate the new system with inventory, accounting, shipping and sales (website, eBay, Amazon and account customers).

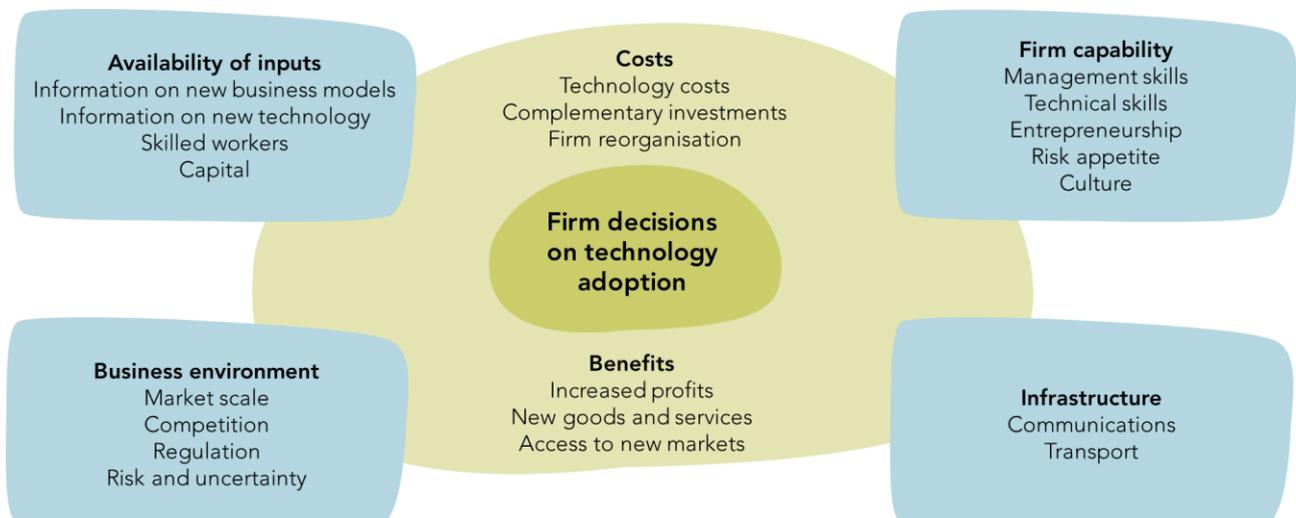
What would happen to his staff? Michael does not think he would need fewer people, but they would be doing different jobs. And the business could get bigger because the machine works faster and can manage more product lines.

Ultimately the decision to automate will depend on benefits, costs and the economic climate – construction and manufacturing goes up and down with the economic cycle – and whether Michael is prepared to take on risk in order to grow the business.

Source: Kavanagh (2019).

Relative prices, risk and rewards are central to firm decisions

Firms want to be successful. In general, the prospect of greater rewards (eg, higher profits, greater market share, furtherance of mission) motivates firms to offer new goods and services, rationalise their offerings, enter new markets and reorganise their production processes. Many factors influence firm decisions on technology adoption (Figure 2.1).

Figure 2.1 Factors influencing firm decisions to adopt technology

At a high level, relative prices and perceived risks and rewards shape firm decisions.

Relative prices are particularly important for input decisions. Shifts in the relative prices of different inputs can encourage firms to change the mix they use in producing their goods and services. Changes in relative prices lead firms to make decisions to substitute between:

- current labour and other labour (eg, unskilled workers replacing skilled ones, or vice versa);
- in-house labour and contracted labour;
- in-house services and outsourced services; and
- machines and other machines.

Changes in relative output prices also influence firm decisions. And perceived risks and uncertainty can discourage action and changes by firms (Box 2.2). The policy environment can either encourage or discourage investment by firms in new technology.

Box 2.2 **How relative prices, risk and rewards have affected dairy in New Zealand**

The recent growth and development of the dairy industry in New Zealand provides an example of how changes in relative prices (on both the input and output side), risks and rewards affect firm-level behaviour and decisions.

Increased international demand and increased output prices have seen farm production shift over the past two decades. Many farmers moved out of meat production and into dairy. The amount of pasture land dedicated to beef and sheep production fell by 19.8% over 2002–16, while land devoted to dairy production increased by over 42% (Stats NZ & Ministry for the Environment, 2018). The total value of meat and wool exports grew by 48% over 2004–19, while dairy export revenue over the same period increased by 197%.

On the input side, the expansion of irrigation and the shift to more efficient systems allowed dairy farmers to bring more land into production and has increased the productivity of existing pastoral land (NZIER & AgFirst Consultants NZ Ltd, 2014). The greater availability of irrigation is closely related to rising output prices, as a key factor driving investment in irrigation schemes is the certainty of cash flow and confidence that farmers will rapidly join (ANZ Research, 2013). High labour costs have encouraged technology adoption, with most dairy farmers using partially automated rotary milking systems to “reduce the number of people required at milking time” (Dairy NZ, sub.20, p.2).

Perceived risks and uncertainty have impeded some forms of technology adoption. For example, Dairy NZ the low take-up of fully-automated milking systems and on-farm data-gathering sensors in New Zealand partly to “the lack of a clear value proposition for farmers”, difficulties adapting foreign technology to local circumstances, a shortage of complementary assets and high debt levels carried by farmers (sub. 20, p. 3).

2.2 Management capability matters

A firm's management capability shapes the likely success of adopting new technology. Bloom, van Reenen and other researchers have undertaken a decades-long international programme of research to identify good management practices and their effects on productivity and other measures of firm performance. Their latest published research surveyed 35 000 US manufacturing plants in 2010 and 2015 (Bloom et al., 2019). Structured management practices accounted for 20% of the variation in productivity among plants.⁶

⁶ The study measured structured management practices using long-established survey instruments covering three main areas: monitoring, targets and incentives. “The monitoring section asked firms about their collection and use of information to monitor and improve the production process ... The targets section asked about the design, integration and realism of production targets ... the incentives section asked about non-managerial and managerial bonus, promotion, and reassignment/dismissal practices” (Bloom et al., 2019, p. 1653).

Together with technology and human capital, management practices accounted for 44% of the difference in productivity performance across firms.

The study showed, in the US context, that labour laws that allowed firms flexibility to adopt effective management practices were an important influence. The arrival in a particular geographic location of large high-performing (typically multi-national) firms also influenced other firms to improve management practices (most likely through managers moving between plants). Higher levels of human capital and competition were also associated with better management practices. These findings suggest that a dynamic business environment is an important driver of good management practices.

Other evidence suggests that better firm management performance is associated with more competitive product markets and a lack of regulatory distortions (Bartelsman, 2013; Bloom et al., 2016). Competition causes managers to revise their perceptions of their performance, and winnows out companies with poor management practices (Coelho et al., 2013).

Effective people-management practices enable firms to make greater and more productive use of ICT (Bloom et al., 2012). For example, Andrews, Nicoletti and Timiliotis (2018) found that the quality of management was associated with higher adoption rates for Customer Relationship Management software and cloud computing services. Fabling and Grimes (2016) found, in a New Zealand sample of just over 2 000 firms, that firms adopting ultrafast broadband after 2010 became significantly more productive only when they also made complementary investments in “organisational capital” (such as organisational restructuring, adopting new management techniques and redesigned processes).

Fabling and Grimes (2014) found, in a sample of over 1 500 New Zealand firms surveyed in 2001 and 2005, that introducing a suite of high-performance human resource management practices (HRM) had a positive effect on firm productivity. Practices included management engagement with staff, the level of autonomy granted to employees and the attention given to the firm’s HRM performance. The benefits of superior HRM performance were reflected in employee pay rather than firm profitability.

Green and Agarwal (2011) found that management capacity in New Zealand manufacturing firms was low to middling compared to better performing OECD countries. Weak competition and poor international connections may have been contributing causes. The study showed that multinational firms performed better than domestic firms; as did publicly listed firms compared to family-run firms.

F2.1

A firm’s management capability is an important factor in the successful adoption of technology. Firms face a complex set of decisions, which create significant management challenges.

F2.2

Connections with high-performing firms (particularly multi-national firms) and competition contribute to raising management capability.

2.3 Government policies influence individual firms’ technology choices

The availability and quality of government services affect firms’ willingness to adopt technology. In many cases, government-provided services and infrastructure are essential complements to firm investments. For instance, government and government agencies are major players in funding, regulating and providing training and education services for the current and future workforce (NZPC, 2019c, 2020). The availability of skilled workers (including skilled managers) is important for technology adoption (section 2.1).

Government also:

- provides transport infrastructure that enable workers and supplies to reach firms efficiently and for firms' goods and services to reach domestic and international markets;
- promotes the development of digital infrastructure that reduces the cost and increases the speed, volume and quality of information transfer and financial transactions;
- provides a legal framework for the protection of intellectual property;
- promotes and regulates trading relationships with other countries, and so makes it less risky and more profitable for firms to enter foreign markets; and
- supports innovation, through funding and supplying basic research, strengthening the innovation infrastructure, supporting technology incubators, and subsidising some firm research and development.

The quality of these investments and services materially affects the risk and rewards for firms adopting technology.

Policies also have indirect effects on technology choices

Government regulation also indirectly affects the relative prices, and the perceived risks and rewards that firms face in their technology choices. Examples include:

- macroeconomic policy that affects interest rates and the cost of capital, and hence firm investment decisions;
- planning regulation that affects the supply and price of land suitable for the firm's operations (and the ability to change the use of such land), and hence the cost of business expansion and contraction; and
- investment screening that changes the costs and risk of seeking foreign equity.

Chapter 4 presents some selected opportunities for improvement to government policy settings that would increase technology adoption by firms.

3 Firm dynamics and the business environment

Key points

- Technology adoption by individual firms improves productivity directly. Even so, reallocation of labour and capital from low productivity firms to high productivity firms makes the greatest contribution to aggregate productivity growth. This happens through:
 - the growth of high-productivity firms and decline of low-productivity firms;
 - entry into the market of new firms that have higher-than-average productivity; and
 - exit from the market of low-productivity firms.
- Competition is important for both technology adoption and productivity improvement. The creation of new firms is a driver of job growth in New Zealand and a source of increases in aggregate productivity. The exit of underperforming firms also increases aggregate productivity, by freeing up resources for use by more productive firms.
- There is some evidence that low-productivity firms offering poor returns to their owners are tying up resources that could be put to better use by other firms.
- Experimentation is fundamental to innovation. Policies that are overly prescriptive about business models, technologies or market boundaries, or imposes high exit costs on firms, can discourage experimentation and hence innovation.

Adoption of new technology can help a firm be more productive. Yet this is only part of the story about how technology raises productivity across an economy. Firms operate in a dynamic, competitive environment – successful firms grow at the expense of less-productive firms, new firms enter the market and others exit. This chapter looks at how these dynamic processes contribute to economy-wide productivity, and the factors (including technology adoption and policy) that shape them.

3.1 There is a wide distribution of firm productivity within industries

It is well known that firms, even within narrowly defined industries, vary greatly in their productivity, both across and within countries (Bartelsman et al., 2013). New Zealand is not unusual in this regard. For example, Conway et al. (2015, p. 3) reported a “very wide” distribution of productivity levels among firms within the same industries.

Even so, the distribution of MFP (multi-factor productivity) across firms in New Zealand has remained stable over the last two decades. In contrast, leading high-productivity firms in many other OECD economies have pulled further ahead of lagging firms over the last 15 years (Conway, 2018).⁷

Section 3.2 looks at the role that firm dynamics play in linking technology adoption to aggregate productivity growth – successful firms grow at the expense of less successful firms, new firms with innovative ideas enter the market, and others leave if they lose market share or become unprofitable. If functioning well, these dynamics provide a powerful engine for technology to contribute to improved economic outcomes

⁷ The term “lagging” (or “laggard”) firms is used in the economics literature to refer to all firms whose performance is behind those at the domestic frontier in their industry. Different researchers have used different cut-off criteria, but generally 90 to 95% of firms are considered to be “lagging”.

3.2 Reallocation makes the largest contribution to productivity growth

Technology adoption that raises productivity within firms is a less important source of productivity growth than “reallocation” – the growth of stronger firms, entry of new firms and the exit of poorly performing ones (Box 3.1).

Box 3.1 Technology and the four sources of productivity growth in an economy

Aggregate productivity growth in the market sector is the combined result of individual firm decisions. Existing firms can adopt new technology and business models that make them more productive. High-productivity firms may decide to increase the scale of their operations. Entrepreneurs may enter a market with new technology and business models, or new products that make them more productive than incumbent firms. Unsuccessful low-productivity firms may be bought out or go out of existence.

Firm decisions contribute to national productivity growth through four “sources”:

- *within-firm* – firms getting better at what they do (ie, increasing their productivity over time);
- *between-firm* – high-productivity firms gaining market share at the expense of low-productivity firms;⁸
- *entry of new firms* – new firms with better than average productivity levels; and
- *exit of poor performing firms* – low-productivity firms ceasing business.

Technology is an important part of this story. Technology creates new uses for resources and can change their relative values in different uses. Any gap between a resource’s current use and its best use is an opportunity for productivity growth.

Technology adoption is both a source of, and a response to, firm dynamism. New technologies can “pull” firms to adopt them, because they create new market niches or lower-cost ways to serve existing markets. And a firm can be “pushed” into adopting technology should better-performing rivals threaten the firm’s profitability or ongoing viability.

Productivity improvements in one industry can also have flow-on effects in other industries. Technology-driven price reductions, for example, can support the growth both of the adopting firm and of firms in unrelated industries (NZPC, 2019b). Similarly, the reallocation of inputs, such as labour, across industries will also affect aggregate productivity if those inputs have different levels of productivity in different industries.

International evidence on reallocation

Much of the difference in aggregate productivity levels across countries, and variations in productivity growth rates, arise from differences in the ability of countries to reallocate economic resources to more productive uses (Bartelsman et al., 2013). Rates of firm entry and exit, and of reallocation from less productive to more productive firms vary across industries, across regions, across countries and across time (Andrews & Hansell, 2019; Bartelsman et al., 2013; Clementi & Palazzo, 2016; Decker et al., 2017; Gourio et al., 2016; He et al., 2017).

Acemoglu et al. (2017) found that reallocation mechanisms contribute as much as 70–80% of productivity growth in the United States. Increases in productivity within firms accounts for the remaining 20–30% of productivity growth. Lentz and Mortenson (2010) estimated that firm entry and exit were responsible for

⁸ These are also potential sources of productivity decline. For example, reallocation can have negative effects on productivity if resources move from high-productivity firms in markets with elastic demand to low-productivity firms in markets with inelastic demand (Baumol, 1967; Nordhaus, 2006).

about one third of productivity growth due to reallocation. Reallocation between existing firms was responsible for the other two-thirds.

The reason for variations in reallocation rates over time are not well understood. In an analysis of the contribution of changes in labour reallocation rates to the slow-down in Australian productivity growth between 2002 and 2016, Andrews and Hansell (2019) found that

weakening responsiveness of employment growth to firm productivity ... potentially account[s] for up to one-quarter of the slowdown in aggregate labour productivity growth for the industries covered in our analysis. (p. 16)

The researchers canvassed possible explanations for the decline in reallocation of labour. A reduction in market dynamism across OECD countries over the same period suggests common global drivers may play a role. These could, for instance, include population ageing and an increase in dual-income households – both of which dampen labour mobility. Or firm-specific human capital may have become more important because of a rise in the relative contribution of intangible capital, which increases the costs for both the employer and the employee if an employee switches to another employer. Alternatively, structural policies that affect competition and labour mobility may play a role (though Andrews and Hansell noted that Australia ranks highly in cross-country comparisons for efficiency in labour allocation in manufacturing).

F3.1

Aggregate productivity growth in the market sector is the combined result of individual firm decisions. Firms contribute through four “sources”:

- productivity growth within firms;
- more productive firms gaining market share at the expense of low-productivity firms;
- new firms with better than average productivity entering the market; and
- low-productivity firms ceasing business.

Within-firm improvements are a less important source of overall productivity growth than reallocation – the growth of stronger firms, entry of new firms and the exit of poorly performing ones.

Poor regulation hampers reallocation and diffusion of technology

Andrews and Criscuolo (2013) argued that barriers to the reallocation of labour and capital can deter digital technology adoption. Firms are more willing to experiment with risky technologies if they expect to be able to rapidly scale-up operations in event of success, and to rapidly scale-down operations (eg, due to employment protection or bankruptcy regulation) or exit the market at low cost in the event of failure.

Andrews and Cingano (2014) similarly found that poorly designed employment protection legislation and product market regulation (eg, competition policy) and restrictions on foreign direct investment, hampered the reallocation of resources from less productive to more productive firms in OECD economies. These effects were stronger in more innovative industries (those with higher patenting intensities).

New Zealand labour market regulation in general rates as flexible in a composite index, though middling for “procedural inconvenience” compared to other OECD countries (NZPC, 2019a; OECD, 2013).

New Zealand evidence on reallocation

Stephenson (2019) updated earlier work on firm dynamics and job creation in New Zealand. He found that job creation for a cohort of firms “born” in 2001 was concentrated in the early stages of firms’ lives (whatever their size), and creation of new firms is an important driver of overall job growth.

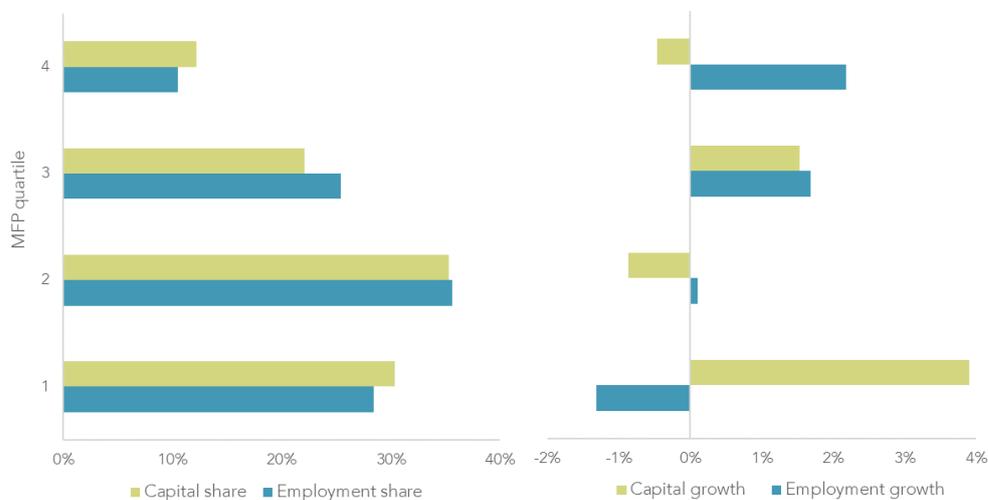
F3.2

The creation of new firms is an important driver of job growth in New Zealand.

Meehan (2019), in a study of reallocation in New Zealand over 2001–12, found that the majority of New Zealand workers are employed in firms with labour productivity below the median. Labour reallocation towards higher-productivity firms was positive but slow.

Figure 3.1 shows further work by Meehan.

Figure 3.1 Reallocation by multifactor productivity quartile, New Zealand, 2001–12



Source: Meehan; in Conway (2018).

Notes:

1. The most productive firms (those with the highest MFP) are in quartile 4. The least productive firms are in quartile 1.
2. The left-hand panel shows the share of employment and capital in the firms in each quartile.
3. The right-hand panel shows the changes in employment and capital stock for each quartile over the years 2001–12.

Commenting on these results, Conway (2018, p. 44) noted that

... firms in the lower two quartiles of the productivity distribution in their industry account for a larger share of employment and capital compared to firms in the upper two quartiles ... This contrasts with the pattern in a number of other OECD economies in which firm productivity and size distributions are positively correlated. As well as weak competition that allows low-productivity firms to survive, this result may also reflect size constraints for relatively productive firms operating in New Zealand’s small domestic markets. More encouragingly, employment growth over the 2000s was weighted towards relatively productive firms, although capital tends to flow to relatively unproductive firms ...

Over 15 years there is a slow trend of labour moving from lower- to higher-productivity firms. The capital trend is less clear. But capital does not appear to be moving towards the most productive firms.

As capital is needed to adopt new technology, this data is indicative of slow rates of technology adoption by New Zealand’s most productive firms. This suggests that the productivity gap between New Zealand’s best-performing firms (those at the “domestic frontier”) and the world’s best-performing firms (those at the “global frontier”) is not closing, consistent with the observations of Conway (2016).

Nolan et al. (2019, p. 5), in answering “Why New Zealand’s productivity is stuck in first gear?”, noted that firm-level data such as this highlights “impaired processes of reallocation and [technology] diffusion” in New Zealand.

F3.3

Capital does not appear to be moving towards New Zealand’s most productive firms. As capital is needed to adopt new technology, this could indicate slow rates of technology adoption by those firms, and an impaired process of reallocation.

Poorly performing New Zealand firms may persist longer than ideal

To survive, a firm needs to offer something its customers value to pay a price high enough to cover the costs of its inputs, and make a profit. “Profit” refers to any excess of firm income over expenses.⁹ Expenses, in this sense, covers payments to everyone other than the firm’s owners. In the short-to-medium term, firms need to make a profit, close down or seek additional equity capital. In the longer term, well-performing firms make profits sufficient to cover the opportunity cost of the equity capital their owners have invested.

However, firms making positive profits but offering poor returns to their owners can linger for a long time, perhaps indefinitely.¹⁰ This can arise when their owners lack sufficient influence or tools to improve the firm’s operating performance but cannot exit (ie, find a buyer for their stake).

This points to the importance of well-functioning capital markets, which allocate ownership of firms to those best placed to improve each firm’s performance. Dynamism in capital markets is thus a crucial aspect of firm dynamism, and an important contributor to national productivity growth via reallocation.

Adalet McGowan et al. (2017b, p. 3) reported that the prevalence of, and resources sunk into, poorly performing firms has risen in OECD countries since the mid-2000s.¹¹ Besides

limiting the expansion possibilities of healthy incumbent firms, market congestion generated by zombie firms can also create barriers to entry and constrain the post-entry growth of young firms.

A related paper by Adalet McGowan et al. (2017a, p. 3) further suggested that

reforms to insolvency regimes which reduce barriers to corporate restructuring and the personal cost associated with entrepreneurial failure may reduce the share of capital sunk in zombie firms. These gains are partly realised via the restructuring of weak firms, which in turn spurs the reallocation of capital to more productive firms.

New Zealand’s insolvency regime (as at 2016) scored around the middle of 34 countries in an OECD comparison (M Adalet McGowan & Andrews, 2018).¹² This suggests there is room for improvement in the regime.

Andrews and Hansell (2019, p. 4) noted that the “rise in zombie firms can account for one-quarter of the decline in business investment in Italy between 2008 and 2013, underscoring the material aggregate consequences of weakening market selection.”

The research by Meehan (2019) is consistent with low-productivity firms offering poor returns to their owners tying up resources that could be put to better use by other firms. The resources in Meehan’s research are capital and labour. However, other resources may also be similarly affected, including urban land (Chapter 4) and managerial talent (Chapter 2).

⁹ This section is worded in terms of investor-owned for-profit firms, but much of the discussion is also applicable to cooperatives, mission-driven not-for-profits, and some public entities. Such organisations face strong incentives to survive, and that requires revenue that covers their costs over the longer term. Moreover, for organisations that lack investors, retained profits are their primary source of capital for expansion.

¹⁰ Some such firms may offer benefits to employees, customers or owners beyond those captured by market transactions. Such benefits are not recognised in the framework presented here. It is less clear, however, the degree to which such benefits would be available (from other sources) should the firm close, and whether any shortfall would outweigh the costs of keeping the firm going.

¹¹ Adalet McGowan et al. (2017b) use the term “zombie” to describe such firms. Firms having persistent difficulty in making interest payments were classified as zombies in their research.

¹² Specifically, on the insol-13 composite indicator retrieved from <http://www.oecd.org/eco/growth/OECD-Insolvency-indicators.xlsx>.

F3.4

There is some evidence that low-productivity firms offering poor returns to their owners are tying up resources that could be put to better use by other firms in New Zealand.

Size and distance constrain the opportunities for New Zealand firms

Reallocation of resources among firms has a global dimension. New Zealand has small domestic markets and is geographically distant from other, larger markets. This creates barriers to productivity growth because:

- small markets make it harder for some firms to reach the scale necessary to achieve efficiencies, justify specialisation or recoup the costs of investments in technology and capital;
- small markets often can only sustain a limited number of firms, leading to less competitive pressure (section 3.3);
- small markets limit the pool from which firms can learn from each other (Zheng, 2016); and
- physical distance from large markets can constrain the flow of ideas and of knowledge about how new technologies can be used to raise productivity.

Small size and distance make it difficult for New Zealand firms to participate in global value chains (GVCs). A “value chain” refers to “the range of activities that firms undertake to bring a product or a service from its conception to its end use by final consumers” (De Backer & Miroudot, 2014, p. 1). Over a period of decades, world trade and production have been increasingly organised in GVCs. A combination of new technologies, falling transport and communication costs and trade policy reforms has enabled firms to disaggregate production processes to better use the comparative advantage of particular locations. GVCs allow greater specialisation and so improvements in productivity. They also facilitate better dissemination of information and technology across country borders. Weta Group is a high-profile New Zealand example of a firm participating in a GVC (Box 3.2)

Box 3.2 Weta Group participates in a global value chain

The Weta Group of companies provide services to support film and television production in New Zealand and internationally, including digital visual effects, physical effects manufacturing and post-production. Access to high-speed broadband and specialised local and international creative talent allow the group to service productions based offshore, led by major international studios. Services include computer-generated imagery, scoring and sound effects.

In the post-production industry, technology is fast-moving – new products and services quickly become obsolete. Weta Digital has won eight SciTech Awards since 2010, demonstrating its ability to remain world class with its New Zealand-based services, and Weta has supported the creation of new software which has since been spun off into a separate business (Massive Software). Scale matters in post-production and Weta Digital’s revenues grew much faster than the New Zealand economy over the period 2007 to 2015. Median earnings of post-production workers are amongst the highest of any industry in New Zealand.

Source: Bealing and Kriebler (2017).

Even so, countries in close proximity to other producers (such as in Europe or East Asia) are the most likely to participate in GVCs. By contrast, New Zealand’s overall participation in GVCs is weak (De Backer & Miroudot, 2014). Even in tradable service industries with low transport costs, the need for timely and frequent communication (often face-to-face) tends to favour proximity in production. Where freight costs (or communication costs) are high relative to value, New Zealand’s location likely favours participation at the beginning of a GVC (eg, food products) or at the end (eg, launching rockets into specialised orbits).

The consequences for New Zealand of size and distance may be getting worse rather than better over time: “there are major advantages associated with industrial clustering and agglomeration for high knowledge-

intensive and high value-added activities, and ... the geographical concentration of these types of activities is becoming ever more important" (McCann, 2009, p. 293). The general world context is one of increasing specialisation and cross-border trade of intermediate inputs.

The Commission's next inquiry will investigate New Zealand's frontier firms, including how innovations, knowledge and technology can diffuse more effectively from frontier to other firms in New Zealand.

3.3 Competition is an important driver of productivity growth

Section 3.2 identified competition policy as an important influence on the reallocation of resources to more productive firms (particularly in innovative industries). This section further explores how competition in product markets drives better aggregate productivity performance. Competition can be for greater market share – as firms with better or lower-price products expand. Competition can also be "for the market" – where, for instance, firms use new technology to produce services that have strong economies of scale or network effects. Well-known examples include internet search engines, social media and cloud computing services.

Firms also compete for financial capital to invest, talented staff and other productive inputs such as prime urban land. These input markets are an important discipline on firms (Jensen, 1993). One reason is that a firm faces different and often more varied competitors in its input markets than it does in its product markets. Regulation that constrains or distorts access to these inputs can hamper efficient reallocation of resources to more productive firms (section 3.2).

Competition in product markets is a driver of better firm performance

The decisions firms make, and the resulting effects on national productivity, depend on the strength of the pressures facing firms. Such pressures arise from competition. Where there are low levels of competition, the diffusion of knowledge and technology from the "frontier" to the rest of the economy is slow, as is the reallocation of resources from lagging firms to leaders (Conway, 2016). Firms with low productivity (and outdated technology) may be able to survive – and even prosper – if there is a low competitive intensity in the market for their products. A well-performing competitor provides both direct pressure (through competition for customers) and unintended help (through information about how to improve performance).

In competitive and open markets, firms face pressures to organise their production methods to achieve efficiency, and to seek greater profits by offering valued goods and services and to expand into new markets. Where competition is weak or absent, firms may have little incentive to use new technology to improve their efficiency or to expand or change their goods and services in ways that customers want.¹³

F3.5

Competition is important for both technology adoption and productivity improvement. A competitive business environment provides opportunities for new firms to enter, allows high-performing firms to grow, and encourages low-performing firms to improve, contract or exit.

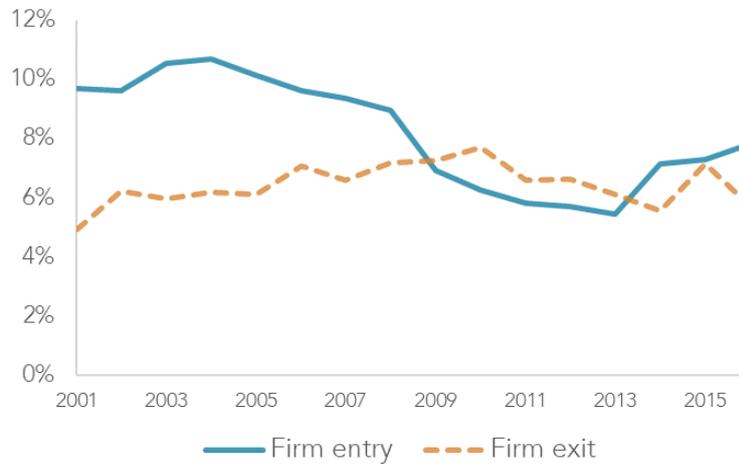
Schiff and Singh (2019) drew on recent research on industry-level measurement of competition in New Zealand by Fabling and Maré (2019). Across different available measures, competition is consistently strong in some industries: horticulture and fruit growing; food, beverage and tobacco product manufacturing; wood and paper products manufacturing; building construction; and construction services. Competition is consistently weak in some other industries: mining; supermarket, grocery stores and specialised food retailing; financial and insurance services; auxiliary finance and insurance services; and rental and hiring services (except real estate).

¹³ Theory and empirical evidence shows that, in some circumstances, too intense competition in an industry can discourage firms from innovation, as any net gains in profit from innovation may be competed away (Aghion et al., 2005). In general, firms in New Zealand do not face such intense competition (Conway, 2018; NZPC, 2014).

Barriers to entry and exit lower competitive pressure

The rate at which new firms enter into, and existing firms exit from, markets reflects the intensity of competition. New Zealand data shows a downwards trend for firm entry rates, and a flat trend for firm exit (Figure 3.2).

Figure 3.2 Firm entry and exit rates, New Zealand, 2001–15



Source: Productivity Commission, using data from Stephenson (2019).

Low rates of entry can signify barriers to entry. Barriers can arise from a variety of sources. Some, such as licensing or approval requirements, may be imposed by governments. Firms may also create barriers to the entry of competitors by, for example, differentiating their products from those of potential rivals.

Low rates of exit can be a sign that competition is not sufficiently intense to force the least productive firms from the industry (section 3.2).

Policies that create high exit costs, such as regulations that overly protect existing employment, allow low-productivity firms to stay in business. Such policies can have a particularly strong impact on digital technology industries. The OECD reported that digital technologies are taken up faster in sectors where entry and exit rates are high.

... OECD research shows that the diffusion of selected digital technologies is typically more advanced in sectors where firm turnover (i.e. entry and exit) is higher ... consistent with the idea that new entrants:

- i) possess a comparative advantage in commercializing new technologies ...;
- ii) place indirect pressure on incumbent firms to adopt new technologies; and
- iii) can more fully reach their potential when they have sufficient space to grow, which is accommodated by the exit of inefficient firms. (2018, p. 58)

4 Implications for government policy and action

Key points

- Keeping the business environment open to flows of goods, services, capital, data and ideas helps to offset the constraints on technology adoption created by New Zealand's small market and location.
- Adoption of technology can be a complicated and high-risk undertaking for firms. Flexibility, especially the ability to easily reorganise production and back out of earlier decisions, is essential for reducing these costs and risks.
- Government policies that seek to protect jobs or firms facing closure slow down the movement of resources to higher-performing firms. A better strategy to encourage technology adoption and productivity growth is to protect workers through improved income protection and access to training.
- Many policies affect firm decisions, even those that are not obviously related to business. Unintended or unexpected consequences from policy decisions can unhelpfully constrain firms' choices. Keeping an eye on wider policy effects is therefore important for maintaining a dynamic business environment.
- Policy stability matters for firm investment decisions.
- There is a place for interventions targeted at specific types or groups of firms, but good design and evaluation is important. Targeted interventions should be designed with an appreciation of the likely economy-wide productivity effects. Interventions should not discourage the entry of new firms, the exit of poorly performing ones, or the reallocation of resources to better performing firms.
- Specific areas where policy action by government would encourage technology adoption by firms include:
 - increasing emissions prices;
 - strengthening the national innovation system;
 - reviewing limits on the use of genetic modification technologies;
 - refreshing competition policy for the digital age;
 - accelerating consumer data rights and open-banking regulatory reforms; and
 - adopting less restrictive land-use regulations.

Questions guiding this inquiry include how the Government can “better position New Zealand and New Zealanders to take advantage of innovation and technological change” and “best encourage technology innovation and uptake”. Earlier draft reports focused on steps the Government can take to better position current and future workers for greater innovation and technological change. This chapter lays out some principles to guide policies for promoting firm innovation and technological adoption and highlights specific areas where government action would be helpful.

4.1 Protect and extend business-environment dynamism

Maintain openness and flexibility

Firms in a small economy located far from most major markets face challenges to successfully develop or adopt new technologies (section 3.2). One way of countering these constraints on technology adoption and productivity growth is to ensure that New Zealand's business environment is open and maintains flexibility for firms in adapting to changing circumstances.

Openness implies keeping barriers low to the free flow of goods, services, capital, skills, data, ideas and technologies. This better allows local firms to learn about new technologies, provides competitive pressures on local firms to innovate, and helps forge connections to international markets.¹⁴

Adoption of technology can be a complicated and high-risk undertaking for firms. Flexibility, especially the ability to easily reorganise production, is essential for reducing these costs and risks. Policies that make it hard for a firm to reverse a decision (eg, laying off staff who were hired in expectation of growth that did not ultimately occur) are likely to discourage adoption in the first place.

New Zealand's current policy settings generally support openness and flexibility. However, maintaining such openness and flexibility requires ongoing vigilance and effort.

Protect workers, not jobs or firms

Greater technological progress and adoption will most likely mean more frequent firm exit, as more productive businesses using newer and better technologies outcompete weaker firms. While this is painful for the owners and workers of the failing firm, the overall process of reallocation is beneficial for New Zealand as a whole. Government policies that seek to protect jobs or firms facing closure, or that make it harder for firms to lay off staff, slow down reallocation and the movements of resources to higher-performing firms. Barriers to restructuring may also push potentially viable firms to fail, by increasing the cost and difficulty of them restoring profitability by reorganising their production methods and inputs.

There are opportunities for the Government to better support smoother and better transitions between jobs, by workers, including:

- improved income protection mechanisms (eg, unemployment insurance, portable individual redundancy accounts or changes to tax and tax credits) for workers who lose their jobs;
- improving access by people in work to training opportunities, including by lifting limits on people borrowing through the Student Loan Scheme for short courses and making it easier for tertiary providers to offer "micro-credentials" or recognition of prior learning; and
- making industry and work-based training available to all people in the workforce, not just employees (NZPC, 2019b, 2019a, 2019c).

Be conscious of spillovers from other policy areas

Many policies affect firm decisions, even those that are not obviously related to business. Building and sustaining a business environment that promotes technology adoption and productivity therefore requires policy makers to be conscious of the effects on firm decisions from other policies.

One example is restrictive land use regulation, which can reduce firms' access to labour and limit the ability of workers to take up new employment opportunities in another city. Worker mobility in New Zealand has been constrained by house price differences between cities, according to research conducted in support of this inquiry (Coleman & Zheng, forthcoming). High house prices in Auckland have discouraged the movement of some workers to Auckland in particular (see section 4.2). US research has similarly found that

¹⁴ For example, the flow of skills (ie, migrants) can affect both a firm's choice of markets and its internal processes. Sin et al. (2014) found that New Zealand firms that employed a higher fraction of high-ability foreigners are more likely to export. McLeod et al. (2014, p. ii) found that firms with a higher share of high skilled recent migrants" were more likely to report introducing new marketing methods, new goods and services, or goods and services new to New Zealand."

high house prices in major cities have suppressed labour mobility, constraining national economic growth and slowing down income convergence between urban and regional areas (Hsieh & Moretti, 2015).

Transport policy is a further example. The ability of goods and people to move easily and swiftly from one place to another matters for productivity growth. In the case of goods, delivery delays can discourage trade and limit the ability of firms to grow and achieve scale. For people, congestion, limited public transport and high transport costs limit the numbers of jobs they can access and therefore lead to poorer matching of their skills to employment opportunities.

Beware of unintended consequences

Unintended or unexpected consequences from policy can constrain firm choices and limit the scope for productivity growth.

One example is tight restrictions on foreign direct investment (FDI) in “sensitive land”, implemented in New Zealand via the Overseas Investment Act 2005. These controls are intended to reflect “the concept of ‘ownership value’. That is, that some New Zealanders derive a welfare benefit from knowing that certain types of land are owned and controlled by New Zealanders” (The Treasury, 2019, p. 91). However, the implementation of these controls has had the unexpected impact of making it harder for New Zealand-registered companies to develop land for residential housing (NZPC, 2015).

More broadly, restrictions on FDI can limit the ability of growing firms to access important capital, expertise and networks. FDI is an important mechanism to forge links between local firms and global value chains. The Australian firm Where 2 Technologies is one example (Box 4.1).

Box 4.1 **Where 2 Technologies and Google Maps**

Where 2 Technologies was a Sydney-based start-up founded by two Australians (Noel Gordon, Stephen Ma) and two Danish migrants (Lars and Jens Rasmussen). It specialised in mapping technologies. Following an unsuccessful attempt to seek funding from US venture capital firms, Where 2's founders made contact with Google co-founder Larry Page, who was sufficiently impressed that Google eventually acquired the Australian firm in 2004.

The Where 2 founders became employees of Google and set up office in Sydney, in “what became the seed of Google’s now 100-person+ engineering centre in Pyrmont” (Rasmussen, 2009, p. 4). Now connected to Google’s wider engineering and development team, the growing Australian team developed the Where 2 concepts to become Google Maps, which was publicly launched in 2005.

Google continues to have a significant R&D presence in Sydney, built on the foundations laid by Where 2.

New Zealand firms are already disadvantaged by their geographic distance from large and sophisticated suppliers and customers. New Zealand’s stringent FDI screening regime may limit rewards for firms and opportunities for productivity growth. A Treasury (2019) consultation document on possible reforms of the Overseas Investment Act 2005 reported that

- applying for consent to invest in New Zealand typically involved high costs and long waiting times;
- “New Zealand attracts proportionately less, and has correspondingly lower stock of, foreign direct investment than many other small, advanced economies” (p. 8); and
- “New Zealand has also struggled to attract the most valuable forms of investment, such as greenfield investment.” (p. 9).

Value policy stability

Sudden or dramatic changes in policy, or a concern that policy may change dramatically in future, creates uncertainty and risk for firms. Such uncertainty and risk discourage firms from making investments in technology and other productivity-boosting inputs, because of concerns that they may not be able to recoup their costs. For example, uncertainty about future climate change policy settings has discouraged investments in carbon-reducing technologies (NZPC, 2018).

This does not mean that policy change should be avoided. There are many areas in which changes to policy settings better support technology adoption and productivity growth. Section 4.2 provides a short, not comprehensive, list of such areas.

However, policy change is most likely to be beneficial and enduring when

- it is signalled well in advance;
- the case for change is clearly and compellingly made; and
- policy design and implementation are well-designed and not rushed (OECD, 2010).

Targeted interventions come with risks and challenges

This report focuses on broad-based policy settings, on the grounds that they have the largest and most important effects on firm decisions. This does not, however, mean there is no role for more targeted interventions. Particular types or groups of firms may face barriers that require focused government action to overcome, and targeted government intervention can also create benefits for others (eg, workers). The Government is currently developing “industry transformation plans” aimed at “growing innovative industries in New Zealand.” (MBIE, 2019a, p. 6)

Examples of successful targeted interventions from New Zealand’s history include:

- industry training, to overcome a coordination failure between firms within the same industry and encourage greater uptake of workplace-based training; and
- encouraging technology development, diffusion and adoption in New Zealand’s agricultural industries (eg, the establishment of experimental farms, a “farm extension service” to spread good practice, and research institutions such as Lincoln Agricultural College, Massey University and the Department of Scientific and Industrial Research).¹⁵

However, targeted interventions can come with risks and challenges. They are prone to capture by incumbent firms, since governments lack the information needed to understand the pressures and choices facing individual firms. They may also encourage dependence and lobbying for further assistance by firms (Mazzucato, 2017).

These problems are not insuperable and can be managed through good policy design (eg, creating incentives for assisted firms to reveal information about their performance, setting objective goals) and evaluation. Targeted interventions should be designed with an appreciation of the likely economy-wide productivity effects. Interventions should not discourage the entry of new firms, the exit of poorly performing ones, or the reallocation of resources to better performing firms.

- Interventions should concentrate on resolving identified problems or achieving desired outcomes, rather than promoting specific technologies, inputs or processes. This creates more opportunities for innovation and efficient responses by firms and reflects the inherent information limitations facing governments.
- Where possible, participation in targeted interventions should be open to new entrants, to increase the potential for experimentation and diffusion and prevent creating closed shops of favoured firms.

¹⁵ Lincoln College became Lincoln University in 1990, and the DSIR was broken up into the Crown Research Institutes in 1992.

- Interventions should be set up with regular review periods, to create options to close failing programmes. As with any set of experiments, some targeted interventions will fail. The highest benefit lies in exiting the failing programmes fast, and reallocating resources to the more successful programmes.
- Governments should not prioritise lifting the performance of weak firms. Such efforts may simply delay the exit of such firms and the reallocation of their resources.¹⁶

F4.1

Interventions targeted at specific groups or types of firms should:

- concentrate on resolving identified problems or achieving desired outcomes, rather than promoting specific technologies, inputs or processes;
- be open to new entrants;
- be set up with regular review periods to create options to close failing programmes; and
- not prioritise lifting the performance of weak firms.

4.2 Some areas where government action would help

There are many areas in which changes to policy settings would better support technology adoption and productivity growth. This section provides a short but not comprehensive list of actions. These actions are mentioned here because

- they could make potentially significant contributions to New Zealand's comparative advantage in some industries;
- of their expected impacts on the dynamism of the business environment (and, through that, rewards and pressures for technology adoption); and
- government holds the levers needed to make change.

Increase emissions prices

More rapid technology development and adoption is needed to respond to climate change. Earlier and faster adoption of lower-carbon technologies is one important means of both reducing the overall economic cost of adaptation and achieving a "net zero" target (NZPC, 2018). One barrier to technology adoption and investment has been inadequate emissions prices, which have been too low to sufficiently change firm behaviour. Higher prices, and expectations of higher prices in future, are needed to drive adoption and investment.

Parliament has recently put in place institutions and policies to promote government action and responses to climate change, and to provide greater policy stability (eg, the Climate Change Response (Zero Carbon) Amendment Act 2019, the independent Climate Change Commission).¹⁷ The challenge now is to put these institutional arrangements to work, and put the first emissions budgets and emissions reduction plans in place.

¹⁶ A recent example of this type of programme is an MBIE-led project to encourage the greater take-up of digital tools by small firms in specific sectors (APC & NZPC, 2019).

¹⁷ Parliament is also considering changes to the Emissions Trading Scheme, through the Climate Change Response (Emissions Trading Reform) Amendment Bill 2019.

Strengthen the national innovation system

National innovation systems – that is, the institutions and policies that collectively encourage knowledge creation and use in a country – play an important part in supporting technology adoption.¹⁸ Although decisions on technology adoption are taken at the level of individual firms, these decisions do not take place in a vacuum. Successful business innovation typically requires support and contributions from other parties outside the firm. National innovation systems help with issues such as identifying innovation and technological opportunities, fostering business-research links, testing and demonstrating new ideas and technology, adapting foreign technologies to local conditions, investing in the skills and capability to deploy technology, funding and finance, and market research and marketing (NZPC, 2018). Some of New Zealand’s more innovative firms have benefited from supportive institutions, policies, public co-investments in complementary assets, and other forms of government assistance (Box 4.2).

Box 4.2 Innovation and technology adoption in the kiwifruit industry

Kiwifruit is one of New Zealand’s largest horticultural industries, making up around 38% of horticulture export revenue in 2019 (Ministry for Primary Industries, 2019). Kiwifruit arrived in New Zealand in 1904, when Whanganui Girls College headmistress Isabel Fraser brought seeds back from China (Campbell & Haggerty, 2008). The first commercial kiwifruit variety was bred by Hayward Wright in New Zealand. The first exports of kiwifruit occurred in the 1950s, and the industry grew rapidly in the late 1970s. Following a crisis in the late 1980s reflecting increased world supply and unstable interest and exchange rates, the industry was reorganised under the single export desk Kiwifruit Marketing Board (now called Zespri). Zespri is owned by 2 700 New Zealand growers.

Today, Zespri is the world’s largest marketer of kiwifruit, selling the fruit into more than 50 countries and managing 30% of global volume (Zespri Group Limited, n.d.). In 2018/19, the company invested about 1.6% of New Zealand revenue in innovation and spent about \$170 million on marketing and promotion (around 5.8% of global revenue). Zespri also operates a large and sophisticated domestic and international logistics chain (NZPC, 2012b). The industry’s sustained investments in innovation have helped it improve profitability and weather disruption, eg, by creating new cultivars that are more resilient to pests and disease, provide taste, choice and more consistent quality for consumers, and can be licensed for profit to foreign growers. Other areas of research interest for Zespri include robotics and precision horticulture to combat rising labour costs and reduce waste (Reidy, 2017).

The kiwifruit industry’s success today is the result of decades of effort by growers, industry leaders and government. On the government side, contributions to the industry’s growth and development include:

- dedicated public horticultural research institutions (eg, originally the DSIR; now the Crown Research Institute Plant & Food Research);
- public subsidies for research;
- regulatory settings that encourage coordination and investment in industry “public good” activities (eg, marketing, commodity levies);
- intellectual property rights that protect the industry’s investments in cultivars and other innovations; and
- government involvement in biosecurity management, standards settings and negotiating international trade rules.

New Zealand’s national innovation system has two identified weaknesses (NZPC, 2018). First, more effort is needed to raise the “absorptive capacity” of local firms – that is, the ability “of firms to learn – usually by using knowledge from their external environment – to improve their productivity” (ibid, p. 169). Second, the

¹⁸ These policies and institutions include intellectual property rights, subsidies for and infrastructure to conduct open science, public subsidies for private research and development, regulatory incentives and direct government purchase of research (NZPC, 2018, pp. 151–153).

system is “highly fragmented and weighted too heavily to investigator-led research”, leading to weaker research-business links (ibid, pp. 169–170). The Government is looking to rebalance New Zealand’s national innovation system, with more emphasis placed on mission-oriented projects and investments, as reflected in its draft Research, Science and Innovation Strategy (MBIE, 2019b).

Review limits on the use of genetic modification technology

Regulation in New Zealand tends not to restrict specific technologies, preferring instead to focus on achieving desired outcomes (eg, greater safety, reduced pollution etc). For example, the Building Act 2004 allows the use of a variety of construction materials and processes, provided they meet the functional requirements for buildings and performance criteria of the Building Code (NZPC, 2012a).

One exception to this general approach is the regulation of genetic modification (GM) technologies under the Hazardous Substances and New Organisms Act 1996 (HSNO).¹⁹ Before any genetically modified organism can be imported, developed, field-tested or released into the environment, approval must first be sought from the Environmental Protection Authority.

New Zealand’s GM regulatory regime has been the subject of considerable debate in recent years, with concerns raised about its costs, fitness-for-purpose and impacts on the country’s ability to innovate and adapt to challenges. Officials and academics have argued that the New Zealand regime may be creating excessive barriers to the use of GM technologies. Kershen (2015, p. 220) described the system as imposing “very costly, time-consuming, paper-intensive, and strict barriers to the field testing and the commercial introduction of plants developed by [gene editing] techniques.” The Ministry for the Environment reported in advice to its Minister that the stringent approach applied through HSNO may be creating

an unnecessarily high threshold, particularly when new technologies are being used to create organisms that are not transgenic, are indistinguishable from organisms produced from a [non-GM] technique ... and in some cases could occur through slower natural processes. This may result in organisms being regulated at a level not proportionate to the risk they pose and New Zealand missing out on the benefits they could provide (such as medical treatments, crops, trees or forage with beneficial properties). Anecdotal evidence suggests the high level of regulation is discouraging potential applicants from submitting an application to the Environmental Protection Authority ... for field trials in containment or a release of a GMO [genetically modified organism] as the perception is they are unlikely to be successful or it will take too much time, effort and financial backing. (Ministry for the Environment, 2018, pp. 2–3)

A review of emerging gene editing technologies (eg, CRISPR) by the Royal Society of New Zealand concluded that the various regulatory regimes governing GM were too complex and inconsistent, did not adequately reflect differences in risk, focused too much on process rather than outcomes, and were out of step with international trends (Royal Society of New Zealand, 2019). The Parliamentary Commissioner for the Environment (2017) and Prime Minister’s Chief Science Advisor (2017) have highlighted the potential benefits for climate change adaptation, agricultural innovation, health services and pest control from the use of genetic technologies and called for a more open and enabling public and regulatory environment. Some research into potentially promising applications of GM technologies to reduce agricultural carbon emissions has had to move offshore as a result of New Zealand’s stringent regulatory regime (Box 4.3).

There is an opportunity to review the current limits on the use of genetic modification technologies, to ensure they keep pace with technological change and evolving knowledge.

¹⁹ Depending on the issue under consideration, other regulatory regimes may apply, such as the Agricultural Compounds and Veterinary Medicines Act 1997, the Animal Products Act 1999, and Biosecurity Act 1993.

Box 4.3 **GM ryegrass and climate change**

New Zealand is unusual amongst developed countries in having almost half of its carbon emissions sourced from agriculture, especially sheep and cattle. Almost three-quarters of emissions from New Zealand pastoral farms are methane produced by livestock as they digest food. There are few options currently available for New Zealand farms to make large reductions in these biological emissions while maintaining production (NZPC, 2018).

Using government and industry funding, AgResearch scientists have developed a genetically modified High Metabolisable Energy (HME) ryegrass that could lead to significant reductions in livestock methane emissions, be more resistant to drought, store more energy and grow faster than conventional grasses. Early results from tests have also suggested that feeding animals with HME ryegrass could lead to less excretion of nitrogen into the environment, less nitrate leaching and lower nitrous oxide emissions (another greenhouse gas). (AgResearch, 2018)

While the initial development and early testing of the ryegrass occurred in New Zealand (at AgResearch's Palmerston North facilities), the field testing phase had to be moved to the United States, where such organisms can be more easily studied outside the laboratory (Taunton, 2018). AgResearch is exploring the feasibility of New Zealand field trials in 2021, although these will require regulatory approvals.

Refresh competition policy for the digital age

Competition policy aims to maintain enough pressure in markets to encourage innovation, dynamism, choice and put downward pressure on prices. The emergence and spread of digital goods and services may make the achievement of these goals more difficult.

- Digital platforms (such as Facebook and Amazon) can exhibit network and “winner-take-most” effects, meaning that one firm can end up dominating a market.
- Price-setting by algorithms could lead to anti-competitive outcomes, but may be legal under current law (as they do not involve an agreement to fix prices) (Every-Palmer QC, 2018).
- Data is an increasingly important business input and can be a source of market power, yet data access issues are often treated separately from competition policy (eg, through privacy laws). Traditional market power controls and measures may not adequately reflect the importance of data in mergers.
- Digital firms have incentives to make it difficult for users to shift platforms by limiting data portability. This can encourage market power and discourage both entry and innovation.
- The traditional application of competition policy tools (eg, market definitions) may not capture competition from digital goods and services.

The competition issues raised by digital technologies are not necessarily new (eg, two- and multi-sided markets, zero-priced goods). It is not yet clear whether current analysis techniques and regulatory tools are adequate to deal with them. It may well be that new regulatory frameworks would promote long-term benefits for New Zealand consumers, and spur innovation by facilitating the entry of new firms or permitting innovation-enhancing mergers and other cooperative ventures.

Stephenson (2019, p. 23) examined the firm dynamics of New Zealand's digital firms, noting that they:

... have higher death rates (low survival rates) than other firms but higher contributions to overall growth, measured by growth in employment or sales of surviving firms. And, in this comparatively new sector, growth is more highly concentrated in firms that are born small compared to non-digital (comparator) firms. These findings are consistent with the view that firm birth, death and growth involves a considerable degree of trial and error and searching for a match between firm capabilities, business ideas and market demand.

This points at a dilemma for those making competition and consumer policy for digital firms. Regulation that might, at first sight, blunt the market power of dominant firms tends to create costs that fall disproportionately on small and new firms (Goldfarb & Tucker, 2012). For example, the European Union's digital privacy regulations harm smaller firms and benefit larger ones (Grelf, 2018; Castro & McQuinn, 2014). Such regulation reduces economic dynamism, replacing Stephenson's "trial and error and searching for a match between firm capabilities, business ideas and market demand" with political and legal wrangling between large incumbent firms, regulators and governments.

The centrepieces of New Zealand competition policy are the Commerce Act 1986 and the Fair Trading Act 1986. Both Acts have received incremental changes over time. However, New Zealand's competition laws have not been fundamentally reviewed to assess their suitability for the digital age.

Accelerate open banking and consumer data rights

Regulation does not just restrict firm choices and decisions. It can also create new markets, opportunities and rewards. There are opportunities to expand markets and rewards for New Zealand firms and consumers through regulatory reforms.

One area in which regulatory reform would be beneficial is in data rights and access. As the reach, quality and variety of digital goods and services has expanded, data about consumers has become an increasingly important input for firms and workers. Firms can use data to offer new and better goods and services, and some workers can use it to obtain jobs (eg, ratings and reputation data matter for platform workers).

However, there are barriers to firms and workers gaining access to consumer data. Such data is often tightly held by some firms that do not want to create openings for their competitors. Consumers may also be concerned about the ability of firms to access data about them. Reforms in Australia and the United Kingdom have sought to overcome these barriers through the creation of consumer data rights.

Consumer data rights enable individuals to access data about them and authorise its use by others. In creating rights for people to access and release information, consumer data rights aim to "support a social license for better data use economy-wide" and "underpin a new wave of competition policy." (Australian Productivity Commission, 2017, p. 191) The extension of data rights in the UK financial system is already having an impact (Box 4.4).

Box 4.4 **Open banking: how regulatory change aided ethical consumption**

Open banking is a regulatory system that enables individuals to securely share their financial information with other service providers (eg, price comparison services, payment platforms, budgeting applications). It establishes an obligation on banks to release this information, when requested by their customers. Open banking aims to encourage competition and innovation in financial services. The United Kingdom introduced open banking regulations in 2018, and Australia is currently implementing a similar system as part of its wider national consumer data right.

One beneficiary of the UK open banking system has been the New Zealand-founded ethical consumption platform CoGo (short for "connecting good"). CoGo is an app-based service that allows members to identify their priorities (eg, reducing waste, supporting firms that pay their staff a living wage, buying vegan or carbon neutral products) and then connects those members with accredited firms that meet those priorities. CoGo launched in New Zealand in 2015 and expanded into the United Kingdom in 2018.

CoGo has used the UK open banking system to offer new services to its members. Those members who connect their bank to the CoGo app will be able to calculate how much of their spending is with firms that have been accredited for taking action on members' consumption priorities. The app will also be able to make recommendations for other accredited firms that are relevant, based on the member's transaction history. The aim is to allow people to make purchases that better align with the issues they care about, and reward firms for ethical practices.

Industry has led work to date on open banking in New Zealand. Progress has been slow (Faafai, 2019). The Commerce and Consumer Affairs Minister is considering the introduction of a broader, legislative consumer data right. The introduction such a right could encourage technology adoption, innovation and productivity growth.²⁰ Greater progress on consumer data rights in New Zealand and harmonisation with Australia would advance the Single Economic Market agenda (APC & NZPC, 2019).

Adopt less restrictive land-use regulation

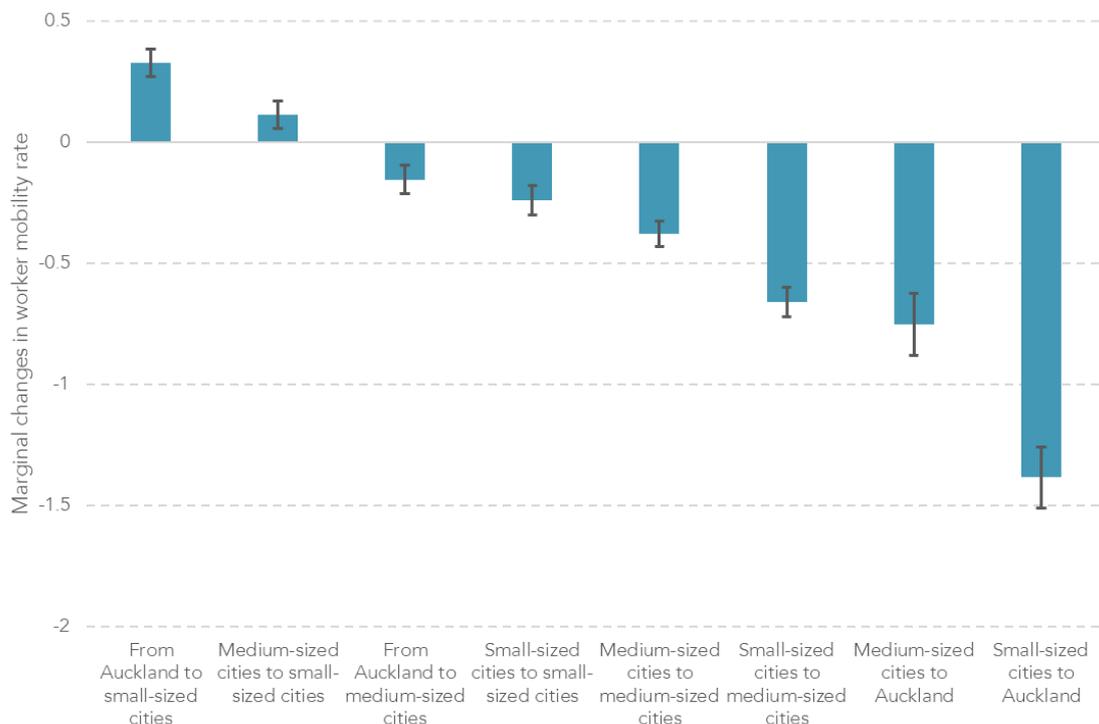
Regulation affects firms' decisions about whether or not to adopt new technology (section 2.3). The availability and price of inputs such as land, labour and capital also affect these decisions. More specifically, firms will not adopt technology if they cannot access the skilled labour, land and other resources complementary to that technology.

New Zealand has restrictive land use regulation increases the price of housing (NZPC, 2015, 2017). This can reduce firms' access to labour and limit worker moves to locations with to better employment opportunities. House price differences have constrained worker mobility between cities (Coleman & Zheng, forthcoming).

Constraints on the supply of land for housing in high-wage cities can price out workers who would be more productive (and receive higher wages) if they moved to take up work opportunities in those cities. Urban areas with relatively high house prices also have relatively high amenities, including better infrastructure, warmer climates, and well-functioning labour markets (Grimes et al., 2014). So, high prices, per se, are not solely caused by regulatory constraints. However, regulatory constraints create artificial scarcity, further inflating prices in the presence of strong demand.

Coleman and Zheng (forthcoming) controlled for quality of life and the business environment in different cities and found a flat relationship between worker mobility and house prices. However, they found a significant relationship when they looked at the effect of house price differences on inter-city migration. Figure 4.1 shows, for eight examples of inter-city migration, how the worker mobility would change if the difference in average house prices between the source and destination cities increased by 1%.

Figure 4.1 Changes in worker mobility, if house price differences between source and destination city increase by 1%

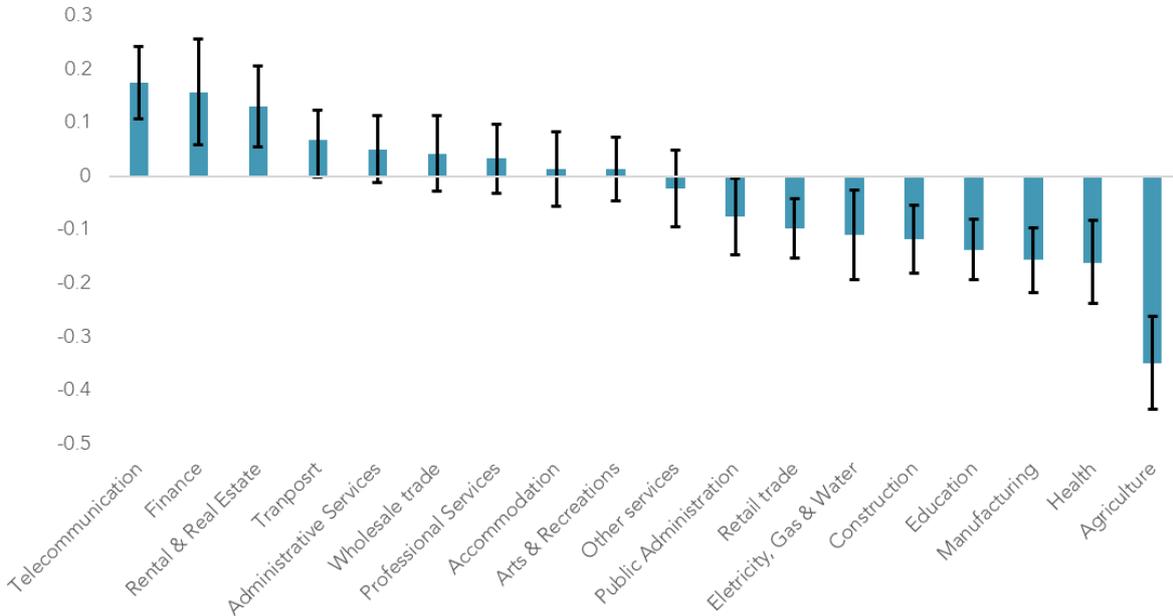


Source: Coleman and Zheng (forthcoming).

²⁰ Consumer data right and open banking reforms are based on *individual* rights to personal data. However, there is an ongoing policy debate about "indigenous data sovereignty" (Kukutai & Taylor, 2016) and the rights of indigenous peoples to govern and control data about their members.

The impact of increased house price differentials on mobility was statistically significant and negative for workers in 7 of 18 industries – agriculture, health, manufacturing, education, construction, electricity gas and water, and retail trade (Figure 4.2). By contrast, higher house prices did not discourage worker mobility in more highly paid and agglomerated industries – telecommunication, finance, and rental and real estate.

Figure 4.2 Changes in worker mobility, if house price differences between source and destination city increase by 1%, by industry



Source: Coleman and Zheng (forthcoming).

Notes:

1. Black vertical bars are 95% confident intervals.
2. "Industry" refers to the industry of the worker's employer prior to their move.

Highly detailed urban planning rules affect firms in other ways, as do slow processes for changing those rules. These limit the availability of suitable sites for firm expansion and add unnecessary delays, costs and uncertainties (NZPC, 2017). More broadly, restrictive land use regulation can constrain the potential for beneficial agglomeration to occur, thereby limiting the ability of New Zealand cities to function effectively.

The Government is undertaking a fundamental review of the resource management system (Ministry for the Environment, 2019), which is the primary regulatory influence on the price of urban land. The review offers an opportunity to change these regulations in ways that are more conducive to firms' adoption of technology and use of other inputs.

Summary of findings

Chapter 1 – Technological change and the future of work – the story so far

F1.1

The rate of worker movement between occupations has slowed over recent decades in New Zealand, Australia and the United States. This is consistent with other evidence that labour market and business dynamism has declined.

Chapter 2 – Firms' decision making, technology adoption and productivity

F2.1

A firm's management capability is an important factor in the successful adoption of technology. Firms face a complex set of decisions, which create significant management challenges.

F2.2

Connections with high-performing firms (particularly multi-national firms) and competition contribute to raising management capability.

Chapter 3 – Firm dynamics and the business environment

F3.1

Aggregate productivity growth in the market sector is the combined result of individual firm decisions. Firms contribute through four "sources":

- productivity growth within firms;
- more productive firms gaining market share at the expense of low-productivity firms;
- new firms with better than average productivity entering the market; and
- low-productivity firms ceasing business.

Within-firm improvements are a less important source of overall productivity growth than is reallocation – the growth of stronger firms, entry of new firms and the exit of poorly performing ones.

F3.2

The creation of new firms is an important driver of job growth in New Zealand.

F3.3

Capital does not appear to be moving towards New Zealand's most productive firms. As capital is needed to adopt new technology, this could indicate slow rates of technology adoption by those firms, and an impaired process of reallocation.

F3.4

There is some evidence that low-productivity firms offering poor returns to their owners are tying up resources that could be put to better use by other firms in New Zealand.

F3.5

Competition is important for both technology adoption and productivity improvement. A competitive business environment provides opportunities for new firms to enter, allows high-performing firms to grow, and encourages low-performing firms to improve, contract or exit.

Chapter 4 – Implications for government policy and action

F4.1

Interventions targeted at specific groups or types of firms should:

- concentrate on resolving identified problems or achieving desired outcomes, rather than promoting specific technologies, inputs or processes;
- be open to new entrants;
- be set up with regular review periods to create options to close failing programmes; and
- not prioritise lifting the performance of weak firms.

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