Paul Conway

PRODUCTIVITY and Changing Technology

An orbital-class rocket with a 3D-printed engine launches into space from the Māhia Peninsula. A self-driving car crosses the Auckland Harbour Bridge. A pizza company begins testing delivery using airborne drones. While these may sound like things of science fiction, they are in fact stories that have been in the New Zealand media over the last year.

These stories provide a glimpse of how technology is changing. Changes are not just happening around the edges but could be as disruptive to models of production as earlier industrial revolutions. As the World Economic Forum noted:

> The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. (Schwab, 2016)

New technologies associated with a fourth industrial revolution include advanced robotics, artificial intelligence, autonomous vehicles, nanotechnology, the internet of things, biotechnology, 3D printing and quantum computing. This short article discusses in broad terms what these new technologies could mean for New Zealand.

Given our geography (our distance from major markets) the news should be good: there are opportunities from a shift to a more 'weightless' economy based on trading knowledge-intensive products down fibre-optic cables (Skilling and Boven, 2007; Conway, 2016). However, getting to that point takes time, as innovation runs ahead of people's capacity to adjust. So rapid technological progress, while ultimately improving productivity and living standards, carries with it the risk of a period of disorienting and uncomfortable change. Policy action is required to make the most of rapid technological change and mitigate any negative side effects.

Productivity and economic development

Since the global financial crisis, New Zealand has enjoyed good growth in average income compared to most other OECD economies. Labour participation is strong and our public finances are in relatively good shape. But one area holding the economy back is our persistently weak labour productivity, which is a measure of the economy's ability to turn resources into goods and services. Between 1995 and 2014 labour productivity growth in New Zealand was the fourth lowest across OECD countries (OECD, 2016a).

This is important for a number of reasons. First, productivity is a major

Paul Conway is the Director, Economics and Research at the New Zealand Productivity Commission.

income driver: for example, the wages of New Zealand workers increase more rapidly when labour productivity growth is strong (Conway, Meehan and Parham, 2015). So with weak productivity growth, many jobs created by New Zealand's strong labour market are low value-add and do not pay very well.

Improved productivity is not just about higher incomes. By delivering more for less, higher productivity brings more opportunities and choices. For the country this means better quality services such as health care and education; excellent roads and public transport; safer communities; stronger support for people who need it; and a 'cleaner and greener' environment. For individual New Zealanders, productivity improvements mean more choices and a higher standard of living, including more time available for leisure (Conway and Meehan, 2013).

Making the most of new technology

Over the last 10-15 years the world's leading firms in a number of different industries have experienced strong productivity growth as new technologies and ideas have driven improvements in efficiency and value-add. In contrast, a long tail of firms with slow productivity growth that are unable to keep up with leading firms has also emerged (OECD, 2016b). This growing 'productivity gap' between leading and lagging firms highlights a stalling in technology diffusion and helps explain why aggregate productivity growth has slowed in a number of countries from the mid-2000s, despite good productivity gains by global frontier firms. It also offers a potential explanation for increased dispersion in household incomes in many countries, as greater productivity differences across firms translate into greater wage inequality (ibid.).

With 'stickiness' in technology diffusion, the movement of resources across firms is also a key productivity driver. Economies in which labour and capital flow more easily to productive firms enjoy higher aggregate productivity growth than economies in which resource allocation is more rigid across firms.

Resource reallocation is particularly important when technology is changing rapidly. The productivity gains from innovation are magnified when innovative firms quickly gain market share and expand at the expense of unsuccessful competitors. Making the most of new technologies associated with the fourth industrial revolution also implies changes in economic structure, highlighting the importance of smooth resource reallocation from 'sunset' to 'sunrise' industries.

The New Zealand experience

The New Zealand Productivity Commission's work shows that technology diffusion and resource reallocation do not work as well as they could in New Zealand.

The New Zealand Productivity Commission's work shows that technology diffusion and resource reallocation do not work as well as they could in New Zealand.

While some firms are very successful, productivity growth in leading New Zealand firms more generally has been much less than in leading international firms, suggesting limited international technology diffusion.

Productivity spillovers within the domestic economy have also been relatively slow, especially in some service industries and the construction industry. Many firms in these industries operate in small local markets insulated from competition and learning opportunities.

Productivity-enhancing resource reallocation is also weak, with a disproportionately large share of employment and capital employed by low-productivity firms (Meehan, forthcoming). Further, firms are born small in New Zealand and grow much more slowly than in other OECD economies, particularly service-sector firms operating in small and insular regional markets (Meehan and Zheng, 2015). This indicates a lack of 'up or out' dynamics, with a large share of productive resources employed by relatively small and old firms.

Disconnected and stuck

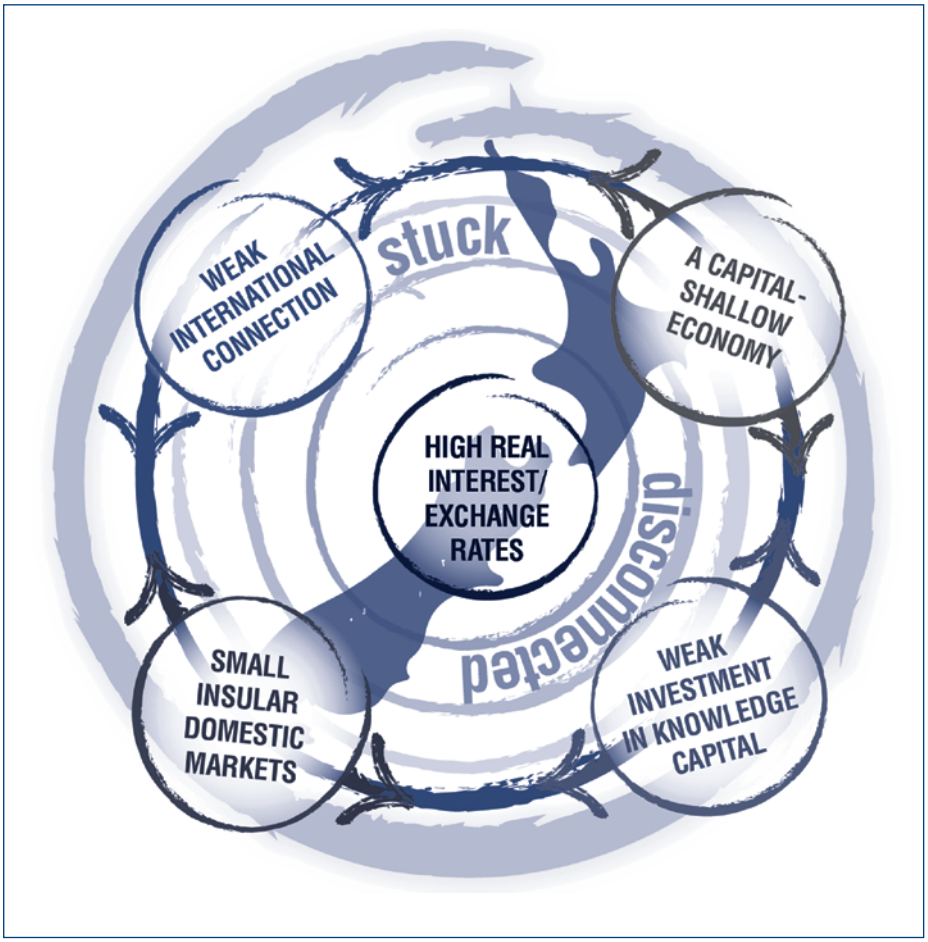
There are a number of underlying reasons for these weaknesses in technology diffusion and resource reallocation. First, most New Zealand firms operate in very small markets. Compared to other small countries, New Zealand firms are not well connected internationally and domestic markets are often small and insular, particularly in the regions. So technology diffusion is weak and productive firms cannot grow and expand, while unproductive firms do not feel the heat of competition and exit.

Second, the economy is capital shallow: investment is low as a share of GDP and especially relative to employment. In part this reflects fast population growth, including strong migration inflows. The cost of capital in New Zealand may also be relatively high – we have a significant real long-run interest rate premium – while labour is relatively cheap. This might also contribute to low capital per worker.

Third, indicative evidence suggests that New Zealand firms have been slow to invest in knowledge-based assets, which are becoming increasingly important in driving productivity improvements. For example, investment in R & D is low, and the available evidence suggests that managerial capability is weak within New Zealand firms. New Zealand firms do not seem to be incentivised to turn themselves inside out to make the most of new ideas and technologies.

Importantly, aspects of this story are self-reinforcing (Figure 1). For example, New Zealand firms are small because they operate in small and insular markets.

Figure 1: Drivers of impaired diffusion and reallocation



So they struggle to learn from global frontier firms and have limited revenues to invest in capital, including knowledge-based assets. In turn, this restricts productivity growth, making it more difficult for these firms to connect into larger international markets. And so it goes.

What this means for policy

Policy needs to adapt as our understanding of the underlying reasons for New Zealand's poor productivity performance and the opportunities and risks implicit in the fourth industrial revolution improve. As such, a key challenge is to better integrate our growing understanding of these issues into the policymaking process. Data and economic research can play a powerful and practical role in developing policy and monitoring its impacts. After all, public policy has a much greater chance of success when based firmly on the economic evidence.

A reform agenda

Improving productivity is the most important public policy issue for lifting living standards and fostering inclusive, sustainable economic growth in New Zealand. With this in mind, the Productivity Commission recently published a 'productivity narrative' laying out a high-level reform agenda aimed at attacking the economic feedback loops that restrict New Zealand firm productivity (Conway, 2016). The Commission has now also published ten inquiries on various topics, which include a large number of detailed policy recommendations aimed at improving performance in specific areas.

In a nutshell, the policy challenge is to improve the flexibility and resilience of the New Zealand economy, with an emphasis on adapting to change, rather than resisting it. This includes a trade policy refresh designed to facilitate New Zealand firms engaging in new ways internationally. With new technologies changing the global trading environment, a growing window of opportunity is opening for small firms in remote locations to exploit highly specialised niches within global value chains.

To make the most of these opportunities, policy needs to help build comparative advantage in new areas of economic activity. Most importantly, a highly skilled labour force enhances the economy's ability to acquire and absorb new knowledge and win the race between education and technology. As such, New Zealand's education system must become more flexible and responsive to demands coming out of the labour market. A strong and deliberate focus on high-skilled migration would also help lift human capital in potential areas of comparative advantage, while improvements in the housing market would allow more people to live where their skills are most valued.

The science and innovation systems could also do more to build deep pools of relevant knowledge and expertise. A greater focus on research areas in which New Zealand firms have strengths and the possibility of global visibility – such as the primary sector, digital effects and business software – could be part of this strategy. For example, reducing agricultural emissions, which is critical if New Zealand is to meet its climate change objectives, could generate valuable frontier technologies for New Zealand firms to roll out internationally. More generally, negative externalities of various kinds need to be properly priced to avoid encouraging environmentally damaging activities.

The performance of the services sector has an increasingly important impact on the extent to which New Zealand firms can connect internationally. As such, policy changes aimed at lifting competition in the services sector would help build comparative advantage for firms operating internationally and improve resource allocation more generally.

While this agenda entails an active role for government, it would not mean picking winners at the individual firm level. Rather, the focus needs to be on supporting thematic platforms, with associated investment in research and information dissemination, regulation, skills and world-class infrastructure.

Even if policy is set just right to ensure that the productivity benefits of the fourth

industrial revolution are large and widely spread, a social safety net will still need to catch people who fall through the cracks and equip them to bounce back. Accordingly, policy must ensure that social support and services function effectively to deal with the side effects of rapid technological change.

As our understanding of the links between policy and productivity grows – for example, the impact of tax settings on productivity growth – these policy suggestions will adapt and evolve.

The Business Growth Agenda

In response to New Zealand's productivity challenges and opportunities, the government has implemented the Business Growth Agenda, with the aim of building a more productive and competitive economy. The Business Growth Agenda is structured around six key themes: export markets, investment, innovation, skills, natural resources and infrastructure. In addition, there are three cross-cutting themes: Māori economic development, regional economic development and regulation.

The Business Growth Agenda is targeting key areas in which improvements in policy and performance would help break the economic feedback loops that have constrained New Zealand's productivity performance. However, as discussed in detail in Conway (2016), the agenda needs to be strengthened to reflect our growing understanding of New Zealand's poor productivity performance if it is to achieve its objectives.

Conclusion

The fourth industrial revolution poses some new challenges and opportunities for the New Zealand economy. To an extent, the impact of these changes is already being felt, with some promising recent signs, such as increasing export diversity and a growing high-tech sector. This suggests that in some areas of economic activity the forces that have worked to limit the productivity of New Zealand firms may be loosening their grip. For example, with dramatic falls in the price of transmitting data over distance, a window of opportunity is opening for some firms to engage in new ways internationally. This trend is likely to continue, given the 'servitisation of manufacturing' and strong growth in digital products that can be marketed and delivered worldwide through fibre-optic cables.

Making the most of these opportunities and avoiding the risks requires some fresh policy thinking. Nothing is guaranteed and unless we work on understanding and addressing New Zealand's productivity weakness, we may fail to make the most of the opportunities these new technologies could provide. The challenge is to continuously inform and improve policy in line with our growing understanding of the reasons for low productivity. Only then will productivity-enhancing innovations, such as those mentioned in the first paragraph above, become the basis for strong, inclusive and sustainable economic growth.

References

Conway, P. (2016) *Achieving New Zealand's Productivity Potential*, research paper 2016/01, Wellington: New Zealand Productivity Commission

Conway, P. and L. Meehan (2013) *Productivity by the Numbers: New Zealand's experience*, working paper, 2013/01, Wellington: New Zealand Productivity Commission

Conway, P., L. Meehan and D. Parham (2015) *Who Benefits from Productivity Growth? The labour income share in New Zealand*, working paper, 2015/1, Wellington: New Zealand Productivity Commission

Meehan, L. (forthcoming) *Productivity in New Zealand: the role of resource allocation among firm*s, working paper, Wellington: New Zealand Productivity Commission

Meehan, L. and G. Zheng (2015) *Firm Dynamics and Job Creation: a perpetual motion machine*, research note 2015/1, Wellington: New Zealand Productivity Commission

Nolan, P. (2014) 'Lifting New Zealand's productivity: a research agenda', *Policy Quarterly*, 10 (2), pp.22-9

OECD (2015) *The Future of Productivity*, Paris: OECD

OECD (2016a) *OECD Compendium of Productivity Indicators 2016*, Paris: OECD

OECD (2016b) *The Productivity-Inclusiveness Nexu*s, OECD: Paris

Productivity Commission (2012) *Housing Affordability Inquiry: final report*, Wellington: New Zealand Productivity Commission

Productivity Commission (2014) *Boosting Productivity in the Services Sector: final report*, Wellington: New Zealand Productivity Commission

Productivity Commission (2015) *Regulatory Institutions and Practices: final report*, Wellington: New Zealand Productivity Commission

Productivity Commission (2016) *New Models of Tertiary Education: draft report*, Wellington: New Zealand Productivity Commission

Productivity Hub (2017) *Getting Under the Hood: recent firm-level research on productivity in New Zealand*, Wellington: New Zealand Productivity Commission and Ministry of Business, Innovation and Employment

Schwab, K. (2016) 'The Fourth Industrial Revolution: what it means, how to respond', https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

Skilling, D. and D. Boven (2007) *So Far Yet So Close: connecting New Zealand to the global economy*, discussion paper 2007/01, Wellington: The New Zealand Institute