

Fast-forwarding technology to address climate change

Productivity and climate change are tightly linked

Climate change is a problem, and we will have to deal with it one way or another. We will either keep warming under some threshold that isn't too disruptive, such as 1.5 degrees C, or we will overshoot that threshold and deal with the consequences.

To limit warming, we need to limit greenhouse gas (GHG) emissions. The question becomes, how can our economic behaviour be organised in a way that reduces emissions from their current level with minimal impact on our wellbeing?

This Insight makes the case that there are two problems in one. First, there is a collective-action problem that should be amenable to standard solutions. Second, the climate problem is also a productivity problem. Part of New Zealand's solution to emissions is solving its low productivity growth rate. Making New Zealand more productive – fast-forwarding its adoption of new technology – gives it the opportunity to address GHG emissions with less social and economic disruption.

In addressing these issues, we have stylised the problems and our analysis. We have also focused on practical approaches informed by our fieldwork, some of which is unpublished or confidential. We make no apology for being practical and would argue that unless we simplify the matter, it becomes insoluble.

Tight targets, flexible approaches

A coherent programme to tackle emissions and climate change needs three components.

First, the government needs to tackle the collective-action problem by establishing socially supported **tight targets** on allowable emissions. They need to be well known, clear, fixed targets for a reduction in GHG emissions. It must be

economically inefficient for people to challenge the targets or take a wait-and-see approach. The targets should describe a New Zealand with a low-carbon economy that meets international agreements. The targets and vision for the economy also need legitimacy with the wider public. He Pou a Rangi - Climate Change Commission (CCC) (2021) agrees; a key element of its advice is *Send clear and consistent signals about how Aotearoa will transition to low emissions and work together across political parties, government agencies and local government* (p. 7).

Second, in contrast to the tight targets, the approach taken to meet them needs to be **loose**. It is critical that we minimise the costs of change in this process, to ensure we can invest the most resources in future wellbeing. To do so, New Zealand needs to rely on the inventiveness and problem-solving of individuals and businesses. They need to have the scope to do what works best for them to reach these targets. A loose approach means allowing people and businesses to change what they buy and how they produce as suits them, without the government getting too involved in the details.

This search for solutions needs to be set in a well-informed environment so all parts of the economy can take advantage of the best services and ideas going. The government can provide support in part by using its considerable resources to develop, assess and understand options without 'picking winners'.

Third, climate policy must address New Zealand's low productivity growth. High carbon emissions mean that we are using too much resource for the output we produce. We could think about reducing our output.

Alternatively, we can look at increasing productivity – the efficient use of available resources – and preserve our environment and our standard of living. The CCC recognises the importance of technology: *The technology and tools the country needs to get there exist today – Aotearoa does not need to rely on future technologies* (p. 10). The important gap, though, is in using or adopting technology in a way that enhances rather than diminishes wellbeing. Whether it is productivity growth for economic output or production changes to respond to the climate change problem, it is the same challenge: reconfiguring our resource use to produce things differently and more efficiently.

Regulatory theory

Savvy readers will recognise two sources for the tight-loose approach above. One source is Peters and Waterman (1982), who described how excellent companies have a tight focus on goals but encourage innovation and entrepreneurship by their employees. Another source is the Porter hypothesis about the effects of regulation on environmental impacts and economic efficiency. Porter and van der Linde (1995) said that environmental regulations could both achieve their principal aims and push businesses to innovate. There are three flavours of the Porter hypothesis (Albrizio et al., 2017). The weak version is that environmental regulations can lead to innovation. The strong version is that those innovations produce economic efficiency as a co-benefit. The narrow version – the one being used here – is that the economic impacts of environmental regulations depend on how they are formulated, and that a loose approach gives the best results.

There are two key criticisms of a loose approach. One is that we will be investing large sums of money, so we should try to solve many problems at once. The other is that a least-cost approach could lead to undesirable impacts on communities, vulnerable people and future generations.

These criticisms are too optimistic about what might be possible with people and policy. The scale of this issue means there is danger in trying to do too much. If the climate policy is effective and efficient, then it does what it needs to do – reduce emissions. The CCC, though, wants more.

It wants to *Design an equitable transitions strategy that results in a fair, inclusive and equitable transition* (p. 7). How does the CCC propose to balance effectiveness, economic efficiency, fairness, inclusion and equity? What inefficiencies will be accepted in favour of inclusion? How much less mitigation will be achieved in order to have equity? Having too many objectives moves the policy away from what should be the key focus: reducing GHG emissions.

The rebuttal is that we can have both. This is the strong version of Porter's hypothesis. It sees GHG reductions and co-benefits as tightly linked. Here is an example (He Pou a Rangi - Climate Change Commission, 2021, p. 149): *There are also opportunities for businesses taking the lead in reducing emissions. Creating new low-emissions products and services could open up opportunities in new markets and could add value to our exports.*

Another example is the focus on waste. The CCC advocates that New Zealand *Reduce emissions from waste, through measures that reduce the amount of waste generated and increase resource recovery*. Of course, if New Zealand can have both, then focusing on emissions reduction should be sufficient. Unfortunately, the temptation is to flip the logic: if emissions are tightly linked to co-benefits, then promoting either one gets us both. Supporting waste reduction, for example, may create emissions reduction. The key question is, *At what cost?*

There is support for the strong hypothesis in economics research (Ambec & Barla, 2002) but also research that suggests the story is more nuanced (Albrizio et al., 2017). In particular, the ability to have productivity growth because of environmental regulations may depend on businesses already being highly productive. This little wrinkle takes the discussion to the main point of this Insight: the need to focus on productivity.

New Zealand's productivity – can we do better?

New Zealand has low productivity growth relative to other industrialised countries. This is a long-standing problem. Although some economists state that the economic reforms of the 1980s and 1990s were successful in increasing labour

productivity (Evans et al., 1996), other analysis suggests that New Zealand's productivity growth began to fall in the early 1990s (Dalziel, 2002).

Over the past 20 years, economists have searched for explanations for this declining relative productivity. MacCulloch (2021), somewhat tongue in cheek, pointed to *more than 15 possible reasons*. More academically, Conway (2018) described the productivity issues that the economy faces. While that article did not explicitly list the explanations, it provided at least 14 causes of low productivity growth.

Table 1 Values and practices for vibrant catchment groups

Explanations of low productivity	
1.	Failure of diffusion from frontier firms to laggard firms
2.	Weak market selection pressures – firms do not die
3.	Small market size limits growth of productive firms
4.	Weak international connections
5.	Geographic segmentation – low density of human capital
6.	Low investment in R&D and managerial capability
7.	No technology spill-over from foreign-owned firms
8.	Poor infrastructure
9.	Governance issues
10.	Government ownership of businesses
11.	High cost of investment goods
12.	Poor schooling
13.	Skills mismatch
14.	Low savings

Source: Conway (2018)

In a sense, the list in Table 1 does not help. By focusing on causes rather than possible remedies, it implicates basically everyone in New Zealand as well as the landmass itself. The problem is consumers and producers, owners and employees, businesses and government – everyone. It is unclear what people are meant to do when the whole country is wrong, and some elements are impossible to change. The list also does not give a sense of relative importance. What are the two or three most important things to fix? If businesses are going to create new products and take advantage of new opportunities as part of meeting New Zealand's climate obligations, what are the best ways to support them?

That is, what are the best things to fix to have the biggest impact on GHG emissions per lost unit of wellbeing?

Make or buy?

If business is key to our climate change response, then productivity needs to be seen through the lens of business decisions. For every part of its operation, a business needs to decide whether to do it in-house or subcontract it (Coase, 1937), the so-called make-or-buy decision. If we think about the elements that make up a business and the make-or-buy decision, we see how systemic and structural the productivity problems are.

Someone running a business uses management skills to figure out how to combine employee skills, plant and equipment and available investment funds to produce something to sell. For each resource, management needs to decide how much to make or buy. Table 2 breaks down the make or buy decision for key resources in the context of the New Zealand economy. That context is: low population density means it is hard to find an employee with just the right skills, high commercial interest rates mean that borrowing is expensive, and small markets for most goods and services mean low payoff to innovation or expansion.

High borrowing costs mean that anything with a payoff period over one year is relatively expensive: technology, labour training, management training. Training is particularly problematic because the returns are split between the business and the employee, so the value to the business is lower than the value to the economy. Compared to businesses in other countries, it is generally cheaper to make than buy. That means businesses are limited to the skills and technology they currently have.

This approach covers a lot of the explanations in MacCulloch (2021) and Conway (2018). Importantly, though, it describes the business process that leads to the low-productivity equilibrium, and it points to the main causes. In New Zealand, money is expensive, and people are spread out geographically across many small firms. Those facts alone explain most of the productivity challenges.

Table 2 Implications of make-or-buy decisions

Business resource	Make-or-buy decision	Economic implications
Employee skills	Make Businesses supply minimal training Buy Low population density means thin labour markets, so businesses buy 'good enough' skills	Persistent skills gaps
Plant and equipment	Make Businesses tend to self-finance so are thinly capitalised Buy Finance costs are high, so businesses avoid outside capital	Low investment Businesses make do with older plant and equipment
Level of technology	Make Low levels of R&D spending Buy Low levels because financing is expensive	Level of technology falls behind the rest of the world
Management skills	Make Self-taught management Buy Only as much professional services as required	Old and static management skills (you don't know what you don't know)

Source: NZIER

Climate solutions in a productive country

Where does this leave New Zealand on climate change? The country needs better technology to reduce resource use to meet emissions targets. The economy is in a low-investment, low-skills equilibrium – the wrong place to be stuck if it wants rapid change.

The challenges boil down to the high cost of capital and low or poorly matched skills among employees and managers. These are the two challenges to address to move New Zealand into a better equilibrium. Businesses are not going to do this themselves. Despite all the reports and chiding for 20 years or more, productivity remains low. We have assigned much of the heavy lifting on innovation to business. Alongside the private sector, the government will need to support or catalyse other necessary changes.

Here are five things the government could do:

- Improve and increase labour training
- Create incentives for more capital investment in plant and equipment
- Create more knowledge through research and development
- Encourage adoption of better technology
- Improve management in private and public sectors.

These measures can be achieved by a combination of direct intervention, tax incentives, training subsidies, and minimum standards.

Let's take each of these actions in turn.

Labour training. In one set of company interviews we did, the consistent message was that they wanted staff with good training but were not willing to fund training themselves. Why? Staff might leave, so the company wouldn't benefit from the training. In other work, we found that levels of training at private businesses were consistently very low. Companies tended to do the mandatory minimum and no more.

Thus, while New Zealand workers report high levels of participation in training, most workers in lower-paid categories report 10 or fewer hours of formal training per year (New Zealand Productivity Commission, 2019). One solution is to share the training costs since the benefits are also shared. Direct government funding of training or tax incentives for training are tools for reducing the costs of training employees. However, the content of the training should be chosen by employers and employees, who have more information about what they need. Another possibility is giving every adult the option of a paid 'training week' when they can upskill on whatever they choose.

Incentives for investment. In work on efficient technology, we found that companies could identify investments in energy efficiency that would pay for themselves (PwC, 2018). However, they often had even better things to do with their limited investment funds. Marketing and product development often provide better returns than small savings on power use. The government could target these efficiency opportunities by making funding or tax incentives available only for efficiency or productivity improvements. Such programmes are available to some extent through EECA. However, to have a wide impact, these programmes need to be large-scale and easy to use. Too much compliance cost, too much managerial time and effort, and energy efficiency falls back down the priority list.

More research and development. We have evaluated many projects, programmes and organisations involved in R&D. The New Zealand experience parallels findings overseas (Alston et al., 2000): some stuff works and some stuff doesn't, but overall scientific research more than pays for itself (Greer & Kaye-Blake, 2017; Hall & Scobie, 2006). We should do more of it. In keeping with the loose approach, though, we should try not to be too prescriptive. Too many sources of funding have onerous processes and powerful gatekeepers, which makes research money expensive to obtain and stifles new thinking.

Encourage adoption of better technology. Partly, this is tied up in better incentives for investment, which was discussed above. Partly, we should realise that the current situation is a low-investment equilibrium. Technology that is

'appropriate' to the current economy – low skills, low wages, low productivity – will move the country only incrementally, if at all, towards better productivity.

This low-investment approach is exacerbated by the public sector discount rate, which the Treasury pegs to private sector rates of return. Thus, both the public and private sectors focus on reproducing the current economy and its low productivity growth. To jump out of that equilibrium, businesses and government might have to think about investing more than their models suggest, as if the country could afford it. We might have to use 'inappropriate' technology and then use it as a challenge to build up commercial practices and skills around it.

Improve management in private and public sectors. The Productivity Commission (2020) found that *Management capability in New Zealand appears poor*. This is just the latest report to find the same thing. New Zealand management skills and practices run the gamut from excellent to execrable but on average they lag behind other countries. In some respects, this is a subset of the training issue discussed above. However, given the centrality of management to the good functioning of businesses and other organisations, a focus on managerial skills is important. New Zealand lacks the mechanisms seen in larger economies for generating managerial capabilities due to a shortage of large-scale firms and links to international businesses. Because of this lack, some other way of creating this capability is required.

Agriculture – an example of success

Agriculture produces about half of New Zealand's GHG emissions, but thus far has avoided inclusion in the key regulatory tool for managing GHGs, the Emissions Trading Scheme. These facts are reasonably well known.

What is less well known is how successful agriculture has been at improving productivity. From 1978 to 2011, the primary sector had the highest level of productivity growth in the economy (Conway & Meehan, 2013).

From 2008 to 2020, agricultural multifactor productivity grew by 27%, according to productivity statistics from Statistics NZ.

The sector was third behind ICT and retailing, and no other sector in the economy achieved even one-half that rate of productivity growth.

How has this growth happened? The sector combines lots of individual production units, each with unique aspects, with clear signals from processors, industry groups and export markets. In one set of farmer workshops run by NZIER, farmers said they had been responding for years to clear signals to increase production. In another set of farmer workshops, we asked what they had changed to achieve improvements over the last few years. The farmers had very different answers for each of their farms. They had figured out what worked for them through trial and error. These workshop discussions demonstrate the potential of a tight-loose approach: tight targets but flexibility on how to achieve them.

Other research has demonstrated repeatedly that agricultural innovations in New Zealand have been successful. Across apples, grapes, seafood and other industries, repeated innovations have been supported by government, researchers and industry to create economic success (Greer & Kaye-Blake, 2017). Some of these innovations have relied on close, voluntary cooperation with growers, grower groups and researchers (Park et al., 2015). These examples show that it is possible to grow productivity in the New Zealand context.

Money and people

Meeting the challenge of emissions reductions will require many individual actions across businesses and consumers. Setting relatively few tight targets and supporting a loose, flexible approach gives them the chance to do what is best for them to meet these targets. The government can support them with the right mix of incentives, guidance and restrictions. These policies need to help businesses overcome New Zealand's chief challenges: expensive capital and thin labour markets. The experience of the agricultural sector shows that productivity growth is absolutely achievable.

Technological change will be part of the solution to reducing GHG emissions. New Zealand's poor performance on productivity means that the past rate of technological change will not be enough.

We need to fast-forward the adoption of new technology that will address the problem of climate change. We need to deal with our productivity problem, which is, at root, about money and people.

References

- Albrizio, S., Kozluk, T., & Zipperer, V. (2017). Environmental policies and productivity growth: Evidence across industries and firms. *Journal of Environmental Economics and Management*, 81, 209–226.
- Alston, J. M., Chan-Kang, C., Marra, M. C., Pardey, P. G., & Wyatt, T. J. (2000). *A meta-analysis of rates of return to agricultural R&D: Ex pede Herculem?* (No. 113). International Food Policy Research Institute.
- Ambec, S., & Barla, P. (2002). A theoretical foundation of the Porter hypothesis. *Economics Letters*, 75(3), 355–360. [https://doi.org/10.1016/S0165-1765\(02\)00005-8](https://doi.org/10.1016/S0165-1765(02)00005-8)
- Coase, R. H. (1937). The Nature of the Firm. *Economica*, 4(16), 386–405.
- Conway, P. (2018). Can the Kiwi Fly? Achieving Productivity Lift-off in New Zealand. *International Productivity Monitor*, 34, 24.
- Conway, P., & Meehan, L. (2013). *Productivity by the numbers: The New Zealand experience* (Research Paper 2013/01; p. 54). Productivity Commission.
- Dalziel, P. (2002). New Zealand's economic reforms: An assessment. *Review of Political Economy*, 14(1), 31–46.
- Evans, L., Grimes, A., Wilkinson, B., & Teece, D. (1996). Economic Reform in New Zealand 1984–95: The Pursuit of Efficiency. *Journal of Economic Literature*, 34(4), 1856–1902.
- Greer, G., & Kaye-Blake, B. (2017). *The impacts of research in an era of more stringent performance evaluation*. 17.

- Hall, J., & Scobie, G. M. (2006). *The role of R&D in productivity growth: The case of agriculture in New Zealand: 1927 to 2001* (Working Paper No. 06/01). New Zealand Treasury.
- He Pou a Rangī - Climate Change Commission. (2021). *Ināia tonu nei: A low emissions future for Aotearoa*.
- MacCulloch, R. (2021, April 20). Propositions for poor productivity performance: From the Ivory Tower: Horrid truths about our low productivity (Commission). NBR. <https://www.nbr.co.nz/node/229780>
- New Zealand Productivity Commission. (2019). *Training New Zealand's workforce. Technological change and the future of work, Draft report 3*.
- New Zealand Productivity Commission. (2020). *Technological change and the future of work*.
- Park, N. M., Williams, T. A., Walker, J. T. S., Butcher, M. R., Turner, J. A., Botha, N., Vereijssen, J., & Taylor, N. M. (2015). Enhancing innovation and technology transfer in the New Zealand apple industry learnings from Apple Futures. *New Zealand Plant Protection*, 68, 291–298. <https://doi.org/10.30843/nzpp.2015.68.5825>
- Peters, T. J., & Waterman, R. H. (1982). *In search of excellence: Lessons from America's best-run companies*. Harper & Row.
- Porter, M. E., & Linde, C. van der. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives*, 9(4), 97–118. <https://doi.org/10.1257/jep.9.4.97>
- PwC. (2018). *Business investment decision making: Large process heat use and energy efficiency New Zealand*. Energy Efficiency and Conservation Authority. <https://www.eeca.govt.nz/insights/eeca-insights/pwc-large-process-heat-users-and-energy-efficiency-in-new-zealand/>

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