



TEC submission on NZPC Frontier Firms Issues Paper

1. The TEC is pleased to respond to the NZPC's request for submissions on its Issues Paper: *New Zealand firms: reaching for the frontier*. As well as the Issues Paper itself, this submission also comments on some matters raised by the NZPC-commissioned report *Frontier firms and small advanced economies* ("The Skilling Report").
2. The TEC concurs with the OECD's definition of "frontier firms" as those in the top 10% of the productivity distribution either among firms globally (the global productivity frontier) or domestic firms (the domestic productivity frontier).

What is TEC's interest in the Frontier Firms Inquiry?

3. The TEC leads the government's relationship with the tertiary education sector, and provides careers services from education through to employment. Its key levers are funding, careers information and enablers, and system stewardship.
4. The TEC is committed to learner-centricity, equity, and lifelong learning through working and learning lives. It is working to improve system flexibility and responsiveness, including through innovation in learning packages and qualifications, and in how they are delivered.
5. As part of its strategic response to Covid-19, the TEC is committed to a more resilient and connected tertiary system that helps place New Zealanders in meaningful work, gives employers access to the right skills, and encourages entrepreneurship, growth and innovation. The TEC intends to strengthen its relationship with universities so that they can better fulfil their role in creating transferrable knowledge that benefits society.
6. The TEC sees a need to better connect to New Zealand's innovation ecosystem, to understand how it can proactively fund tertiary education and deliver careers services that contribute to emerging fields, technologies and industries.
7. This submission gives an overview of tertiary education's contribution to frontier firm productivity, and discusses how this might be enhanced in future. It then responds to those Issues Paper questions that TEC has specialised interest in.

Tertiary education's contribution to frontier firm productivity

8. TEC agrees that productivity growth determines per capita income. Frontier firms, especially internationally-oriented ones are key to productivity performance. The Skilling Report (2020) notes that among small advanced economies New Zealand ranks very poorly in international orientation and export performance. It advocates

substantially increased investment in skills and innovation, and highlights the critical role of research universities. The TEC concurs.

9. Universities foster economic growth at regional, nation state and international levels (see Valero & van Reenen 2016; Deloitte Access Economics 2018). They drive innovation and productivity growth through their higher education and skills development, research, intellectual property creation and licensing, the spin-off of start-up firms, and the fostering of entrepreneurial skills and mind-sets.
10. Our universities form a provision network to meet New Zealand's higher education needs. They are part of a wider innovation ecosystem that connects to international research, and which includes MBIE and HRC funding, the Royal Society (the Marsden Fund), Callaghan Innovation, CRIs, and private research entities. TEC's major responsibilities include the Performance-Based Research Fund (PBRF) and Centres of Research Excellence (CoREs).
11. Top international universities such as MIT and Stanford have a strong focus on research and on technological impacts at the industry and firm level. Alumni from MIT have founded firms with aggregate revenues of around US\$2 trillion a year – equivalent to the 10th largest economy in the world. Stanford's alumni gave rise to Silicon Valley. MIT and Stanford universities have fewer students than Auckland University, yet far stronger graduate schools. Other key strengths include their alumni endowments, access to venture capital, and proximity to discriminating and large-scale market demand.
12. While for reasons such as scale New Zealand cannot replicate MIT and Stanford, we can draw lessons from them and from other international universities with high productivity impacts. New Zealand universities have played a key role in our industry development, including for frontier food and fibre, engineering, and digitally-enabled and "weightless" knowledge-intensive firms. This can be built on.
13. University research delivers the "co-produced goods" of new knowledge and advanced post-graduate student skills development. An insightful case study is the power and automation technologies developed in New Zealand from the 1980s, based on research and higher education from Canterbury and Auckland University engineering schools (Turner, 2020). This involved teaching-linked research that delivered basic and applied results, and which saw skills developed in universities transferred through masters and PhD graduates moving into firms. Auckland University Professors John Boys and Grant Covic later led world-class research in inductive power transfer that helped give rise to firms such as PowerByProxi.
14. Top academic researchers can contribute to both basic public good research and also have industry impacts. For example, Professor Bob Elliot played a key role in the science underpinning a2 Milk and its subsequent commercial success, as well as making fundamental and high health impact advances in medical research.

How can tertiary education make an enhanced impact on frontier firm productivity?

15. TEC suggests that tertiary education can lift its impact on frontier firm productivity through:

An enhanced university role in research linked to technological innovation in firms

16. Since its inception in 2002 the PBRF has evolved, and it works well as a capability fund and to support university research excellence. However, it is academically-oriented rather than technologically and commercially-focused.
17. There is concern internationally about the stagnating productivity and poor outcomes from much basic research driven by peer review and citation-driven incentives. Sarewitz (2016) argues that research needs to connect to technological applications that have tangible benefits in the economy and society. For example, the US DARPA funding model supports advanced, focused research that underpins leading-edge technology with wide applications. This research is tightly focused on technology creation, and it moves between basic and applied research as needed to deliver the technology required.

18. Some countries are refocusing basic research to have clearer pathways to technological application. In the US the bi-partisan Schumer-Young Bill (titled “The Endless Frontiers Act”) seeks US\$500 billion over five years to invest through the National Science Foundation to ensure future US technological leadership.
19. If university research and associated higher skills development is to lift productivity in New Zealand there needs to be more focus on technological and industry development. It must be funded at the scale and with the stability to build outwards-facing university capabilities that pathway from science to technology and deliver impacts in and through frontier firms.
20. Enhanced career pathways for top doctorate and other research graduates may have high productivity impacts. One of several options to consider is Universities New Zealand (UNZ’s) proposal for a new type of government-funded “end user PhD” to address real-world end-user problems and opportunities (UNZ 2020). Such doctorate research could deliver graduates with practical industry knowledge and connections, and would foster deeper linkages between universities, frontier firms and other users.

Reform of Vocational Education (RoVE)

21. New Zealand needs to upgrade skill levels in all industries and across many firms. Vocational Education and Training (VET) has a key role in this. RoVE aims to deliver an enhanced nation-wide, work-integrated vocational training system through the creation of NZIST and Workforce Development Councils (WDCs). WDC and NZIST engagement with frontier and other firms should support flows of learning between the tertiary sector and industry that diffuses technology more widely.
22. WDCs will develop standards and qualifications, and NZIST and other providers the programmes to deliver them through work-integrated learning. WDCs are also tasked with skills leadership for their industries. While WDCs will primarily focus on the skills needed for the average firm, in any industry there is high variance in productivity between different firms. That is, there are significant differentiated needs – one size does not fit all.
23. Differentiated firms are often “disruptors”, and some of them are high productivity frontier firms, or will be in time. WDC skills leadership must therefore include identifying emerging skills and developing the standards and qualifications for them. This will help accelerate adoption of new international technology and have productivity impacts in New Zealand firms.

TEC’s response to Issues Paper Questions

24. The TEC’s responses to Issues Paper questions directly related to tertiary education are:

Q6: What are the most important drivers of the diffusion of technology, ideas and business practices from frontier firms to other firms in New Zealand?

25. Competition in any market economy is a key driver of technological diffusion, and of new ideas and business management and practices. Internationally connected teaching-linked research develops leading-edge skills for frontier firms that need to compete in international markets. These frontier firm skills then diffuse to lower-productivity firms that are behind the frontier.
26. Another key driver is worker movement between firms and industries. High worker progression from job to job and between different firms and industries is associated with dynamism and productivity growth. To foster such job to job flows workers need to be able to recognise and understand the opportunities, and access the learning to take advantage of them.
27. TEC’s career services, its investment in transferrable skills development, innovation in learning packages, and TEO agility in delivering them will facilitate productivity-enhancing job to job flows. This supports NZPC’s view that productivity can be enhanced through resources (people, capital) moving from low to higher productivity firms and industries.

Q8: In your view, what are the key ingredients that would lead to a successful New Zealand economy, and what would success look like?

28. New Zealand has good institutions, high trust in government, macroeconomic stability and micro-economic flexibility. Key “ingredients” to enhance would include firm and workplace learning capabilities, domestic savings and capital formation, and financial and human capital allocation. Productivity growth comes from firm capacity to learn from research and from their industry environment and innovation ecosystem, and to apply that learning to new opportunities (see Arrow 1962a and 1962b).
29. Within human capital development, leadership, management capability and entrepreneurship are key enablers. Entrepreneurial business start-ups and market entries are strongly associated with dynamism and innovation (see Akcigit & Ates 2019). Entrepreneurial firm founders create value from new ideas, deep technical and other content knowledge and networking capabilities.
30. Employees with entrepreneurial mind-sets and skills can also identify and create new value for employers, colleagues and customers. Entrepreneurial skills and mind-sets are therefore transferrable skills for lifelong learning that can complement or be integrated into mainstream higher education. TEC is linked to MBIE-led work with universities and other entities to foster entrepreneurial education.
31. Success would mean higher productivity and per capita incomes. We would see a tradeable sector bigger in absolute and relative terms, and a more sophisticated and knowledge-intensive export product and services mix. This would be reflected in a higher Economic Complexity Index rating – see the Atlas of Economic Complexity <https://atlas.cid.harvard.edu/> New Zealand would also have a stronger Net International Investment Position (NIIP).

Q13: What are the main challenges for New Zealand firms that aspire to reach the performance of the best firms globally?

32. New Zealand is distant from major international markets and sources of new technology. Universities play a key role in accessing international knowledge and technology and creating deeper economic and cultural links with other countries.
33. While distance can be an advantage, for example during pandemics, it imposes higher costs on exporters in servicing overseas markets. New Zealand needs to shift more of its export mix to more knowledge-intensive and “weightless” products and services, and needs to actively leverage its international connections to accelerate the adoption of international technology within New Zealand.
34. From Glaxo on, New Zealand has a long history of creating technology and knowledge-intensive firms that can compete internationally. However, only rarely have we been able to develop the full international potential of such firms, whilst still anchoring and capturing benefit streams from them in New Zealand. A key constraint has been lack of deep, sophisticated and patient New Zealand-sourced capital. NZ Growth Capital Partners, including the new Elevate NZ Venture Fund is a basis to build from.
35. Many firms that develop in New Zealand and reach the domestic or international frontier fail to fulfil their international potential, and in many cases they sell to overseas competitors, or they move offshore. Challenges include the different skills and management capabilities needed at different firm development stages.

Q15: How do New Zealand’s frontier firms learn about, adapt and adopt cutting edge technologies and practices?

36. Sources of learning and technology application vary depending on such factors as industry and market structure, and interaction with customers, suppliers and competitors. Tertiary institutions are key sources of learning through their research, and especially through graduates with leading-edge knowledge and skills moving into firms. This is most effective when tertiary provision is linked to research that connects to the international frontier in relevant disciplines.

37. As noted by Turner (2020), firm managers can benefit greatly from ongoing post-graduate study and research to upgrade their knowledge, especially if targeted at disciplines and industries important to New Zealand's productivity performance. Linkages between firms and outwards-facing university research capabilities can create valuable networks and two-way learning relationships benefiting universities as well as firms.

Q16: What types of international connections make the biggest difference for diffusion from the global to the domestic frontier?

38. Within the tertiary sector, the biggest diffusion impacts come from university involvement in international research connections, and from top international academics and students coming to work or study in New Zealand universities, often leading to residency.

Q30: What are the top three things you would like to see come out of this inquiry?

39. The three top things for tertiary education that can contribute to frontier firm performance would be:

Funding for university research focusing on technological innovation for frontier firms

40. TEC would like an NZPC analysis of the potential for enhanced research funding for university technology-oriented research and higher skills development. This could specifically focus on technological innovation in and for New Zealand frontier firms. Such funding would deliver both new knowledge and the post-graduate and other higher-level skills needed for firms to leverage productivity gains and enhance their competitiveness, especially in international markets.

Attracting top-level academics and students to New Zealand aligned to innovation in frontier firms

41. Our tertiary education and training system must focus primarily on lifting the knowledge and skills of New Zealanders to ensure their prosperity and wider wellbeing. Our system must be tailored to unique New Zealand opportunities, for example as arising from Te Ao Māori, and from our environmental and sustainability challenges. We must also be outward-looking as an economy and society.

42. Skilling (2020) argues that substantial net migration growth over the last 25 years has distorted investment allocation in New Zealand, put downwards pressure on wages that have deterred business investment in labour productivity enhancement, whilst putting upwards pressure on the exchange rate. It is accepted that sub-degree international education has in some cases been used as a pathway to residency rather than primarily for an educational purpose.

43. However, highly skilled and entrepreneurial immigration is productivity-enhancing. The Covid-19 crisis and international political tensions may make New Zealand more attractive to gifted and innovative people, many of whom could pathway to citizenship through university study. NZPC could analyse the case for more active recruitment by our universities of top-level international STEM academics and students, including how their skills could enhance technological innovation in New Zealand frontier firms.

Analysis of skills transferability that extends firms' productivity frontiers

44. The TEC encourages the NZPC to do in depth analysis of how skills diffuse through the economy, as this impacts on adoption and application of new technology and on frontier firm productivity.

45. We need to know more about skills transferability that enables workers to do better as they move to higher-level roles in firms, and as they move between firms and industries. To what extent are skills part of wider skills clusters (see AlphaBeta 2018)? How can skill development best support progression within and between firms, and how can the tertiary system help upgrade and create new skills for workers through their working and learning lives?

46. In addressing these questions, NZPC could build on past research by MBIE, Motu Economic and Policy Research and TEC. More in-depth understanding of skills transferability could greatly assist the WDCs' work, and facilitate innovation in skills-related learning packages and in how they are delivered. This analysis could also inform TEC's careers information services and enablers.

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