

## New Zealand Productivity Commission's inquiry into Frontier Firms

### **Submission by the University of Auckland - 1 September 2020**

1. The University of Auckland welcomes the opportunity to make a submission to the Productivity Commission's inquiry into frontier firms. This submission will respond to the inquiry in a general sense, as opposed to systematically addressing the specific questions raised in the issues paper. The University of Auckland is committed to maximising its impact by helping to lift the innovative capacity in Aotearoa New Zealand and stimulate the development of more frontier firms.
2. The issues paper highlights the identification of practical government policies as a key purpose of the inquiry. This submission will propose policy interventions with the potential to strengthen the contribution of New Zealand's universities to New Zealand's innovation capacity and productivity. It is our view that insufficient attention is currently paid to the role of education in productivity, and within that frame, the economic and social contributions of universities as developers of new knowledge, creators of new enterprises, and educators of researchers and managers. Thus, the most valuable contribution that the University can make to this inquiry is to suggest policy approaches that can help unleash the potential inherent in our universities.
3. There are many new opportunities and challenges facing our society that demand more from our universities. The need to diversify our economy and overcome the persistent productivity challenge that New Zealand faces is long standing, and we will need many more firms at the frontier and in a broader array of knowledge intensive sectors to address this challenge. Further the context in which we now need to address the productivity challenge is more complex than ever, with pressure for broad societal transformation in response to the sustainability agenda (i.e. responding to climate change and growing social inequalities).
4. Related to this point, we note the Commission's question about the definition of productivity, while also singling out frontier firms amongst Māori businesses for further study. We encourage the Commission to explore the intersection of these two themes to better understand productivity from the Māori worldview, a perspective that has potential to yield significant insight about the complex environmental and social contexts of our productivity challenge.
5. The Productivity Commission's definition of frontier firms centres on the relative position of these firms on the global or domestic productivity frontier. We agree with this, and whilst it may be implicit in the Productivity Commission's adoption of the OECD definition, we would like to highlight additional characteristics of frontier firms identified by the OECD (2015, p.10), namely that such firms are generally "larger, more profitable, more likely to belong to a group/conglomerate and patent more intensively than other firms." Large firms typically benefit from scale, and also invest more in R&D and learning. They are sources of learning for the small and medium sized enterprises (SMEs) that deal with them as suppliers and customers. As New Zealand has a relative lack of such large firms, universities as large complex organizations focused on knowledge creation and learning can help to fill the resulting gap in our innovation system.
6. New Zealand has a greater proportion of its research expenditure provided by government and universities than the OECD average and a relatively low rate of business enterprise research and development (BERD). Thus, how new technology is transferred across the university-industry interface is particularly important, but the processes for this remains under-developed, as does the absorptive capacity of New Zealand firms.

## Innovation impacts of universities

7. The importance of innovation for productivity and prosperity is well documented. Universities play a critical part in innovation through their dual roles, generating new knowledge and ideas that underpin ground-breaking innovations, and educating highly skilled people. As such, universities supply two of the key ingredients for productive and competitive economies. Universities' impact on innovation is also closely linked to their role in fostering a more entrepreneurial economy. Entrepreneurship is considered alongside innovation in this submission.
8. Universities have a particularly important role to play in stimulating the creation of innovation-based firms; those more likely to be at the frontier. Research-driven innovations happen in universities, which when successfully commercialised, underpin the formation of new firms. The impact of these firms depends on the nature of the innovations that underpin the firm's product or service, and their capacity to scale and grow. Unlike the average start-up, start-ups based on new, game-changing, radical technologies originating in universities have an inherently strong growth-potential, and as such the potential to produce substantive benefits in terms of both wealth and job generation. In this context, academic start-ups or student start-ups are of notable importance, and for that reason, leading research universities have a strong drive to stimulate academic and student start-ups.
9. Universities are also an important source of innovation for existing firms. Successful knowledge and technology transfer to firms enhances their innovation capacity. This occurs through many channels, e.g., licencing of IP, joint research projects, consultancy services, as well as through outreach such as conferences and lectures. The primary, though often overlooked mechanism for technology transfer, is through our highly skilled graduates, especially those who have undertaken research at the postgraduate level<sup>1</sup>. Joint research projects aimed at problem-solving activities have been found to have particularly positive impacts on firm innovation. Collaboration with university researchers on specific problems that a firm faces can lead to significant improvements in its innovation outcomes (Moon et al., 2019).
10. Research also suggests that the effects of technology transfers on innovation are particularly sizeable for SMEs, explained by the fact that collaboration with universities helps to overcome some of the barriers to innovation that these organisations face (e.g., access to specialised knowledge and equipment) (Garcia-Vega and Vicente-Chirivella, 2020). In that regard the low levels of collaboration between universities and SMEs in New Zealand is of concern (OECD, 2017).
11. Relatedly, the R&D tax credit and other related policy instruments emphasise science based research and do little to incentivise firm engagement with universities on a wider range of research problems involving social science and business disciplines, that could result in identifying new markets, aid internationalisation, or lead to incremental innovations and process improvements.
12. Collaboration between universities and industry across a range of disciplines and problems is fundamental to fostering the innovative frontier research needed to tackle major global challenges. By engaging with industry, universities gain a more nuanced understanding of real-world problems and pathways to application of research, thereby ensuring maximum relevance and impact. Closer links also aid quicker and more effective diffusion of new ideas and encourage a start-up culture within the University that can generate new industries. Industry benefits from

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<sup>1</sup> New Zealand has a significant deficit in regard to students who have participated in study at postgraduate level, with only 5% of adults having a Masters degree compared to the OECD average of 13% (OECD, 2019).

access to the latest developments, cutting-edge research and talent leading to significant improvements in products and services. Another benefit of closer university-industry collaboration is enhanced labour market relevance of university programmes as it offers opportunities for industry to feed into curriculum design and work-integrated learning, ensuring that graduates are work and innovation ready and have the right balance between technical and soft skills mirroring the requirements of industry (European Commission, 2018).

13. However, New Zealand's level of university-industry collaboration lags well behind other small advanced economies, as for example, evidenced by the comparatively low rates of academic-industry co-authored publications. By comparison, Denmark and Switzerland have four times as many (MBIE, 2018). Government has an important role to play in encouraging and supporting stronger university-industry collaboration through policies that reduce barriers and provide incentives. As identified in the issues paper, the policies that support connections between research and industry fall short of international best practice, and new solutions are needed.

## **Skills and capability**

14. The other critical element to grow both the number of innovative start-ups and to enhance the innovative capabilities of existing firms, is a highly skilled workforce with strong innovation and entrepreneurial capabilities. A highly skilled workforce enhances the absorptive capacity in the economy, enabling the efficient uptake of new knowledge and technology. The flows of human capital from university to industry and other organisations is often considered one of the most important channels of knowledge and technology transfer.
15. Two human capital related factors are mentioned in the issues paper: the lack of managerial capability as a constraint on firm's innovation, and the alignment of the education system with industry needs (skills matching). The relative under-development of managerial capability is noted by David Skilling's report prepared for the enquiry, and in prior research such as that by Green and Renu (2011). Research shows that Māori trusts and SMEs are particularly challenged to recruit and retain high quality leaders and invest relatively little in up-skilling (e.g., Icehouse, 2013). Another factor that has been found to constrain the growth of New Zealand businesses is the lack of growth aspirations of many New Zealand business owners, who chose lifestyle over growth (KPMG, 2016). Our School of Business is particularly engaged in both researching the issue and designing innovative new programmes to improve managerial capability and absorptive capacity. However, this topic deserves greater attention as a factor underlying lower productivity, and thus as a focus of policy and investment.
16. Research shows that research-based education is linked to growth through innovation at both the firm and macro level, with university-trained employees enhancing absorptive capacity. Research-based education has been found to correlate with productivity growth. A study of Danish firms found that the 5-year growth rate of labour-productivity is higher in firms employing high shares of university-trained workers vis-à-vis firms with low shares of university graduates. The same study also concluded that "firms doing R&D and firms with higher shares of university graduates produce more "drastic innovations" (Schneider and Sørensen, 2016, p.31).
17. While participation in tertiary education is high in New Zealand, our graduates have lower degree levels, on average, than graduates in other small advanced countries (OCED, 2019). As a result, their exposure to, and direct involvement in, research is less as this tends to occur principally at Masters and Doctoral level. Thus, the quality and absorptive capacity of human capital in New

Zealand is likely less than in countries with higher participation levels in Masters and Doctoral studies.

18. Our experience is that almost all of our successful start-up companies and licenses owe their birth and continued success to PhD students who started their companies (often with their supervisors as Chief Technology Officer, or consulting to the company), and that hiring additional PhD graduates is vital to the continued growth of the company. Furthermore, almost all of the investors who fund and add value to these firms have some level of post-graduate education.
19. The importance of instilling innovation and entrepreneurial skills in graduates also deserves further consideration as part of this inquiry. Graduates with these skills are particularly well equipped to drive greater levels of innovation in New Zealand, either as founders of new innovative firms, or as innovative employees in existing firms enhancing the absorptive capacity of these.
20. New Zealand is playing catch-up when it comes to the promotion of entrepreneurial education. As the OECD notes “Globally, efforts to build entrepreneurship competencies through education have increased significantly over time” (OECD, 2018). In Europe, for example, entrepreneurial education has been part of the policy landscape for almost two decades. As a result of a policy directive from the EU as part of the Europe 2020 Strategy, many European countries introduced national strategies on innovation that included policy initiatives aimed at promoting entrepreneurial education across all levels of education from primary to higher education. Notably, almost three-quarters of European countries dedicate public funding to entrepreneurship education, and many countries also received funding from the EU for entrepreneurship education (European Commission, 2016). Meanwhile, in New Zealand, the importance of entrepreneurial education has been largely overlooked within both innovation and higher education policy. In New Zealand, there has been some inclusion of Education for Enterprise (E4E<sup>2</sup>) in the primary and secondary sector aimed at instilling enterprising competencies in younger students, but there is no equivalent in the university sector.
21. New Zealand universities are beginning to build programmes dedicated to educating our students to contribute to innovation and entrepreneurship and the country is seeing the benefits of these. A survey of our alumni found that they have high levels of involvement in innovation and entrepreneurial activities (The University of Auckland, 2020). Yet, government policy is vital to support the education of these graduates with the aim of supporting the absorptive capacities of firms. Much more could be done with some changes to policy settings and targeted investments in the sector.

## **Policy Recommendations**

22. The establishment, growth and success of frontier firms relies on the knowledge, skills and services for innovation and entrepreneurship supplied by universities. R&D and innovation policies, as well as education policies, greatly affect how universities deliver these ingredients. We offer several policy options that the Commission might explore:

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<sup>2</sup> <https://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-Enterprise/About-E4E#collapsible1>

### Innovation and technology transfer

- **Innovation vouchers:** Used by policymakers in the Netherlands, Ireland and the UK to improve the competitiveness and growth of small and medium-sized enterprises. Innovation vouchers are credit provided by governments to firms to purchase R&D services from universities to introduce innovation.
- **Starting and scaling start-ups:** Universities could launch more start-ups and build clusters. To address this opportunity, the Government could continue to support and expand the programmes it has in place such as the Pre-Seed Accelerator Programme, the Commercialisation Partner Network and the support for Seed and Venture capital, that have proven that they can add value.
- **Larger investments in strategic areas:** Larger targeted investment has greater impact than smaller pots of funding. This approach also aligns with the broader economic argument of a structured approach to strategic prioritisation of policy and resource investment, organised around opportunities where New Zealand can have competitive or comparative advantage and potential, and challenges for New Zealand that have global impact.
- **Review National Science Challenge model:** There is mounting evidence to suggest that the Centres of Research Excellence programme has been very successful in producing high quality, IP rich research. By contrast the National Science Challenge model has been less successful and we suggest a review. There is a case for reducing the complexity and overhead in the system and reducing the number of sub-scale programmes. Further, the Centres of Research Excellence model could be extended.
- **Review R&D tax credit and grant schemes:** Ensure that the R&D Tax incentive is fit for purpose and reflects current research/business realities. These policies may over emphasize science-based research and do not incentivise firms, especially SMEs and start-ups, to engage with universities in social science and business research that could lead to new markets, incremental innovation, and process improvements.

### Human capital development

- **Develop management expertise:** As inadequate management development is acknowledged as a factor in New Zealand's productivity challenge, furthering the education of managers and owners could be encouraged through funding for part-time education and the provision of education vouchers.
- **Support enhanced entrepreneurial education:** Some universities are successfully offering student learning experiences that aim to build an entrepreneurial mindset and skills to the benefit of both students and industry. For example, ideas challenges where students solve real-world interdisciplinary challenges proposed by industry partners, maker spaces, accelerators, and start-up co-location spaces. However, these are funded by small surpluses or philanthropy and therefore difficult to scale. Targeted Government support for such programmes would allow universities to scale such activities.
- **Support work integrated learning:** Work integrated learning helps to develop the work-readiness and transferable skills of graduates. It also increases the absorptive capacity of firms and can result in increased research engagement between firms and universities, and the identification of new business opportunities. However, work integrated learning has increased coordination costs for universities, and firms may need incentives to participate and grow the number of opportunities available.

- **Support a new industry-focused PhD pathway:** Three-year doctoral programmes are not enough in most disciplines and are not the norm in the most productive countries with whom we wish to compete. Government could consider funding an extra year specifying that this is used for programmes to build in experiential and transferable skills components to prepare industry ready graduates.
- **Commercialisation internships:** The inclusion of a commercialisation internship could incentivise industry to co-fund a PhD graduate to spend 6 months working on the commercialisation of an idea in collaboration with an industry partner.
- **Postdoctoral start-up scheme:** Support the development of a national “entrepreneurs scholarship fund” or “entrepreneurial postdoctoral scheme” for carefully selected PhDs to develop their research into a start-up that also includes some buy-out for the supervisor of the PhD research.

## Concluding comment

23. The Productivity Commission points out in its issues paper that a successful New Zealand economy (with greater levels of innovation and productivity, and more frontier firms), will provide New Zealand with “a stronger platform for addressing wider environmental and social challenges, such as shifting towards a low-emissions economy”. Within that context, we highlight the importance of not considering innovation and productivity in isolation. R&D and Innovation policy, and education policies that support the development of human capital, ought to be considered together, and within the context of the complex societal challenges that we face, particularly the need for forging a more sustainable development path.

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