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*This is a submission on behalf of the **Artificial Intelligence Forum of New Zealand / Te Kāhui Atamai Iahiko o Aotearoa** to the New Zealand Productivity Commission's Issues Paper – Technological change and the future of work.*

**Background on the AI Forum NZ:**

Te Kāhui Atamai Iahiko o Aotearoa (Artificial Intelligence Forum of New Zealand - AI Forum) is a purpose-driven, not-for-profit, non-governmental organisation (NGO) that is funded by members. The association was founded in 2017.

The AI Forum brings together New Zealand's community of artificial intelligence technology innovators, end users, investor groups, regulators, researchers, educators, entrepreneurs and interested public to work together to find ways to use AI to help enable a prosperous, inclusive and thriving future for our nation.

The Forum advances New Zealand's AI ecosystem through connections, advocacy, growing talent and collaboration. The AI Forum promotes the economic opportunities raised by AI, supporting great applications of AI and emerging New Zealand AI firms, and also works to ensure that society can adapt to the rapid and far-reaching changes that AI technology will bring.

The AI Forum is part of the NZ Tech Alliance. The New Zealand Tech Alliance is a group of independent technology associations from across New Zealand that work together to ensure a strong voice for technology.

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*The AI Forum have formatted our submission around the questions asked in the Issues Paper:*

**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?**

Technological change is likely to:

- increase productivity and overall wellbeing (as past experience shows us),
- disrupt some current occupations and eliminate some sectors from the economy, and
- introduce whole new industries and new kinds of work involving technology.
- deliver innovative, sometimes transformative, solutions to current wellbeing challenges

We are optimistic that there are myriad opportunities from new and emerging technologies - in particular AI (data, algorithms and models) - to be harnessed to deliver targeted solutions to some of today's gnarliest of policy challenges. This impact could yield a step change in wellbeing that is currently unimagined. (Witness sustained global increases in longevity, health and other wellbeing metrics around the world which would not have been imagined 100 years ago - https://ourworldindata.org/ ). Given that the unit costs of these technologies generally decreases on an exponential curve, a thorough analysis of these opportunities may yield a clear cost benefit analysis for investment to resolve them sooner than otherwise.

**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?**

New Zealand is likely to benefit economically from technology in three key ways:

- staying ahead in areas that support our current strengths (e.g. developing agricultural technology), and
- identifying near future new technological opportunities which build more structural resilience to the NZ economy (eg enabling diversification away from agriculture and tourism income)
- identifying the near future new technological opportunities not yet exploited globally (and investing in R&D to exploit the opportunity)

As a country we need to put effort into understanding the subtleties to be drawn between different "technologies" and how they are expected to interact with the economy and jobs. For example, there should be a distinction drawn between narrow application technologies and general purpose technologies (GPTs) such as AI - both will have different diffusion curves and offer different opportunities for New Zealand.

Focusing on accumulating evidence of which technologies provide the optimum opportunity for New Zealand (and how) rather than just lumping all "technologies" together and leaving it to (largely) overseas market-driven forces to decide how they diffuse is one of the imperatives of this enquiry.

We also need to assess carefully the apparent historical trend of labour being devalued relative to capital needs in light of global economics and demographics. For example, Google's Chief Economist Hal Varian expresses optimism that the value of labour (in the US at least) is about to uptick, largely due to the shortage of skills. (See https://www.youtube.com/watch?v=VLcnN3kLUKI )

New Zealand must also actively participate and contribute to cooperative international efforts to model the global impact of technology diffusion - and perhaps moderate the "race condition" reflex to "catch up / keep up / overtake" international peers. New Zealand - like many other nations - is unlikely to be able to 'catch-up' with technologies already succeeding globally if not already developing/succeeding with them.

At a high level, we are of the view that policies that enable firms to accelerate adoption and application of new technologies are more likely to provide productivity benefits for New Zealand. Current or proposed regulation that slows adoption is likely to slow productivity growth. However, it is also important that people are not left behind - that technologies focus on benefits to people, and that they have the financial and social stability that comes with satisfying work. The question is, are these two aims mutually exclusive, is a balance required - or can we actually achieve both using new solutions?

1. **Are the scenarios developed by the Commission useful for considering the future labour market effects of technological change? How could they be improved?**

   The scenarios are not exhaustive and many others could be envisioned. For example, another scenario could be one where there is significant technological uptake, an initial massive disruption in jobs, but the labour market settles, and after appropriate retraining, into a state with a similar number of jobs as today.

   In reference to Figure 3.2, such a scenario would hover between 1 and 2, but this 5th scenario would achieve those outcomes having got there via a curve that dips into the lower half of the quadrant before rising again towards the right hand side. This illustrates the importance of the temporal dimension in these changes.

   Therefore, the scenarios are useful to discuss as endpoints, but less so as trajectories.

   We feel that the stagnation scenario is least likely and there is little evidence to support it. The experience since the industrial revolution demonstrates that innovation has kept growing at a rapid pace.

   To us, there is a clear winner scenario here - More Tech and More Jobs. An effective outcome of this enquiry would be to conclude this early on, and have policy discussions centre around what actions need to be done to steer towards this scenario.

2. **What other consequences might be expected under each scenario?**

   In reference to Figure 3.2, fast adoption of tech may indeed mean growing inequality within NZ (this is the more tech, fewer jobs scenario), but slow adoption will almost certainly put NZ behind the rest of the world. So it is important to head towards the more tech more jobs scenario.

3. **How might the impacts of each scenario vary across different groups in society or across different locations in New Zealand?**

   There is evidence from overseas (as referred to here - https://theconversation.com/most-of-americas-rural-areas-are-doomed-to-decline-115343) of advances in technology contributing towards a continuing worldwide trend of urbanization and decline in regional economies. Given that future technology-related services are likely to provide higher paying jobs than (say) agricultural services, it would be useful to model whether in New Zealand these future jobs will be concentrated in larger urban areas or be distributed further into the regions.

   New Zealand has a potential automation advantage in the case of agriculture, with the advent of IoT generating valuable data and agricultural AI / robotics improving productivity. However, it may be that without careful investment, lower-skilled rural jobs disappear and near fully-automated farms are run by remote control from comfortable control rooms in cities.

   If jobs do concentrate further into the cities then New Zealand's future employment and social landscape starts to look far more like highly urbanised areas like Singapore (but with an expansive backyard) than our traditional self-image of farmers forming the backbone of the economy and our national identity.

   There may be interventions required to help manage the accelerated decline of rural communities as jobs and young people rapidly displace to cities, as well as managing the reversion of land back to nature.

4. **How should government monitor the impacts of technological change on the labour market?**

   More linked government data systems which help to increase understanding of the links and correlations between education, employment, income (taxation), health and other outcomes and inform more responsive, evidence-based policy - while still providing for individual privacy. One possible way of collecting this data is through a national registry of employment information, maintained by employer data inputs. This would need to be managed to ensure that there isn't duplication of data entry.

The Government could also invest in / purchase analysis and predictions from real time digital twin data and AI-driven models of the economy and labour market - with data included from other economies around the world rather than just New Zealand.

5. **What policy objectives should governments pursue for the labour market of the future?**

   Investment in education on demand including through micro-credentials, financial support for transitions (including in time off work) should be considered. Working with the private sector to incentivise and coordinate training should also be key.
   We also need to upskill teachers, educators, and train more technology educators (e.g. teach education to those from technology courses not technology to those from teaching courses). And also encourage and fund more people into technical (STEM) education and fundamental skills that support such fields. This needs to start early in the education system, so encouraging technical people into teaching is important to the success of this.

   Consideration could be given to a “universal education basic income“ model. This might be a lifelong annualised personal education budget which can be saved up over several years and enables people in all lines of work to fund productive time out from their careers. (Whether as an extended sabbatical or just 1 day off per week, for example). This flexible model could enable people to use the funds as much for living / travel costs while learning as for approved education provider fees - facilitating people to self-direct their own learning efforts in the age of ubiquitous (often near-free) online knowledge and resources. (Arguably the scarce learning resource in future won’t be getting access to education and knowledge, but the ability to take time out from paid work to invest in one’s own skills and training).

   Consideration should be given to more closely monitoring what is happening in other economies around the world - and understanding the global trends driving change which affects New Zealand.

6. **What are the potential tensions between different policy goals? How might such tensions be best addressed?**

   Principles of intergenerational equity will be needed to balance out the increasing value of skills and education for younger citizens against older generations who perhaps will not economically benefit so much from them. This is a tension that exists with all policy questions however is accelerated as the pace of technological adoption increases.

7. **For each of the future scenarios, what policies would provide the best mix of worker protections and low barriers to workforce participation?**

   Regardless of the individual scenario there appears to be more people undertaking work in the ‘gig economy’. This presents a number of issues for their ability to have secure and

sustainable employment. We need to ensure that regulatory settings reflect this (suggested policies outlined below in Q.8)

The growth in portfolio careers can have positive benefits for New Zealand, with a greater diversity in skills and experience being shared across a greater number of businesses, and with government.

8. **What are the likely consequences of a large-scale increase in the proportion of independent contractors in the workforce? How should government respond to any negative consequences?**

Insufficient retirement protection which may mean we need to more strongly incentivise independent contractors to investment in retirement savings.

For example, being an independent contractor with one or more clients could be made as simple as being an employee. This might mean reducing the complexity / exclusivity of employment obligations while also designing equivalent safety nets for contractors. There could be tax incentives for individuals operating as independent contractors which offset the loss in employment benefits.

Continued simplification of tax calculation for independent contractors so that tax on net income can be paid incrementally and seamlessly as calculated by approved independent software package without the need for an expensive third party accountant.

Making movement from being an employee to an independent contractor (and back again) seamless for those who want to enable more fluidity in their careers. Effectively in these cases being an employee would be equivalent to being an independent contractor with just one client.

Ensure that long-service employee benefits which have been accrued can be carried through to future re-employment - in the case of someone leaving a company to pursue another job elsewhere and then returning later on. (This would likely have a positive productivity impact, encouraging people to pursue new challenges rather than stick in the same role due to the opportunity cost).

9. **What types of worker protections might be required where technology provides employers with a growing ability to monitor staff or discriminate against some people?**

Clear privacy legislation, codes of conduct and recourse to immediate legal action where employee privacy is breached.

Consider some sort of mitigation away from the excessively one-sided exclusive nature of employer-employee contractual relationships - for example recognising that an employee

has rights to keep his/her work products, emails from his/her time of employment after termination rather than all belonging to the employer (on the understanding of continued confidentiality obligations).

Application of existing anti-discrimination law in the case of new technologies being used to enable new types of discrimination.

10. **Apart from a potential increase in gig work, what other new work arrangements are emerging, or are likely to emerge in the near-future? What are the implications of these work arrangements, and what response from government might be required?**

    There are cases in the US of individual students selling “stakes in themselves” - effectively a share in their future income. See https://www.bloomberg.com/news/articles/2019-04-09/college-grads-sell-stakes-in-themselves-to-wall-street

    People may participate in distributed-ledger (eg blockchain) based marketplaces for labour which operate in digital token based remuneration, cross borders and hence make application of any particular jurisdiction employment laws or taxation regimes difficult to enforce.

11. **How might minimum wage settings affect incentives on firms to adopt labour-replacing technologies? What changes to minimum wage policy might be appropriate under each of the future scenarios?**

    New Zealand wages are relatively low compared to other OECD countries, so there is currently low incentive to replace labour with automation. This means that technological adoption in NZ could be slow. This is a problem, because fast movers stand to gain the most according to most economic modelling. The connection between wage levels and investment in automation should be explored further - for example would substantially raising the minimum wage over time act to stimulate investment in automation, and hence enhanced worker productivity. (I.e. a tool to engineer policy to aim for Scenario 1). [As noted above, this point is important, there are 4 scenarios illustrated as possible futures, but selected policies also in part determine the scenario that eventuates].

12. **What changes might be required to minimum notice periods under each of the future scenarios?**

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13. **How effective is the income support system in assisting different groups of people? What specific challenges might arise under the future scenarios? What changes to the system might be needed to address these challenges?**

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14. **What are the advantages and disadvantages of the following policies under each of the future scenarios - universal basic income, unemployment insurance and redundancy compensation schemes? What other income support policies are worth considering?**

    It can be argued that New Zealand already has a Universal Basic Income (Super), but eligibility for this is discriminated based upon age. In light of the potential changes in value of labour due to automation, principles of intergenerational equity will need to be considered as our country's population ages further and the burden on younger income tax paying generations to fund this ever expanding obligation through work continues to grow.

    As in Answer 5 above, A "universal learning / education income" could be considered to increase individuals' investment in their own training and skills and go some way to reducing intergenerational inequities.

15. **How might the effectiveness of active labour market policies change under the future scenarios? What changes would be needed to the design of active labour market policies under each scenario? What other active labour market policies might be needed?**

    Active labour market policies might be needed to encourage skilled people into industries other than finance and big tech, which at present are absorbing 60% of people with AI and machine learning skills. If we want to use advanced technology to solve all kinds of societal problems then we will need to encourage talent into all kinds of sectors.

16. **Are there particular areas where occupational regulation makes it harder for people to shift jobs or adjust to technological change? Would this change under each of the future scenarios?**

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17. **How well do the current outcomes from the education and skills system position New Zealand to respond to changing technology and different future scenarios?**

    Poorly. As outlined in Q5, NZ needs to train a lot more technical experts. This means a greater emphasis on mathematics, science and computer science at school so that these options remain open to school leavers. Often courses are effectively not available to people because they earlier stopped taking the recommended subjects at NCEA level.

    For Computer Science, anecdotally the main problem is that students opt for easier (or perceived easier) options. Technical subjects are difficult and students can get turned off all such subjects by, for example, bad experiences in high school maths.

18. **What changes to immigration policy to address skills needs might be required under different future scenarios?**

    Immigration settings are currently largely adequate, but more explicit listing of the skills needed could be made (e.g. ‘machine learning’), and fast tracking of immigration for those with technological skills. Consulting with MBIE on the content and wording of the Skills Shortage Lists during the current or next update could raise the profile of AI and automation expert opportunities in NZ

19. **What, if any, further measures are needed to improve skills among adults with low proficiency to enable them to successfully participate in any future labour market?**

    If technological training is not possible (due to never having taken mathematics, coding, science, etc) then offer training in service and human skills. For example in aged care and environmental protection. Industries that will grow as we continue to age, and continue to put more strain on the environment.

20. **What evidence is there of digital divides in New Zealand? What are the consequences for labour market participation and which groups are most disadvantaged?**

    There is an issue with diversity in the tech sector. In particular the participation of women, Maori and Pasifika. Investment in education, at an early stage, is necessary to encourage more people into the sector.

21. **What, if any, further measures are needed to address any digital divides in New Zealand?**

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22. **What factors underpin New Zealand’s apparently poor matching of skills with jobs? To what extent are mismatches a problem?**

    New Zealand is a small labour market and as with any societal organisation (throughout history) the larger the group the more specialised the labour. So this mismatch is a function of scale. This means it is hard to fix. Instead we should exploit this advantage.

    It means that people are able to quickly change focus. So if we spot a future technological opportunity, we should rapidly invest in diverting a portion of industry/labour to this opportunity.

    The government needs a 20 year vision. For example, compare with the US focus initially on the internet (1970 - early 1990) and now on nanotech. We could focus on agricultural technology as non-animal food sources will be a massive market in the future.

There are also a number of relatively simple, practical considerations which could rapidly increase the efficiency of matching skills with jobs, given our low population density and long distances between centres:

- Drive a nationwide culture change to encourage remote video conferencing rather than face to face meetings - change “catchup over coffee” to “catchup over Zoom”. This would help to burst regional skill bubbles and also reduce carbon emissions from needing to catch flights / drive for in-person meetings.
- We can also drive cultural change to enable more people to work remotely where the job does not absolutely require being present in person.
- Encourage co-working spaces in regional centres to facilitate more remote workers, including working with regional government to utilise their spaces more effectively.

**23. What future scenarios are most likely to accentuate poor matching? What policy options are available to improve matching in the New Zealand labour market?**

Scenarios 1 and 2 are most likely to accentuate poor matching. Scenario 1 because there won’t be enough technically trained people for the work on offer. Scenario 2 because there won’t be enough jobs in general (so most people will likely be overqualified for their job if they have one).

**24. How well does New Zealand’s education and training system reflect the changing skill needs of industry? Is the education and training system able to effectively respond to changing technology and different future scenarios?**

One New Zealand school principal has told the AI Forum that he perceives low alignment between formal education and training and needs of industry. He thought this was particularly the case at secondary school level and suggested that employers should make more effort to get together and work with educators. Government could facilitate this through their power to convene.

The new Digital Technologies curriculum 2020 needs a lot more support. Mostly this is training for teachers to actually be able to deliver the tech vision. One possibility is to instigate programmes where tech companies help to teach in the classroom in conjunction with current teachers until a large cohort of additional tech educators can be trained and deployed.

There is a global shortage of AI skills and talent: “Availability of talent and access to training data are AI entrepreneurs’ key challenges.” (https://www.mmcventures.com/wp-content/uploads/2019/02/The-State-of-AI-2019-Divergence.pdf )

Another option is the response to the global AI talent shortage by a number of large international tech companies who have been priming the talent pipeline by offering free

courses online. For example, Microsoft has created an ‘AI School’. These free courses are something that NZ talent could utilise, but perhaps we need to arrange formal recognition of these courses in NZ.

Another skills gap is the soft skills/critical thinking/communication skills area. These are in demand from employers and will become more important as we see increasing automation of routine tasks. The AI Forum's working group on Growing the AI Talent Pool has heard from tertiary providers that soft skills courses are not popular with students. One solution to this is to integrate soft skills development into learning methods (lectures, assignments) for technical subjects. (Or another alternative would be to require technical skills from those who more naturally tend toward soft-skilled fields (e.g. humanities)).

Overall, there are not any easy answers. Tertiary level education in NZ is demand driven by students. Universities put more resources into areas where more students want to go. Such a system has many benefits, but it does cause difficulties and there is little direct action the NZ government can take to affect what students decide to study. Other systems are possible. For example, university places are limited and funding is agreed in advance in different degree programmes and the programmes are capped. Or target the free-fee scheme to particular desired outcomes.

**25. What programmes exist to support people to retrain, upskill or adapt to changing technology, and how effective are they?**

Most universities have a Diploma for Graduates that typically takes 1 - 1.5 years of full time study and are essentially retraining degrees. There are also some industry aligned programmes such as the SIGNAL ICT Graduate School. These programmes are effective, but they require significant investment in time and lost earnings on the part of the student. This is very difficult for students who have other responsibilities.

**26. How well equipped is New Zealand’s education and skills system to support people to adapt to technological change over the course of their careers?**

Not sufficiently equipped. Tertiary education tends to ‘front load’, i.e. train people at the start of their careers then forget about them. We need more courses focused on mid-career and upskilling. Any skill that is now suddenly in-demand among industry should have a corresponding short tertiary course (e.g. 3-12 months) to upskill those who are already very skilled (hold postgraduate degrees) but not in this specific skill.

Paid education leave should be considered. This investment by government could contribute to attaining Scenario 1 (and the associated boost to wellbeing). The payoff is there, but requires investment and patience. The payoff for autonomous technology is negative for the first few years. Government needs to realise that losses might be needed at first (see economic modelling by McKinsey Global Institute and PWC).

We also support the move towards micro-credentials being recognised by the TEC. However, tertiary providers will need more incentive to offer such credentials and industry may need more incentive to encourage staff to take-up this training.

**27. How might the incentives for firms to invest in staff training change under each of the Commission's future scenarios? Under which scenarios would there be a case for greater government investment in firm-based training?**

Scenario 1 (see answer immediately above). But note also the point above that the policy choices, i.e. investment choices, also help to bring about the scenarios. So we shouldn't just wait to see which scenario eventuates, we should be actively aiming for Scenario 1, which is the clear 'winner' of the 4 scenarios presented. However, we need to understand the dynamics through time of how we get from here to there.

**28. What changes are needed to provide prospective students, including adults and those already part-way through a career, with the skills needed to make informed decisions about education and careers?**

Two suggestions:

(1) a fees-free programme for mid-career people to retrain or upskill, even if they already have engaged with Tertiary education before.
(2) As previously mentioned, a "personal learning account" / "universal education income" which enables individuals to fund their own learning throughout their life.

**29. Which barriers to competition and investment should be priorities for reform in a government innovation strategy?**

Fundamentally this is where long term culture change is required. New Zealand's business and government leaders need to be more educated about and incentivised to make, investments into innovation,while being less risk averse to potential failures.

Incentives to continue increasing the quantity and diversity of venture capital investment in New Zealand should be explored. Changing terms of reference of sovereign wealth fund (NZ Super) and Kiwisaver funds to invest a proportion of their funds under management into a domestic venture capital asset class, would be an avenue to explore.

Continue to review the effectiveness of current tax credit policy aimed at increasing R&D and if it is effective, consider increasing the tax credits further.

Re-look at the Financial Markets Conduct Act 2013 to ensure that the revised definition of "Eligible Investor" is not overly exclusionary to people who may want to take part in early stage investment.

30. **Are there particular regulations or areas of regulation that will need to be updated to maximise the benefits from technological change? Do these areas differ, depending on the future scenario?**

    There appears to be a significant tension between the way that government is operationally structured into historically-evolved siloes and the modern need for more seamless, joined-up government services. At the heart of this, government-stewarded data needs to liberated from the current siloed operational model, while at the same time ensuring that citizen privacy and other data security / governance concerns are adequately and consistently addressed.

    Recent work from the Open Data Institute (https://theodi.org/) in Europe is looking at new models for Data Trusts which may be a potential direction to explore balancing the need for data protection with the need for joined-up, efficient and effective digital government services.

    Unless this structural inefficiency within Government is brought out into the open, analysed more deeply and adequately addressed then New Zealand Government will continue to struggle to deliver the quality of services which its citizens expect. (This should hopefully be addressed, at least in part, by the current review of the State Sector Act). It will also struggle to use new technologies such as AI and machine learning to leverage publicly stewarded data at scale to support more evidence-based policy.

    For a useful commentary on data related regulation, please see Data Driven Innovation, Sapere 2015, p41-58.

    For our comments on Copyright Reform, please see the AI Forum's 2018 report *Artificial Intelligence - Shaping A Future New Zealand*, page 86, recommendation 6.3.3: Review Copyright Law with respect to potential barriers to data use: The current review of New Zealand's copyright law should consider flexible exceptions to remove New Zealanders' perceived competitive disadvantage in respect to text and data.

31. **What changes, including to government funding for R&D, might be needed to improve the returns to firms from innovation?**

    Refrain from forcing researchers to compete with each other for grant funding. Try the 'everyone gets a slice of the pie' approach, but base it on milestones. Every time a research group achieves something interesting/useful for industry then distribute the next allocation of funding. This distributed portfolio approach is arguably less risky than massive one-off investments in winning proposals.

    This would work both for the research sector (universities and CRIs) and for industry. Funding many small grants incrementally may produce better results than funding a few large grants.

Additionally, the government could explore how to:

- Stimulate better access for industry to publicly funded research in New Zealand (for example that publicly funded research be “open source” by default)
- Encourage researchers to take time to work directly in industry
- Increase funding for foundational research - we cannot predict what will be successful and foundational research has broader industrial applications.
- Explore funding for use-inspired basic research. At a basic level, current funding is on a foundational-applied split. Marsden largely funds foundational research. MBIE Endeavour Fund funds applied research and often requires a pretty close link to industry. There is less obvious funding for use-inspired foundational research (see https://theconversation.com/tracing-the-links-between-basic-research-and-real-world-applications-82198). Indications are that this sort of research leads to both important foundational results and new innovations and industries.

**32. What steps should be taken to promote technology transfer and build absorptive capacity in New Zealand firms?**

Upskilling of company managers and directors to understand technology and associated investment cases.

Upskilling of people with technical skillsets in soft skills, people management and business management.

Increasing the opportunities for career paths to executive management and boards for those with technology sector career backgrounds. For example, encouraging more internal promotions of technical skillsets to executive leadership positions. Encouraging more of a leadership voice for “digital natives”.

**33. What steps should be taken to strengthen the international connections of New Zealand firms?**

- Increasing the number of New Zealanders visiting international markets.
- Increasing the number of overseas individuals visiting New Zealand.
- Increasing New Zealanders’ exposure to overseas markets, business practices and cultures.
- Encouraging more remote communication and collaboration (eg videoconferencing) to build relationships without physical travel. (Will have a carbon accounting advantage too).
- Callaghan and others have recognised that large firms, particularly those in the technology industry, are significant smart investors in R&D. Building productive relationships with these companies helps to attract smart investment and highly skilled talent to NZ.