OTAGO INNOVATION LTD SUBMISSION ON TE ARA PAERANGI FUTURE PATHWAYS CONSULTATION PROCESS

We are appreciative of the opportunity to provide a submission to the Te Ara Paerangi Future Pathways consultation process. A government's commitment to forge a research, science and innovation system that contributes to its nation is crucial, and none more so than in Aotearoa New Zealand.

About Otago Innovation Limited (Otago Innovation)

Otago Innovation is the University of Otago's technology transfer office (TTO). We are a specialist commercialisation office (commercialisation is our primary goal and raison d'être) that has been in operation for just over 20 years. TTOs are the bridge between science and business, where staff have amongst other things well-honed skills in market validation, intellectual property management, academic and industry communications, and commercialising publicly funded research. TTO professionals are embedded within the research, science and innovation system (RSI) and are also becoming more involved in assisting universities and principal investigators with funding applications, non-monetary type initiatives that support the broad university environment and increasingly identified by O'Kane et al 2021[1] as "pivotal cross-level brokers within entrepreneurial and innovation ecosystems." Our staff has a combined experience greater than 55 years, and a strong acquaintance with, and participation in, Aotearoa New Zealand's commercialisation environment.

We have had the distinction of holding contracts for the PreSeed Accelerator Fund since the fund's inception, and are seeing some significant returns on our previous licencing and spinout efforts. We are a stakeholder in KiwiNet and participate in and benefit from a number of Return on Science investment committees supported by the Commercialisation Partner Network(CPN). We have taken a leadership role in matauranga Maori, particularly within the University and Crown Research Institutes (CRI) commercialisation ecosystem, and are often sought out for advice and guidance on indigenous intellectual property matters. In all, we feel we are well placed to respond to the MBIE Future Pathways Green Paper ("Paper"), though we approach it specifically from a TTO perspective and associated lens.

While we are extremely supportive of change, we do not advocate change for change sake. However, because not all of the issues raised in the Paper are directly related to our primary objective – commercialisation – we have chosen to respond only to those questions for which we believe we have the necessary understanding, experience, insights and expertise to provide an informed opinion.

[1] O'Kane, C., Cunningham, J., Menter, M., & Walton, S. (2021) The brokering role of technology transfer offices within entrepreneurial ecosystems: an investigation of macro–meso–micro factors. The Journal of Technology Transfer, Springer, vol. 46(6), pages 1814-1844, December.

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Research Priorities

KEY QUESTION 1 – What principles could be used to determine the scope and focus of research priorities?
In our opinion, two separate types of research priority should exist — (1) priorities that shape society and (2) priorities that make the most use of available natural resources, natural advantages, human capital, capabilities, and knowledge.

Priorities that shape our society should be focused on growing knowledge and awareness and are, in the main, for public or societal good and benefit. Examples may include environmental monitoring of greenhouse gas emissions, air pollution, waterways, mining residues etc, as well as public health initiatives such as smoking cessation and healthy housing activities. Because these goals are less likely to yield true economic value, business cases trying to demonstrate value are largely irrelevant. They should be viewed for what they are; for the greater welfare of and benefit to society, and defended on the grounds that they are necessary for a vibrant, secure and dynamic society.

On the other hand, objectives that capitalise on Aotearoa New Zealand's natural resources and natural and human resource advantage have the potential to yield large economic returns. The value proposition of one project against another should be quantifiable and comparable to other alternative opportunities. This will aid in the selection of which initiatives to support, when financial resources are limited, allowing for more objective decision-making.

In contestable financing rounds, the two sets of priorities should not be pitted against one another. They serve very distinct goals; each is deserving in its own right, but is dissimilar enough that it might be examined inside its own priority setting, rather than across priorities, as it is today. By way of example, a programme of work to determine the ability of our natural resources to absorb carbon dioxide (allowing for baseline data to be determined, and changes over time monitored) should not be competing for funding with a technology to sequester carbon dioxide, as the latter may provide economic and financial benefit to investors and other interested parties (such as iwi).

Te Tiriti, matauranga Maori and Maori aspirations

KEY QUESTION 5 - What are your thoughts on how to enable and protect mātauranga Māori in the research system?

The University of Otago is a university with a strong emphasis on biomedical research. Technology transfer is how new medical innovations progress from the laboratory to the marketplace and ultimately to the general population. While the academic inventor’s contribution cannot be overstated, it is the job of the university’s TTO to guarantee that intellectual property rights for new innovations are handled and used effectively.

Biomedical research increases the likelihood that patients may benefit from these medicinal therapies. Additionally, it increases the probability that patent-protected ideas will be evaluated through clinical research trials and ultimately commercialised, implying that they will generate a greater financial return for the university. Over the last 25 years, small molecule drug research has revealed that 5% of medications are derived from natural products (for example, plants), 27% are derivatives of natural products and natural products inspire one-in-three synthetic drugs. However, nearly a quarter of all plant-based medications contain at least one component derived from Indigenous people’s expertise. Indigenous people’s knowledge contribution to pharmaceutical goods may be as high as 60% in rich countries and up to 85% in underdeveloped ones, with around 80% of indigenous medical knowledge appropriation occurring through academic literary database research and screening.

Aotearoa New Zealand is a natural repository of indigenous species, and the patenting of inventions derived from indigenous species is not uncommon. In its response to Wai 262, the Waitangi Tribunal recommended reform across three interrelated areas on the research and commercial continuum — bioprospecting, genetic modification, and intellectual property. None can be viewed in isolation without impacting on the other. All three are part of a unified, interconnected RSI system that begins with scientific enquiry and (occasionally) concludes with the commercialisation and protection of an invention through the intellectual property rights regime. If the Paper is looking at the research sector, it must also look at its commercialisation.

To protect and enable mātauranga Māori in the RSI system and avoid misappropriation, it essentially comes down to who controls mātauranga. Regarding taonga species, Wai 262 claimants exemplified their concerns across three issues (1) unlawful use of mātauranga Māori in bioprospecting research, leading to unauthorised scientific or commercial use of genetic and biological resources; (2) interference with taonga's whakapapa through genetic modification (which Māori find offensive), and (3) leveraging the intellectual property rights regime to exploit rights in ways that exclude kaitiaki and damage the kaitiaki-taonga connection. The Treaty of Waitangi requires the Crown to maintain iwi and hapu authority over their taonga and knowledge to fulfil their kaitiaki responsibilities. That requires Maori to have veto rights over the use of mātauranga Maori across the entire research-commercialisation continuum. Enabling and protecting mātauranga Maori may be exemplified through —

- A bioprospecting framework giving researchers guidance and rules on engaging with Maori and what steps are required to ensure mātauranga Māori is enabled and protected.
- University intellectual property policies to reflect the importance of mātauranga Māori, Treaty of Waitangi and, if appropriate Wai 262.
- Access and Benefit Share agreements between universities and kaitiaki outlining prior informed consent and mutually agreed terms on the use of mātauranga Māori in research and commercialisation.
- Ideally, changes to IP law to accommodate Maori veto rights over mātauranga Māori in the commercialisation of 'works' derived from mātauranga Māori would align with the proposed changes to the research science system.
- A taonga registry identifying taonga works, taonga derived works and specific taonga species of importance for each iwi and hapū. While it would not capture all taonga, international evidence suggests it does curb the misappropriation of traditional knowledge to some degree.

KEY QUESTION 6 - What are your thoughts on regionally based Māori knowledge hubs?

As a "go to" for researchers and commercialisation professionals to engage with, regionally-based Māori knowledge hubs make sense. However, mātauranga Maori is kaitiaki specific (there is no single te ao Māori); representation of each hapū, runanga would be essential to include in the knowledge hub. Resourcing of the knowledge hub, availability of kaitiaki and appropriate compensation for kaitiaki would be only fair and reasonable.

Funding

KEY QUESTION 7 – How should we determine a core function and what constitutes a core function and how should core functions be funded?

As noted in 3.1.1 of the Paper, weak links between funding and strategic research needs have been identified. As outlined in our response to KEY QUESTION 1, we advocate that a single process comparing incomparable

priorities and projects should be abandoned. Rather than that, social good and commercially viable initiatives should be considered and supported separately, guaranteeing that non-commercial but societally beneficial opportunities are never pitted against commercial opportunities, as their objectives may be diametrically opposed.

It is also noted in 3.1.2 that unproductive competition is evident. We concur with this observation. Presently, grant applications have a requirement for NZ-based industry engagement to be demonstrated. This is problematic in our opinion, as many Aotearoa New Zealand enterprises are ill-equipped to capitalise on a commercial opportunity that may arise as a result of a programme of work, let alone be able to do so worldwide. Oftentimes there is a need to have more than one commercial partner engaged; again, this creates unhelpful competition between firms, neither of which might we well placed to commercially exploit the opportunity.

We have similarly observed both interspecific and intraspecific competition not only between individual tertiary institutions, but also with and between tertiary institutions and CRIs. As CRIs appear to require additional income streams to support their core research activities, they oftentimes offer their services to tertiary institutions competing for the same funds. Ultimately the tertiary institution which is prepared to pay the CRI the most will win their services.

Core functions seems highly relevant to CRIs, and to a large extent are reflected through the names a number of them have adopted. For example: AgResearch, Plant & Food, Geological and Nuclear sciences etc depict a domain that they operate within. By concentrating knowledge in certain areas and seeking to minimise duplication (perhaps through the use of disincentives to avoid straying into each other's domain), efficiency gains may be realised. Clarifying CRIs' expectations for commercialisation would also help in this aspect, as each appears to have a very different perspective on their need for, right to, or capacity to pursue commercialisation.

KEY QUESTION 8 – Do you think a base grant funding model will improve stability and resilience for research organisations, and how should we go about designing and implementing such a funding model?

A way to reduce the 'undesirable' behaviour referred to earlier in section 3 of the Paper would be through the funding of CRIs under a base funding model. Granting CRIs base funding and prohibiting them from competing on contestable funds appears to be a reasonable answer to this dilemma. The base funding would need to be sufficient to deter them from seeking external funding, and they would be obligated to support the research program(s) that most closely align with their core experience and expertise. Ideally, at little or no cost to the contractor, as they will have already been compensated through base funding for provision of this input. This would also avoid the issue of the highest (tertiary institution) bidder securing the CRI's assistance.

A consistent amount of basic support for universities would also enable them to prioritise their activities rather than spreading them thinly as appears to be the situation currently. Building on expertise to ensure continuity of service provision in key areas (such as health) would then become a possibility. If there was a certain amount of base money for each academic, then the contestable grant funding might be used entirely for outsourced capabilities, seasonal staff, consumables and other expenses, assuming that the academics' base salaries were already covered.

This could have the potential to deter competition for research funding which would appear oftentimes to be motivated by a need to retain staff, rather than undertake truly valuable research. Consequently, retained staff then have a greater chance of securing additional research money to advance valuable projects and programmes.

A significant problem with base financing would be to guarantee that it is insufficient to allow low-performing staff to grow complacent since their wage is always paid regardless of performance. While some critical key performance indicators would still need to be maintained to ensure basic funding was appropriate for a given individual, they should not be as onerous as applying for grants is now.

This applies equally to CRI employees.

Institutions

It is noted in 4.2.1 that a reasonable amount of work of CRIs is not strictly focused on public good …. and that for some a substantial amount of income is secured via commercial routes. It would seem from our observation at various commercialisation forums that there is uncertainty around what any given CRI is permitted to do commercially (for example some seem to believe that they cannot form a start-up company, yet others actively pursue it).

Our preference would be for any organisation that receives government financing for programmes considered to be economically beneficial (as opposed to societally beneficial) to be totally committed to commercialisation of those outcomes. It would be ideal if they were mandated to demonstrate their commitment to such through the establishment of a dedicated team or forum, and by allocating appropriate financial and human resources to do so. For those who lack that capability or who do not intend to formalise a role inside their own organisation, the CPN may be well placed to direct them to an entity that they could contract to do the work on their behalf.

There should not be a standardised approach to commercialisation; none truly exist. When commercialising an invention, there is a conventional view that the licensing route is generally less risky than a spin-out, but there are a number of methods of transferring technology to third parties, and no one approach fits all. Fundamentally, the difference comes down to whether the intellectual property owner or a new company takes on developing the technology. The outcome is a balance of decisions made by the supply side (inventors, owners) and the demand side (companies, investors).

It is evident from attempts overseas to centralise commercialisation functions that they do not work either. Recently, the University of Queensland's UniQuest (a TTO) established itself as a service provider to numerous Australian universities. This failed to yield results, and has arguably had a detrimental effect across the entire ecosystem. The respective entities are now rebuilding their own in-house capabilities.

KEY QUESTION 9 – How do we design collaborative, adaptive and agile research institutions that will serve our current and future needs?

Current literature and our experience of the TTO space has found that the most commonly stated impediment to commercialisation is the cultural divide between the TTO, academic scientists, and industry. A key success factor for TTOs is a strong university culture of research, innovation, and entrepreneurship, but it needs to be embedded across the entire RSI system. Universities and industry are uneasy partners. Academic researchers value their freedom and independence, business values secrecy when it comes to commercialisation.

It seems to us that the options to create collaborative, adaptive and agile research institutions that will serve our current and future needs are achieved either through (1) a centralised system or (2) a decentralised system or (3) a hybrid of both.

In our experience, currently (3) already exists. A centralised support might be seen to benefit those organisations too small or insufficiently resourced to undertake the function themselves. Those entities can and probably should either be required to develop the skill and expertise for themselves before they can receive government funds, or contract a well-equipped entity to act on their behalf.

Autonomous, well-resourced TTO's are likewise dedicated to supporting colleagues across the RSI continuum, but are equally less reliant on a centralised system. The reason is obvious, universities (somewhat like CRI's), tend to be domain specific – Otago, biomedical and physical sciences; Auckland, biomedical, bioengineering and engineering; Canterbury, engineering; Lincoln and Massy, agriculture etc. thus have and require domain-specific needs and support. As such, they have developed the requisite skills and expertise and most importantly trusted relationships to serve their organisation; something that would be extremely difficult to do via a centralised system.

Technology transfer will occur only when university faculty and business and industry representatives collaborate for mutual benefit, and devise mechanisms to resolve the inherent conflict between openness, a characteristic of the scientific community, and privacy/secrecy, a characteristic of the industrial world. As a result, collaboration between industry and academia cannot be compelled, and cultural differences must be acknowledged and we must do it within our own organisations first, before cross-organisational collaboration can succeed. In that, while we can learn from offshore practice and adapt those learnings endemically, whatever the solution is, it needs to be Aotearoa New Zealand-centric and account for the unique ecosystem that is Aotearoa New Zealand.

KEY QUESTION 10 – How can institutions be designed or incentivised to better support capability, skills and workforce development?

We suggest two considerations – (1) industry-accredited PhD candidates and (2) minimise the risk to academics wishing to transition from academia to industry.

To begin, industry-accredited PhD programmes (such as those recently offered in Australia) may be a good first step. While it is obvious that many individuals who complete PhD studies will never pursue a career in academia, many of them are perfectly suited to careers in industry. By establishing and formalising industry-led PhD programmes, the proper individuals will be able to transfer into industry following completion of their studies.

Furthermore, the current system particularly in tertiary institutions, is not conducive to academics moving from academia to industry (especially start-up businesses derived from their research outputs). A lack of job security, and the risk of losing it all by moving from academia to a start-up is a risk too great for most to take. A transitional phase might minimise the risk. It might be worth exploring the potential for industry-led sabbaticals for qualifying academics to move from their academic post into a start-up for a period of time. If within the defined period of time the venture fails, or the academic decides it is not for them, they can fall back into their tertiary institution role. On the other hand, if they enjoy the new environment, they may want to go from academia to the business world. The critical point is to allow for exploration of the opportunity, as it will likely incentivise more academics to try a start-up venture and generate value for Aotearoa New Zealand in the process.

KEY QUESTION 12 – How do we design Tiriti-enabled institutions?

See our response to KEY QUESTION 5, which outlines practical steps to consider.

KEY QUESTION 13 – How do we better support knowledge exchange and impact generation? What should be the role of research institutions in transferring knowledge to operational environments and technologies?

Nearly 75 per cent of the world's most creative ideas come from universities, many of which are medical technologies. Inventions such as the world's first surgical procedure under anaesthetic, x-ray machines, ultrasound technology, the contraceptive pill and Magnetic Resonance Imaging were conceived in universities. While many of these inventions aim to make our lives easier, healthier and more enjoyable, universities also seek to exploit these discoveries commercially.

Commercial exploitation in universities is done through technology transfer, which is how new medical technologies, like those above, move from the university laboratory to the marketplace and eventually to the benefit of humanity. The role of the academic inventor cannot be underestimated, but it is the responsibility of the university's (TTO) to ensure that intellectual property rights for new technologies are appropriately handled and exploited. Moving IP ownership away from Institutions would complicate this significantly.

As indicated under the Institutions heading, having Tertiary Institutions and CRIs commit (mandated) to knowledge exchange through the pursuit of commercialisation would be a way of ensuring impact.

In broad terms, inventorship establishes who has the right to file for a patent, ownership establishes who has the right to exploit the innovation, and beneficiaries get recompense for their contributions to the inventions but may or may not be inventors or owners (who too are beneficiaries). University ownership of inventions, like those above, derived from publicly funded research funds in Aotearoa New Zealand is characterised through three instruments (1) the Master Investment Contact with the New Zealand Government, (2) the university intellectual rights policy and (3) the Patents Act 2013. To achieve the outcomes as outlined above, ownership needs to vest with the university or CRI.

Having governments procure ownership of the outcomes of the research they fund will likely, for the most part, inhibit impact. It is commonly known that many government agencies claim ownership of intellectual property (IP) arising from publicly funded research (eg. ACC, MoH) yet we are unaware whether they are able to do anything with the resulting IP. The best place for the IP to reside is with university and CRI TTOs, and in private venture when they acquire the rights to it from the TTO. Along these lines, the Bayh-Dole Act 1980 was enacted in the United States to move ownership from funding agencies to Institutions. It was noted that prior to the Act being passed, little commercialisation activity occurred, however, post its passing patenting and licensing activity accelerated.

Any system developed needs to be home-grown. Aotearoa New Zealand is a unique environment and operational ecosystem, so simply transplanting something deemed best practice elsewhere in the world is very unlikely to work here, primarily because there are unique aspects in the other part of the world that ensures their system works (for them).

There are already significant incentives within tertiary institutions for academics to participate in knowledge exchange via commercialisation. Most all tertiary institutions have adopted a 1/3, 1/3, 1/3 benefit share scheme, which sees inventors formally benefit when a venture is successful. The fact that the entity bears all cost and there is no employment risk or financial cost to the academic, seems to ensure this is not an impediment.

Unfortunately, the same does not apply to CRIs, and in most cases CRI employees are forbidden to receive benefit from knowledge exchange via commercialisation. There needs to be parity in this regard if the two types of entities are to continue working together, as it is grossly unfair that a university academic will receive financial and non-financial benefit but a CRI employee cannot. This has, and will continue to create an awkwardness

amongst collaborating teams to the extent tertiary institution staff have tried to share their own benefit with CRI counterparts, only to find it would be illegal for the CRI employee to accept it. We have experienced this issue firsthand.

As indicated previously, the government support available for commercialisation is better now than it ever has been. There is a continuum of support from pre seed funding to venture investment. There is a fine line between having enough money and having too much money in the system. A scarcity will compel prioritising, and is accepting of the fact that some worthwhile opportunities will be lost. Undoubtedly, excessive resources risk being spent on worthless or sub-par initiatives, simply due to the availability of too much money.

It appears to us that there is insufficient resource in some institutions to support commercialisation, yet all entities should be required to support it if they receive government funding. To this end it could be considered to fund a base level of commercialisation activity with new money to all entities, and the balance be supported through a combination of the entities own funds, PreSeed Accelerator Funds and private equity.

Alternatively, those entities who elect not to resource commercialisation should be required to engage with and work through an entity who does. Again, we must stress that centralisation is not being proposed here.

One way the resourcing issue could be addressed is by adding new and additional funding (say 10%) to every grant fund awarded to be allocated toward supporting commercialisation in conjunction with the TTO. This will ensure that there is at least some base funding to explore the commercial merit of the outputs of a given work programme. Clearly, in line with our response to KEY QUESTION 1, this would not necessarily apply for societal good funded projects and programmes where commercial drivers are not the objective.

A question is posed in section 4.6 as to whether there should be alternative knowledge exchange approaches. It questions the use of licensing and spinouts over alternatives. We acknowledge other methods, however licensing and spinout formation are recognised the world over as appropriate means through which to transfer knowledge and IP. To recreate this would appear to be inconsistent with universally established best practices.

That said, impact can be achieved in other ways, particularly though not exclusively for societal good outcomes. To that end, the development of practitioners akin commercialisation professionals who understand the various routes to impact, may well augment the traditional activities.

Research Workforce

KEY QUESTION 14 – How should we include workforce considerations in the design of research Priorities?
Our response to KEY QUESTION 10, in part, addresses this. Having a system that affords academic staff the opportunity to “hop off the bus” and explore the commercial world through involvement in a spinout company is one way that workforce could be supported.

Furthermore, our comments under KEY QUESTIONs 7 & 8 about base funding will also assist in this regard. An academic, in particularly an early career academic, who needs to balance writing and submitting grant applications with their other academic duties (for example, teaching) sees significant stress for those who are unsuccessful in their grant applications. The volume of hours spent preparing unsuccessful grants seems to come at a huge professional and personal cost to the science system.

KEY QUESTION 15 – How do we design new funding mechanisms that strongly focus on workforce outcomes?

As indicated in our previous responses to other questions, a level of base funding seems likely to provide a level of efficiency in the system. However, we acknowledge the amount of base funding needed is a delicate balanced between supporting academic endeavour and limiting an over-reliance on the base funding.

As such it seems that performance measures need to be developed and met to ensure that base funding is being utilised well. However, such performance measure should not be sufficiently onerous, time-wise, yet should be sufficiently specific and measurable to ensure the efficient use of base funding. It might be that if a given person falls below the line 2 years in a row, that the third year's base funding is reduced, and if that continues is cut off entirely.

Research infrastructure

KEY QUESTION 17 – How do we support sustainable, efficient and enabling investment in research infrastructure?

We acknowledge research infrastructure is key to allow researcher to do what they do. Researchers are naturally collaborative. However, from a commercialisation perspective, shared use of infrastructure and resources particularly when combined with collaborative research programmes adds additional complexity to an already challenging environment. The need to unpick ownership and who contributed what resource at what time and when, can at times make an ordinarily feasible commercial opportunity infeasible.

While it is critical to avoid duplication of infrastructure, particularly highly specialised and expensive equipment, there must be clear lines of ownership and support for access to it to ensure that when someone uses it, they are not burdened by unreasonable encumbrances that impede commercialisation activities.

We trust that our insights above contribute to the furtherment of Aotearoa New Zealand through a refreshed commitment to the research, science and innovation system.

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