Te Ara Paerangi – Future Pathways Submission

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About this document

This is the submission from The Elshire Group Limited, a contract genomics research firm with primarily international collaborators. You can contact us at Privacy - 9(2)(a)

We kindly thank and show great appreciation to the members of the Te Ara Paerangi Community for their generous collaboration in the mahi that lead to this submission.

Meta Topics

Tertiary education organisations are an integral part of our research system and must be included in any restructuring of the research system

The Te Ara Paerangi green paper states that its focus is considering changes to institutions that are within the Research, Science and Innovation ministerial portfolio, while not 'actively considering structural or design changes to TEOs (tertiary education organisations)" (p. 8). In Chapter 4. NGĀ HINONGA INSTITUTIONS, the focus is specifically on Crown Research Institutes, questioning the functionality of their research goals and institutional structure, given the emerging problems and possibilities within Aotearoa. Additionally, a key relationship mentioned multiple times in the document is the one between Crown Research Institutes and other research institutions such as tertiary education organisations. This relationship is vital when pursuing dynamic, fluid and collaborative knowledge production. But, while the green paper makes a strong argument for restructuring and rethinking one end of this relationship, it fails to recognise that creating a healthy research culture across institutions will also require similar rethinking and restructuring of tertiary education organisations.

Many of the limitations of Crown Research Institutes identified by the green paper on page 52, as highlighted by the Te Pae Kahurangi report, also apply to the current state of tertiary education organisations. These include lack of role clarity, unhelpful competition, siloed strategies and priority setting, inability to adapt to changing contexts, and poor financial and organisational resilience. Reports on universities of Aotearoa have pointed to the following;

- the unmanageable, yet widely pursued, international student market and the financial reliance of tertiary education organisations on international students(1)
- the fact that policy reforms in the past four decades have failed to address issues of representation and funding, and that assessment of such reforms remains in its infancy(2)
- Performance-based research funding processes which systemically undervalue the volume, scope and quality of Māori and Pasifica designed and led research(3), adding to their ongoing exclusion from all tertiary education organisations(4)
- the ongoing institutional reliance on precariously hired faculty on fixed term contracts(5)

- lack of an ethics of care within tertiary education organisations and how this undermines collective resilience of the institution while supporting competition which induces vulnerability among the students(6).

These examples are just a snapshot of the significant limitations within our tertiary education organisations, which require an active, sustained and collaborative response, much like the green paper is suggesting for the Crown Research Institutes.

A transformation of the institutional and funding culture and pathways of tertiary education organisations is critical to achieving the proposed opportunities for change as identified in Te Ara Paerangi. As the paper has discussed, the overall research ecosystem of Aotearoa needs to move towards a more collaborative, less complicated, and more efficient system. This cannot be achieved simply by reforming Crown Research Institutes, which are but one entity within the national research ecosystem. The changes envisioned by the green paper need to focus on relationships.

However, along with a focus on relationships between different research institutions, there should also be a focus on relationships within research institutions. Tertiary education organisations play a critical role in the national research ecosystem. Transforming the way knowledge is produced, managed, assessed and distributed within this ecosystem will require a concerted effort at addressing the issues identified above. Without such efforts, the transformation of Aotearoa's public research system will end up reproducing the current limitations it is aiming to resolve.

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Understanding and Reforging the 'Compact Between Science and Society'

Vannevar Bush founded the successful post-war mission of the United States National Science Foundation on five fundamental principles.1 These included protection of basic research, and the

institutions housing it, from direct control of the funder or immediate demands such as the race to applications Bush himself had overseen as director of the Manhattan Project. A relationship of trust grew by housing the entire funding apparatus within the US democratic system.

The intent extended to post-war New Zealand, but was embodied imperfectly in the Department of Scientific and Industrial Research (DSIR), which was not independent of government. The Marsden Fund provides a more fitting implementation, beloved by the scientific community, but beset by the challenges of hypercompetition.

The concept of Bush's compact between 'Science and Society' seems to be largely forgotten within the New Zealand Science Community. Reforging the fundamental basis for trust and stability in a nation's political economy of science funding has required reconsideration since the end of the Cold War. In the 1990s, recognition grew that applied and fundamental science were complementary rather than competing endeavours.2 Grand challenges in climate change and the environment began to be invoked.3,4 More recently, recognition of the importance that gender, ethnic, and geographic diversity provide a better mirror between science and society has been echoed by the clear need to include social science in solving any large problem.5

In today's New Zealand, the institutional hypercompetition for contestable research funds leaves little room for trust. An open debate about how to reforge trust and reciprocity deserves deep consideration. Concerns about 'Silencing Science' voiced by Hendy6 remain unsolved, and lost in a noisy new balkanisation that has emerged over whether science can embrace mātauranga and indigenous knowledge. A commission or body capable of developing the philosophy and ethics underlying the search for truths and utility from science and research may be needed. Delineation and trust is likely a prerequisite to the practical implementation of ethical standards by institutions, and along with efforts to more fill a long standing gap in the development of science policy for New Zealand.

Vannevar Bush's full essay, "The Endless Frontier" can be found online, and the Five Fundamentals appearing at its end are reproduced here to inspire consideration.

https://www.nsf.gov/od/lpa/nsf50/vbush1945.htm#ch6.3

Five Fundamentals

There are certain basic principles which must underlie the program of Government support for scientific research and education if such support is to be effective and if it is to avoid impairing the very things we seek to foster. These principles are as follows:

1. Whatever the extent of support may be, there must be stability of funds over a period of years so that long-range programs may be undertaken.
2. The agency to administer such funds should be composed of citizens selected only on the basis of their interest in and capacity to promote the work of the agency. They should be persons of broad interest in and understanding of the peculiarities of scientific research and education.
3. The agency should promote research through contracts or grants to organizations outside the Federal Government. It should not operate any laboratories of its own.

4. Support of basic research in the public and private colleges, universities, and research institutes must leave the internal control of policy, personnel, and the method and scope of the research to the institutions themselves. This is of the utmost importance.
5. While assuring complete independence and freedom for the nature, scope, and methodology of research carried on in the institutions receiving public funds, and while retaining discretion in the allocation of funds among such institutions, the Foundation proposed herein must be responsible to the President and the Congress. Only through such responsibility can we maintain the proper relationship between science and other aspects of a democratic system. The usual controls of audits, reports, budgeting, and the like, should, of course, apply to the administrative and fiscal operations of the Foundation, subject, however, to such adjustments in procedure as are necessary to meet the special requirements of research.

Basic research is a long-term process - it ceases to be basic if immediate results are expected on short-term support. Methods should therefore be found which will permit the agency to make commitments of funds from current appropriations for programs of five years duration or longer. Continuity and stability of the program and its support may be expected (a) from the growing realisation by the Congress of the benefits to the public from scientific research, and (b) from the conviction which will grow among those who conduct research under the auspices of the agency that good quality work will be followed by continuing support.

Reference:

Baisden, Troy. (2022). Understanding and Reforging the 'Compact Between Science and Society'. Zenodo. https://doi.org/10.5281/zenodo.6354908

Comments on the premise of the review

The MBIE Te Ara Paerangi review asserts that the aim is “a connected, resilient and adaptable modern system”. Māori have a very different view of the progression of time than traditional Western thinking, as embodied in variations of the whakataukī, *titiro whakamuri, kōkiri whakamua*. We hope that the aim of ‘modernity’ does not preclude incorporating lessons from how our tūpuna organised and experienced knowledge, and imparted it in local wānanga, and that the net has been cast wide, outside participants within the ‘old school RSI ecosystem’ in order to include these diverse perspectives.

We also note that while some of us (particularly those of us already ‘baked in’ to the existing RSI ecosystem) have financial support to contribute to this discussion through the ‘service’ requirement of our mahi, many voices that would be valuable in this discussion are not resourced in the same way. The lack of acknowledgement of the time, ideas, and cultural expertise of these potential participants is at odds with central tenets of Te Ao Māori, namely take-utu-ea. We often talk about the ‘leaky pipeline’ of talent loss within the RSI sector, and the soft (and hard) barriers that lead to this. A similar perspective, perhaps, should be taken to considering what voices have not been heard in these green paper conversations, due to the barriers of funding and time that local community members might face, reducing their ability to engage.

The other assumption in the introduction to the green paper is that the “research, science and

innovation sector has served Aotearoa New Zealand exceptionally well." We think it is not unfair, nor unkind, to say, "some of Aotearoa" given the persistently stubborn signs of inequity and resistance to Te Ao Māori within the RSI system (Naepi et al., 2019; Stewart, 2021). Although some of these inequities are acknowledged in the green paper, the focus on the overall "exceptional" status of the RSI system suggests that perhaps the experiences of Māori are not being given their due weight. It is therefore clear that slapping a band-aid on the current system is not going to be adequate and the development of novel pathways provisioned by Māori-specific funding to support Māori-led research driven by the wants and aspirations of local Māori communities is required.

References

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Stewart, G. T. (2021). Defending science from what? Educational Philosophy and Theory, 1–4.

Increasing Māori community participation in the RSI sector

There are two major roles in the RSI sector: the person/people who ask the questions, and person/people who answer the questions (credit to Willy-John Martin for this concept from one of the MBIE hui). Before Europeans arrived in Aotearoa, Māori carried out both of these roles through wānanga and the development of mātaraunga. However, following colonisation, the asking/answering roles have both been concentrated in TEOs, CRIs and other RSI structures of the crown. This is disempowering, and any reimagining of the RSI system needs to re-balance this, to make sure the questions getting asked in the RSI system reflect questions important to Māori communities.

Addressing this will require dedicated funding to support research originating out of Māori communities, including base-grant funding if that is the model that is adopted for the rest of the RSI ecosystem. Currently, many funding streams are difficult to navigate and take a large amount of time to apply for. While institutional support for developing these grant applications is available in many current RSI institutes, local communities are not likely to be as specialised or resourced for submitting grant applications. The process of applying for funding needs to be simple and streamlined enough that is not overly onerous for communities.

Researcher-driven questions are likely to continue under a revised RSI system. It is important to note that current funding schemes – particularly for early career researchers who have not have time to previously establish relationships with Māori communities – do not align with the time necessary to build adequate relationships with local communities. In addition, communities are not funded for the time they spend engaging with researchers, unless researchers build this into their grants. A re-imagined RSI sector needs a code of ethics/funding/time for these interactions, to ensure communities are not bearing the cost of "consultation". In addition, mechanisms for communities to 'enter' into existing platforms of research (e.g. the NSCs, the CoREs, Genomics Aotearoa etc) need to be made more clear.

Finally, Māori communities should be considered in any discussion of research infrastructure in Aotearoa. Currently, access to research infrastructure being restricted to institutions within the RSI sector bakes in inequities e.g. until Māori are as equally represented in computationally-heavy disciplines as Tangata Te Tiriti, the number of users of infrastructure, such as NeSI, will not be equitable. How can this be addressed so that communities can be empowered to access and utilise these resources themselves, rather than having to be incorporated in an institute? Could attempts to mitigate these inequities take the form of addressing long-acknowledged substandard infrastructure (i.e. internet) in areas where a large proportion of the population is Māori?

Hypercompetition: Observations and Remedies

In response to the Te Ara Paerangi Future Pathways Green Paper Consultation, this paper reviews the case that the current funding environment is hypercompetitive, with negative implications on research and the well-being and diversity of the research workforce. Evidence for hypercompetition includes impacts on the workforce such as accumulating precarity across PhD student and post-doctoral funding, poor diversity outcomes that resist policies aimed at improvement, and funding rates in the 10% range for contestable proposal systems. It may be important to avoid positive feedback causing the rich-get-richer Matthew effect, such as avoiding overlap between funding mechanisms that can amplify a cycle of more researchers applying to contestable funding, undermining the potential to increase funding in response to low funding rates. Recommended solutions include well designed base funding, fellowships, reform of competitive funding mechanisms, and smaller funding packages, along with direct collaborative or international exchanges. Ensuring more effective and equitable future research funding through more anticipatory science policy may be achieved by improved monitoring focusing on the success, connectivity and responsiveness of independent research organisation and the early career tracks of researchers.

Reference:

Patel, Sneh, Baisden, Troy, Stewart, Lucy, & Yee, Grace. (2022). 5. Hypercompetition: Observations and Remedies. https://doi.org/10.5281/zenodo.6354888.

Democratizing the Science-Society Interface and envisioning multi-stakeholder knowledge production

The *Te Ara Paerangi* green paper states on page 8 as part of the scope of the document that this solicitation is “interested in improving the connectivity between businesses and other users of knowledge generated by our public research institutions, and the channels of knowledge exchange and transfer between research institutions, businesses and others to achieve greater impact”. While the document highlights the needs for more transparent, contextual and fluid movement of knowledge, a key concern is the focus on how this knowledge is produced. Questions of access and representation are important concerns and the recent focus on science communication in some institutions are attempting to address this.(**1**) But research does not have a one directional flow, emerging in certain institutions, produced by certain individuals/communities and communicated to others. Public research should involve the public, not just at the receiving end, but as an active element throughout the process of knowledge production. Stakeholders in the scientific process

should not be identified mainly based on their financial and political clout. Engagement should be more democratically determined, actively addressing the historic exclusion of certain individuals/communities who could be inordinately impacted by the knowledge/scientific produced. Multi-stakeholder knowledge production, with adequate support structures in place to really compensate subjects for their time and energy is critical in envisioning a more equitable research community and space.

To better enable such a transformation, recent reports have highlighted the precarious nature of work within the tertiary education sector, with international students, Māori and Pasifika and students in general noting the significant impacts on their well being, lack of livelihood security, inadequate compensation and workplace harassment.(**2**) Such concerns combine to make a career in research/knowledge production quite impossible for many people. Other reports have highlighted the burgeoning initiatives which attempt to create culturally and intellectually plural spaces for knowledge production, especially in collaboration with Māori communities/practitioners.(**3,4**) However, many of these attempts suffer from proper representation along various parts of the knowledge production process, which are the empirical (when discrete data is identified/collected), the analytical (when the data is investigated and manipulated) and finally the representational (when the results are presented in different formats).(**5**) Ultimately, while citizen science is seen as part of the research ecosystem, proper methodology around transdisciplinary, multi-stakeholder, knowledge production, assessment and dissemination are still quite underdeveloped.(**6**)

Science is both a framework of knowledge production and a foundational tenet of society. The access of individuals/communities within a certain nation to the scientific ecosystem should not be determined by their intrinsic identities of gender, race, ethnicity, nationality, religion etc. The citizen in citizen science, is more than just a worker following directives of a scientific chain of command. They are actual collaborators in the process of knowledge production. Unfortunately, the severe gatekeeping within the research space often does not foster or nurture such collaboration. If the research, science, and innovation sector of Aotearoa is to become more dynamic, productive, inclusive and effective then such an exclusionary culture will need to be challenged by a more reflexive, democratic and plural process of knowledge production. Additionally, ethics of labour and those around the management of ideas will need to provide a system of accountability, ensuring that the system functions for all and not just a few.(**7**)

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5. Ritodhi Chakraborty, Sadeepa Jayathunga, Hirini Paerangi Matunga, Shannon Davis, Lizzie Matunga, James Eggers and Pablo Gregorini (2022) Pursuing Plurality: Exploring the Synergies and Challenges of Knowledge Co-production in Multifunctional Landscape Design. Front. Sustain. Food Syst., 20 January https://doi.org/10.3389/fsufs.2021.680587
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A New Paradigm to Deliver Prioritisation: Towards Collaboration

Te Ara Paerangi Future Pathways Green Paper seeks a major transformation of Aotearoa New Zealand's research, science and technology (RS&T) system and places 'prioritisation' at the head of its consultation process. Work to date has found that prioritisation is the most challenging topic, yet one that can provide a powerful test of whether proposed changes in all other categories can transform Aotearoa New Zealand's research system as desired. This work analyses the potential to use more effective prioritisation as a target for transformational and feasible reform by sequentially applying frameworks identified by Meadows and Ostrom, to prioritise interventions in systems and manage common pool resources, respectively. The analysis identifies how to reframe the historic paradigms driving reform to prioritise and maximise the appropriation of well-being benefits of RS&T expenditure within Aotearoa, using an 'NZ inc' perspective. The analysis supports reframing and managing the nation's RS&T institutions, infrastructure and funding as a common resource pool.

Link to full brief (and citeable content): https://doi.org/10.5281/zenodo.6300595

Reference

Baisden, W Troy. (2022). 2. A New Paradigm to Deliver Prioritisation: Towards Collaboration. Zenodo. https://doi.org/10.5281/zenodo.6300595

Dismantling the old boy's club system

We need to ensure that National Science Challenges and other funded entities (e.g. Genomics Aotearoa, CoREs) have 'on ramps' to allow researchers and communities with diverse perspectives to 'come on board'. While the aim of the NSCs (to enhance collaboration) is admirable, in practice, the strong reliance on networking associated with assembling a bid for all long-term funding opportunities makes it hard for fresh thinking from "outside" of traditional RSI structures to break in. While bids that have cast a wide net to ensure that diverse perspectives are included exist in the current RSI ecosystem, unfortunately not all bids fall under this category, and can perpetuate the benefits of belonging to an "old boys' club".

Building Responsive Science and Innovation

Analysis preceding and developed for Aotearoa New Zealand's Te Ara Paerangi Future Pathways Green Paper Consultation can be combined with a systems perspective to suggest Aotearoa's Research, Science and Innovation (RSI) system does not prioritise or respond as well as it should, and lacks coordinated strategies to address major issues. How can we assess concerns that potentially successful ideas and innovation are being stopped unnecessarily at systemic barriers, which could be removed in the current push for systemic reform? Ostrom's eight principles for managing common pool resources provide a well-designed framework that can overcome the high level barriers, which may arise from hypercompetition and other dilemmas born out of the institutional structures and funding systems. There are at least three good options for implementing Ostrom's principles in high level institutional and funding structures. These provide enabling conditions for ensuring that efforts to address workforce career issues, funding stability, and improved funding mechanisms lead to a more effective and responsive RSI system. A more compelling basis for enhanced funding levels, trust and self-organising prioritisation can come from: 1) a well-implemented base funding system, 2) implementation of Ostrom's principles and values-driven approaches to rebuild trust, and 3) fellowships support that addresses the stress, connectivity and responsiveness issues currently observed.

Reference

Baisden, W Troy. (2022). 4. Building Responsive Science and Innovation. Zenodo. https://doi.org/10.5281/zenodo.6354852

Participant-driven Research

Informed consent, informed control, and informed trust, is important in research. We need to place importance on research participants having control over what is done.

The Problem - Lack of Control

Open research is about having control over our own research. When we consider the methods, kits, and programs used for research, we (as the "developers" of research) should have control over the way that we can use them, the way that we can study them, the way that we can change them, and the way we can share them with others for carrying out research that we consider important. A key part of this control is having knowledge about the things that we are doing, and the things that other researchers are doing. Access to that knowledge gives us the ability to avoid mistakes, both ones that have been made before (and reported by others), and ones that could be predicted by understanding the limitation of our research methods.

However, we must also be mindful of the effects that our research may have on research participants and on other people.

User Control for Software

In the computer software world, there is a concept of *Software Freedom*, which is a concept that concentrates more on *user* control than *developer* control. Software freedom emphasises the importance that we need to place on the users of software having control over what their software does, and the control that the users have over what is done. When this control is lost, bad things can

happen, as the Cambridge Analytical scandal has shown, and subsequent commentary on the reasons why it happened. All it takes is one clueless developer; someone who didn't have the foresight to think through all the implications of their actions.

Participant Control for Research

Informed consent, informed control, and informed trust, is important in research. We need to place importance on research participants having control over what is done. The concepts of Software Freedom can also apply to research, leading to a *Research Freedom* concept that concentrates more on *participant* control than *researcher* control. Research Freedom emphasises the importance that we need to place on the participants of research having control over the research that is carried out using their personal data. When this control is lost, bad things can happen. All it takes is one clueless PhD student (or professor); someone who didn't have the foresight to think through all the implications of their actions.

A Proposed Solution - Guidelines for Participant-driven Research

I believe it is necessary to reframe research as a task that emerges from discussion with participants, and will naturally lead to something that is given back to the participants of the research. To this end, I propose four key guidelines that help to make sure that research is carried out in a way that is agreeable to everyone involved:

1. Communication is Mediated

Projects must have an agreed academic mediator for the entirety of the research project. The role of this mediator is to communicate academic gobbledygook to study participants (or their representatives) in an understandable fashion (i.e. ensuring they are fully informed throughout the research project), but also to communicate participant concerns as soon as possible to the academic investigators.

2. Participants Maintain Control

While it is understood that a public disclosure is difficult (or impossible) to retract, participants should be able to otherwise maintain control over the biological samples, data, and results dissemination. An appropriate storage system should be set up in such a way that any participant can have their data excluded from results at any time. The aggregation of samples or data for academic efficiency, including separate management of sample and results control (e.g. biobanking), removes control from the participants and should not be recommended for a research project. A decentralised research project makes it easier for participants to have a say in what happens.

3. Consent is a Continual Process

Consent is enthusiastic, freely given, and continuous.

Researchers should be made aware that the initial ethical approval at the start of the study does not mean they have automatic approval for dissemination of results once the study is completed. Approval can be withdrawn by participants at any time.

Any public disclosure (or intended public disclosure) in any form must be be authorised by participants. This includes poster presentations, submission of manuscripts for peer review, conference abstracts, and public speaking events such as TEDx talks. Agreements made for blanket approval of public disclosure (e.g. “there is no need to approve every student presentation”) should not be allowed.

4. Study participants Are Informed

Researchers should be provided with an agreed method by which they can directly communicate research findings to study participants during the course of the research project (for those participants who are interested in knowing the results of studies). Examples of this could be in the form of invited attendance at participant gatherings, or a mailout of results.

Conclusion

Ethical research is about being as open as possible with everyone involved. All this amounts to quite a lot of work for both researchers and participants, and demonstrates how different the ethical landscape can be when you look at it from a different perspective.

But there’s no need to hurry with this. People are not going to disappear, and newer technologies will give us better capabilities to do research in the future.

I think it’s important to work through these issues, and make sure that research is done properly in a way that’s acceptable to everyone involved. This sometimes means listening to people who disagree with you, and maybe occasionally trying to take some of their suggestions on board. Because there’s an ocean of questions to be answered, and our best chance for finding the answers to the biggest questions in research is to make that journey together.

Research Funding

After 34 years of aspirational funding goals, real increases are needed

The last time there were reforms of the research system, the funding level was 1.02% of the Gross Domestic Product (GDP). That is the common way of looking at research spending. In 1986, the Beattie report(**1**) (the recommendations of the equivalent to Te Ara Paerangi -- Future Pathways) recommended a doubling of that to 2% by fiscal year 1994. As at 2019, our investment in research as a country was 1.4% of the GDP. That is a .38% increase in 34 years. No doubling to be seen. All along the way, successive governments have promised 2%, but not much happened.

It is obvious to most people that the research sector is not alone in being underfunded. Decades of public under investment in things like infrastructure, teachers, mental health workers, and nurses (to name but a few), have brought us to a point where so many things need to be improved or restored. We are not suggesting taking from other areas which have been neglected, but rather that a whole of government approach is needed to address all of these deficiencies.

Reference

1. "key to prosperity / science & technology" Report of the Ministerial working party, November 1986

New Zealand's High Research Overheads: An International Anomaly

Aotearoa New Zealand’s high research overheads are internationally anomalous, and are over 100% of directly accounted for research costs such as salary, consumables and operating expenses. This means that the majority of taxpayer-derived funding provided by the Government to public institutions is difficult or impossible to properly account for. They also serve as a constant source of tension and confusion for all international migration and collaboration in the research sector.

Link to full brief and citeable content: https://doi.org/10.5281/zenodo.6360794

Reference:

Baisden, Troy, & Patel, Sneh. (2022). New Zealand's High Research Overheads: An International Anomaly. Zenodo. https://doi.org/10.5281/zenodo.6360794

Designing Base Funding to Support the Research Workforce

Previous briefs addressing Te Ara Paerangi Future Pathways Green Paper evolve from awareness that the pandemic has raised serious concerns about the sustainability of today’s research institutions and funding systems. Aotearoa’s highly contestable funding raises concerns that our system may be among the most unstable internationally and prone to the problems observed in increasingly hypercompetitive research systems worldwide. Hypercompetition is associated with poor behaviours and mediocrity, undermines diversity, equity and inclusion (DEI), and reduces the likelihood of funding innovative projects and careers. How can we build more collaborative, connected careers within research systems appropriate for taking society on innovative journeys to solve the biggest challenges such as climate change and protecting endangered biodiversity? This paper and previous work describes analysis to arrive at design suggestions for an innovative base funding proposal that better achieves the historical intentions to meet national research needs that have evolved considerably over 30 years. The proposed system would reallocate existing and possibly additional government funding to support 30–50% of researchers’ salaries and related costs. The intent is to enhance the overall well being of the research workforce and knowledge systems by creating or incentivising a number of features that overcome current dilemmas, improving the responsiveness, connectivity and use of research within Aotearoa New Zealand, though self-organisation following Ostrom’s principles of common resource pool allocation. The proposed scheme has advantages over the current highly contestable system, and is expected to outperform tenure-driven systems.

Link to full brief and citeable content: https://doi.org/10.5281/zenodo.6324775

Reference

Baisden, W Troy. (2022). 3. Designing Base Funding to Support the Research Workforce. Zenodo. https://doi.org/10.5281/zenodo.6324775

Base funding to the researchers

As pointed out in the green paper, overheads disincentivize employing people, and incentivize having students. However, most institutions have issues with structural racism and other inequities. Providing the institutions with “base-grants” will perpetuate these inequities. It would be better to

put at least some of this base-funding in the hands of the researchers themselves e.g. if you meet a minimum standard of excellence (e.g. 2nd quintile on Marsden), you are eligible for funding/salary support. Including a target for Māori researchers funded at each institution would also be a way to address the chronic underrepresentation of Māori within the RSI workforce.

Precarity in academia is tied to the contestable funding model.

Kia ora! Sharing this piece on the interface of the current funding model and our precarious research workforce written for the NZAS. There is a vision of how base funding might support researchers salary providing stability as well as recognition for all the work we do in addition to the research tasks described in our funded grant applications. 'This brief explores some of the drivers of precarity that are inherently built-in to our current contestable research funding model; although not by design. Herein, it is also highlighted why funding research and indeed researchers, 100% from contestable sources, does not reflect the reality of what academic researchers do with their time. In reality, researchers need to use a % of their time to do research-related (research-support) tasks, career-building tasks as well as research community contributions that are not explicitly described within the research projects that actually supply 100% of their salary. The system also fails to recognise that research is a continuum of knowledge-building rather than a series of individual research projects. With no element of stable funding base in the current system, the ability of researchers to carry out knowledge-building is compromised and there is therefore knowledge-loss. Precarity of our research workforce also drives skill-loss and is subsequently wasting money and resources. The proposal of a base grant model goes some way to recognise the reality of how research is actually carried out and therefore support a more efficient, flexible system, putting people and their talent first.'

Reference:

Lee, K.L. (2022). Precarity in academia is tied to the contestable funding model. (1.0). Zenodo. https://doi.org/10.5281/zenodo.6350640

Stop Competitive Funding

When you make something a target, people will fire arrows at it, regardless of how small the target is. Competitive funding will always reward cheaters and privileged researchers (including reviewers' friends) more than anyone doing things that follow the spirit of the rules.

The Problem - Competitive Funding

I believe in an academic future that is diverse, open, and non-competitive. The core issue with competitive funding is that it requires an increasing amount of effort, year on year, for people to get the same amount of money. As that effort is increased, less privileged people (who can't afford to spend more money/effort) lose out. I will demonstrate this by considering the most lucrative fund in Aotearoa.

The Marsden Fund is a competitive fund in which the "top" researchers are given money to do proposed research.

In 2021, $82,345k was awarded to 120 projects. That's a mean of ~$230k per project. When considering 100% institute overheads, that ~$230k over 3 years ends up as enough for 1.5 researchers at Massey's Step 1 lecturer salary ($74k, or about $35/hr). Unfortunately those 120 projects had 394 named investigators, or around 3.3 investigators per project. In other words, the awards are not sufficient to cover researcher *salary*, let alone additional research costs.

However, Marsden is a competitive fund, which pretty much means researchers need to do pre-research in order to even have a chance at getting those funds. So, the cost of research should be factored into the award when considering net gain from the fund. In 2021, the Marsden Fund had 1152 Expressions of Interest... and 1032 of those weren't funded this year. Assuming 3 researchers per unfunded application working 100 hours as a Step 1 Lecturer, that's $11,140k wasted.

The Marsden Fund does involve a two-round process, so alternatively I could consider 20h work at L1 lecturer salary for 1032 applications for round 1, and 100h work at $200/h for 108 applications: $2,450k round 1 $7,130k round 2. This comes out to a similar amount of wasted money ($9,580k vs $11,140k).

Those researchers *still* need to get their research funded from another source in order to continue as a researcher. An award success rate of 10.4% for the Marsden Fund means researchers will need to spend ~10 times that amount in order to get funded (assuming their only source of income was Marsden Fund-like sources... and non-Marsden tend to have smaller payouts). Even at the Step 1 Lecturer salary, when accounting for multiple applications, once again the wasted pre-research comes out as *higher than the award money allocated* regardless of which calculation is used.

Summary: it does not seem to be worth a researcher's time, effort and money to carry out work towards applying for the Marsden Fund.

A common counter-argument is that this pre-research time is not wasted; because it improves chances for other grants. However, I still consider it wasted time because it's targeted specifically for a project that has not been funded: researcher time could be better spent doing something else, e.g. science communication to the public.

A Proposed Solution - Equal Distribution of Funds

My proposal to reduce wasted money and time does not require any funding increases. It can be done using the same systems already available, with less administrative overhead.

My proposal is that we have a low, fixed threshold for acceptance (i.e. constant from year to year), followed by universal distribution of available funds to everyone who passes that threshold. This makes the targets predictable (allowing people to know in advance whether they have a good chance of getting funded), and creates a much fairer distribution of funds that has no preference for white men, established researchers, peer review bias, or "safe" research (all of which are a problem with the current peer-reviewed system, see https://doi.org/10.38126/JSPG180105).

Suppose, instead, that every researcher who applied were provided with an equal proportion of the $82,345k award money. That's ~$21k per researcher, for an input effort of 100 hours. Instead, 394 of the "best" researchers get $209k each for a similar effort.

*A common counter-argument is that giving out money evenly to all "fundable" applications means projects will never be given what they need. However, consider that with the current system the majority of researchers get **no** money, and have also put in additional effort for that non-reward.*

It's a numbers game. Are there more researchers who can do great research with less money [than researchers who need lots of funding to do *any* research]? Are there researchers who can pool their money to collaborate in larger projects?

Success / reward simulations suggest the benefits are greater when funding is more universal. This simulation research indicates that when working out how to implement universal basic funding, the "universal" part is more important than the "basic" part:

https://doi.org/10.48550/arXiv.1802.07068

[Note: this post is essentially an unrolling of this Twitter thread: https://twitter.com/gringene_bio/status/1456130900689756169]

More Condensed Summary

Stop competitive funding.

I believe in an academic future that is diverse, open, and non-competitive. The core issue with competitive funding is that it requires an increasing amount of effort, year on year, for people to get the same amount of money. As that effort is increased, less privileged people (who can't afford to spend more money/effort) lose out.

The Marsden Fund is the most lucrative fund in Aotearoa, and yet the amount of money provided to researchers is not sufficient to support their salary (let alone their additional research costs). Furthermore, the costs involved in applying for a Marsden Grant (when considering the funding success rate) exceed the awarded amount. These costs will only increase due to the competitive nature of the award: assuming research skill improves over time, the skill level (and associated cost) required for grant acceptance will also increase over time.

A strange game. The only winning move is not to play.

https://www.youtube.com/watch?v=s93KC4AGKnY

Removing the competitive nature of funding would remove at least systemic waste caused by researchers trying to continually one-up each other to get a slice of the pie.

Instead, we should have a low, fixed threshold for acceptance (i.e. constant from year to year), followed by universal distribution of available funds to everyone who passes that threshold. This makes the targets predictable (allowing people to know in advance whether they have a good chance of getting funded), and creates a much fairer distribution of funds that has no preference for white men, established researchers, peer review bias, or "safe" research (all of which are a problem with the current peer-reviewed system, see https://doi.org/10.38126/JSPG180105).

Research Workforce

The Case for Urgency

The Te Ara Paerangi Future Pathways green paper lays open for consultation ideas intended to drive system-level transformation in our research, science and innovation system. Consultation has been opened to a broad swath of participants from both within and outside the current system, with specific encouragement to engage for early-career researchers and those who are underrepresented at the current time. We understand that system-level change is an overwhelming process that requires significant time to implement well-thought out, achievable changes, and that these changes will also require time to become real. During an early consultation session, it was stated by facilitators that this process has a realistic timeline for change of seven or more years. Still, it is important to consider those who are in the system now. Many hundreds of early-career staff, including those bearing the extra burden for the underrepresented, cannot wait seven years. A key aspect missing in the current thinking is urgency. While it is important to aim for long-term and lasting change, we must implement short-term bridges for our early-career workforce so that they will be part of the research system they are working to help improve.

In 2021 MBIE funded a one-off cohort of thirty Whitinga Fellowships, a programme designed to bridge early-career researchers through the impact of COVID-19. While praiseworthy for its progressive selection process and the opportunity it provided, this fellowship scheme was small in scope. Due to the restrictions on eligibility, and funding distribution many who would otherwise be considered early-career researchers were excluded from application. When considering how many early-career researchers are in precarious positions, thirty fellowships is almost a rounding error. The funding period is only two-years which is simply shifting a burden down the road.

In order for early-career research workforce, who are spending countless unpaid hours contributing to Te Ara Paerangi Future Pathways, to have stable research career pathways during the process, we suggest further fellowship rounds based on the Whitinga Fellowship model. Improvements can be made to fund those in the later stages of their early-career by doubling the maximum funding available per-fellowship ($620,000). The number of fellowships offered should also be increased to reflect the number of people in this career stage, and this figure may be determined using data from the MBIE RSI Workforce surveys. Fellowship rounds should be offered annually until they are no longer needed. While it is true that this would cost money, it is the result of decades of underinvestment in pathways for our research workforce.

A Strong and Resilient Research System is Built by Valuing People

Background

The last major round of reforms of the New Zealand research system started in the late 1980’s and ran through the early 1990’s. These reforms brought in New Public Management(**1**) (also sometimes called corporatism, managerialism, or neo-liberalism) as the basis of how the new system would operate. To get a sense of what researchers thought of this new system as it was at the beginning and after the first 10 (out of 30) years under it we offer these quotes:

> “When the history of science in this country comes to be written, the six years between 1986 and 1992 will appear barren and traumatic ones – ones principally of discouragement to scientists. “
>
> E.G. Bollard (1992)(**2**)

> “I would not see a scientific career as compatible with human existence, at the present time. Scientists lead a bloody miserable life”
>
> Sir Peter Gluckman (2001)(**3**)

> “At the beginning of my study I thought the major concern of scientific workers would be intellectual property and the commodification of knowledge. When I started talking to people I quickly discovered that this was not an issue at all. Staff were worried about something much more mundane but of much more consequence – their survival.”
>
> Lesley M. Hunt (2003)(**4**)

While these quotes speak of *science* and *scientists*, if one substituted *research* and *researchers* the sentiment (and lived experiences) would remain essentially the same. One would hope that the situation had improved in the last 20 years, in which case this would be a more pleasant piece to read (and indeed write). Not only are conditions still poor for our researchers, but our research system itself has suffered from the last round of reforms. We will take stock of the current situation for researchers. Then look at ways to improve both the working lives of researchers and the research system along with them.

(Under)Valuing Knowledge Producers

Different kinds of researchers use different tools and approaches, but creating new knowledge is what makes it research. Most other activities in life do not *create knowledge*. Many researchers' first taste of doing research happens when they are Master or Doctoral (PhD) scholars. In fact, a requirement to earn those degrees is writing a thesis that demonstrates that their work resulted in something *novel* (or new). It is from new knowledge that we better understand the world around us and improve the condition in which we all live.

Researchers at this early stage are under-valued and over-worked (a common theme as we will see). The average pay from PhD scholarships is below minimum wage. The time it takes to do the work necessary for a PhD is often longer than the three-year scholarships(**5**). Too often they receive no pay during the time between the end of the scholarship and completing their research. The situation is similar or even worse for Masters scholars. In 2021, there were a number of researcher led efforts to increase the pay of these emerging scholars. One of those was addressed at the Royal Society’s Marsden Fund.(**6**) That effort was successful, to a point. The Marsden fund increased the pay for Doctoral scholars funded by it’s grant to *minimum wage* starting in the 2022 rounds. In the meantime, cost of living increases resulted in a rise in minimum wage. That rise starts before the next Marsden round, leaving those scholars earning less than minimum wage, still. This comes as no surprise to those pushing for better pay.(**7**)

After completing a PhD, researchers find themselves competing for what few positions are available. There are many fewer positions (most not permanent) than there are those seeking them. This puts our early career researchers in an unstable situation, both professionally and personally. A term often used to describe this situation is precarious. The group of people in a precarious situation, are sometimes called the precariat. In 2021, a group of researchers surveyed the academic work force and produced *Elephant In The Room: Precarious Work in New Zealand Universities*.(**8**) In brief, New Zealand has a pool of highly trained researchers who are in unstable employment conditions, sometimes for decades. Often with multiple short term contracts with the same employer in one year. These researchers lack the benefits one has with permanent employment of any type.

For those who do gain a permanent position, the situation is still not what many kiwis might reasonably think it ought to be. Most researchers are expected to fund their own salaries from grants in a system that has been hyper-competitive for over 30 years. That kind of competition can lead to a culture where bullying is a career advantage.(**9**) The institutions (universities and crown research institutes) in which mid and senior career researchers work have expected *all staff* (including researchers) to do more as a result of repeated rounds of cost cutting measures and down-sizing. Everyone is too busy, all of the time - leaving little time and energy to do their core activity: deep, considered thinking about a topic or issue (which is fundamental to research). The almost continuous restructuring and redundancies in our research system over the last decade show that permanent positions are not really permanent. A recent study in Australia demonstrated that wage theft is common in universities there. (**10**) It does not appear to be any better here.

Similar things happened across all segments of government as the New Public Management system rolled out across ministries and departments. At the same time, the same approach was being applied in the business sector. Much of what we write about here will be familiar to almost any Kiwi in almost any job. Implementing the ideas in the next section would help everyone, not only researchers.

Towards Valuing People

How do we get from the system we have to one that builds a strong, resilient research system? We do the things that will build a research work force with stability in employment and which supports professional growth starting at the earliest stages of research careers. In 2005, the European Commission published a single, short (36 page) document containing the “European Charter for Researchers and a Code of Conduct for Recruitment of Researchers”. (**11**) We suggest adopting the recommendations and requirements in this document for our research system. We quote only the first 4 to provide a base for the reader to start with.

1. That Member States endeavour to undertake the necessary steps to ensure that employers or funders of researchers develop and maintain a supportive research environment and working culture, where individuals and research groups are valued, encouraged and supported, and provided with the necessary material and intangible support to enable them to fulfil their objectives and tasks. Within this context, particular priority should be given to the organisation of working and training conditions in the early stage of the researchers’ careers, as it contributes to the future choices and attractiveness of a career in R&D.

2. That Member States endeavour to take, wherever necessary, the crucial steps to ensure that employers or funders of researchers improve the recruitment methods and career evaluation/appraisal systems in order to create a more transparent, open, equal and internationally accepted system of recruitment and career development as a prerequisite for a genuine European labour market for researchers.
3. That Member States - as they formulate and adopt their strategies and systems for developing sustainable careers for researchers – take duly into account and are guided by the general principles and requirements, referred to as The European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers outlined in the Annex.
4. That Member States endeavour to transpose these general principles and requirements within their area of responsibility into national regulatory frameworks or sectoral and/or institutional standards and guidelines (charters and/or codes for researchers). In so doing they should take into account the great diversity of the laws, regulations and practices which, in different countries and in different sectors, determine the path, organisation and working conditions of a career in R&D.

The Institute of Agrifood Research and Technology in Catalonia adopted these practices and was awarded the “HR Excellence in Research” by the European Commission in 2015. The two key plans that were highlighted by the European Commission were IRTA’s Ethical Code(**12**) and IRTA’s Equal Opportunity Plan(**13**). We could learn much from the approach this institution has taken. More about how they value people is available from their web site. (**14**)

Adopting a version of the *European Charter for Researchers and A Code of Conduct for Recruitment of Researchers* would go a long way towards improving our research workforce, their working conditions, and the research system itself. Purging the system of bullying and related behaviour is also clearly necessary. Re-enabling a research culture of idea exchange that was central to research prior to the introduction of New Public Management and the secrecy it instilled will ignite innovation. These actions are not the kind of tinkering around the edges that has characterised the middling reforms in since the last major system wide reform. They are part of the fundamentals. To paraphrase Troy Baisden in *2. A New Paradigm to Deliver Prioritisation: Towards Collaboration*(**15**), the system will resist "change unless a major transformation can be designed." The ideas presented here can be part of that design.

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Supporting All Workers

The *Te Ara Paerangi* Green paper in Chapter 5 raises important questions addressing the support and development of a research workforce. The goal is to ensure dynamism, career support and ensure retention within the research, science, and innovation system while also allowing the overall establishment to best marshal the emerging workforce. Additionally, Chapter 4 of the report focuses on the design and shape of institutions to address the needed changes. While these two sections/entities are addressed separately in the document, the institutional setup and culture are deeply intertwined with the well-being and professional needs of the workforce. A change in one, must be accompanied by and supported through a change in the other. A great example of transforming one without the other is presented in the Equity, diversity and inclusion section on Page 66. The report notes that simply hiring more women, Māori or Pacific peoples cannot addresses issues of inclusion and representation within the research system, since often these individuals are "tokenised, undervalued" and asked to perform extra labour as a "cultural expert". This is clearly an institutional problem and rectifying it through changes in hiring practices will do little to address it. However, the systemic sexism and racism plaguing the research in Aotearoa requires a reflexive hiring agenda, as well, which actively works to eradicate such a culture. Therefore, these forms of collaborative policy making, with 'twin interventions' addressing opposite sides of the same problem need to be pursued by any form of future restructuring. That being said, it is also important to understand some key emerging issues within the RSI workforce which any future restructuring will need to address.

The research establishment in Aotearoa, like other places(**1**), is very unequal, systemically biased against women(**2**), indigenous peoples(**3,4**) and various other ethnically/religiously(**5**) othered and racialized minorities. These experiences of discrimination are from within the research system and support the argument that even though historically excluded individuals are allowed to enter the research space, they are subjected to various forms of othering within the establishments. More than diversity training or anti-bias training is needed to address these issues(**6**). To build the structures of support which will support early career researchers, racialized, gendered and ethnically othered groups, there needs to be:

- An active investment in the establishment of processual accountability, with clearly stated punitive repercussions and pathways to address such issues without fear of institutional retaliation(**7**)
- The establishment of frequent systemic assessment of institutions upholding anti-discrimination clauses built on the foundation of Te Tiriti(**8**) and,
- The creation of worker well being focused policy and its implementation through a task force that is professionally trained in the diagnostic and mitigational tools of anti-discrimination with a diverse population(**9**)
- Contextual accessible services for different individuals based on their life situations (This could encompass everything from adequately compensated parental leave to emotional/material support for individuals unable to connect with their families due to border restrictions)(**10**)
- The development of various hybrid funded programs to address the livelihood precarity of junior scholars, working on fixed term contracts, irrespective of gender, age, religion, ethnicity, immigration status and other such qualifying variables.(**11)**

Along with these measures it is critical that worker focused restructuring of the research, science, and innovation system be matched with a corollary in the institutional make up. The *Te Pae Kahurangi* report on Crown Research Institutes notes that there is a culture of competition over collaboration, inefficient use of scarce funds, weak engagement with tertiary educational institutions and an undermining of Māori aspirations. All these shortcomings, along with creating a less than optimal science and research spaces, directly impact the creation of a supportive, sustainable and inclusive work culture. These critiques can be applied to tertiary educational institutions as well, who are poised to address many of these concerns in light of the recent stories of workplace discrimination(**12**) and the ongoing financial challenges due to COVID-19 related border closures.(**13**)

The aspirations of the *Te ara Paerangi* document's fifth chapter need to consider the contextual and exceptional life circumstances of the diverse research workforce of Aotearoa. This means an active focus on the most vulnerable individuals which often include Māori, Pasifica, women, immigrants on temporary work visas and other minority groups. Additionally, any support for the workforce will have to be supplemented and complemented by institutional restructuring to allow such support to flourish.

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Increasing numbers of Māori entering the RSI sector as researchers

We must grow the researchers we want in our RSI ecosystem. This means equitably investing in education and infrastructure (e.g. internet, chrome books for pupils) in all areas of the country to support our youth with interests that they may have in RSI, including ensuring training in RSI-relevant curricula in Māori-medium kura. Issues of representation of Māori within the RSI workforce cannot be viewed in isolation of underfunding of educational resources/infrastructure, particularly in areas where Māori make up a larger proportion of the population (i.e. Te Tai Tokerau, Te Tairāwhiti).

The development of regional hubs of research proposed in the green paper would be a powerful way to uplift local mātauranga, ensure research is both relevant to local communities and led/co-led by them, and to ensure that Māori researchers do not have to make a choice between remaining close to their whānau and engaging in the RSI system. A potential model for this could be the "extension

office" system associated with universities in the USA. Interchange between such hubs and other RSI institutions could be facilitated through dedicated sabbaticals to ensure the development of relationships across the RSI sector and with Māori communities, ensuring researchers within the RSI sector have an understanding of aspirations and concerns of Māori communities.

However, having Māori distributed throughout the 'big RSI players' (i.e. universities, CRIs) in a re-imagined RSI system is also a powerful check in ensuring decisions are not made about us, without us, and that the RSI workforce reflects the demographics of society at large. One effective mechanism for ensuring the health workforce reflects the faces of those in Aotearoa has been the 'Mirror on Society' pipeline at the University of Otago (https://www.otago.ac.nz/healthsciences/students/professional/otago686979.html). We propose a 'Mirror on Society' type policy, but for the RSI sector, with funding to support young Māori researchers. Acknowledging the collective nature of Māori society, there would be an explicit role for Māori communities to identify young folks from their community who would thrive in an RSI setting. They would go to university, and potentially to graduate school depending on their interests, supported on a scholarship. They would then be "bonded back" to their community with associated funding, bringing the knowledge and connections they have formed back with them, potentially helping to support the regional hubs of research described above. A similar approach (https://teachfirstnz.org/) has been used to reduce educational inequity in New Zealand, and the 'home residency requirement' has been recognised by international programs such as Fulbright as important for information and cultural exchange. In the process of increasing Māori participation in the RSI sector, the RSI sector is also enriched by experiencing the perspectives of these young researchers and the Māori communities they represent.

There is no trouble getting scholars into mātauranga-centering institutes within higher education. Therefore, our lack of Māori scholars in other RSI fields represents a failure from harakeke roots level to weave these careers with Te Ao Māori. Education and integration between the NZ education system, downstream careers, and local communities is key.

Retaining Māori entering the RSI sector as researchers

It can be a lonely experience being Māori within the RSI sector. When Māori are under-represented, they are more likely to (a) experience "unsafe" workspaces e.g. they may witness colleagues being disrespectful in their attitudes towards working with Māori communities or may experience disparaging remarks about "Māori stuff" and (b) be overworked due to their 'dual role' (as acknowledged within the green paper). One solution is to ensure cohort hires. For departments/institutions without Māori, the emphasis should be on hiring multiple Māori researchers in cohort hires to ensure a strong peer-to-peer support network.

In addition, the RSI sector could be doing a far better job upskilling Tangata Te Tiriti researchers, so that the burden of educating (including in situations when power dynamics may make this very difficult) does not full solely on Māori researchers. A minimum level of competency for all researchers in the RSI sector around appropriate tikanga, New Zealand history, and respectful engagement with Māori communities is necessary to increase the comfort/safety of Māori communities who interact with these researchers, and of Māori researchers within the system. RSI

institutions should implement performance assessment and hiring practices that includes prioritizing competency in these areas and facilitate the necessary training to ensure staff can increase their competency.

An additional issue of promotion and progression within the RSI system, is whether the “outputs” of Māori researchers are valued, and whether the researchers feel like they have the freedom to pursue research of interest to them and their communities. If the reimagining of ‘research priorities’ proposed by the green paper explicitly includes Māori aspirations, then this may address the issue of Māori researchers feeling like they belong within the RSI system. Adequately and fairly assessing the outputs of Māori researchers, however, will require some changes. For example, although there are some great examples in the published literature of the intersection of mātauranga and the current RSI system (for example Clapcott et al., 2018; McAllister, Beggs, et al., 2019; Mercier & Jackson, 2019; Wehi et al., 2019), publications are not the right ‘currency’ to measure benefits accruing to local communities from their interactions with RSI. This results in researchers who work with communities in this manner being systematically devalued under traditional metrics of academic success (e.g. number of publications, H-index etc). This may be able to be solved by listening to Māori communities who work with RSI researchers about their perception of the impact of the research, however, the larger point is that how research impact is defined is important and it should not be defined solely in economic and scientific outputs.

Māori on average have families when they are younger (Stats NZ, 2019), and currently, no paid parental support is offered to students who wish to start families (McAllister et al., 2021). This, and inadequate levels of parental support for workers within universities (McAllister et al., 2021) appears to contribute to knock-on impacts in underrepresentation of women at more senior levels, likely compounded for wāhine Māori (Walker et al., 2020). Instead of forcing women to choose between whānau and training within the RSI sector, parental leave should be remedied to an internationally acceptable level, including extending this to students. In addition, although the extension of eligibility following childbirth (and/or other reasons for taking time away from work) for Marsden and Rutherford funding is excellent, potentially this grace period should also be extended to graduate students who have a child during their degree. In addition to parental support, creating environments where people feel free to bring their babies and children to work (within reason – obviously not in dangerous lab areas!) would hew more closely to values held within Te Ao Māori.

One additional problem is that under the current RSI system, funding targeted at individual researchers (e.g. Marsden, Rutherford) is largely contingent on an institution agreeing to host the individual if they are successful in obtaining funds. Because neither of these awards can cover full salary (Marsden Fast-Starts at current funding are too limited to fund a FTE=1.0 postdoc with overheads) and/or overheads (Rutherford postdoc/discovery fellowship), the researcher/institution needs to (a) cover the shortfall in salary (e.g. through teaching contracts, other grants etc) and/or (b) accept a “loss on the books” of overhead. This has led to some Māori researchers being blocked by their current institution from applying for these grants: another lever removing Māori from the pipeline.

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Postgraduate Students and the Aotearoa New Zealand Research Workforce

A brief on the mismatch between doctoral student enrollments and the research workforce, by me and Troy Baisden. Citable version here: https://zenodo.org/record/6342486#.YiquZehBxCg

One of the six major issues raised in the Te Ara Paerangi green paper is the research workforce. The green paper states that “We want to ensure the research workforce can be offered attractive and flexible careers and career pathways.” It is also acknowledged that “Significantly more research-related doctoral candidates are coming out of New Zealand universities than permanent public research roles available”.1

In light of this, we want to highlight some available data on employment in the research workforce over the last twelve years. Firstly, all discussion about the research workforce needs to be grounded in the fact that New Zealand has doubled the number of PhD students since 2008 (Figure 1).

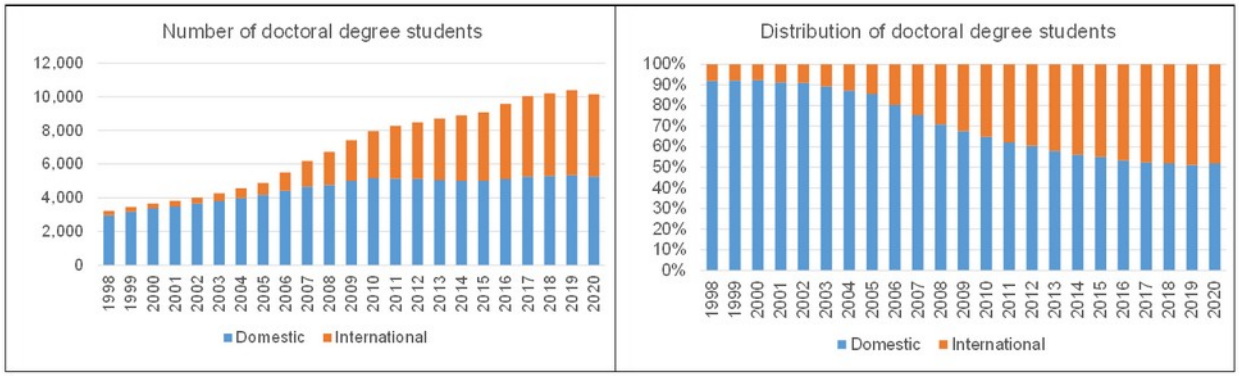


Figure 1: Number and distribution of doctoral degree students in New Zealand, divided between international and domestic students. Graphs are from the Education Counts website.2

It is obvious that the bulk of this growth has come from international students rather than domestic students. Domestic enrollment rose in the late 90s but has been largely stable since 2008. International student enrollment made up less than 10% of total doctoral student enrollment in 1998, but is now nearly 50% of total enrollment (which has itself tripled over the same time period). Although a New Zealand doctoral degree is usually expected to take three years, the total number of PhD graduates per year is less than ⅓ of this total enrollment figure, at approximately 1,500 graduates per year (Figure 2). This is probably partially due to the average length to graduation now being four years or longer across all disciplines.3 The rest of the mismatch can likely be attributed to non-completions.

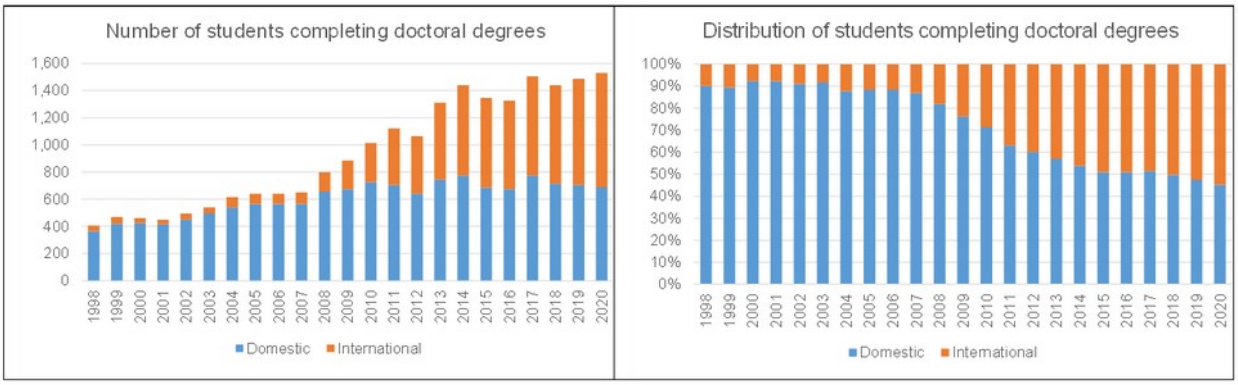


Figure 2: Students completing doctoral degrees annually and distribution between domestic and international enrollments. Graphs are from the Education Counts website.2

Meanwhile, total doctoral student enrollment now greatly surpasses the number of FTE PhD researchers across all sectors, not just “permanent public research roles” (Figure 3). The number of FTE PhD-holding researchers has been stable at approximately 4000 total FTEs since 2010. On average, this means that we are graduating approximately ⅓ as many PhDs per year as there is full-time work for our total PhD-educated R&D workforce. This ratio has worsened over time. In 2010 just over 1,000 people graduated with PhDs and there were just under 4,000 PhD-educated FTEs in R&D. By 2020 there were around the same number of employed FTEs, but 50% more graduates. Obviously FTEs are not headcounts and particularly in higher education many people will be employed in roles that are only partially attributable to R&D as a sector. Nevertheless, there is no scenario here where a PhD graduate can consider a research role in any sector in New Zealand a normative outcome of graduating with a PhD - a qualification which principally trains its holders to conduct research. The number of full-time roles in research, beyond study, is vastly lower than the number of people holding qualifications.

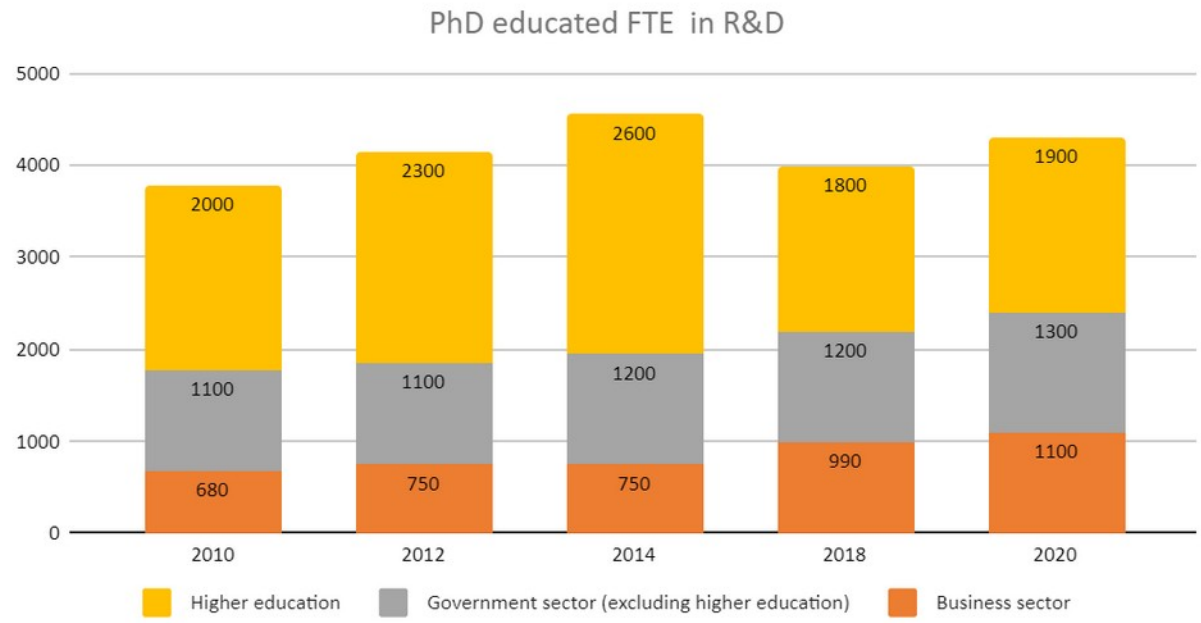


Figure 3: PhD-educated FTEs in research and development across all major sectors (higher education, government, and business). Data from Stats NZ Research and Development survey4

The final point that we would like to highlight is that MBIE highlights New Zealand (in its 2021 Research, Science, and Innovation report,5 see Figure 4) as a highly efficient producer of research outputs on an international stage. We submit that it is very easy to be highly efficient when you have a large, internationally-recruited workforce who are not considered workers in legal terms and are effectively employed on fixed-term contracts, but are counted as part of the research workforce in terms of their outputs and for the purposes of determining productivity (as the RSI report does - the Figure 14 caption notes that Masters students are included for the purposes of determining productivity per researcher).

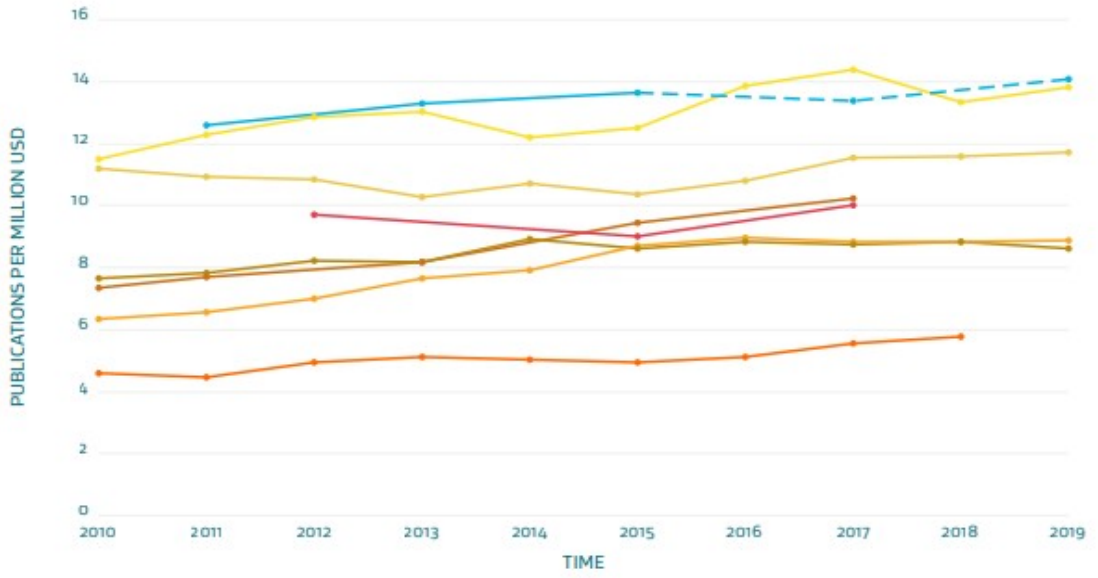
We believe that these graphs, taken together, show a fundamental imbalance in the New Zealand research system. We have vastly increased the number of people we are training for research roles, but that has not translated meaningfully into employment in research. We also believe that there is fundamental good in people learning how to become researchers and that these skills are transferable to many other non-research careers. The question we ask is: how stable can a research system be when the bulk of people involved in it are, by definition, temporary?

FIGURE 15

Publications per million dollars spent compared with other small advanced economies

New Zealand researchers consistently produce a high number of publications per dollar spent when compared to Australia and most small advanced economies (except for Ireland).

The number of New Zealand publications per dollar spent increased by 13 per cent from 2011 to 2019.



Data source:
Dimensions bibliometrics data See page 100
OECD main science and technology indicators See page 101
Stats NZ research and development survey See page 101

Publications per dollar spent are measured annually. The number of publications with authors affiliated to New Zealand research institutions is calculated with data from Dimensions[28]. The OECD offsets New Zealand data by 1 year for comparative purposes (ie 2018 Stats NZ R&D data is shown as 2017 OECD data). National currency data was converted to USD using the purchasing power parity[29] series from the OECD National Accounts Division. See further information[30]. Expenditure on research by business is excluded. Data for 2017 was recalculated based on revised 2020 Stats NZ R&D survey data and data for 2019 was approximated using 2020 Stats NZ R&D survey data. The dashed line leads through the approximated values.

Country/region
- New Zealand
- Ireland
- Israel
- Australia
- Switzerland
- Finland
- Denmark
- Singapore

Figure 4 (from MBIE Research, Science and Innovation Report - 2021): New Zealand publications per million dollars.

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4. Data from Stats NZ Research and Development Survey, Table RAD011AA (Full-time equivalents involved in research and development by highest qualification (Annual-Jun)), https://infoshare.stats.govt.nz/
5. Ministry of Business, Innovation & Employment, "The Research, Science and Innovation Report - 2021." Wellington, Aotearoa New Zealand. October 2021.

FMHS PGSA's submission - regarding the PhD stipend being below the minimum wage

Included with authors' permission.

Who Are We?

The Faculty of Medical and Health Sciences – Postgraduate Students' Association (FMHS-PGSA) is based at the University of Auckland. The signatories of this document are the board members of the FMHS-PGSA. This work stems from our open petition which garnered over 700 signatures – representative not only of our wider research community, but many constituent members of our organisation.

Joseph Chen, Co-President, FMHS-PGSA 2022

Julia Plank, Co-President, FMHS-PGSA 2022

Benjamin Lear, Faculty Research Committee Representative, FMHS-PGSA 2022

Div Panesar, Faculty Education Committee Representative, FMHS-PGSA 2021

Shree Senthil-Kumar, President, FMHS-PGSA 2021

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Section 7: Research workforce

In this section, we want information to help us understand how workforce considerations affect Research Priorities and how base grant funding would affect the research workforce, as well as information to help us design funding focused on workforce outcomes.

(See pages 66-68 of the Green Paper for context on these questions)

25. Workforce and research Priorities: How should we include workforce considerations in the design of national research Priorities?

(See pages 69-70 of the Green Paper for additional information related to this question)

We present the argument that PhD students should become officially paid employees and in turn, formalised as members of the research workforce. Their funding stream should therefore be linked to national research priorities. We present several misconceptions, their corresponding rebuttals, and the respective reasons on why PhD students should become officially paid employees.

Misconception #1: Postgraduate student researchers are volunteers. “The research work students do would not be the sort of work that would ordinarily be done by an employed researcher”. This misconception was sent to us by the MBIE team as justification why PhD students should be paid below minimum wage – see this link.

Rebuttal #1: The work of PhD students in medical research are typically expected to be published in peer-reviewed academic journals. To suggest that this work is not expected to be on par with professional research would be disingenuous. For example, the authors of this response are all in the process or have published in academic journals. Irrespective of whether a peer-reviewed journal article was written by a staff researcher or a student, both are treated to the same level of scrutiny and both are included in the QS world university rankings for research outputs.

Furthermore, in the Labour Inspectorate, drafted by the MBIE, they state five indicators that a worker should not be classified as a volunteer, and is potentially an employee:

1. The worker is being paid for their work – including rewards such as free accommodation or food
2. The worker expected to be rewarded for their work
3. There is an economic gain made to the business from the work performed by the worker
4. The work is integral to a business and it is work an employee would normally perform
5. The workers’ hours of work are controlled.

Our corresponding points all relate to the rules and regulations of the University of Auckland Doctoral Scholarships (https://cdn.auckland.ac.nz/assets/Scholarships/regulations/university-of-auckland-doctoral-scholarship.pdf):

1. “The intention of the Scholarship is to encourage and support academically excellent domestic and international students … to undertake doctoral study at the University of Auckland.” That is to say, the University is financially encouraging a PhD student to study at the University of Auckland by providing money. Much like how a business might financially pay a worker to perform their task at their business.
2. PhD students risk having their scholarship payments terminated if their work is unsatisfactory – see Point 14: A Scholarship may be terminated by the University of Auckland Council should it receive a report from the Board of Graduate Studies that a candidate’s academic progress is unsatisfactory. The PhD student can expect a lack of

financial compensation for a lack of work – similarly, the PhD student can therefore expect to be rewarded financially for producing work.

3. The work performed by PhD students (e.g. performing research duties, experiments, producing research outputs) directly allows Principal Investigators to use these research outputs of evidence of work in order to apply for more funding. Applying for more funding directly produces an economic gain to the University.
4. Producing research outputs (e.g. journal articles), performing experiments, and writing up these works are all integral functions of a research-intensive institution such as a University.
5. PhD students are restricted to undertake a maximum of 500 total hours of work per scholarship year (see Point 12 in the linked document). So, yes, PhD students' hours of work are controlled.

Misconception #2: Postgraduate student researchers are inexperienced. They are solely getting an education. We have heard pushback from our petition for a minimum wage stipend that because of the educational benefits of a PhD, the University is not required to pay a minimum wage; but rather, the training wage.

Rebuttal #2: In order to enrol in a PhD, you need to have completed either an Honours degree or a Masters degree. To say that a Masters degree graduate is then worth below the minimum wage severely denigrates the entire research profession. Furthermore, the suggestion that the educational benefits of a PhD justifies paying below minimum wage is absurd. Does this mean no on-the-job learning is expected in any other research role?

Misconception #3: The PhD scholarship is similar to the minimum wage when tuition fees are included.

Rebuttal #3: Firstly, taken at face value, this is not true. Even including tuition fees for 2022 at the University of Auckland (NZD 7,454.40) + stipend (NZD 28,800), this yields a total annual monetary value of NZD 36,254.40. Minimum wage as of 1st April 2022 is $21.20 per hour (* 40 hours * 52 weeks) yielding a value of NZD 44,096. Even if you take away tax, this would yield a take-home pay of NZD 37,253.79. Besides, it is the stipend that a PhD student can use to purchase rent. The free fees tuition waiver does not financially enable the PhD student.

Furthermore, we argue that the term 'tuition' is misleading as the vast majority of training is placed on the shoulders of supervisors, research fellows, technicians and other PhD students. The main incentives for supervising PhD students is for professional development and, as discussed above, labour. Other than the supervisor, there is no obligation by any other party to provide such training and instead is done out of the good will or from utter necessity to reach grant deadlines or fill labour shortages in an underfunded industry. This relationship has long been taken advantage of by the

university as no party other than the university benefits from this tuition fee, it is simply an overhead for students to be in research group which already pays overheads.

If tuition fees are being used to fill grants to assist with PhD student research, we argue that only a minority of supervisors have access to the RDA grants and this is not specifically for supporting the student. Furthermore, the PReSS account (a financial account a PhD student has access) of $2,900 per annum is only a fraction of the $7,454.40 tuition fees, however irrespective of whether this money is used by the student; which industry expects the worker to pay out of pocket for materials used at work? Overall, the PhD student experience is being paid by the supervisor/ research group who already pay the university overheads, the university is simply cashing in on the existence of the PhD student.

Misconception #4: We can promote equity and diversity in the research workforce whilst paying PhD students below the minimum wage.

Rebuttal #4: The principal author of this feedback has been involved in teaching every single PGDipBiomedSc/PGDip Physiology/Masters of Biomedical Science student since 2017. With roughly 30 students each year, across 5 years, only two students were of Māori ethnicity. Both did not continue in the research workforce. In this author's teaching experience in the medical science field, students of Māori descent do not view research as a viable pathway as they cannot survive on a PhD stipend which barely pays them enough to support themselves, let alone their family members – whom are usually dependent on the would-be students' support. As a Faculty-based Postgraduate Students' Association, we interact widely with numerous postgraduate students involved in medical research and we struggle immensely to engage with and sustain our tangata whenua. All advertisements directed to Māori undergraduate students encourages them to pursue a clinical career (via the MAPAS programme) due to the ability to get a job after graduation. Any suggestion that we must increase the representation of Māori research workforce cannot begin without raising the PhD stipend as that is a current huge bottleneck which disincentivises the entry into the research profession. As the Green Paper has rightly said, Māori researchers are often expected to work a double-shift as a researcher and a "cultural expert". To alleviate the workloads of these double-shifted Māori academics, we must increase the number of Māori PhD students particularly in areas of national research priority. The lack of a sustainable PhD stipend acts directly against promoting diversity and equity, acting instead to further broaden the ever widening equity gap in the research workforce in New Zealand. The MBIE boasts its policies shall be made with te Tiriti guidance, however we fail to see how any te Tiriti principles are upheld with the policy changes.

Conclusion: PhD students are already required to be highly trained – notably with a requirement of a Masters degree or an Honours degree. Yet, they are paid as if they are not highly trained. This has meant that PhD students have simply been used as "cheap labour". In fact, supervisors have been known to encourage PhD students to prolong their studies or even actively obstruct their completion due to the low cost they can pay a PhD student (80,000pa). Given the lack of coverage of

employment law over PhD students, this has allowed numerous cases of abuse of PhD students that are regularly ‘swept under the rug’ with little to no consequences to the perpetrators. By tying PhD student employment to research priorities, it sends a clear, easier signal of entry into the research workforce to both undergraduate students and target equity groups of a prescribed career trajectory.

26. Base grant and workforce: What impact would a base grant have on the research workforce?

(See pages 70-71 of the Green Paper for additional information related to this question)

The base grant idea would be good to stabilise long-term funding and improve career stability. We also strongly concur with the problem of academic precarity (in reference to the recent work by NZUSA and NZAS) as a definitive deterrent for many people thinking of continuing their research careers in New Zealand – thereby encouraging many postgraduates overseas after completion of their PhD. However, we must strongly reiterate that these base grants appear to give institutions more power to underpay their PhD students and employ them in below minimum wage situations. Perhaps if the “base grant” was tied to the condition that PhD students directly tied to national research priorities were considered employees, this could be more effective in promoting the research career. In our recent interactions with numerous staff on the matter of PhD stipends, they have refused to accept the stipend was below the minimum wage and been dismissive in the plight of PhD students. For example:

“As indicated earlier I do not accept the argument with regard to either minimum wage…”

- Despite the fact that the cash on hand is $8750 lower for the UOA PhD Stipend (2022) than the 2022 minimum wage.

“The allowable 500 hours/year additional work (without paying secondary tax) is a reasonable way to cover other costs and certainly is an earning opportunity that would not be so attractive to a minimum wage workers who would be paying secondary tax on that 500 hours.”

- Despite the fact that this would mean PhD students are expected to work 50 hours per week to make ends meet; and that any excessive tax is paid back to the taxpayer’s bank account at the end of the tax year. This shows a complete lack of empathy or understanding from senior University staff.

“As holder of a UoA guaranteed doctoral scholarship the student has a degree of freedom to choose what they do and don't do when following their research ideas that a minimum wage worker could only dream of (or even a PhD student who is tied to a grant funded stipend and has to work toward the goals and aims of that grant). That freedom has a tangible value.”

- We asked for the dollar value this person would associate with this “freedom”. They have yet to justify this amount.

“The student has access to a work environment, equipment, expertise, mentoring, international travel (pre-2020), a securely funded 3 years and other intangible "perks" that the typical minimum wage worker (who has nowhere near the same earning security) could only dream of. The skills and knowledge being acquired, and the close mentorship and guidance from supervisors also has a tangible value.”

- Despite the fact that students are often abused and depression rates amongst postgraduate students are higher than in the general public. No thought is given to the occupational hazard of poorer mental health outcomes when it comes to postgraduate student researchers.

“The period on the near minimum wage (slightly above in my opinion - see 1) is very temporary. Within 3-3 1/2 years of starting their research training, post-doc starting salary at UoA is 1.6 times the median NZ salary - there are not too many other fields where there is such a significant jump like that.”

- If PhD students were **guaranteed** to get a job after their graduation, we would not be arguing as tenaciously about this – but PhD students are not given any sense of job security post-graduation.
- “In fact, only 65% of the doctoral cohort will find employment 4 years after they last studied. This was a lower rate of employment in New Zealand than domestic bachelors and masters graduates from the same leaving year.” https://www.educationcounts.govt.nz/publications/80898/do-people-with-doctoral-degrees-get-jobs-in-nz-post-study
- Furthermore, if future high wages are a justification for paying a below-minimum wage, then we would like to query what the point of a minimum wage is in any position.

Many of our interactions with regards to the minimum wage PhD stipend are outlined in this document:
https://docs.google.com/document/d/1iXhFGHbYcdRajbC6oEaTKk9lfkae7lEUNo3AO92hV84/edit#

We note that time and time again, many people dismiss the issues that are tangibly affecting postgraduate students’ welfare.

27. Better designed funding mechanisms: How do we design new funding mechanisms that strongly focus on workforce outcomes?

(See page 72 of the Green Paper for additional information related to this question)

We advocate for PhD students to be regarded as employees when working on national research priorities. This would bring their wage up to a liveable and legal standard. By doing this, this would attract people to a sustainable profession which would allow people who otherwise would not have the means to enter this research profession and promote diversity in the future workforce. Funding mechanisms should come with stipulations that PhD student researchers must be employed and base grants should stipulate that any PhD student researcher should be employed at such institutions.

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A robust Research, Science and Innovation system must include funding programs and hiring schemes that reflect the unique challenges faced by temporary migrant workers

Synopsis: Aotearoa is by far the biggest per-capita issuer of temporary work permits for migrant workers within the OECD. This workforce plays a critical role in the science and research industry and adds immense financial, social, and cultural capital to the nation. However, the precarious work contracts and temporary immigration permits, have an adverse effect on the physical and mental wellbeing of these workers. Any restructuring to the Research, Science and Innovation workforce which does not address the specific vulnerabilities of these workers will fail to retain and benefit from the ideas and labour of this community.

The Te Ara Paerangi green paper states that this undertaking is focused on considering changes to the Research, Science and Innovation workforce that would make it more diverse and dynamic and simultaneously attract and retain excellent talent. It goes on to state in Chapter 5. Te Hunga Mahi Rangahau Research Workforce that they want to address issues of Equity, Diversity and Inclusion; career precarity for early career researchers; and create a better Research, Science and Innovation education pipeline. Such considerations are vital for the competitiveness of Aotearoa's research sector, but also to ensure the wellbeing of the workforce. However, while addressing these issues for permanent residents and citizens of Aotearoa is essential, the plight of individuals working in the Research, Science and Innovation system on temporary work permits is absent from the document. The fact that immigrant workers lack many of the rights and benefits granted to residents/citizens of Aotearoa limits their engagement with the workplace, and broader society. Creating productive and harmonious work teams is very difficult under conditions where a large segment of the workforce spends significant time and resources dealing with the immigration processes, often without much institutional support. A rethinking of the Research, Science and Innovation workforce requires an active inclusion of the aspirations of such workers and the creation of a more inclusive model of hiring, funding and support which extends beyond residents/citizens.

Any overhaul of the Research, Science and Innovation system needs to consider the wellbeing and resilience needs of the temporary permit workforce. For example, the question of including workforce considerations in the design of research priorities or the exploration of new funding mechanisms that strongly focus on workforce outcomes. Recent reports and research into the situation of temporary workers, many of whom derive from the massive international student population, have unearthed the following trends. Despite popular fears, often sustained through various media outlets, international students are not taking jobs from the citizens of Aotearoa(**1**) and, despite creating significant jobs within the country, are usually unable to find long term employment in high skilled industries(**2**). Many highly skilled workers end up doing non-standard/platform mediated/gig work that does not utilise their skills. Many temporary permit workers are employed through such means which often denies them the benefits of collective bargaining through unions and the benefits of more standard labour contracts which include paid parental leave(**3**). In a recent Royal Society of New Zealand Te Apaerangi briefing paper(**4**) it was noted that employment rates for people with PhDs decreased from 85% in 2006 to 77% in 2018. At the same time, Crown Research Institutes were noting a lack of competitive applications from domestic applicants and a need to hire workers from overseas. It also reported a significant increase in the number of precariously employed workers in a variety of disciplines across the Research, Science and Innovation system. How the precarious work situation impacts the wellbeing, productivity and innovation potential of individuals hired through temporary work permits is not well understood. There needs to be much more research done to understand how the lack of permanent jobs, the border closures due to COVID-19 and the increasing unemployment rates for workers with advanced educational degrees, impact the temporary permit workforce and through it the current and future health of the Research, Science and Innovation system. The exceptional vulnerability of individuals and their whānau due to their temporary immigration status undermines their ability to be efficient workers and invest more sustainably in the broader society of Aotearoa. It also creates a situation of exploitation through extractive labour contracts, which thwart movement towards meaningful, non-exploitative employment within the Research, Science and

Innovation system. If the government is serious about tackling the issues of labour precarity and discrimination while catalysing a dynamic, productive and collaborative workforce, the process needs to address the specific vulnerabilities and aspirations of the temporary permit workforce.

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Training-Workforce Mismatch for New Zealand Doctorates

Current and future gains from increased Business R&D may be limited by a large and growing gap between employment of PhD-qualified researchers in Business R&D. Positions for 4300 PhD-qualified researchers would be needed to bring the Business R&D sector to one PhD FTE per $0.5 m R&D expenditure, currently. At this ratio, twice this estimate (8600 FTE) will be required for R&D to reach 2% of GDP.

Additional tables from the StatsNZ R&D Survey were obtained from StatsNZ Infoshare to produce these results.

Reference:

Baisden, W Troy. (2022). 8. Training-Workforce Mismatch for New Zealand Doctorates. Zenodo. https://doi.org/10.5281/zenodo.6354873

Cross-RSI ecosystem internships

We need to make sure that students have the ability to match their skills and passions to downstream careers in the RSI sector. One way to achieve this would be to mandate internships for students with other entities in the RSi sector (e.g. private industry, CRIs, local government, iwi, central government) and/or placement at regional hubs. The co-location of government agencies, universities, and wānanga at regional hubs could potentially follow the model of shared campuses of government agencies and universities in the United States. This regional hub model is likely to facilitate benefit return and knowledge return to communities, but in addition, this needs to be explicitly required by all funding streams.

Proposal to develop a government postdoctoral scheme

This submission proposes that MBIE develop a postdoctoral program to place early career researchers into roles within central government. It argues that a government postdoctoral fellowship scheme would be a low investment, high impact, way to improve the research, science, and innovation career pipeline. It would (i) retain talent in New Zealand, (ii) provide a career pathway into government and industry for ECRs, and (iii) strengthen collaboration at the science-policy interface.

We include it here by reference: https://zenodo.org/record/6336190#.YibJh5NBzzc

Assessing the success of training based on the happiness of trainees

Universities should be at least partly assessed based on the satisfaction of former students with the jobs that they are now in. This is why it is slightly puzzling that PBRF has not been considered within the scope of this review. Currently, training of people within the workforce is largely driven by universities, where PBRF forms an appreciable chunk of funding. PBRF is skewed to rewarding publications rather than, for example, relationship building with local communities or ensuring trainees are going on to satisfying downstream careers. Without a holistic focus on all sources of funding, universities will continue to train students in an environment that prioritizes journal articles rather than communities and people, and these attitudes will propagate into the workforce at large through the people lucky enough to stay in the RSI sector.

Rebuilding a Research, Science, & Innovation system that is just, inclusive and kind

As members of the research, science, and innovation system, it is our collective responsibility to call out practices & policies that we identify as unjust, non-inclusive and unkind. There are many groups putting laudable time and effort into responses to Te Ara Paerangi / Future Pathways (Green Paper) that aspire to change the way we do research, science, and innovation in Aotearoa. In addition to the scholarship being shared here (e.g., A strong and resilient research system is built by valuing people), we are grateful for recent initiatives led by exceptional teams of early career researchers (e.g., Simpson et al. 2022 , Nissen et al. 2020), and a growing literature (e.g., Wehi et al., 2014; Kidman, 2019; Wehi et al., 2019; McAllister et al., 2020; Naepi et al., 2020; Walker et al., 2020, Brower & James, 2021; McAllister et al., 2022). We look forward to seeing these and others' contributions (including those yet to come) shape a new research, science, and innovatin system that is just, inclusive and kind.

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Te Tiriti & mātauranga Māori

What is missing from the RSI system is not just mātauranga, it is tikanga

Unless significant changes are made, any Māori researchers retained in the RSI system will face similar challenges to researchers currently within the system, namely that manaakitanga and kaitiakitanga are not embedded in the system. The RSI sector currently trains too many PhD students for research jobs that do not exist. Although this makes for a 'productive' research landscape from the perspective that talent is always available, it is brutal and demoralizing to individuals who end up under-employed for the training that they have. Even for those who graduate and manage to secure a job in the RSI sector, the precarity of employment is soul destroying. It delays people from being able to buy homes, start families, and save for retirement. It stops them being able to put roots down, because it is likely with the end of each contract, they will have to move locations. In whatever new form the RSI sector takes, valuing people and their lives needs to be at the centre of it.

How mātauranga, te reo, tikanga and other taonga is protected and uplifted

Embedding Te Tiriti in a reimagined RSI system will require greater protection for the various taonga of Māori of interest to the RSI system, including taonga species, their data, and mātauranga. There have been relatively recent examples where taonga species have had their genomes sequenced, and the data has been placed on overseas data repositories, extinguishing any rights to benefits under Te Tiriti. When a conversation with free, prior, and informed consent (FPIC; "United Nations Declaration on the Rights of Indigenous Peoples," 2007) for uploading data offshore occurs with local communities in language that is "reMāorified"/Indigenised ("reMāorification", a term coined by Moana Jackson: Cairns, 2020) so that Māori communities thoroughly understand the risks, and they exercise their tino rangatiratanga to make a decision to upload the data offshore, kei te pai. However, in many of these cases, such conversations are not documented in the methods, nor are the Māori communities with kaitiakitanga responsibilities for the samples mentioned in the acknowledgements, suggesting these conversations have not taken place. Museums seem to be particularly represented in "overseas lending" practices, which allows colonisation to cut twice – once when the samples were taken historically without consulting with kaitiaki, and again when this lack of engagement cuts once more. Full, prior and informed consent as a model would facilitate the "reMāorification" of science, assisting tikanga experts working with scientists.

All research with Māori communities should be compliant with the concerns raised in WAI262 and any re-imagining of the RSI sector needs to include the ability for Māori communities to have sovereignty over data collected from within their takiwā/rohe. Despite institutions having over two decades since WAI262 to implement responsiveness to Māori and mātauranga within institutional policy, some seem resistant to change. One way to incentivize change would be to provision public funds only to institutions that have a comprehensive policy on Te Tiriti and Māori responsiveness i.e., institutions that have signalled that they are ready to move forward working constructively with whānau, hapū, and iwi Māori, and have all the policies and practices in place to do this in a mutually beneficial way.

Furthermore, tikanga experts should be involved in discussions of data repositories to ensure data is stored safely (e.g. considerations about where the data of the dead are stored relative to that of the living), as well as appropriate protocols (e.g. karakia) being implemented when data is collected/samples taken. In addition, education is again key, to ensure that RSI practitioners are aware of their obligations to taonga under WAI262, and to ensure that any work with Māori communities does not rely on extractive use of mātauranga. In addition, an RSI system that funds "non-traditional outputs" related to mātauranga, and the safe guarding of mātauranga is important (e.g. it may not be appropriate for mātauranga to be recorded, but instead passed down to the next kaitiaki of this knowledge). In short, there are strong opportunities for New Zealand to lead the world in data collection/management/storage protocols that enshrine the values and priorities of Indigenous Peoples.

The role for te reo Māori and tikanga Māori in a newly envisioned RSI system has not yet been adequately signalled within the green paper. This is despite the strong projections of te reo Māori

and tikanga through research conducted at kura kaupapa and PhD theses presented at wānanga. In te reo Māori immersion spaces from kōhanga reo all the way through to wānanga and whare wānanga, te reo Māori and tikanga are at the heart of research through the act of heritage deliberation, discussion, cooperation, and the dissemination of knowledge. The underpinning te reo and tikanga Māori facilitate active and rich collaboration, participatory learning, and sharing. While we identify the gap in acknowledgement of te reo and tikanga within the green paper, we also emphasize that ensuring academic research integrity when it comes to researching te reo Māori and tikanga Māori should also be of the highest priority.

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Te Ara Paerangi – Future Pathways Programme submission: proposal for formal Te Tiriti and mātauranga Māori curriculum for researchers

This proposes that MBIE develop a formal, regular curriculum on Te Tiriti and mātauranga Māori for all researchers in Aotearoa who apply for government funds. We propose that this course be a requirement for funding, both base funding and project specific streams. More in-depth, optional, specialised courses would be offered for those researchers who work directly with human resources, be that communities, individuals, sensitive information related to communities or individuals, clinical samples, cell lines or data such as genomes or gene expression patterns; or for all researchers who work in Aotearoa with endemic and native non-human species; or for researchers who are involved in applying for funding for projects in Aotearoa that include any of the above. This programme would mirror similar training requirements enforced by the Ministry of Primary Industries regarding responsible animal use as per the Animal Welfare Act 1991 and the Environmental Protection Authority under Ministry for the Environment biosecurity protocols required for genetically modified organisms as per the Hazardous Substances and New Organisms Act 1996, for example. We consider ethical research with, by and on Māori to be of equal importance, justifying widespread minimum basic training. Such minimum basic training has been proposed by the National Science Challenges and Ngā Pae o te Māramataka Rauika Māngai in the ‘Guide to Vision Mātauranga’ report from 2020 (pg. 11, 69).

It would address the following question in the Green Paper:

- Key Question 5: What are your thoughts on how to enable and protect mātauranga Māori in the research system?

The programme would consist of a short seminar (basic training) or a longer detailed programme (sector specific), to be completed before initiation of projects and a refresher course every 12 months. It could be carried out by an authorised in-house cultural advisor, or an external contracted party, and would involve post-seminar quizzes on basic cultural competency. It would consist of the

following topics, with optional exploration of sector relevant information in the detailed programmes:

1. General topics
    1. Basic content of Te Tiriti and relevance to research in modern day Aotearoa.
    2. Basic explanation of mātauranga Māori and unique value to research.
2. Sector specific topics
    1. Basic te reo terms relevant to their sector.
    2. Basic overview of Māori inequities in the researcher audience sector.
    3. Brief history of Māori community relationships with research in their sector.
3. Code of conduct when engaging with Māori and Māori communities in the course of research, whether that be as:
    1. External community collaborator (e.g. iwi sharing research relevant mātauranga/knowledge on e.g. local waterway)
    2. External service provider (e.g. field guide)
    3. Research subject (e.g. clinical trial patients and whānau)
    4. Fellow researcher (e.g. PhD student)
4. Group lead/Funding applicant specific topic
    1. Best practices and behaviour to avoid in incorporating mātauranga Māori into existing or proposed research (e.g. Vision Mātauranga in funding applications, project design considerations)
5. Time for general questions and discussion on mātauranga, Māori communities, and research, which can take place in a space that does not put that burden on Māori colleagues.

This programme would, in the short term:

1. Vastly and quickly increase the basic knowledge of the entire hierarchy of the Research Science and Innovation (RSI) system, especially amongst tangata Tiriti who lack cultural competency, and international researchers choosing to undertake research in Aotearoa. Many researchers are aware cultural competency is an area they need to improve in, but are unsure how best to go about this.
2. Move Te Tiriti and mātauranga Māori from an optional career development upskill for those researchers already inclined to further knowledge on Te Ao Māori into a required key minimum competency for every researcher whose work impacts Māori.
3. Decrease the chance of racist research being carried out, whether that be stealing Māori intellectual property, perpetuating racist stereotypes, inadequate consultation, or erecting barriers to Māori access to research outcomes such as medical therapies.
4. Formalise, centralise and standardise already existing cultural training courses for researchers in Aotearoa. It is envisioned that this would reduce but not eliminate the need for already existing training programmes within institutions, as these could be reprioritised to give more industry specific (e.g. clinical, taonga species etc) or in-depth training. The course would also not replace the need for project-specific community engagement, but serve as foundational knowledge for that work to begin.
5. Minimise rare Māori researchers having to work double shifts/aronga takirua to oversee research from their tangata Tiriti colleagues and make sure it is culturally ethical and safe,

while also trying to carry out their own research. Especially for those Māori researchers where a cultural advisor role is not part of their designated job description.

This programme would, in the long term:

1. Increase Māori trust in the RSI system, and therefore increase equity and diversity as Māori see the RSI system as a viable career choice.
2. Improve connectivity between the RSI system and Māori communities and therefore lead to more and better collaborations and successful research.
3. Normalise the consideration of tikanga and Te Ao Māori values in all sectors of research in Aotearoa, and lead to deeper general understanding among RSI workers and their associates of Te Tiriti, mātauranga Māori and Te Ao Māori in general.
4. Serve as a pilot for efficient and effective cultural literacy and reciprocity training that reduces surprise scenarios for international collaborations.

Feasibility. A government programme that requires Aotearoa researchers to display minimum cultural competency would have some start-up costs required, and would take time to approve curriculum, publicise the new requirement, and train course providers. However, taking advantage of the training resources for similar already extant courses within several institutions, this set-up cost and time can be minimised. Examples of training programmes already in use are:

1. Te Tiriti Course led by Robert Consadine based on material in his book (Consedine and Consedine, 2012)
2. The Science for Technological Innovation (SfTI) Capacity Development Programme, which includes modules on Vision Mātauranga (Q.10, pg 14)
3. University courses, for example:
    a. Manukau Institute of Technology programme on cultural competency
    b. Victoria University of Wellington Te Hāpai programme
    c. Massey University course on Te Reo and tikanga Māori
4. Various international graduate and undergraduate courses based on the book ‘Decolonising Methodologies’ by Linda Tuhiwai Smith (Smith, 2012) for instance in Australia, the UK and USA.

Conclusion. A government Te Tiriti and Mātauranga Māori programme for researchers would undoubtedly improve the research, science, and innovation system, with long-term benefits and reach beyond the RSI sector. Although it would require not insignificant set-up costs, the benefits both intangible and tangible would strengthen the RSI system as a whole and more than make up for this investment. This proposal would roundly improve the RSI system and support the aspirations of the Te Ara Paerangi – Future Pathways Programme as a modern, accessible, inclusive, and productive sector of Aotearoa.

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A citable version of this proposal can be found at https://zenodo.org/record/6355132#.YjA2hlhBy3I

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A rōhi by any other name

We note that even just relatively recently (in 2015), the ‘Endeavour’ fund was created, administered through MBIE. In addition, The Royal Society Te Apārangi administers a “James Cook Research Fellowship”. We hope it can be appreciated that Māori may have mixed feelings about applying for such fellowships, given through their naming, they privilege an English explorer’s name and the name of his ship (and contact with a civilisation that had negative impacts on Māori), over the many Māori tūpuna and their waka who had arrived centuries before. In fact, although we acknowledge that due to colonisation many Māori do not have te reo Māori names, only 2 of the 23 funding opportunities advertised by the Royal Society Te Apārangi have te reo Māori names. It may seem like a relatively small thing, but a key tenet of Te Ao Māori is that names have power. The names we chose for awards and funding opportunities should reflect this power, as well as the diversity we want to see among the work force. Our built environments also reflect this issue. Many buildings/structures throughout the RSI system could be from anywhere in the Northern Hemisphere: it is hard to see a visual representation of Te Ao Māori within the current RSI sector. Weaving Te Ao Māori into the RSI sector in a holistic manner – the way that Te Ao Māori functions – will nurture the uniqueness and strength of RSI in Aotearoa.

By Māori, for Māori

In the Ministers’ foreword, the green paper states that “we saw the best of our research system through the support it provided to the country during the COVID-19 pandemic.” While this might be true in general, systematic failures have been identified in the extent to which the government honoured Te Tiriti in its response to COVID (WAI2575, 2021). Despite the alarm being sounded by Māori leaders and service providers, this advice appeared to be ignored, leading to disproportionate death among Māori from COVID-19 (Megget, 2022). While this might serve as an extreme example, it shows the current reluctance of the crown to respect Māori knowledge structures and expertise e.g. a “seat at the table” is not enough, if decision makers are not prioritising Māori needs and aspirations.

A solution is to embed Māori as ‘decision makers’ in the newly realised RSI system, including Māori-specific funding streams administered by Māori, for Māori, to the benefit of Māori communities. It is also important to note that embedding Māori within organisational management is key. Some of us have experience working with organisations that have Māori-specific ‘oversight’ of research proposals (i.e. a kāhui, or reviewers of Vision Mātauranga), yet intermediate operational decisions can stymie the ability of Māori-relevant research to even reach these final reviews. These

points (“by Māori, for Māori” and embedding Māori as decision makers) are important to consider across the questions asked throughout the green paper. For example, Māori should set national research priorities, Māori should decide what core functions are, and Māori should choose “performance metrics”. Māori should be present in management structures of all research organisations with real power to influence decisions (and not just as a ‘token’ gesture of diversity), there should be Māori researchers doing the work, Māori should explicitly benefit from research, and Māori should be the ones who assess the impact of this benefit. While this can (and should) be achieved within current institutions, Māori-led entities (e.g. whānau, hapū, iwi, the aforementioned regional hubs) should also be provided the funding and freedom to succeed under these terms as well.

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Supervisors to take responsibility for whakawhanaungatanga

Ideally relationships with Māori and other communities involved in ‘benefit return’ need to be held by supervisors rather than students or fixed-term workers (to whom these relationships can then be extended). This is because if the supervisors have not cultivated these relationships – the students/fixed-term workers are left in the position of developing these relationships instead of doing their science, which then comes at a professional cost to them (in terms of fewer publications). Because publications are what are rewarded in the current system, this rewards bad behaviour (from a Te Tiriti standpoint), in that the science is prioritized over relationship building.

Infrastructure

A Nuanced Approach to Genomics Infrastructure Will Serve Well

Introduction

Genomics is a broad research discipline, covering things from COVID-19 sequencing to human health to the biological diversity which sustains the planet. To support the best possible genomics research, the research system of the future must be more nimble, encouraging rapid integration of changes that happen in this field while being mindful of the mature parts of the science that continue to underpin research capability. There are many ways we can approach this challenge. Here we will look at two key aspects of genomics research as examples: DNA sequencing and computational analyses.

DNA sequencing

In brief, DNA sequencing 'reads' the letters in DNA producing data composed of the base letters A, C, G, and T. There are many technologies that do this job. Each with its own particular best use case. Some of them produce small amounts of very accurate data. Here we are referring to Sanger Sequencing. This is one of the workhorses of molecular biology. The country has this capability

now and will continue to need it in the future. There are other technologies (many different flavours) that produce lots and lots of sequence data. Some of these are big and expensive, but we have enough call for to have a reasonable number of in country for shared use. Other types of these instruments would be used so rarely, that a capital investment may not make sense. Still others, are very inexpensive and able to be deployed in the field rather than in a big institutional laboratory. Many more are yet to be invented. A one-size-fits-all policy would serve genomics science very poorly. What could serve genomics research and the communities it supports well is careful exploration of current capabilities and future possibilities within a flexible framework lead by researchers.

Computational analyses

There are many types of analyses done with genomic data. In computational infrastructure, like the different sequencing technologies, one size does not fit all. Our current menagerie of computing infrastructure is mainly based on technologies that are well past their prime. Changing this kind of infrastructure can be difficult due to the appearance of sunk costs and players who are comfortable working the current system. Alternatives to our current model already exist. It is time to empower researchers to choose the best approaches for the work that they are doing and let them push on the cutting edge. This can be done by providing the option of including computational costs in grants, rather than only including them in institutional overheads or a handful of publicly funded national institutions.

Conclusion

For genomics research to reach its potential benefits for all New Zealanders, we must avoid the narrow (and incorrect) a few-sizes-fits-many approaches to DNA sequencing and computational infrastructures. The private and NGO sectors in Aotearoa are already demonstrating how to do this, improving the science and innovating along the way. This is the case for the two example areas of genomics which we describe here and others as well.

Strengthening and Streamlining Our Research Computer Network

The research system is fortunate to have had visionaries push for a research computing network which was started in 2005 as the Kiwi Advanced Research and Education Network (KAREN). It is now operated by the crown entity Research and Education Advanced Network New Zealand (REANNZ). National research and education networks are different that the standard internet. They are designed to serve the specific needs of the research and education sectors. The need to transfer large amounts of data at speed have grown rapidly since KAREN was started. This is particularly true in fields such as genomics and astro-physics, but impacts many others as well. In the age of the pandemic and video conference meetings the importance of a strong, stable, accessible research network is obvious.

At present, some of the funding for REANNZ and KAREN comes from 'member subscriptions' paid out of member institutions's budgets. Decades of very low funding across they system have made the job of convincing those institutions to join or renew membership harder and more time consuming. The research network is such a central part of the research system today, that it is not an optional 'nice to have' if we can afford it component. We argue that the structure of how we in New

Zealand pay for and deliver research networking should change. One way is for the central government to set allocate operational and capital funds to REANNZ and for REANNZ to provide their service to the same institutions as they do now, with room for expansion in the future. In this way, the REANNZ staff could focus on providing the essential service that they are so good at, and develop the services of the future.

Institutions

Improving Transparency and Social Responsibility

Crown Research Institutes are State Owned Enterprises, companies own by Crown. Universities and other tertiary education organisations have been seen to be operating as businesses as well, hence the talk about the $5 billion Tertiary Education Industry over the last years. As Crown entities of one form or another, all of these organisations should be working for the benefit of all New Zealanders. At the moment, there is very little transparency around how they operate, are governed, and how well they perform in terms of social responsibility. The usual conflicts of interest in a small country make this even more difficult.

To encourage the research, science, and innovation system related Crown entities to become world leaders in transparency, governance, and social responsibility, we recommend that they be required to become certified Benefit Corporations. This process uses external assessors and internationally agreed upon standards to work towards a staged improvement of the entity. See references for links to more information about Benefit Corporations.

References

B Lab

B Lab Australia Guide Overview