Te Ara Paerangi Future Pathways Green Paper 2021

Submission from the Academy of the Royal Society Te Apārangi

March 2022

The Academy of the Royal Society Te Apārangi welcomes the opportunity to comment on the Te Ara Paerangi Future Pathways Green Paper.

The mission of the Academy of the Royal Society Te Apārangi is to honour, recognise and encourage outstanding achievement in the sciences, technologies and humanities, as well as to assist and support the activities of Royal Society Te Apārangi, including providing independent and nonpartisan advice to government policy makers and the wider community on science, technology and the humanities.

This submission has been prepared by the Academy Executive Committee, who are elected by the Society's Fellows, but it does not necessarily express the views of all the Academy's Fellowship.

Research Priorities

Guiding principles for the scope and focus of research priorities

Summary:

- Government departments, iwi, business, researchers and the community must be involved, and have the means to be involved, as end-users and intermediaries, in priority setting.
- Key principles could include: Responsive to national priorities; supports future needs; invests in emergent sectors; supports the advancement of knowledge in general; supports co-design; highly collaborative; respectful of different types of knowledge; engages internationally; and is world leading.

Currently, the Green Paper identifies the articulation of research priorities as an area of focus. Given the membership of the Academy spans organisations and disciplines, the focus of our comments seeks to be on wider research system perspectives, and principles to enable, and reach, priorities.

There are already priorities set within the MBIE funding system. These encompass 21 areas, ranging across biosecurity, environmental, various ecosystems, productivity sectors, heritage and law. Each of these areas has a particular amount of investment dollars associated with it in each funding round. These priority areas of research, and the funding allocated to each, are decided by Government, but the level of cross-government departmental consultation on priorities, or discussions with end users, is not clear. Government departments, iwi, business, researchers and the community must be involved, and have the means to be involved, as end-users and intermediaries, in priority setting.

It will not be without its challenges. There will be a need to trade off the need of the 'no surprises' policy environment with the requirement for researcher independence, and overcome the pressures of Government Departments being driven to look short-term at the issue-of-the-day. To address this, Government Departments need to be dynamic, with engagement around science priorities spearheaded by science advisors.

It should also be noted that not all research funding comes from Government, although it clearly tracks some priorities. For example, New Zealand's largest CRI, Plant & Food Research, currently receives 36% ($66.8 million) of its revenue from Government sources either directly, or indirectly. The remaining 64% ($117.2 million) comes from commercial activities or royalty streams. This also applies to some other CRIs, Universities and independent research organisations. Government research priorities, therefore, even where they exist, can be a somewhat weak lever for the Government to direct research.

Nevertheless, it is important for New Zealand that Government can ensure work on national priorities is undertaken so there needs to be research-priority setting procedures.

In today's research context, research is becoming more transdisciplinary, and encompassing of different types of knowledge. Increasingly, New Zealand's research sector encompasses a broader range of fields and knowledge systems across the sciences, social sciences, humanities and Māori knowledge. National research priorities should take account of the benefits, both long and short term, of research that incorporates more than one discipline.

History

It is worthwhile looking back to systems that were in place in New Zealand to establish national research priorities and to assess their fitness for purposes at those times to learn "what worked" and "what didn't", and how we can build a new system for priority-setting that meets the exigencies of today.

In 1963 the National Research Council Act (NRAC) established a Council whose functions "… shall be to advise the Minister on- (a) The promotion and development of scientific research in New Zealand, and (b) The planning and coordination of scientific research and services in New Zealand".

Some 27 years later, this Council's function was replaced through the Foundation for Research, Science, and Technology Act 1990 whereby, inter alia, the Foundation's (FRST) "… advice on matters relating to national priorities for research, science, and technology shall be formulated after consultation between the Foundation and representatives of industry, researchers, Māori, and the community."

This Act was repealed by the Research, Science and Technology Act 2010, which established "… boards to make independent funding decisions in respect of the allocation of specified expenses appropriated for the purposes of research, science, or technology, or related activities."

Since 2010, there has been investment decision making only within broad categories, with minimal strategic priority setting.

In this context, we suggest that key principles to guide research priorities could be that it:

- responds to current national priorities (e.g. Te Tiriti partnership obligations, responses to the pandemic, climate change, Pacific development, social cohesion, individual and societal wellbeing)
- supports future national research needs (e.g. improving the wellbeing and health of people and of the environment, improving productivity)
- invests in emergent knowledge rich sectors that are likely to drive future change (e.g. technological change, indigenous knowledge, globally successful business in areas such as AI/VR, medical technologies, environmentally sustainable practices)
- supports the advancement of knowledge even if the application of this new knowledge is not yet known
- supports co-designing research with a range of partners

- supports programmes that are highly collaborative involving researchers from across New Zealand and internationally, and strengthen links between Universities and CRIs.
- respects that there are different types of knowledge, constructed through different cultural, social and disciplinary lenses, and that there are politics that lie beneath how different types of knowledge are produced (e.g., some types of knowledge are commonly assigned a higher value than others)
- engages with people and ideas internationally to ensure that New Zealand is at the cutting-edge of creating new knowledge not only nationally but globally
- creates knowledge that is widely-recognised as world-leading rather than following. This might mean engaging in ventures that are more speculative and of higher risk but also might produce higher returns

As noted above, given that research organisations have been successful in building revenue outside of Government, and that they have been highly successful in delivering impact to end-users, it will be important that there be a strong weighting to the role and requirements of end-users in setting research priorities and the need for long- term sustainable relationships that underpin effective connectivity. The make-up of the old NRAC Board provides some insights as to how end-users can influence priority setting. This could be modernised to address today's challenges and priorities.

Establishment of an independent Research Council

Summary:
- Support the formation of a Research Development and Innovation Council
- Such a body should:
  - work closely with Government departments, iwi, business, researchers and the community;
  - promote the development of workplace capability and diversity;
  - make New Zealand a desirable place to conduct research;
  - invest in research infrastructure; and
  - have research cost transparency

It would be useful to re-establish a priority-setting mechanism. Science New Zealand in their "Pathways to the Future" document proposes forming a Research Development and Innovation (RDI) Council with a so-called 'quadruple helix' engagement of industry, government, Māori and researchers. This is a good idea.

It could build on the strengths exhibited by the NRAC and FRST and adapt them to modern day circumstances to provide missions, strategies and purposes into which research organisations, such as CRIs, Universities, CoREs, and NSCs can work together, where possible, to achieve enhanced impact.

In our view, such a body should:
- ensure that the strategy set by the Council has been determined through working closely with Government, iwi, business, researchers and communities
- promote a high level of development of workplace capability and diversity and enable accurate data collection to facilitate decision making and strategy development.
- encourage excellence on all fronts making New Zealand a highly desirable place in which to conduct research (for both New Zealanders and international researchers)
- skilfully manage investment in the research infrastructure in order to deliver on the strategy
- ensure there is complete transparency of the cost of conducting research

The recommendation in the Parliamentary Commissioner for the Environment's report *A review of the funding and prioritisation of environmental research in New Zealand*, for establishing an Environmental Research Council, with ring-fenced funding, is also supported in that it puts the relevant department (MfE)

squarely in the picture in setting the high-level priorities that environmental research should serve. This model may well apply to other sectors of New Zealand's research portfolio and the option of government departments designating some directed funding into priority projects (such is done by Fisheries New Zealand), should be a possibility.

Te Tiriti, Mātauranga Māori and Supporting Māori Aspirations

Summary:

- Better enabling Mātauranga Māori and the interface between Mātauranga and science
- Provide active protection of Māori interests, the right of development and partnership/ power sharing through the recognition of Māori autonomy
- Government needs to co-invest with Māori and enable Māori to be the primary decision maker on that research investment, with a dedicated funding pūtea and a Māori-led decision body or bodies.

We must have an intentional focus on strengthening the role and positioning of Māori in the research system and consider whether the system enables and facilitates the achievement of outcomes for Māori. We need to re-imagine the obligations and opportunities for Te Tiriti in our research, science and innovation system, better enabling Mātauranga Māori and an effective interface between Mātauranga and science. Conceptually, the development of a Green Paper is little different from any other change proposals for future pathways in research. How any innovations are introduced, however, is important if they are both to be effective and not to be resisted or met with a level of antipathy. The Green Paper, to its credit, appears to want to NOT obscure one critical element, that of the special status of Māori as tangata whenua. Cultural issues deserve closer - and wider - considerations, in the forms of kaupapa whakaaro (concepts) and reo (language).

Aotearoa New Zealand's genesis as a country in its present form relates to a country forged on an agreed relationship between two sovereign peoples. The nature of this relationship is spelled out in the Treaty of Waitangi and is now firmly established as a partnership between Māori and the Crown. While there is debate about versions and interpretations of the Treaty, the Treaty is widely recognized as having an important place in the development of pathways forward for our country. The statement with regards to forging relationships like those that emanate from many other educational and social entities, recognises and upholds the importance of the Treaty for the professional practice of research in its structures, policies and codes of ethics. Clearly, the place of the Treaty and the principles inherent in it should be re-assessed, and reinstated in the research imperatives, and subsequently in the final document.

There is a call for continued attention to the Treaty of Waitangi, given that it has appreciable implications for research, at many levels and in many activities. Each of the first three Articles has direct significance and relevance:

- Article 1 (the notion of partnership) contends that there are two Treaty partners who share responsibility for shaping the direction of Aotearoa New Zealand in all arenas, including the development of policy.
- Article 2 (the notion of protection) asserts that while Māori ceded administrative control (kawanatanga) to the colonial government, they retained their autonomy (tino rangatiratanga) over defining, promoting and protecting their own treasures (taonga) which include the protections and transmission of language, practices, and knowledge. For research, Article 2 upholds the rights of Māori to define matters relating to mātauranga (knowledge) and to determine appropriate methodologies (the research practices).
- Article 3 (the notion of participation) insists on there being equitable access to the resources of the State, and the right to expect equity of outcomes for Māori scholarship in its variety of forms.

In essence, any research reform activities in Aotearoa New Zealand should address in detail, all Articles of the Treaty, especially the Crown's duty of active protection of Māori interests (see for example Ko Aotearoa Tēnei : Te Taumata Tuarua, Vol 2, p 682; The Ngātiwai Mandate Inquiry Report, 2017) , the right of development (see for example The Ngāi Tahu Sea Fisheries Report, 1992), and of partnership/power sharing through the recognition of Māori autonomy. This level of participation needs to be visible in terms of developing revised documents, and needs to take into account the content of the Green Paper and the manner in which it is ultimately presented.

The present Vision Mātauranga (VM) statement is an insufficient mechanism for authentic participation of, and with, Māori. It heavily loads Māori researchers to contribute for the benefit of others and does not adequately involve Māori in conceptual and critical decision making on research that is intended to benefit Māori. Rather, Government needs to co-invest with Māori, and enable Māori to be the primary decision maker on that research investment. We advocate introducing a dedicated funding pūtea and a Māori-led decision body or bodies. Also, centralisation of decision making is at odds with Kaupapa Māori whakaaro, and so localisation of decision making on funding will yield best results – the actual mechanisms and governance need to be co-developed with Māori. Such a pathway would be more in tandem with Te Tiriti, Mātauranga Māori, and Māori aspirations.

Funding

Summary:

- The connection between government policies and how research money is allocated should be strengthened.
- Research funding overlap should be identified and co-ordinated.
- Funding should be available for long, medium and short term national needs

As noted in the section on research priorities, there is often a disconnect between government policies and how research money is allocated. The overall science system, including universities, CRIs, hospitals, and industry, are funded by a wide range of mechanisms. These mechanisms include PBRF (Vote Education), research science funding (e.g. MBIE, Health Research Council, Marsden Fund), and industry research funding (e.g. direct investment with public research partners, Callaghan Innovation co-investment). All these mechanisms play a role in supporting the scientists and capital required to keep New Zealand at the leading edge in research. More critically, it is a system, where changes in just one area are unlikely to consider the systemic impacts and the law of unintended consequences. It is thus potentially more urgent to consider major changes in research funding levels, distribution, and outcomes at a system level.

A major drawback in replying to this paper is the lack of a clear defined goal. What exactly is New Zealand Science supposed to be doing? This question is not answered and in the absence of goals or outcomes desired by Government for its research investment, it is very difficult to respond to proposed changes in one or a few pieces of an inter-connected funding system with any clarity. Where does Government want to see New Zealand science contributing?

In particular, if the goal is to be more like Germany with a high-tech knowledge economy focus, we could see one distribution of funding and roles between universities and CRIs changing to a tighter, far more integrated approach. Equally, if the goal is to see more innovation independent of existing or desired industries, than the distribution and allocations across the system and the relative utility its elements (universities, CRIs, industry, others) would be different again. Both could be different from what we see now.

Thus, what is the goal, outcome or contribution government would like see from New Zealand science in terms of New Zealand's future economy and society?

Given the current funding climate we suggest that while there are benefits to overlaps in expertise in the programmes of CRIs, Independent research organisations, and universities, especially where there is a need for both industry and the public interest to be taken into account, in a small competitive funding system it can be difficult for one to not crowd out the other. It will be important to coordinate such expertise, wherever it is found, via mechanisms like the CoREs or National Science Challenges, as has happened with the *M.Bovis* eradication programme and the COVID response, while taking care over the governance/administration costs of such coordinating programmes. In addition, full-cost research funding should be applied across all of government.

CRI funding

In terms of the extent of overheads and base funding of CRIs, the Strategic Science Investment Funding allocated to CRIs is static from year-to-year (and because of inflation, is effectively declining in value). CRIs must earn a substantial, and increasing, level of revenue to support staff, programmes and equipment, and they cannot fund scientists unless they have supportive programmes. This alone makes their funding insecure between funding cycles, depending on current and changing research priorities. These problems are not faced to the same extent by universities but, at the same time, universities rely heavily on public research funding for staff and overhead support. Any changes to core funding of CRIs with respect to overhead funding must consider how this will affect other research providers, such as universities and independent research organisations, in terms of competitiveness for government research funding.

University Funding

The distortion at the boundary between doctoral students and post-doctoral early career researchers should be addressed, which impact significantly on research career pipelines. This has been driven by unrealistic budget caps on grants that have not been increased for so long that postdoc salaries simply don't fit, and PhD students not attracting overhead costs, which post-docs and other early career researchers do.

Workforce

Summary:

- more graduate students directed towards, or prepared for the applied and commercial sectors, policy development, or the research, science and innovation system outside of academia.
- A continued and expanded engagement between CRIs, industry, government and Universities would be very worthwhile, to ensure training in relevant areas, and provide career paths for students.
- CRI workforce funding should be flexible so that CRI impacts can also continue to be realised through commercial work and royalty-based research

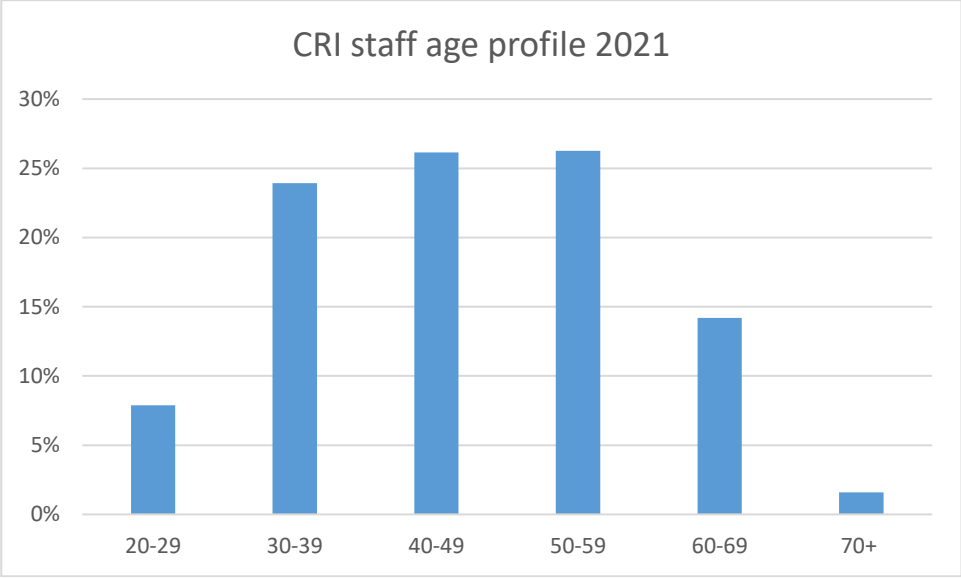
The Green Paper highlights the key workforce issues in the Research Science & Innovation system as being equity, early-career precariousness, diversity, and supporting the education system. There has been a substantial body of work completed in the last few years on under-representation, bias and pay/promotion gaps[1][2]. This work has tended to focus on the University sector because it draws on PBRF

[1] Brower A, James A (2020) Research performance and age explain less than half of the gender pay gap in New Zealand universities. PLoS ONE 15(1): e0226392. https://doi.org/10.1371/journal.pone.0226392

[2] McAllister T.G. et al. (2019) Why isn't my professor Māori? MAI. http://www.journal.mai.ac.nz/sites/default/files/MAIJrnl_8_2_McAllister_FINAL.pdf

data, emphasising one of the key problems in workforce being the lack of good data to support decisions. In the 2020 Royal Society Te Apārangi report on The Research Workforce of Aotearoa New Zealand, it highlighted the need to address the mismatch between the relatively narrow skills graduates exit their PhD studies with and the skills needed in employment roles in which they could launch successful careers of value to New Zealand as well as themselves.

In the CRI sector, data from 2021[3] show that of the total staff of 4,556, some 1,776 are scientists, and 1,075 are technical staff. Across all CRIs the workforce split is 52:48 male:female. The age break-down for all staff (scientist, technical and support) is given below.



Early to mid-career employees (<49 years of age) comprise about 58% of the staff complement, and there are concerns about job security given the changing nature of funding and short-term projects.

In terms of recruitment into the CRI sector, for two of New Zealand's largest CRIs, the proportion of overseas appointees is between 25-35%. There should be more graduate students directed towards, or prepared for the applied and commercial sectors, policy development or the research, science and innovation system outside of academia. A continued and expanded engagement between CRIs, industry, government and Universities would be very worthwhile. This would help ensure that post-graduates are being trained in areas relevant to the core missions of other organisations and areas they are developing for future research. It would also help with career-path training for students. It should be noted, however, that permanent full-time jobs may continue to be a finite resource for many post-graduates.

It would seem important that the CRIs, industry and government become more actively engaged with and support the University system so that joint graduate programmes can benefit both the Universities' academic developments, and the economy's need for new staff. This will take co-design of graduate teaching systems with direct input from CRI, industry and government actors. All academic areas that would benefit from this, including the physical, biological, environmental and social sciences, Māori studies, economics, and the humanities. The conceptual model for a Collaborative PhD builds on an existing successful scheme, the Callaghan Innovation R&D Fellowship Grants, but with the form of the PhD programme becoming much more flexible, and with the student working on a real problem of a private

[3] Data collected by AgResearch from all CRIs

sector or non-profit organisation (the sponsor). The concept of such a PhD programme was discussed in the 2020 Royal Society Te Apārangi Presidential address.[4]

However, as noted above, current system favours PhDs over post-doctoral early career positions, in grant applications in terms of overhead costs. In addition, many PhD stipends are now substantially below living wage (end even minimum wage) after tax. This has been rationalised historically by arguing that the student is receiving educational benefits, but it is a significant barrier for many under-represented groups. This is fuelling our research, science and innovation system with a cheap, transient labour force at the expense of equity. This needs to be carefully reconsidered. Providing more pricing signals in the PhD labour market can be a further feature to the Collaborative PhD concept. If the field of study is one with high market demand for graduates, and consequentially high remuneration, encouraging the sponsor to top-up the stipend beyond the accepted standardised level set by government would be highly desirable.

CRI workforce

MBIE has pondered the impact of possible base-funding on the research workforce and where this would alleviate pressures on the uncertainties faced by early-career researchers. However, base funding would need to be treated with care, for how would this allocation be distributed across the workforce within CRIs? Without careful planning, guidelines and implementation, it could well be disruptive, inequitable, and restrict flexibility if CRI staff were simply divided into 'base-funded' and 'commercially funded'. A flexible solution will be needed so that CRI impacts can also continue to be realised through commercial work and royalty-based research.

Research Infrastructure

Summary

- Nationally Significant Collections and Databases are a critical component of New Zealand's science infrastructure and should be properly funded.
- Research infrastructure, and the workforce to support it, need to be an important consideration in this funding review

Research collections and databases

Research collections and databases are a critical component of New Zealand's research infrastructure (For example *National taxonomic collections in New Zealand 2015*). Not only are they of immense value to New Zealand research, but they also represent a global responsibility of New Zealand for international science and research.

The investment in collections and taxonomic research in New Zealand is fragmented. The key sources of investment are the Ministry for Business, Innovation and Employment (for CRIs and Cawthron Institute); the Ministry for Culture and Heritage (Museum of New Zealand Te Papa Tongarewa); City Councils (metropolitan and regional museums); Tertiary Education Commission (Performance Based Research Fund) and Universities (assorted research funds). There is no coordinated national process for assessing whether collections' research activities, and the collection development policies of individual institutions, meet national and stakeholder needs. Nor, in the absence of national scale oversight, are collections' infrastructure safe from individual institutional policy changes and priorities. The combination of eroding support, lack of formal protection, and reliance on individual organisations' prioritisation processes, poses a risk of unintentional consequences if not addressed.

[4] https://www.royalsociety.org.nz/news/professor-wendy-larners-final-presidential-address/

Within the CRIs, all the 'Nationally Significant Collections and Databases' are grossly underfunded, which means that they are at risk of becoming 'museums' of collections and only due to the enthusiasm of key individuals are they able to make some contribution to wider national and international science. This contribution could be much greater if they were better funded. For example, all accessions in the Margot Forde Germplasm Centre at AgResearch should be represented by a herbarium specimen in the Allan Herbarium at Manaaki Whenuai Landcare Research. If the databases of each collection could talk to each other, then any taxonomic changes recorded in the national herbarium would be immediately implemented in the germplasm collection. Likewise, deposits of new accessions of plant-associated arthropods and microbes could be linked to definitive 'live' taxonomy by depositing herbarium specimens associated with any collections. If databases were interconnected and could 'talk' to each other, then the information held within collections could be interrogated to a substantially greater extent for much greater value to national and international science.

Another missed opportunity associated with the taxonomic collections and databases involves the advances in genomics, with extensive DNA sequences being deposited in bioinformatic databases. Many of the organism identification associated with DNA databases are based on taxonomic identifications by non-specialists. There is no way of validating past entries because there are rarely any preserved specimens held in collections, rendering many entries in DNA databases of dubious value. However, without additional resources, the curators of New Zealand collections could not cope with the expected increase contributions associated with DNA sequences; yet this is fundamentally important to resolve for scientific value and science credibility.

A whole-of-systems approach must be taken to interconnect providers, custodians, practitioners, stakeholders, and end-users.

Equipment

The infrastructural needs to do modern research are a continual challenge to meet. These needs extend to a full spectrum of high-tech lab equipment, ships, super computers, satellite access, ocean and climate sensing equipment, and so on. The costs include capital and ongoing depreciation, as well as maintenance contracts, and highly skilled personnel to run equipment. These are often people with technical skills working in the background to ensure that research can take place. The research sector is struggling to meet these costs, especially with essentially static funding. As inflation, staff remuneration, and overhead costs increase, science funding is eroding rapidly.

In any review of funding and priorities, the need for funding the necessary infrastructure, including associated key peronnel, must be a key part of the discussion. So, we merely highlight that this is a well-known and increasing problem that needs addressing within the context of research priorities.

Libraries, Archives, Galleries and Museums

National, regional and local institutions hold a range of highly valued collections, most of them containing unique items. These can also be considered research collections, and the institutions that hold them as part of the research laboratories for a wide range of researchers. The collections include documentary heritage, photographs, taonga, works of art, archives, natural history materials, digital archives and much more.

Archives New Zealand is the statutory repository for the records of government. It performs a constitutional and research role. The National Library of New Zealand including the Alexander Turnbull Library (the latter a

gift to the nation from Alexander Horsburgh Turnbull in 1919) also exists under statute. These institutions contain materials that are unique. These are records of Aotearoa New Zealand that exist nowhere else.

They support research across a wide range of subjects, and from a wide range of researchers. They include Te Tiriti o Waitangi, and also such world renowned collections as PapersPast and the historical collection of digital platforms (started early in the 1990s).

While such places have statutory functions they require resourcing to function adequately. There is much potential to be drawn from seeing these institutions' collections (and their regional and local cousins) in a wider Science, Innovation and Sector vision.

Further information

This paper has been developed for the Academy of the Royal Society Te Apārangi. For further information, please contact academy@royalsociety.org.nz or go to the Royal Society Te Apārangi web page: http://www.royalsociety.org.nz