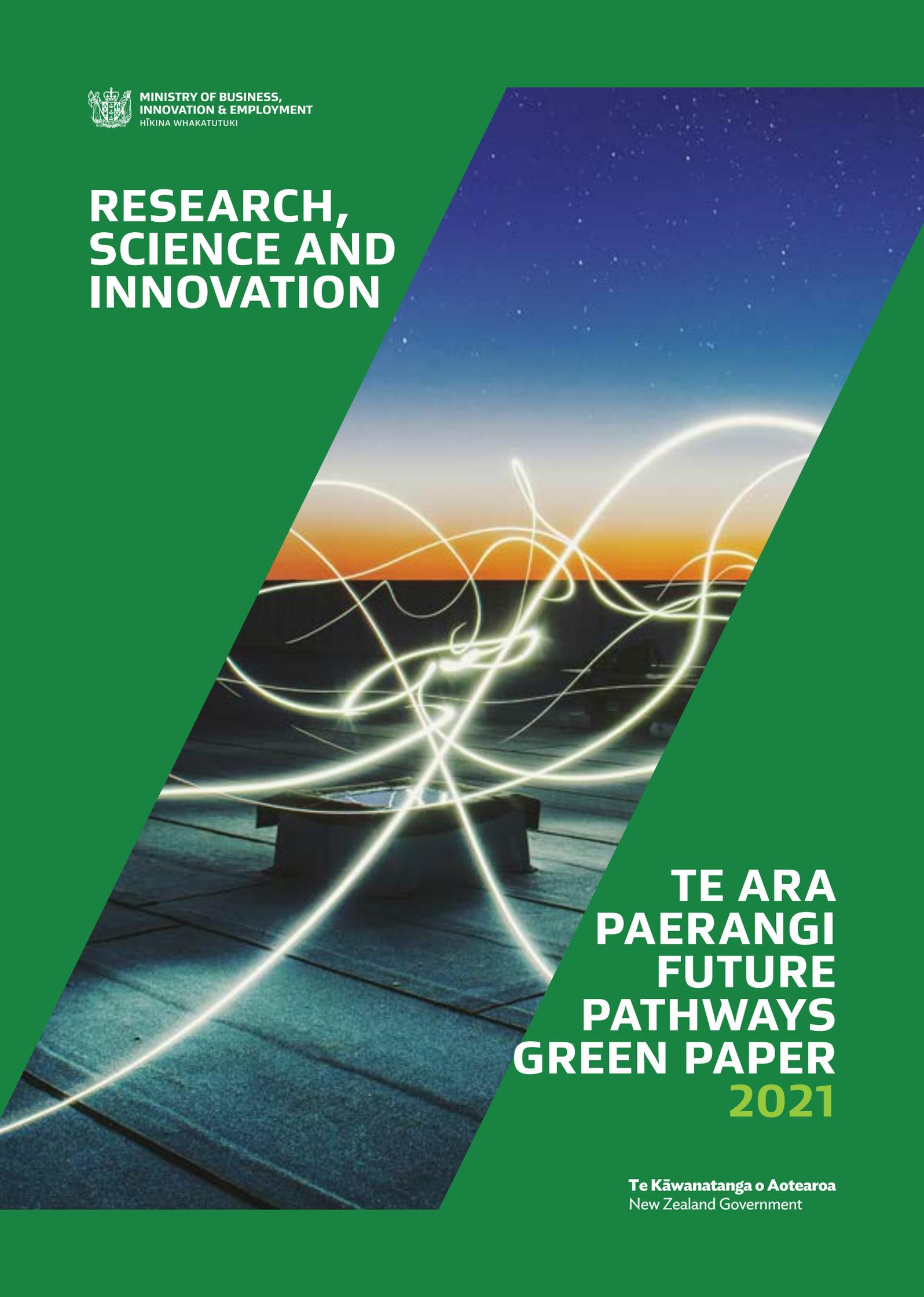




MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

RESEARCH, SCIENCE AND INNOVATION



TE ARA PAERANGI FUTURE PATHWAYS GREEN PAPER 2021

Te Kāwanatanga o Aotearoa
New Zealand Government



Ministry of Business, Innovation and Employment (MBIE)
Hīkina Whakatutuki – Lifting to make successful

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HE KUPU WHAKATAKI

MINISTER'S FOREWORD

The research, science and innovation (RSI) sector has served New Zealand exceptionally well over the past 30 years. It is now timely to consider how we can best position our research system for the future.

The research, science and innovation sector has served New Zealand exceptionally well over the past 30 years. Crown research institutes (CRIs), universities and other TEOs, independent research organisations, and other parts of the RSI system have contributed to New Zealand on multiple fronts. Their contribution has spanned breakthrough research, supporting critical sectors of the economy and society, enhancing understanding of the natural world, solving environmental challenges, and responding to multiple emergencies. New Zealanders have all benefited environmentally, economically and socially from the work the research community has undertaken on their behalf.

It is now timely to consider how we best position New Zealand's research system for the future. A modern, future focused research system for New Zealand must strengthen the role of Māori in the system and consider how the system achieves outcomes for Māori. We need to embed Te Tiriti o Waitangi (Te Tiriti) across our RSI system, better enabling mātauranga Māori and the interface between mātauranga and other forms of research.

Such a research system will support and build on the excellent and impactful research already underway on addressing New Zealand's significant environmental challenges, such as climate change. We saw the best of our research system through the support it provided to the country during the COVID-19 pandemic. We need to consider building on those aspects of the system that served the country so well, ensuring it is well positioned to provide such support again when the need arises.

We also need to consider how our research system can leverage future economic opportunities in a rapidly changing world to support our recovery from COVID-19, and shape a future economy that is more productive, resilient and diverse. This includes supporting the transformation of traditional sectors in our economy (such as diversifying and adding value in food and fibre) and supporting the growth of knowledge-intensive industries. It also includes supporting the creation of the knowledge-intensive and scalable firms that the Productivity Commission's report on 'frontier firms' notes are vital to uplifting New Zealand's national productivity and wellbeing. Our research system needs to build novel and transformative options for the new economy of the future, as it continues to support current jobs and industries.

Addressing the opportunities and challenges of the future will mean considering the social aspects of goals like a just transition. Our social research will have a key role to play, and we need to consider its increasing importance in decision-making and policy formation in a range of domains. Improving social wellbeing and ensuring the economy works for everybody are fundamental to a successful future for New Zealand; research into the long-term drivers of wellbeing are vital.

Meeting the challenges and opportunities of the future will require harnessing the collective capability of our RSI system across all fields and disciplines including social research. Collaborative, multifaceted and interdisciplinary approaches will be essential to tackling the complex and interdependent challenges that are central to New Zealand's future.

This green paper presents ideas and opportunities that build on the direction of previous policy development to form a research system that is connected, adaptable and resilient.

In 2010, the Government reasserted the importance of the public good mission of our CRIs through the CRI Taskforce. CRIs are, by design, focused on the traditional sectors of the economy, such as food and fibre, and aspects of the environment and natural hazards, and have performed exceptionally well for those sectors. Public good research, however, extends beyond these sectors and organisations. We need to consider how to enhance and extend the role of all research organisations into broader challenges and opportunities for the country, as well as speaking directly to the needs of a more productive future economy.

In 2014, in response to this context, we made the most recent attempt to introduce a set of cross-system, national research priorities through the National Science Challenges (NSCs). The NSCs have worked well in terms of improving collaboration across the system, and have produced much excellent research. However, the NSCs were also layered across an existing framework of organisations and funding, which has placed constraints on their success. Opportunities are now available to do more and better with national research Priorities and mission-driven innovation.

The Government funding that supports research activities in New Zealand has increased significantly since 2010, by around 75 per cent. With it, the system has grown and done much more. However, the way in which funding is distributed has led to precarity in organisational revenue for CRIs, despite the overall funding increases, and we continue to observe elements of unproductive competition across all organisations in the research system. Overall, we see a system where demand for its support far outstrips the supply of resources. This makes our goal of raising national research and development expenditure to 2 per cent of gross domestic product a bare minimum.

Despite the recommendations of the 2010 CRI Taskforce, research institutions in New Zealand have largely remained within the same operational form and design as established in the early 1990s. It is timely to check in on the design and organisation of our institutions to make sure we continue to have sound design principles, and are connected, resilient, adaptable and able to meet the future needs of New Zealand.

There remain huge opportunities to grow the ways in which our system serves and includes Māori, and therefore all of New Zealand, including by placing Te Tiriti at the forefront of its design. The people who work within the RSI system – who are its single most important aspect – need to experience a system that values equity, diversity and inclusion, and that provides rich, varied, exciting and stable careers.

We need to gain a better understanding of the areas requiring change, to ensure the research system responds to and meets the nation's future needs. The future state for the system needs to be one that is adaptable for the future, resilient to changes, and connected; to itself, to industry, to public sector users of research, and internationally. This green paper starts the conversation on how we build that system together.



Hon Dr Megan Woods
Minister of Research, Science and Innovation



Hon Dr Ayesha Verrall
Associate Minister of Research, Science and Innovation



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TĀ MĀTOU E WHAI ANA KI TE WHAKATUTUKI WHAT WE ARE SEEKING TO ACHIEVE

Through this green paper, we are seeking to start an open, wide ranging and deliberative conversation about the future of New Zealand’s research system.

Through this green paper, we are seeking to start a wide-ranging and deliberative conversation about the future of New Zealand’s research system. We are seeking to achieve two things. Firstly, to gather a broad base of views on the current system, to better understand the problems it faces and opportunities for improving it. In some areas canvassed in this document, we are unsure of the best solutions to the opportunities and problems identified. Second, we are seeking to test the ideas we have developed in response.

We would like your views on whether these ideas will work, to what extent, and if other, better, ideas exist that we have not canvassed.

TE HŌKAITANGA SCOPE

The focus for this green paper is the design of the ‘public’ research system. A technical description is that we are considering changes to aspects of funding administered as part of the RSI ministerial portfolio, and changes to institutions within that portfolio, principally the Crown research institutes (CRIs) and Callaghan Innovation. The research that takes place in other public institutions, such as universities, Te Pūkenga and wānanga, is also within scope of this green paper, as is the publicly funded research that takes place in independent research organisations and other independent entities.

We take a broad definition of research for the purposes of this paper (see the glossary for more info). The term ‘research’ when used as a single word should be read to encompass all activities usually understood as such, including but not limited to research into the arts and humanities, social research, and natural sciences.

We are not actively considering changes to Vote: Tertiary Education funds, such as the Performance-Based Research Fund (PBRF) as part of this work programme, nor are we actively considering structural or design changes to TEOs. But we recognise the importance of connections across the wider RSI sector, and that some organisations receive funding through both RSI and Tertiary Education mechanisms, so we are interested in feedback on the relationships between Tertiary Education funding streams and structures, and the proposals suggested in this document. In general, at this stage, we would like to gather a broad range of feedback on all aspects of this system to get a wider understanding of intersects between the education and RSI systems.

We are not planning changes to business-facing RSI programmes as part of this work (such as the R&D Tax Incentive) so they can be considered as out of scope. However, we are interested in improving 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. Along with aspects of system and institutional design that improve channels of knowledge exchange and transfer between businesses and research institutions, we remain interested in hearing feedback on business-facing RSI schemes, especially if they relate to parts of the system that are in scope.

A guiding principle for this reform is that we have no pre-commitment to specific solutions, unless otherwise noted. In general, we are keen on the most open exploration of the problems and opportunities we present. In qualifying this, we note the following:

- › We consider that the problems we raise are real issues that need to be addressed in any future research system. This means we have to act in some way. This is the case for all the problems we raise, unless this green paper specifically asks for comment on whether you think we have identified the right problem. While we are interested in deep discussion about these problems, we will likely make changes to address them, unless presented with compelling reasons why we should not.
- › Our proposals in this paper are intended to provide model solutions, to stimulate discussion on system design and test the robustness of those solutions. None are set in stone, and we are very open to discussion on alternatives.
- › For some specific areas covered in this document, work is already under way, and may have been for some time. We are interested in feedback on these areas, but ask you to note that we have already taken steps in a particular direction. These are:
 - › Accelerating the impact of Vision Mātauranga, via funding through Budget 2020
 - › seeking to encourage combined property planning and co-location between CRIs and universities
 - › ensuring a robust basis for future investments in our e-research infrastructure (currently through Research Education Advanced Network New Zealand and New Zealand eScience Infrastructure)

TĀ MĀTOU TUKANGA OUR PROCESS

This consultation will be open for from 28 October 2021 to 16 March 2022. After that time, MBIE will compile the feedback received and provide advice to Ministers on next steps. We expect Ministers will then take key decisions at Cabinet in early 2022. Because the proposals in this green paper have the potential to result in significant reforms, we expect any decisions leading to major change will be subject to further consultation, discussion and, potentially, co-design or other ways of further engaging with researchers and members of the public. Ministers will make decisions on those further engagement processes following the first phase of consultation that this green paper sets out.

We will adopt the following engagement principles for this programme of work:

- › Our processes will be as transparent as possible, while respecting Parliament’s and Ministers’ roles and requirements as decision-makers.
- › We will provide meaningful opportunities for Māori, as Tiriti partners, to help shape our engagement plan and process, and to inform us of their interests and views in the substantive issues in this work stream (we discuss this further in Section 2).
- › We will signal key decision points and processes in advance, with sufficient time for stakeholders and Māori to prepare for and provide input.
- › We continue to create opportunities for broad stakeholder and Māori participation – including beyond this consultation.
- › All input is valuable and will be considered, be it at a detailed or more strategic level.
- › The outcomes of this process will be informed by your input; there is no pre-commitment to specific solutions unless otherwise noted (see ‘scope’ above for more on this), and feedback preferring the status quo is a valid response

KA AHATIA TŌ URUPARE WHAT WILL HAPPEN TO YOUR FEEDBACK

All feedback will be read by MBIE officials and considered carefully. A summary of feedback will be provided to Ministers and Cabinet. All feedback is valuable and will be considered. This does not mean that decisions will necessarily follow the majority of feedback; decisions will also be informed by other evidence, analysis and judgement. It is important to this process that we have access to a broad range of your ideas, preferences and experiences. They will all be considered.

We plan to publish all feedback received on the MBIE website. This will include your name and any other identifying details, if they are provided as part of your submission. If you do not want some or all of the information you provide as part of this consultation to be made public, please let us know when you give your feedback. This does not guarantee we will not release this information, because we may be required to under the Official Information Act 1982. It does mean that we will contact you if we are considering releasing information that you have asked that we keep in confidence. We will take your reasons for seeking confidentiality into account when making a decision on whether to release the information. We will not contact you before publishing your feedback if you have not requested confidentiality.

We are particularly interested in stimulating ongoing discussion during the consultation period, and sharing any positive, exciting or visionary new thinking we receive. We will therefore consider publishing feedback we receive as we receive it, that is, during the consultation period.

HOW TO PROVIDE FEEDBACK

We want to hear from anyone in the broader research, science and innovation system. Whether you're a researcher, scientist, leader, manager or user of the system, we want your feedback. You can provide your feedback in a number of ways:

Email us directly at: FuturePathways@mbie.govt.nz

Completing the online submission form available at www.mbie.govt.nz/futurepathways

By mailing your submission to:

Future Pathways Policy Team
Ministry of Business, Innovation & Employment
PO Box 1473
Wellington 6140

TE HANGANGA O TĒNEI PEPA KĀKĀRIKI STRUCTURE OF THIS GREEN PAPER

This green paper is divided into six chapters, which we suggest are the main areas where we could take action. These are:

- › Research Priorities
- › Institutions
- › Funding
- › Te Tiriti, Mātauranga Māori, and Māori Aspirations
- › The Research Workforce
- › National Research Infrastructure

Each chapter outlines proposed opportunities for change and asks for feedback on possible solutions.

Chapter one: discusses the role that clearly expressed, whole-of-system research Priorities can play in helping to focus activities of the research system and concentrate resources meaningfully towards these Priorities.



Important questions and areas of discussion for feedback are how we design those priorities, how we run a process for deciding what they are, and how we set up how Priorities are governed and operationalised. We are also interested in your feedback on how the establishment of Priorities may affect the RSI workforce.

Chapter two: discusses how the research system can seek to understand and honour Te Tiriti obligations and opportunities, and explores pathways to a modern research system for Aotearoa that is Tiriti led and reimagine how to give life to Māori research aspirations, and better enable mātauranga Māori in our research system and the interface between mātauranga Māori and other activities in the system.

Key questions and areas of discussion that we are seeking your feedback on in this chapter are around Māori preferences for engagement, thoughts on how mātauranga Māori can be better enabled and protected, and regionally based Māori knowledge hubs.

Throughout the rest of the paper, we have also sought to highlight areas where we think there is potential to give effect to Te Tiriti, elevate Māori aspirations in the system, and create a system more responsive to Māori priorities.

Chapter three: discusses possible ways to reshape the funding system for the future. This includes how funding can be used to give effect to whole-of-system Priorities and reduce unproductive competition, along with ensuring institutions can adapt to changing priorities and respond to emerging opportunities. We investigate how we can properly fund important activities, such as critical research functions, high priority services, emergency response, and databases and collections.

Important questions and areas of discussion for feedback are on how we decide what the core functions of the RSI system are and how to fund them, and whether introducing a base grant funding model might improve stability and resilience for organisations in the research system.

Chapter four: focuses on the design and shape of research institutions to enable them to give effect to whole-of-system Priorities and be adaptable in a fast-changing world.

Key questions and areas of discussion that we are seeking your feedback on are regarding institutional design, including designing Tiriti enabled institutions and exploring the roles that institutions should play areas such as workforce development, coordinating large capital investments and enabling better knowledge exchange.

Chapter five: discusses how the system can better support the development and retention of the research workforce.

Important questions and areas of discussion for feedback are on how we enable attractive and flexible careers and career pathways for the research workforce, including designing funding mechanisms that explicitly support workforce development, and how we include workforce considerations into the design of research Priorities.

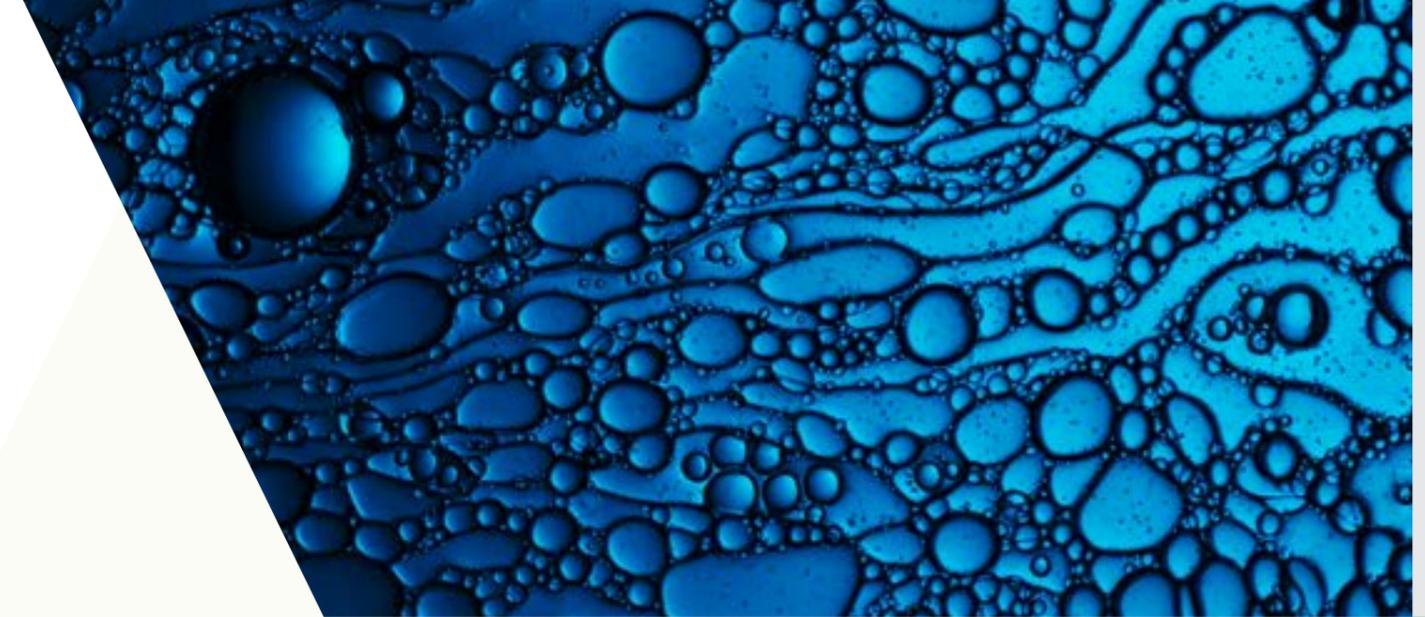
Chapter six: discusses research infrastructure, including future funding, governance and ownership arrangements for national research infrastructure, and how we can maximise our investment in research infrastructure.

Important questions and areas of discussion for feedback are on how we should support sustainable, efficient and enabling investment in research infrastructure.

Table 1: Summary of questions

Question	Section	Question
1. Research Priorities		
1	1.2.2	Ngā kōwhiringa hoahoa Whakaarotau Matua Priorities design What principles could be used to determine the scope and focus of national research Priorities?
2	1.3.2	Ngā kōwhiringa hoahoa mō te tukanga tautuhi whakaarotau Priority-setting process What principles should guide a national research Priority-setting process? How can the process best give effect to Te Tiriti?
3	1.4.2	Ngā kōwhiringa hoahoa whakahaere matua Operationalising Priorities How should the strategy for each national research Priority be set and how do we operationalise them?
2. Te Tiriti, mātauranga Māori and Māori aspirations		
4	2.2	Te huarahi e marohitia ana Engagement How would you like to be engaged?
5	2.3	Te whakamana me te whakahaumarū i te mātauranga Māori Mātauranga Māori What are your thoughts on how to enable and protect mātauranga Māori in the research system?
6	2.4	Te whakapakari hononga ki te mātauranga Māori ā-rohe Regionally based Māori knowledge hubs What are your thoughts on regionally based Māori knowledge hubs?
3. Funding		
7	3.2.1	Ngā kōwhiringa matua mō ngā taumahi matua Core functions How should we decide what constitutes a core function and how do we fund them?
8	3.3.2	Ngā kōwhiringa hoahoa mō tētahi tauira tuku pūtea hou Establishing a base grant and base grant design Do you think a base grant funding model will improve stability and resilience for research organisations, and how should we go about designing and implementing such a funding model?

Question	Section	Question
4. Institutions		
9	4.4.1	Te āhua, whakaruruhau me te hanganga o te whakahaere Institution design How do we design collaborative, adaptive and agile research institutions that will serve current and future needs?
10	4.4.2	Te whakawhanaketanga me te tautiaki pai ake o te hunga mahi me te raukaha Role of institutions in workforce development How can institutions be designed to better support capability, skills and workforce development?
Question Section Question		
11	4.4.3	Te ruruku pakari ake me te arotautanga o ngā haupū rawa me ngā rawa nunui Better coordinated property and capital investment How should we make decisions on large property and capital investments under a more coordinated approach?
Question Section Question		
12	4.5	Te tautoko i ngā wawata o te Māori Institution design and Te Tiriti How do we design Tiriti-enabled institutions?



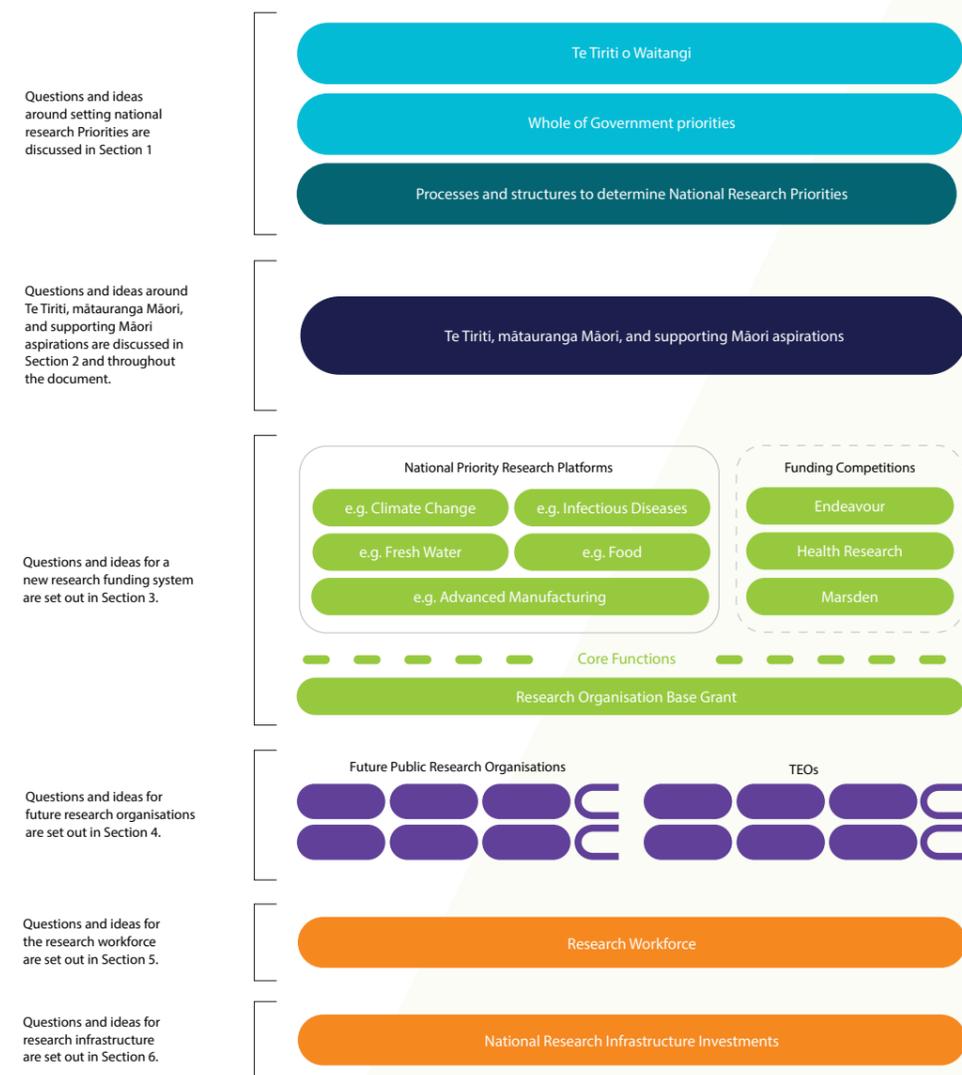
Question	Section	Question
13	4.6	Ngā pāpātanga pai ake – te whakawhiti mōhiotia me ngā pāpātanga rangahau Knowledge exchange How do we better support knowledge exchange and impact generation? What should be the role of research institutions in transferring knowledge into operational environments and technologies?
5. Research workforce		
14	5.2	Ngā whakaarotau me te hunga mahi rangahau Workforce and research Priorities How should we include workforce considerations in the design of national research Priorities?
15	5.3.1	Ngā pūtea me te hunga mahi rangahau Base grant and workforce What impact would a base grant have on the research workforce?
16	5.3.2	Ngā tikanga tuku pūtea hou Better designed funding mechanisms How do we design new funding mechanisms that strongly focus on workforce outcomes?
6. Research infrastructure		
17	6.2.2	Ngā kōwhiringa hoahoa matua mō te tuku pūtea ki te hanganga rangahau Funding research infrastructure How do we support sustainable, efficient and enabling investment in research infrastructure?

Figure 1 outlines a possible model for a future research system for New Zealand. Proposals in this green paper are often linked in a way that needs to be considered a ‘package’, that is, they are mutually reinforcing, and some changes may not be effective unless they are made alongside others. Figure 1 is intended to be a high-level guide to the full scope of changes proposed in this document.

Figure 1: Possible model of future RSI system for New Zealand

THE IDEAS FOR THE SYSTEM WE REFER TO IN THIS GREEN PAPER

This green paper uses a set of ideas for a future research system as a basis for discussion. The diagram to the right sets out a high-level picture of those discussion areas, and how they fit together.



TE WHAKAMĀRAMATANGA INTRODUCTION

Meeting the challenges and opportunities of the future will require harnessing the collective capability of New Zealand’s research, science and innovation system.

Research, science and innovation will drive New Zealand’s future prosperity and well-being. Combined, the public research organisations, including universities, CRIs, Callaghan Innovation, wānanga, te pūkenga, Ministries and other government organisations, represent nearly half of New Zealand’s overall RSI investment. These organisations dominate the public good research areas, including environmental monitoring, climate change, public health in terms of food safety, infectious diseases, productivity, biodiversity and biosecurity, water supply and natural hazards.

It is vital the arrangements supporting public research organisations allow researchers to deliver excellent and impactful research, support critical functions, infrastructure and collections, address significant risks to life and well-being, and embody Te Tiriti in action.

TE KAUPAPA MŌ TE PANONI CASE FOR CHANGE

Recent reports make a compelling case for change and present various recommendations for a future state.

1. Ministry of Business, Innovation and Employment. (2020). *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand’s current and future needs.* www.mbie.govt.nz/assets/te-pae-kahurangi-report.pdf
2. New Zealand Productivity Commission. (2021). *New Zealand Firms: Reaching for the frontier.* www.productivity.govt.nz/assets/Documents/Final-report-Frontier-firms.pdf
3. Parliamentary Commissioner for the Environment. (2020). *A review of the funding and prioritisation of environmental research in New Zealand.* www.pce.parliament.nz/publications/environmental-research-funding-review
4. Office of the Prime Minister’s Chief Science Advisor. (2021). *The future of commercial fishing in Aotearoa New Zealand.* www.pmcsa.ac.nz/what-we-do/publications
5. Ngā Pae o te Māramatanga. (2021). *Te Pūtahitanga: A Tiriti-led Science-Policy Approach for Aotearoa New Zealand.* www.maramatanga.co.nz/publication/te-p-tahitanga-tiriti-led-science-policy-approach-aotearoa-new-zealand
6. The Cabinet Paper, May 2021, which established this reform programme. www.mbie/futurepathways

In addition, throughout 2018 and 2019, we consulted extensively on a new RSI strategy, the development of which was interrupted by the COVID-19 pandemic. Consultation revealed strong views that the current research system suffers from weak connectivity. Researchers found it challenging to connect with researchers from different organisations; research organisations found it hard to connect with each other; businesses found it challenging to engage productively with the public research sector; and data showed that the RSI system continues to struggle to connect effectively internationally. This is similar to feedback received during engagement on the Health Research Strategy in 2017.

Additionally, responsiveness to Māori was noted to be weak and models of engagement poor. Stakeholders noted much work needed to be done to improve the way the system interacts with Māori at multiple levels.

The 2020 *Te Pae Kahurangi* review echoed many themes from the RSI strategy consultation. It found a lack of role clarity exists for institutions, unproductive competition occurs between institutions and integration is lacking between universities, CRIs and other parts of the research system. It repeated findings from the RSI strategy about the system's weak responsiveness to Māori.

Te Pae Kahurangi also noted difficulties the research system has in adapting to changing national needs and building capabilities necessary for future resilience and transformation. It found a proliferation of governance and a large number of competing strategies and priorities, which struggle to be given effect.

In sum, these reports and previous consultations reveal significant issues with the current system for funding research, in particular:

- › There is a significant amount of fragmentation that results in a lack of role clarity for institutions, unproductive competition between institutions, and lack of integration between our universities, CRIs, and other parts of the research system.
- › There is a large proliferation of governance and competing strategies and priorities, which struggle to be given effect and connect directly to funding.
- › System responsiveness to Māori is weak and models of engagement poor.
- › There is weak connectivity between researchers, organisations, businesses, the public sector, and internationally.
- › Difficulty adapting to changing national need and building capabilities necessary for future resilience and transformation.

The problems noted in these recent reports are similar to those which have been canvassed repeatedly over the last ten years. Successive governments have made various changes to the research system to improve connectivity and responsiveness, reduce fragmentation and establish a clear line of sight where it contributes clearly and effectively to national goals and challenges.

While these reforms have often been successful within their scope, collectively they have not led to the system-level transformation needed.

NGĀ ĀHUAHIRA O TĒTAHI PŪNAHA RANGAHAU HOU FEATURES OF A MODERN RESEARCH SYSTEM

We want to create a modern, future-focused research system for New Zealand. It needs to be adaptable for a rapidly changing future, resilient to changes, and connected: to itself, to industry, to public sector users of research, and internationally. We have used these core principles, of a system that is connected, adaptable and resilient, to guide development of the proposals in this green paper.

Such a system will need to reflect New Zealand's unique opportunities and challenges. It will need to embed Te Tiriti across the design and delivery attributes of the system, and enable opportunities for mātauranga Māori. It will also need to recognise that research is a global undertaking and seek to stand alongside the best systems in the world.



When we consider modern research systems in other small advanced economies, the following features are apparent:

1. **A high degree of connectivity**, with collaborative projects the norm, and researchers who are able to move easily between institutions, and into and out of industry and public services. A high priority is given to participation in global research communities, even when addressing mainly local problems or opportunities.
2. **A significantly greater level of investment than New Zealand’s current level**, proportional to gross domestic product (GDP). We have already set a goal of raising research and development (R&D) expenditure to 2 per cent of GDP by 2027, and put measures in place to encourage the private sector to make up a greater proportion of that expenditure.
3. **A serious approach to talent development**, resourcing, attraction and retention, with a strongly international mindset. Many systems support early to mid-career researchers with pathways to establish programmes and teams, and have dedicated schemes for attracting and retaining outstanding international researchers to establish research groups and programmes.
4. **A recognition of the impact on human capital development adjacent to research**. Researchers working at the cutting edge in advanced research techniques with students in their labs enable those students to step into government, industry and civil society with deep understanding of the technology, and related skills. These skills assist with a country’s broad ability to apply technology to improving a wide range of services and industries.
5. **A strong leadership role for the research system** in identifying and creating desirable future states for the economy, society and environment, and leading areas of global intellectual and technology development.
6. **Related, a system responsive to national research priorities**, usually focused on generating unique value for the economy from advanced technology, or addressing large-scale long-term problems, such as the challenges presented by climate change, or intergenerational disadvantage.
7. **Treatment of the research system as a distinct ‘system’**, as opposed to a set of operational functions that feed into disparate industry sectors, government departments, or exist as adjunct functions of other public services.
8. **Planned, ongoing investment in research infrastructure**. Modern, flexible working environments that provide access to cutting-edge equipment and technologies that allow researchers to engage at the global frontier of knowledge production.

The generic development of research and innovation systems was summarised by the European Union in its 2020 report *Science, Research and Innovation Performance of the EU*¹, and is reproduced in figure 2. We would like to accelerate the development of New Zealand’s research system to support it to stand alongside the best in the world; a system that creates transformative change and supports grand challenges.

1 European Commission. (2020). *Science, Research and Innovation Performance of the EU 2020: A fair, green and digital Europe*. https://ec.europa.eu/info/publications/science-research-and-innovation-performance-eu-2020_en

Figure 2: Three frames in innovation policy

Framing	Key features	Policy rationale	Policy approaches (examples)
Science and technology for growth (since 1950s)	Linear innovation model, driven by R&D (research and development)	Addressing market failures (firms invest insufficiently in R&D because of public good character of innovation)	State financing of R&D; subsidies or tax incentives for business R&D
National and sectoral systems of innovation for improved competitiveness (since 1980s)	Focus on knowledge flows between upstream actors (universities, firms, agencies)	Responding to system failures, e.g. improving linkages between actors, addressing institutional problems (in laws, property rights, regulations)	Promoting science hubs and science-industry collaboration; education and training; cluster policies
Transformative change to address grand challenges (since 2010s)	Nurture radical innovation and new pathways; shape directionality of innovation	Promote system transformation, which incumbent actors are slow or reluctant to do	Missions and goals (SDGs, climate targets), assisting new entrants, creating transformative coalitions, learning, experimentation

Source: European Commission. (2020). *Science, Research and Innovation Performance of the EU 2020*, page 575.

We expect that building these features into our world class system will be shaped by specific activities for which New Zealand has a particular interest and talent. For instance, threading mātauranga Māori throughout as an integral part of transformation will be key to building our new system and expanding the potential for transformation.



1

**NGĀ WHAKAAROTAU
RANGAHAU RESEARCH
PRIORITIES**

1. NGĀ WHAKAAROTAU RANGAHAU RESEARCH PRIORITIES

This chapter discusses the role that clearly expressed, whole-of-system research Priorities can play in helping focus activities of the research system and to concentrate resources meaningfully towards national challenges and opportunities.

1.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

Researchers naturally seek to address the most important and pressing opportunities and problems that are facing people and the planet. Research systems often aim to codify those opportunities and problems, and place supporting structures around them through research priorities or mission-driven funds.

We made the most recent attempt to introduce cross-system, national research priorities in New Zealand through the National Science Challenges (NSCs). The NSCs have worked extremely well in improving collaboration across the system and have produced much excellent and impactful research. However, the NSCs were layered across an existing framework of organisations and funding, which have placed constraints on their success. Opportunities exist to do more and better with national research priorities and mission driven innovation. The Productivity Commission’s report on frontier firms² emphasises the importance of focused innovation policies at scale that build ecosystems of deep capabilities in which those frontier firms can flourish.

We do not currently have a single, consistent set of national research priorities for New Zealand. How and when Te Tiriti is engaged across our system when setting priorities for research is also variable. Instead, our system is characterised by many different priorities. Priorities can be integral (e.g. as embodied in the NSCs), implicit in annual budget or other government policy decisions (eg, new Strategic Science Investment Fund platforms), or originate from government departments in the form of various science roadmaps, strategy documents and priority lists. In addition, organisational strategies (and therefore priorities) are set individually by TEOs and CRIs, creating a further series of priorities. Added to this are priorities set by various private sector bodies.

Despite researchers’ natural tendencies to align behind grand challenges, the overall picture of our system is one of unnecessary fragmentation and priority clutter. Our research system struggles to direct resources clearly towards areas of the highest importance, while the Government, as funder and steward of the research system, struggles to give effect to its priorities through the same system. For example, the system currently lacks a locus of effort for climate change research. Equally, few of our current research priority mechanisms

² New Zealand Productivity Commission. (2021). *New Zealand Firms: Reaching for the frontier*. www.productivity.govt.nz/assets/Documents/Final-report-Frontier-firms.pdf

speak directly to Māori needs or aspirations. In many areas, government struggles to identify how much is actually invested, whether it is invested in the right way, and how this investment might be most effectively improved.

The 2021 Te Pūtahitanga report noted it is particularly problematic that little data exists on the scale of investment in research conducted by Māori, or for the benefit of Māori³.

This means the RSI system struggles with:

- › **ineffective resource allocation:** it is difficult to align resources, such as expertise, investment and infrastructure, to tackle specific problems, and the system is unable to clearly direct resources towards specific areas. It also results in a lack of coordination of research, which may be replicated in different places or not done in such a way that it can connect with other relevant research.
- › **lack of transparency over purpose and accountability:** it is difficult to know who is responsible for specific issues and areas. This makes it hard for researchers and users of the system to connect and collaborate meaningfully. It also makes it hard to evaluate the results of government investments.
- › **unnecessary complexity:** it is difficult for users to navigate the system and find a focal point for entry.
- › **inability to easily shift priorities over time:** when no locus of activity exists for an important area of research, it is hard to make meaningful changes to that area, which may include increasing investment.

³ Ngā Pae o te Māramatanga. (2021). *Te Pūtahitanga: A Tiriti-led Science-Policy Approach for Aotearoa New Zealand*. www.maramatanga.co.nz/publication/te-p-tahitanga-tiriti-led-science-policy-approach-aotearoa-new-zealand



- › **persistent uncertainty over the value of investments:** because it is challenging to locate and account for research intended to address specific problems or opportunities, it is hard to quantify and evaluate the amount of research being directed to different areas and to measure the impact of research investment.
- › **underprioritisation of mātauranga Māori and Te Tiriti:** A number of reports consistently describe a mismatch between the intent and the operationalisation of Te Tiriti and the RSI policies and practices that seek to enable it. This often expresses itself as deprioritisation, underinvestment, and mismanagement of mātauranga Māori in our system. It also appears to disincentivise or disempower Māori from flourishing within the system. We need to consider how our current structures and processes of prioritisation side-line Māori priorities.
- › **unbalanced investment portfolios:** we risk concentrating efforts on incremental improvements that forgo the opportunity for more transformative long-term problem-solving, or, conversely, conducting a large amount of fundamental exploratory research at the expense of more immediate needs. A system with a strong sense of priorities will address both goals with appropriate funding and delivery mechanisms.

The research system needs a set of clearly expressed, whole-of-system research Priorities. Ideally, Priorities will act as focal points for investment and accountability and provide transparency for Government's investment intentions. The system will be more effective if it concentrates appropriate resources meaningfully on a focussed set of activities.

Clearly expressed research Priorities will also offer the opportunity for government to make new, proactive investments in research areas of emerging importance. These Priorities could serve as more explicit drivers of focused technology, innovation or environmental policies. They could act as focal points for balancing research portfolios, ensuring an appropriate mix of leading-edge transformative research and experimental development in operational environments. Priorities could also provide the opportunity to monitor and evaluate translation of research activity into outcomes related to government priorities or strategies.

1.2 TE HOAHOA WHAKAAROTAU RANGAHAU DESIGNING RESEARCH PRIORITIES

1.2.1 He aha te tikanga o te whakaarotau? What do we mean by a Priority?

We are seeking feedback on suggested design features for national research Priorities. To start the discussion, the main features are presented here that might be seen in future research Priorities.

1. Priorities will be the vehicle for government to invest proactively in research areas it considers important. For example, a Priority focus might be climate change, infectious diseases, biosecurity, or data-intensive social research.
2. We expect all research Priorities to be co-developed with Māori, and to give active effect to Te Tiriti, with a clear process in place to enable this; which may be different for different Priorities.
3. Research Priorities will have dedicated funding. With reference to the current system, they will be similar to Strategic Science Investment Fund platforms or NSCs. It is an important feature of a future system that some funding is tied directly to Priorities that are strategically determined, rather than funding being determined separately to a Priority-setting process.

4. A specific amount of funding will be allocated to each Priority for a relatively long time, at least five years and potentially longer, depending on the area.
5. Priorities will form a single 'home' for their research focus in the RSI system. This does not mean all research under that focus area must be funded under the Priority. Investigator-led projects might be funded through different mechanisms, but we would expect the Priority to form, at the least, a locus of coordination and information sharing.
6. Priorities will be an expression of the most important matters for New Zealand that can be enabled through the research system. They will not describe all research activity that will happen. They will describe a sub-set of research with a particular focus of activity and resources. There will remain funding and support for investigator-led research that takes place outside of these priorities.
7. Priorities will support the full range of research activity, including basic research, applied R&D and knowledge transfer activities. The mix of these activities may be different for different Priorities.
8. We expect most, if not all Priorities will be multi-institutional and multidisciplinary, including social research. Priorities should draw on expertise from across the research system, to reflect the complex and multidisciplinary nature of the research required.

We would like your feedback on these choices. Are there any reasons we should or should not choose to adopt this direction?

1.2.2 Ngā kōwhiringa hoahoa Whakaarotau Matua Key Priority design choices

KEY QUESTION 1: What principles could be used to determine the scope and focus of research Priorities?

Assuming that a scheme of national research Priorities is adopted as described above, several further choices will be needed. We will need to determine **the type of focus of research Priorities**. For example, research Priorities could focus on a problem (e.g., pollution), an opportunity (e.g., alternative proteins), a technology (e.g., CRISPR), a mission (e.g., space) or a field of research (e.g., soil science). The type of focus might also depend on the context.

We are interested in your feedback on whether any type of focus is preferred over another and whether we could have a successful mix of different types of focus.

The scope of different Priorities and the principles for determining scope also need to be considered. Research Priorities will likely be developed in different sizes, depending on their unique circumstances and scopes, and it is unlikely one ideal size will suit every Priority. The range of Priorities and investments must create a coherent whole. Principles and attributes should be established that help determine the size and scope of the national research Priorities and we are interested in your feedback on what these should be.



1.3 TE TAUTUHI WHAKAAROTAU RANGAHAU Ā-MOTU SETTING NATIONAL RESEARCH PRIORITIES

1.3.1 Me pēhea te tautuhi i ngā Whakaarotau rangahau ā-motu? How should we set national research Priorities?

We will need a process for determining national research Priorities. Such a process should be predictable, insofar as it is planned, and provide good notice to those involved. It should be transparent, so users have confidence in how decisions are made and decision-makers can be held accountable. The system needs to be flexible enough to modify, create or disband national research priorities in response to changing contexts.

We will need to consider the criteria used to guide the priority-setting process. These criteria should take into account both current and future needs across the environment, society and economy, and embed Te Tiriti in any decision-making process. Our system will need instruments and resources, to create future opportunities for New Zealand and serve immediate needs.

Other countries with mechanisms already in place for setting research priorities have different structures, process and outcomes. However, they tend to consist of a mix of three components:

- 1. information and analysis:** most priority-setting is supported by background information and technical analysis of a country's context, society, environment, economy and global relative position across these factors.
- 2. consultation:** sometimes consultation is limited to particular stakeholders or takes place through different forms of workshop or structured group decision-making. It can also be directed broadly to the general public.

- 3. expert or executive decision-making:** judgement is ultimately exercised in final decision-making. This can be through independent panels of experts or lay people, executive groups of government officials, or by politicians; or by a series of such bodies, sometimes with mixed membership of a variety of stakeholders, or a combination of these.

How we set research Priorities in New Zealand will also need to uphold Te Tiriti and the diversity of the community as a whole.

1.3.2 Ngā kōwhiringa hoahoa mō te tukanga tautuhi whakaarotau Priority-setting process design choices

KEY QUESTION 2:

- What principles should guide a national research Priority-setting process?
- How can this process best give effect to Te Tiriti?

Many choices are available in how we design and run **priority-setting processes**.

We need to determine the attributes and principles that will guide a national research Priority-setting process, along with how such a process will combine information, analysis, consultation and decision-making. Any process will need to be co-designed with Māori and should offer government sufficient flexibility to make choices in changing contexts.

We need to determine who should make which decisions in the process and why. Some systems have a strong preference for independent or expert decision-makers, but our system will need to give effect to Government's research Priorities. We need to determine whether we can and should design a process that can accommodate both.

The national research Priorities need to be developed and defined in partnership with Māori and give effect to Te Tiriti. We need to carefully consider what partnership and co-development look like at different stages of the development process and how the process can ensure that voices and views from across Te Ao Māori are recognised.

Finally, we need to determine how frequently the research priority-setting process should be run. To invest strategically for the long term, most research priorities will need to be stable for some time. However, there also needs to be the agility to introduce new priorities in a timely fashion. We will need to consider how a process might be able to deal with emerging, out-of-cycle priorities.

1.4 TE HOAHOA Ā-ROTO O NGĀ WHAKAAROTAU RANGAHAU Ā-MOTU INTERNAL DESIGN OF NATIONAL RESEARCH PRIORITIES

1.4.1 Me pēhea ngā Whakaarotau rangahau ā-motu e mahi ai? How should national research Priorities operate?

The means for determining the research Priorities and their funding will be one where decisions are made about what is important and how they are resourced. But research priorities will also need to make internal decisions on what research to conduct, and focus on undertaking a sub-set of research of particular importance.

We want a system where decisions on research projects are reflective of Māori needs and give effect to Te Tiriti. Decisions should also reflect the interests and involvement of key stakeholders, and include responsibility and accountability mechanisms that partner with those stakeholders in the operation of research Priorities.

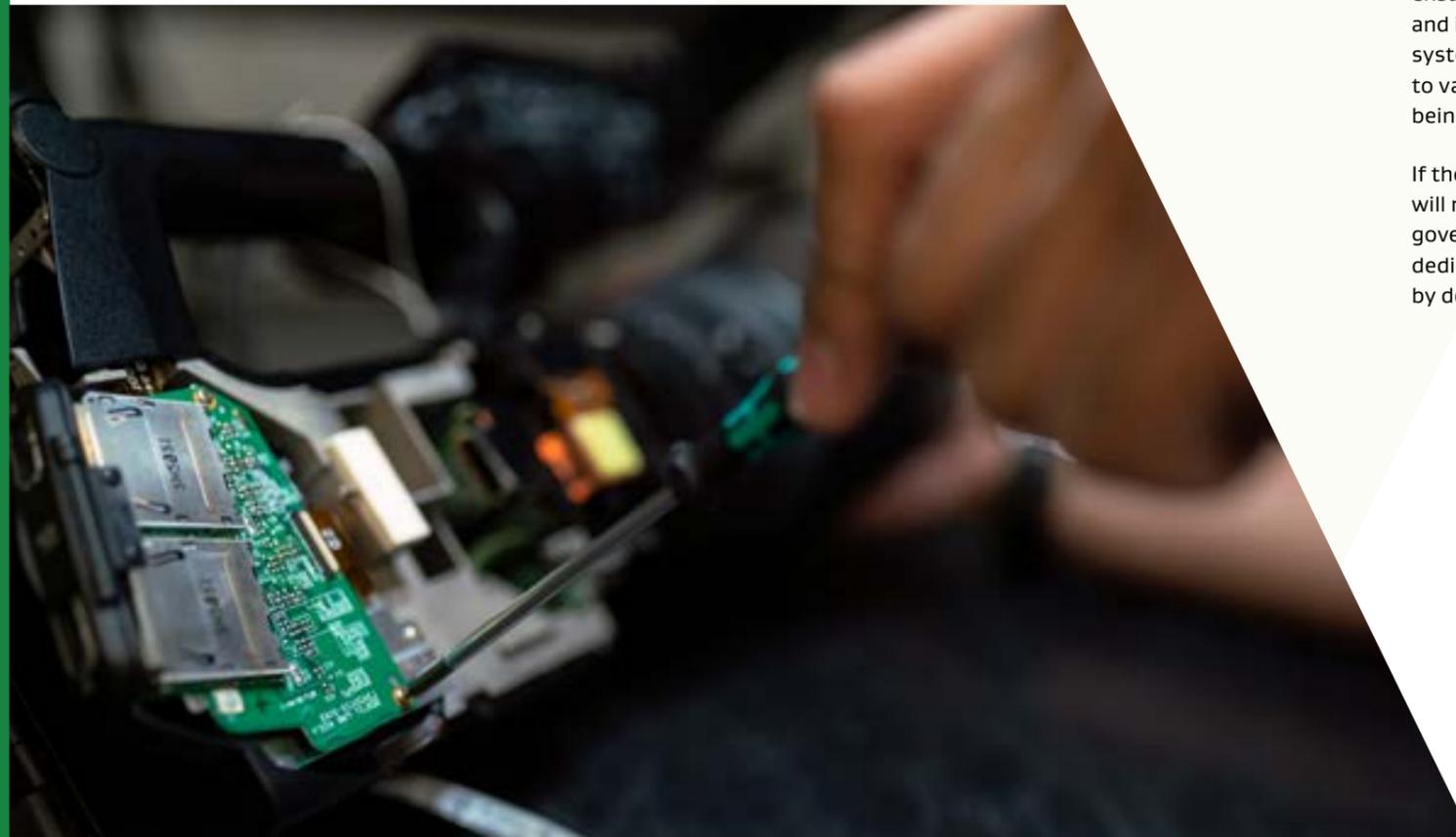
Stakeholders in this context means those closely reliant on research conducted by the Priority in question. They could be government or public service entities, such as health system participants, or significant government users of research, such as local government, or central government agencies, such as the Ministry for the Environment. They should also include Māori partners, together with industry or non-governmental organisation partners, as appropriate. We also need to consider how we might govern Priorities in areas of new or emerging technology, where there may not be any obvious existing stakeholders.



The operation of research Priorities will need to consider the needs and aspirations of these stakeholders and ensure the research is forward-looking and using the best techniques and processes available. Any system will need to guard against the prioritisation of short-term operational functions of a particular stakeholder group over longer term or more transformational research, and vice versa. Priorities should act as focal points for balancing a portfolio of different types of research, ensuring as far as possible an overview is given of the results chain from research to impact.

Strong research leadership and fit-for-purpose accountability mechanisms will need to ensure projects within a priority are meeting the highest standards of research excellence and impact. Research excellence will remain an important guiding principle of the RSI system but will look different in different research contexts. Research Priorities will need to value different modes of excellence, depending on the field and type of research being undertaken.

If the Government does choose to adopt a system of national research Priorities, strategies will need to be specifically linked to identified funding, and vice versa. In the past, some government research strategies have not achieved the impact intended because of a lack of dedicated funding. In the future, the priority-driven parts of our system should be matched by dedicated funding, for clarity and transparency in resourcing decisions.



1.4.2 Ngā kōwhiringa hoahoa whakahaere matua **Priority operation design choices**

KEY QUESTION 3: How should the strategy for each research Priority be set and how do we operationalise and implement them?

The main factors to consider are those of strategy, governance and leadership. The strategy for a Priority will determine broad resourcing choices and objectives. Governance will provide a point of accountability and decision-making. Leadership will provide day-to-day direction and set the culture and working environment for a Priority. Leadership may also provide intellectual direction. The distribution of responsibility between these functions, and their relative independence, forms the main design choices. We will need to consider how to enable the operations of Priorities to give effect to Te Tiriti through partnership at the level of governance, management and operations.

We may not want to adopt a single model for all Priorities. Different models could be adopted, based on what works best for the Priority in question.

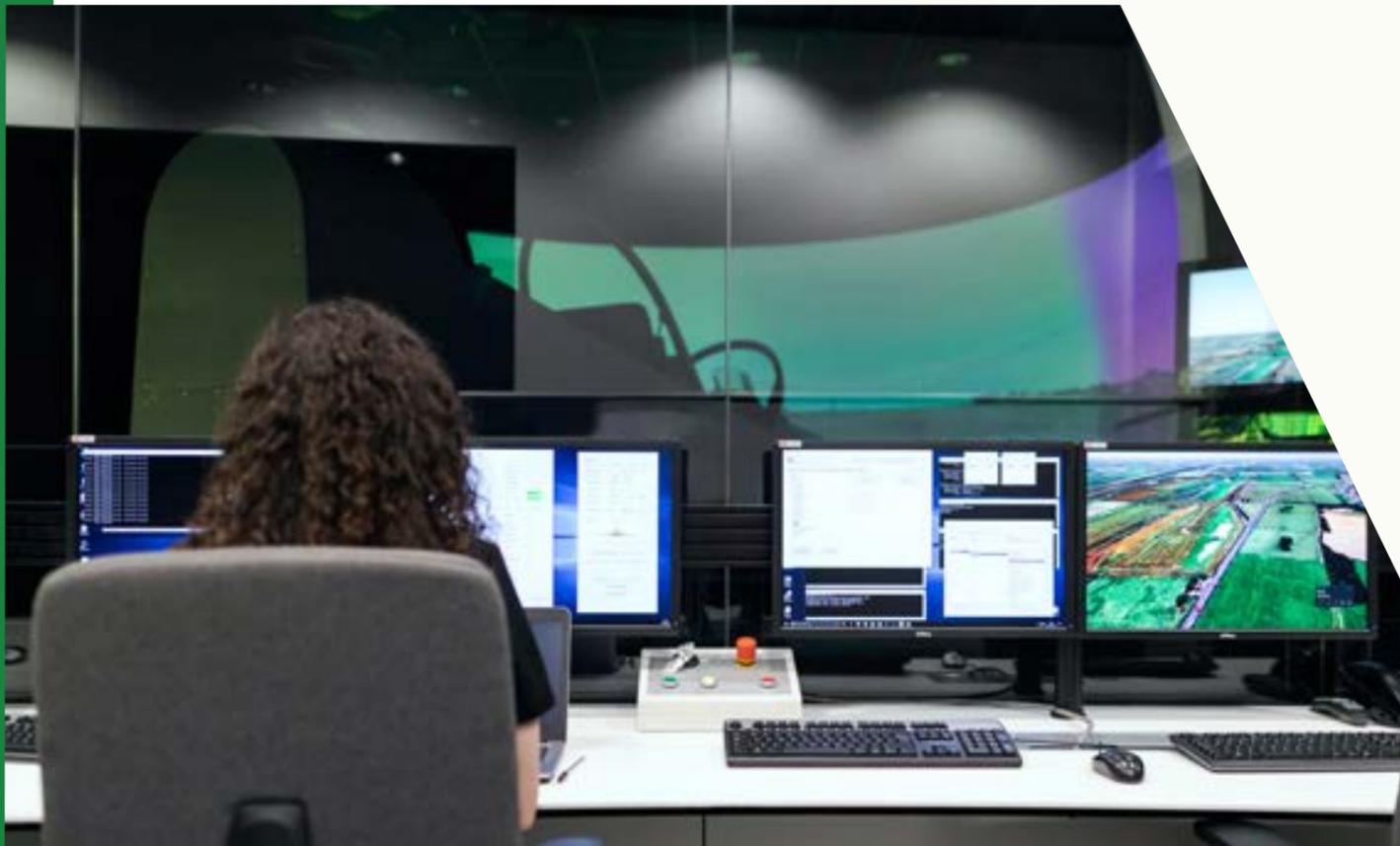
We need to determine how the strategy for each national research Priority should be set. This should consider whether strategy setting should be done separately from the Priority, for example, by government or those with relevant expertise, such as an expert panel. We also need to consider how stakeholders are included in the strategy-setting process and the information that should inform the strategy.



We need to determine how research Priorities are governed. This will include the modes and models of oversight and accountability that might be adopted and available. This includes how independently the national research Priorities should be governed, whether oversight roles can be split from operational ones, and whether multiple national research Priorities could share governance.

We note a proliferation of governance mechanisms in the current system at many levels, some with conflicting or cross-cutting responsibilities. At one end of the system are the existing governance mechanisms for research organisations and at the other is governance of individual research programmes. Many existing priority mechanisms have their own governance boards, which set direction and provide a point of accountability for leadership. In the future, we do not want governance functions that form barriers to connecting across the system. We also need avenues for input and oversight from Māori and stakeholder groups, as well as basic accountability relationships.

We need to determine the role and mandate that research leaders have in the research priorities and how they can be best supported. Discussions with research system stewards in other countries have highlighted that strong research leadership of work programmes (e.g. principal investigators or centre leaders) is the most critical success factor, more so than system design or strong governance. This should include consideration of the responsibilities or accountabilities and participation in other roles in areas such as strategy setting.





2

**TE TIRITI, MĀTAURANGA
MĀORI ME NGĀ WAWATA
O TE MĀORI** **TE TIRITI,
MĀTAURANGA MĀORI
AND MĀORI
ASPIRATIONS**

2. TE TIRITI, MĀTAURANGA MĀORI ME NGĀ WAWATA O TE MĀORI TE TIRITI, MĀTAURANGA MĀORI AND MĀORI ASPIRATIONS

This chapter discusses how the research system can seek to understand and honour Te Tiriti obligations and opportunities, reimagine how to give life to Maori research aspirations, and explores pathways to a modern research system for Aotearoa that is Te Tiriti led.

It is clear from multiple reports and our previous consultation exercises that more work needs to be done to explore how the research system can best uphold Te Tiriti obligations and opportunities. We must consider how to embed Te Tiriti within the fabric of the research system, in decision making, in our processes, in collecting advice and information, in our workforce, and in research outcomes. We need to consider the diverse ways in which Māori organise as iwi, hapū, whānau, businesses, interest groups, subject matter experts, researchers and as individuals. We need to reimagine how to give life to Māori research aspirations, the right ways to enable mātauranga Māori – Māori knowledge – in our research system and the interface between mātauranga Māori and other activities in the system.

Throughout this green paper, we have highlighted areas where the potential exists to give effect to Te Tiriti, to elevate the aspirations of Māori in the system, and create a system more responsive to Māori aspirations. This section outlines further proposals intended to give better effect to Te Tiriti. The section draws heavily on a large body of work from Māori scholars and experts, and, in particular, the reports *Te Pūtahitanga: A Tiriti-led science-policy approach for Aotearoa New Zealand*⁴ and *Ko Aotearoa Tēnei: A Report into Claims Concerning New Zealand Law and Policy Affecting Māori Culture and Identity: Wai 262*⁵. We acknowledge the authors of these works, and the Wai 262 claimants, for their thoughtful and generous contribution to the national discussion.

4 Ngā Pae o te Māramatanga. (2021). *Te Pūtahitanga: A Tiriti-led Science-Policy Approach for Aotearoa New Zealand*. www.maramatanga.co.nz/publication/te-p-tahitanga-tiriti-led-science-policy-approach-aotearoa-new-zealand

5 Waitangi Tribunal. (2011). *Ko Aotearoa Tēnei: A Report into Claims Concerning New Zealand Law and Policy Affecting Māori Culture and Identity*. https://forms.justice.govt.nz/search/Documents/WT/wt_DOC_68356054/KoAotearoaTeneiTT1W.pdf

2.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

Lack of recognition of Te Tiriti, and protection and support for mātauranga Māori in New Zealand, is well documented. The Waitangi Tribunal described in *Ko Aotearoa Tēnei* that: “successive colonial and post-colonial governments in New Zealand have been hostile to the survival of Māori culture generally and of mātauranga Māori in particular” (p 576)⁶. On the RSI system specifically, the Tribunal took the view that mātauranga Māori remained “clearly at the ... margins” (p 573)⁷.

The authors of *Te Pūtahitanga* point to entrenched values that result not only in Māori knowledge continuing to be undervalued within the RSI system, but also “underinvestment in Māori research infrastructure, Māori capacity and Māori science advice.” They argue (p 17):

Within the RSI sector generally, there is a strong belief that Western science is universal and culture-free, and that it should be as values-free as possible. ... It is the belief in objectivity and universality that enables Western scientists to hold their own knowledge system above others, often in a non-critical way.⁸

The *Ko Aotearoa Tēnei*, *Te Pūtahitanga* and *Te Pae Kahurangi*⁹ reports all acknowledge that misappropriation and mismanagement of mātauranga Māori has occurred within our system. The dual challenges of underinvestment in and mismanagement of mātauranga Māori highlights an overarching need to strengthen the ways our system understands and invests in mātauranga Māori. Our research system needs stronger and explicit processes, procedures and mechanisms to ensure that mātauranga Māori is not misappropriated within our system, and that the mana or mandate for its use is appropriately retained by its Māori owners or kaitiaki.

As noted, we have highlighted areas throughout this green paper where the potential exists to address the issues discussed above. This work programme provides the opportunity to rebuild the RSI system with Te Tiriti and Tiriti partnership as a foundation, to enhance the special features of the system that set New Zealand apart from other advanced economies, and that are integral to building a world-class research system.

6 Waitangi Tribunal. (2011). *Ko Aotearoa Tēnei: A Report into Claims Concerning New Zealand Law and Policy Affecting Māori Culture and Identity*. *Te Taumata Tuarua Volume 2*. https://forms.justice.govt.nz/search/Documents/WT/wt_DOC_68356606/KoAotearoaTeneiTT2Vol2W.pdf, page 576.

7 Waitangi Tribunal, 2011, above note 6.

8 Ngā Pae o te Māramatanga, 2021, above note 4.

9 Ministry of Business, Innovation and Employment. (2020). *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand's current and future needs*. www.mbie.govt.nz/assets/te-pae-kahurangi-report.pdf

2.2 TE HUARAHI E MAROHITIA ANA PROPOSED APPROACH

KEY QUESTION 4: How would you like to be engaged?

Open and genuine engagement with Māori will be vitally important to the development of a research system that gives effect to Te Tiriti.

We are particularly interested to hear about Māori preferences for engagement as we move through any programme of work arising from this Future Pathways green paper, which will continue for some time following the initial consultation period.

As an individual researcher, member of a representative body, representative of your iwi, user of research, or any other role you may hold, we are keen to hear how best to organise our ongoing engagement with you. This could be individually, as part of a reference group, during broader consultation exercises, such as this one, or in any other context that would work well.

We would also like to know what roles Māori should take in the work programme and how these roles should be organised and appointed; they could include governance, decision-making, advising, undertaking analytical work, or any other ideas you might have.

We do not expect this green paper to be our only avenue of engagement on this work programme. We will seek to create ongoing and appropriate opportunities to engage with Māori throughout any reform processes that follows this consultation. Te Tira Whakahihi, a working group comprising Māori RSI experts (together with MBIE officials) has already provided advice on the content of this green paper. We will continue to engage with Māori, encompassing more and diverse Māori groups and interests as the programme of work expands.

2.3 TE WHAKAMANA ME TE WHAKAHAUMARU I TE MĀTAURANGA MĀORI ENABLING AND PROTECTING MĀTAURANGA MĀORI

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

We acknowledge the rich ecosystem of mātauranga Māori that exists across Te Ao Māori. Section 2.1 describes how the research system needs better ways to support mātauranga Māori, as it does well with other kinds of knowledge.

Enabling mātauranga Māori in our research system gives effect to the obligations and opportunities embodied in Article 3 of Te Tiriti. This underpins a commitment that Māori and Māori knowledge will be provided equitable support and access to the resources, tools, research institutions, developments, impacts and generated outcomes of the system as other research knowledges that are currently supported.

Mātauranga Māori is also a taonga Māori, which means it has special provisions under

Article 2 of Te Tiriti. In particular, this provides that the rangatiratanga relationship Māori have with their taonga, as owners, kaitiaki and benefactors, should be appropriately protected and retained throughout any enablement, use, development and application of mātauranga Māori within the research system.

As we have described in section 2.1 above, we need to strengthen the ways in which our system enables and protects mātauranga Māori. Creating better pathways whereby mātauranga Māori can obtain funding and support from the research system, as other knowledge systems do, can help accelerate and amplify the distinctive contribution of mātauranga Māori. Better protections will ensure mātauranga Māori is enabled responsibly and ethically, in a way that protects the rangatiratanga of its owners and kaitiaki.

We would like to explore ideas on how our research system can better enable and protect mātauranga Māori. We anticipate that there will be no single way to achieve this. A suite of approaches may be needed at different times, and at different parts of our system, and where mātauranga Māori interfaces with other knowledge systems. Approaches could include a mixture of focussed and distributed mātauranga Māori expertise, a leadership or advisory body or bodies, the integration of mātauranga Māori experts across key organisations and agencies, mechanisms to coordinate mātauranga Māori expertise. It could include processes to enable and routinize the development of new policies, guidelines and tools for emerging and reapplied mātauranga Māori, and as new technologies, challenges and opportunities present themselves.

We would like to hear your thoughts and responses to these ideas, the advantages and disadvantages of different approaches, and an appropriate role for the Crown in such processes.

2.4 TE WHAKAPAKARI HONONGA KI TE MĀTAURANGA MĀORI Ā-ROHE STRENGTHENING CONNECTIONS WITH REGIONALLY BASED MĀORI KNOWLEDGE

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

Te Pūtahitanga and other reports have sought stronger deployment of research system resources to the regions, that is, to where Māori knowledge is practiced, and where mātauranga Māori experts and practitioners live and work. Supporting and mobilising mātauranga Māori has been seen to hold great and distinctive opportunities for communities and society as a whole. These reports have also encouraged better information and co-designing of research and policy with regional Māori communities, including whānau, hapū and iwi.

We would like to explore these ideas further. We would like to understand how stronger connections with regional Māori knowledge might be accomplished, what connections within and between other parts of the research system might help sustain and amplify the reach and potency of mātauranga Māori research, and what structures and processes might underpin and enable these connections. We would like to engage in conversations about the advantages and disadvantages of different options around these ideas, and an appropriate role for the Crown in such processes.



3

TE TUKU PŪTEA
FUNDING

3. TE TUKU PŪTEA FUNDING

This chapter discusses possible ways to reshape the funding system for the future. It covers how funding could be used to give effect to whole-of-system Priorities, reduce unproductive competition, and ensure institutions can respond and adapt to emerging opportunities.

3.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

The main way the Government influences the RSI system is through funding research. What is funded, and the way it is funded, lies at the core of RSI policy. The Government funding that supports research activities has increased significantly over the past 10 years, by around 75 per cent since 2010. With it our system has grown and done much more. The system has regularly shown the value of increased investment in R&D.

However, the underpinning mechanisms by which that funding is distributed have led to precarity in organisational revenue for CRIs. Despite the overall increases, elements of unproductive competition continue across the research system. Overall, demand for support far outstrips the supply of resources in the RSI system. This makes the goal of raising national R&D expenditure to 2 per cent of GDP a bare minimum.

3.1.1 Te hono pūtea ki ngā Whakaarotau Linking funding to Priorities

As noted above, the current system suffers from weak links between funding and strategic research needs. Proposals here are designed to address this problem by setting specific Priorities through a single process, funding those Priorities explicitly and directly, and having the allocation within the Priorities linked to research strategies.

3.1.2 Te whakaiti i ngā raruraru o te whakataetae korehua Reducing problems of unproductive competition

We have observed that the RSI system contains elements of unproductive competition. Sometimes competitions become competitions for revenue between organisations rather than of the best teams or ideas. High-stakes revenue competitions can form barriers to collaboration and connections between organisations. We have also heard about behaviour that treats stakeholder relationships as inputs into funding bids rather than as valued outcomes in their own right. This problem is often cited by both Māori and industry, who are sometimes asked to provide support for funding applications but then experience little subsequent engagement.



Funding competitions, such as Endeavour and Marsden, are, and will remain, important components of the research system. If we adopt a new model of national research priorities, as suggested in this green paper, it will be important that parts of the research system are not solely priority driven, to allow for wide ranging innovative and transformative research. Researchers need to be able to investigate future opportunities for New Zealand whether or not they align with existing conditions or priorities. Funding competitions will continue to be an important aspect of this part of the system. However, the system must ensure that competition within these funds remains productive and does not result in unintended outcomes.

3.1.3 Te whakarite kia taea e ngā whakahaere rangahau te urutau ki ngā whakaarotau panoni Ensuring research organisations can adapt to changing priorities

CRIs in New Zealand rely heavily on various streams of government research funding for revenue stability. The mismatch between the function of these funds (supporting research awarded through various processes) and their practical use (supporting organisations to keep the lights on) means changing priorities, or the results of funding competitions, can represent a significant disruption to CRIs. This in turn makes it challenging for government to evolve or adapt research priorities over time.

3.1.4 Te tuku pūtea tika ki ērā mea e hira ana ki a mātou Properly funding things we think are important

Numerous reports on the research system have observed that dedicated funding should be provided for critical research functions, high priority services, emergency response and databases and collections. In the current state, and in the context of slightly different arm's-length funding arrangements, specific funding decisions on these items are delegated to research organisations to manage and trade off against other priorities. This means research organisations often face hard choices about balancing research services against each other or against other research functions, without priority guidance from the Government. Research organisations also lack dedicated funding sufficient to maintain all aspects of their operation. Some of these same problems are visible for research infrastructure, which is discussed in chapter 6.



3.2 NGĀ TAUMAHĪ MATUA TUKU PŪTEA FUNDING CORE FUNCTIONS

The 2020 *Te Pae Kahurangi* report recommended that dedicated funding should be provided for critical research functions, high-priority services, emergency responses and databases and collections.¹⁰ The underpinning concept is that certain functions or services exist that developed countries and small advanced economies, such as New Zealand, expect their governments to perform that deliver a standard of living that distinguishes them from other nations. Where these functions are identified, government should fund them and specifically ensure their viability in the same way as, for example, a tax system or police force. One possible model for this is the way the Government funds the Measurement Standards Laboratory, which is part of Callaghan Innovation, but has its own dedicated, ring-fenced budget and supporting legislation.

We consider at least three categories of activity exist that could meet the test of being a ‘core function’:

1. **Critical research:** research capability that is essential to New Zealand’s functioning as a country. For example, ongoing research into infectious diseases and cybersecurity threats.
2. **High-priority services:** these are not necessarily research activities in themselves but might provide data input into research or require scientific expertise to function. Seismic monitoring or forensic laboratories might fall into this category.

3. **Databases, collections and monitoring:** data are necessary to understand the status and health of resources, to support research and to serve various other functions. For example, weather data have both commercial and public good value, and type specimen collections support national biosecurity and biodiversity conservation systems.

Common to all of these activities is that they are intuitively important, but it is hard to be precise about what exactly should belong on a complete list. Government has access to finite resources but lacks a finite list of activities that fit the general description of a core function. Determination about what is critical will need to reflect the diversity of values in our society and Te Tiriti.

In addition, New Zealand has various arrangements for managing such activities, for example:

- › Our criminal forensic laboratories, which are housed in the Institute of Environmental Science and Research but paid for through a contract with New Zealand Police
- › Our weather monitoring systems, where ownership of the monitoring network is shared between the National Institute of Water and Atmospheric Research and MetService, but forecasting and other attendant services are provided by different public and private organisations
- › Our geophysical monitoring system operated by GNS Science through the GeoNet programme, paid for by the Earthquake Commission, Land Information New Zealand and MBIE
- › Scientific collections, some of which are funded centrally and some of which are housed in and paid for by museums or universities, as well as CRIs
- › Our biosecurity facilities, where laboratory capability is partly owned, paid for and housed in the Ministry for Primary Industries, while also being heavily reliant on the CRIs.

We are not recommending any of these arrangements over others, except to note the following international trends. In small economies, it appears research functions – those designed and intended to generate new knowledge – tend to be housed deliberately in research organisations. Conversely, service or monitoring functions – where a proven service is delivered repeatedly or data are collected on an ongoing basis – tend to be housed with service agencies or government departments. Given they are all eventually funded by government, the distinction may appear academic. But individual organisations will tend to make resourcing decisions within the scope of their organisations. A geological survey undertaken by a government department will have the resources needed to carry it out judged against other government functions, such as providing policy advice.

A geological survey undertaken by a research organisation will have its resources judged against competing research activities. We cannot avoid the fact that finite resources will lead to choices that need to be made. We can, however, try to make those choices as sensible as possible.

¹⁰ Ministry of Business, Innovation and Employment. (2020). *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand’s current and future needs.* www.mbie.govt.nz/assets/te-pae-kahurangi-report.pdf

3.2.1 Ngā kōwhiringa matua mō ngā taumahi matua Key design choices for core functions

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

If we proceed with this proposal, we will need to determine what constitutes a core function and how this differs from a research programme. We need to develop a set of criteria that let us identify core functions and apply limited resources effectively to things we think are important.

We will need to consider how to make resourcing decisions about these functions, who should make them, and what the most effective model is for housing and managing distinct types of core functions. For example, who should be responsible for determining the distribution of scarce resources amongst the things we think are important; how can we ensure determinations of 'what is important' uphold Te Tiriti and the different values and views held in communities; and what is the best arrangement for organising these functions?

3.3 HE PĒHEA TĀ MĀTOU TUKU PŪTEA KI NGĀ WHAKAHAERE RANGAHAU HOW WE FUND OUR RESEARCH ORGANISATIONS

Numerous reports and commentaries have emphasised the importance of stable funding for CRIs. And CRIs report that uncertainty about future funding complicates medium-term planning and reduces their scope to commit to long-term partnerships. It can also affect their capacity and capability to innovate through targeted risk taking. We have also noted problems with unproductive competition in the system.

This green paper outlines proposals to focus the system on priorities that would be determined independently of research organisations. We need the system to be adaptive to these priorities and resilient in the face of change, or choices on research priorities will be constrained by the circumstances of the research organisation.



We have the potential to resolve this contradiction by re-examining the way government funds research organisations.

Vote: Tertiary Education funds, such as the Performance-Based Research Fund (PBRF), are out of scope for this green paper.¹¹ We recognise, however, that submitters may have thoughts on the relationship between the PBRF and the funding model changes proposed, and we are interested in any feedback you have on this.

3.3.1 Ngā whai wāhitanga ki ngā tauira tuku pūtea rerekē Opportunities for different funding models

Unlike most other countries, New Zealand funds the 'full cost' of research through an overhead component calculated as part of project- or programme-specific research grants. We do not allocate specific grants to fund overhead costs for organisations. Funding to maintain buildings, pay non-research staff, invest in infrastructure, and basically keep the lights on, is all delivered as a percentage top-up on research contracts. This means some research organisations, particularly CRIs, can be heavily exposed to the outcomes of funding competitions and changing national priorities. The end of a research grant does not just mean the end of that research project, it also means the end of the funding for the fraction of buildings, information technology, human resources services and other overheads that were attributed to it.

We could instead fund some or all of these costs through a specific grant. The stability of a base grant designed to meet ongoing costs could allow research organisations to be

¹¹ The PBRF is a bulk funding mechanism, designed to encourage and reward high-quality tertiary education research, across all subject areas and types, in degree-granting TEOs.



far more adaptable and resilient to future changes in Priorities than they are at present. It could also allow funding competitions to fulfil their function completely and become forums for a competition for the best new ideas generated by the research community.

The idea of providing research organisations with a base grant separate to specific research funding is not new. It is the way most other countries' research systems have worked for a long time; in fact, it is hard for us to identify another country that funds research the way we do. Harmonisation with international systems is another important argument for changing the way we fund research, because it would reduce barriers to research organisations participating in international research programmes.

We would like feedback on all aspects of this proposal, including factors that would make this proposal more or less successful, whether you know of international schemes like this that work well or poorly, and, if so, why.

3.3.2 Ngā kōwhiringa hoahoa mō tētahi tauira tuku pūtea hou **Design choices for a new funding model**

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

Our starting position for considering changes to the research funding model is that, as far as possible, **the research funding regime should provide a level playing field for different types of research organisation.** While different types of research will need different types of funding, we do not want research to be funded differently simply because it is done by different types of organisations. A funding regime that deliberately funds research differently solely on the basis of the type of organisation is likely to create or exacerbate barriers to connection between organisations, increase fragmentation, and be complex and confusing to operate.

There are three subsequent design choices we need to address to evaluate the potential value of a base grant regime.

- 1. Who gets a base grant?** A starting point is to examine which organisations receive RSI funding that comes with an overhead component. Universities and CRIs make up most of these recipients, but the list includes independent research organisations, district health boards, businesses and museums. Of these organisations, some will sometimes be in receipt of RSI funds and other times not, meaning their case for receiving an ongoing base grant is less clear cut. We need to consider whether all of these organisations would receive a base grant and what the implications are if some do not.
- 2. What would a base grant pay for?** Such a grant could mirror current settings and pay for non-attributable costs, such as corporate overheads and research infrastructure. The potential is, however, that a base grant could also meet a greater proportion of research costs, including a proportion of, or even full, salaries. This latter option would support the goal of a much stronger approach to the research workforce and provide maximum stability, but it could also leave much less funding available for allocation through priorities and competitions. We need to consider how to achieve this balance and what other factors are involved when choosing between a larger or smaller base grant.
- 3. How would the sum awarded as a base grant change over time, and can an organisation enter or leave the base grant scheme?** Allocations within the scheme would almost certainly need to be variable over time, to deal with changes



in organisations based on the research they were undertaking. But the basis for how this change should take place is not obvious. Generic options for varying the level of grant include:

- a performance-based system, where metrics are used periodically to adjust levels of funding. An important choice about such a system would be the metrics chosen as a basis for adjustment
- an activity-based system, where funding is adjusted periodically to match the quantified level of activity within the research organisation
- a negotiated system, where government makes periodic judgements about the relative investments appropriate to different research organisations.

A funding system could also combine one or more of these features. All options have advantages and disadvantages, and all run the risk of addressing one presenting problem while creating or exacerbating another. We would like to explore the advantages and disadvantages of these options and whether some are clearly better than others.

The idea of varying a base grant over time also raises the possibility that, at some point, a research organisation's grant allocation may drop to zero. But enabling research providers to enter or leave the base grant scheme under certain conditions may be a valuable design feature. For example, it could be a way to resolve problems raised in the design choices on who gets a base grant. We would like to explore whether we could usefully make a base grant an optional component of a funding system, if research organisations preferred to remain in the current system.



4

**NGĀ HINONGA
INSTITUTIONS**

4. NGĀ HINONGA INSTITUTIONS

This chapter focuses on the design and shape of research institutions, to enable them to give effect to whole-of-system Priorities and be adaptable in a fast-changing world.

4.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

In 2010, the Government reasserted the importance of the public good mission of CRIs through the CRI Taskforce. Our CRIs are, by design, focused on traditional sectors of the economy, such as food and fibre, and aspects of the environment and natural hazards. They have performed exceptionally well in their respective focus areas.

However, public good research extends beyond these sectors. We need to consider how to enhance and extend this role into broader challenges and opportunities for the country, as well as speak to the needs of a more productive future economy. We also need to consider that all research of importance to New Zealand does not, and does not need to, take place in CRIs. Our Universities, other tertiary education organisations (TEOs) and independent research organisations undertake slightly more research in aggregate than our CRIs, and have made outstanding contributions to national life. The co-production of excellent research and excellent researchers that occurs in tertiary organisations is an enormously valuable aspect of their operation. We need to consider how to encourage greater dynamism and fluidity across different types of organisations.

Despite the significant recommendations of the 2010 CRI Taskforce, our CRIs have remained within the same operational form and design as that established in the early 1990s. It is timely to assess the design and organisation of these institutions. This will ensure we continue to have sound design principles, because the structural limitations of the current operating model for CRIs are becoming increasingly evident. Recent reports such as *Te Pae Kahurangi*¹² highlight many of these limitations, including:

- › lack of role clarity and fragmentation
- › complexity, creating confusion and adding transaction costs
- › unhelpful competition that hinders meaningful collaboration
- › siloed strategies and priority setting
- › inability to adapt to changing contexts and emerging opportunities
- › ineffective and inefficient resource use
- › poor financial and organisational resilience.

12 Ministry of Business, Innovation and Employment. (2020). *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand's current and future needs.* www.mbie.govt.nz/assets/te-pae-kahurangi-report.pdf

In addition, a growing body of research and commentary suggests problems of institutional racism in our research institutions¹³. As discussed further in chapter five (workforce), equity, diversity and inclusion are vital to a thriving research system. Where there are structural or institutional barriers to a diverse research workforce, we need to understand those and address them.

4.2 ME WHAKAHOU NGĀ MĀTĀPONO HOU ME NGĀ KŌWHIRINGA I HANGAIA AI Ā MĀTOU HINONGA RANGAHAU NĀ TE KARAUNA (CRI) DESIGN PRINCIPLES AND CHOICES THAT FORMED OUR CRIS NEED TO BE REFRESHED

Our CRIs were created in the early 1990s. Their design features were heavily weighted towards classic microeconomic structures, market values and mechanisms, and commercial discipline. This focused on the separation of policy, funding and doing research. The current operating model for CRIs is, by design, decentralised, and parts of the system were designed specifically for the economy of the 1990s, focusing on sectors that extracted value from food and fibre. The early disestablishment of the social research CRI has meant a lack of a clear 'home' in the research system for this vital mode of investigation.

New Zealand's economic and social make up and aspirations have shifted since that time. We need organisations that are able to respond adaptively to a changing future and that are dynamic, connected and linked closely to each other. Our CRIs, TEOs and other research organisations need to operate within a framework that encourages collaboration across institutional boundaries. Any new design needs to point towards a more seamless and fluid model, where different types of organisation appear less distinct and separate.

4.2.1 Te tauira whakahaere ā-kamupene mā ngā CRI Company model of operation for CRIs

CRIs are set up as companies. The current operating model is organised as seven standalone and separately governed organisations that are all Crown owned. The Companies Act 1993 imposes duties on directors to act in the best interests of the company. The CRI Act 1992 specifies the primary purpose of CRIs is to provide research for the benefit of New Zealand (while acting in a financially responsible manner). The 2020 report *Te Pae Kahurangi* suggests this tension can impede collaborations that would contribute to the national benefit (p 6):

The CRI Act requires CRIs to undertake research for the national benefit. The Companies Act status of CRIs creates a duty for directors to act in the best interests of the company. In organising to tackle increasingly interdependent research problems, this duty is not a good foundation for a collaborative operating model for CRIs. The financial and liability frameworks of the Companies Act can be a complication for CRIs in emergency response.¹⁴

The company model creates a strong focus on the commercial performance of individual CRIs. However, much CRI activity is for public benefit. *Te Pae Kahurangi* found that about

13 e.g. McAllister, TG; Kokaua, J; Naepi, S; Kidman, J; Theodore, R (2020). Glass Ceilings in New Zealand Universities. *Mai Journal*. DOI: 10.20507/MAIJournal.2020.9.3.8

14 See *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand's current and future needs*, above note 12.

two-thirds of CRI funding was from various central and local government entities. In certain circumstances, CRIs may prefer to lean towards commercial gains from research, rather than maximising the public good (for example, by making research results more freely available). The 2010 CRI Taskforce report notes (p 7):

Currently, it is not clear if a CRI's objective is to create value for itself, as a company, or to generate value for New Zealand. Current ownership arrangements seem to place undue emphasis on research and development that produces outputs that individual CRIs can capture in their statements of revenue and balance sheets, rather than on research that contributes to the wellbeing and prosperity of New Zealand. This can reduce quite significantly the overall impact of government investment in CRIs.¹⁵

The original decision documents that established CRIs in the early 1990s place strong emphasis on responsible financial management, incentives to improve efficiency and the efficient deployment of capital in management decisions.

However, optimising these factors from the viewpoint of an individual organisation may not be the same as optimising from a national perspective. Other models of organisational constitution are available that may place less weight on individually optimised financial management and more weight on maximising the public good benefits of the research conducted. It is unclear if these aspects of operation have been optimised according to the original design principles. CRIs will sometimes act against their own financial interests to act in the public good, to the detriment of their revenue stability, capital planning and financial outlook. Directors sometimes face unnecessarily difficult choices within the current structures.

In considering the problems about organisational format, we must remember that a reasonable amount of the work in CRIs is not strictly focused on pure public good applications. Some CRIs derive a substantial proportion of their income from commercial sources. Any alternative organisational format will need to recognise the importance of these more commercial relationships and consider their potential future state when weighing up different models.

Te Pae Kahurangi also queried the appropriateness of the company operating model when considering emergency responses. In such situations, where a high degree of criticality is attached to government activities, it may be more appropriate to house functions in organisations that are closer to central government in organisational form and funding. Similarly, for core activities where only one sensible provider exists – national seismic monitoring might be a good example of this – the benefits of a company operating model are not really applicable even where they do apply, so a different type of organisation may be more appropriate.

4.2.2 Te whakataetae korehua me ngā tauārai ki te pāhekoheko puta noa i ngā whakahaere rangahau katoa **Unproductive competition and barriers to collaboration across all research organisations**

The current system is not well suited to pursuing opportunities that cross institutional boundaries, be they CRIs, TEOs, independent research organisations, or businesses. As discussed in chapter 3, competition for limited funds often limits collaboration at institutional level and results in an overall lack of connectivity. The need to generate

¹⁵ Crown Research Institute Taskforce. (2010). *How to enhance the value of New Zealand's investment in Crown Research Institutes: Report of the Crown Research Institute Taskforce.* www.mbie.govt.nz/assets/7502750043/how-to-enhance-the-value-report-of-the-cri-taskforce.pdf

revenue often leads to unhealthy competition between institutions, and financial considerations winning over benefit considerations in decision-making. Revenue generation can form a barrier to sharing resources and expertise and promotes contest between organisations rather than of ideas in contestable funding mechanisms.

4.2.3 Ngā hononga kaiwhaipānga kurutete **Transactional stakeholder relationships**

Stakeholder relationships may also be constrained by the current model. Stakeholders' views of relationships with CRIs are mixed, with satisfaction often related to the degree of influence stakeholders feel they have over CRIs' research. Research users provide a crucial link in research uptake and delivering impact, and some have reported difficulties in building strong research relationships with CRIs or difficulty navigating the system and finding a point of entry to working with CRIs.

Recent reports have also highlighted difficulties for Māori, particularly in getting CRIs to actively engage and partner in research, and creating meaningful and enduring relationships beyond what is often seen as token engagement to meet requirements of funding rounds.

Reports on university responsiveness are similarly mixed. New Zealand's industry investment into universities is low by international standards. This and other similar metrics point towards ongoing difficulties connecting into and out of university research.

4.2.4 Te kore āhei ki te urupare ki ngā whakaarotau pūnaha me te kore urutaunga **Inability to respond to system priorities and lack of adaptability**

The current model also constrains CRIs' ability to respond to strategic priorities and complex interdependent research due in part to its narrow institutional design. Our CRIs have fixed core purposes that give them limited ability to flex and change direction in response to the changing world. This limits their ability to be future focused and hinders the system's ability to respond to broad challenges that need a connected approach, drawing from multiple disciplines and sectors. Conversely, universities tend to be more flexible and adaptive when it comes to the changing research landscape; this makes a further case for lowering the boundaries between different types of research organisation.

4.2.5 Te kore mahi tahi ki ngā haumitanga haupū rawa me ngā rawa nunui **Lack of coordination for large property and capital investments**

There is currently no overall co-ordination of major RSI system property and capital investments. Decisions on capital investments are largely institution specific and driven by institution-specific benefits, potentially at the expense of system-wide benefits. This applies to both property and large research infrastructure investment.

4.3 TE TŪNGA O CALLAGHAN INNOVATION I ROTO I TE PŪNAHA RANGAHAU, PŪTAIAO ME TE AUAHATANGA (RSI) **ROLE OF CALLAGHAN INNOVATION IN THE RSI SYSTEM**

The changes we make to the research system to make it more connected, adaptive and resilient will also require us to think about how it interacts with the innovation system.

The Productivity Commission's report on frontier firms notes the importance of upgrading New Zealand's innovation ecosystems to support lifting national productivity and wellbeing.¹⁶ We need to consider the role of an innovation agency and innovation infrastructure.

New Zealand's innovation agency, Callaghan Innovation, performs various roles within a single entity:

- › It is an operational delivery agency that administers grant and other funding programmes in the innovation sector, for example, project grants, incubators and accelerators, and the technology incubator programme.
- › It is an advocate for innovative businesses within government.
- › It charges a fee for R&D services in advanced manufacturing and materials, data and sensing, biotechnology, and measurement and standards.
- › It is a connector, navigator and facilitator between innovative businesses, business services and the wider public research sector.

Sometimes roles conflict or are perceived to compete with the interests of potential partners in the public research system in ways that form barriers to collaboration. While considering the design of the public research system, we should also consider its interactions with the innovation system and institutions so we can increase collaboration and connections across the system.

System changes also provide an opportunity to think about how we tackle one of the biggest weaknesses of the innovation system to date: poor connections between New Zealand firms and public research institutions. Without strong connections, it will be a struggle to bring together the diverse ideas, knowledge, capabilities and investment needed to innovate at the global frontier.

¹⁶ New Zealand Productivity Commission. (2021). *New Zealand Firms: Reaching for the frontier*. www.productivity.govt.nz/assets/Documents/Final-report-Frontier-firms.pdf

4.4 NGĀ KŌWHIRINGA HOAHOA HIRA MŌ TE WHENUA ĀPŌPŌ KEY DESIGN CHOICES FOR THE FUTURE STATE

We need our institutions to be collaborative, adaptive, agile, and enabled to respond to Priorities. We need to consider how best to position our public research institutions for the future. This includes thinking about their design, organisation, governance and remit, and their future role within the RSI system.

4.4.1 Te āhua, whakaruruhau me te hanganga o te whakahaere Organisational form, governance and structure

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

We would like feedback on the organisational form, governance and structure of future public research institutions.

For this question, we are also asking for feedback on potential changes to CRIs and what future public research organisations might look like.

Although we are not actively considering changes to the institutional design of other research organisations through this process, we are interested in comments and ideas about the relationship between those future organisations and other research organisations (such as universities).

International models suggest global trends towards:

- › fewer and larger organisations
- › structural reforms that enhance connectivity with universities and focus on industry-targeted research
- › reforms that position public research institutions as part of a national research system rather than inputs into a specific government department or economic sector
- › use of funding, rather than institutional design, as the main strategy implementation lever.

We think fewer, larger and more resilient organisations would result in greater connectivity and interdisciplinary research, creating hubs of capability across multiple sectors. Reconsidering and broadening the narrow, fixed core purposes of public research institutions (for example, by grouping aligned disciplines) would allow more effective collaboration, to tackle research missions, and allow responses to broad challenges that require a connected, multidisciplinary approach.

Larger and more financially resilient institutions may also have greater agility in responding to government priorities, industry demands and emerging opportunities. Larger institutions may also allow more effective and efficient deployment of resources, to grow capability in areas of national importance, and ensure a broad base of public sector RSI capability to support innovation across the whole economy.

Various policy choices are available for fewer, larger organisations that focus on the basis on which they would be constituted.



Our design choices for organisational form, governance and structure are:

- 1. Operational form:** We have seen the limitations of the company operating model. What are the main design aspects we should consider when deciding the operating and institutional model of the future?
- 2. Size and remit of institutions:** We need to consider the role of size and remit of organisations in ensuring more institutional resilience and adaptability. Larger organisations would be more stable but may be less agile in pursuing emerging opportunities and changes.
- 3. Research focus:** In the 1990s, CRIs were intentionally designed to focus on specific economic sectors or aspects of the natural environment to “operate in fields of strategic importance to New Zealand” at that time. We need to consider how the remit and focus of research institutions are decided and how this enables interdisciplinary collaboration and complex challenges to be addressed.

4.4.2 Te whakawhanaketanga me te tautiaki pai ake o te hunga mahi me te raukaha **Better workforce and capability development and maintenance**

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

We consider that research institutions will have vital roles to play in workforce capability planning and development, and provide rewarding career pathways for researchers.

For this question, we are asking for feedback on all research organisations, including TEOs.

We discuss in chapter 5 the investment mechanisms that might support the development of career pathways, increase diversity and reduce precarity. Here we are interested in feedback on aspects of organisational incentives, design or remit that will better support capability development, talent development and attraction, and offer more flexible and diverse careers and career pathways to researchers.

In particular, we would like to explore the roles research institutions should play in capability and skills development and how to better coordinate this across the RSI system. We would also like to look at ways institutions can support the movement of researchers around the RSI system.

4.4.3 Te ruruku pakari ake me te arotautanga o ngā haupū rawa me ngā rawa nunui **Stronger coordination and optimisation of large capital investments and property**

KEY QUESTION 11: How should we make decisions on large property and capital investments under a more coordinated approach?

We discuss future research infrastructure funding in chapter 6. Here we consider how better coordination of property and capital investment and co-location can enable stronger connections between researchers across the RSI system and support institutional resilience through the efficient and effective use of resources.

Internationally, co-location, particularly between universities and public research institutes, has offered the potential to:

- › increase spill overs from researcher interactions to drive innovation and economic growth
- › share facilities and equipment, leading to more efficient use of capital
- › decrease the transaction cost of collaboration and connectivity across the RSI system
- › enable more fluid redeployment of property and infrastructure in the future
- › enhance adaptability and resilience as research institutes change in response to new opportunities and changing demands.

We are interested in feedback on how we could achieve a good balance between institutional autonomy and system benefits. This includes who should be involved and consulted in decision-making on large property investments and how we ensure universities and other parts of the research system are included in a more coordinated approach regarding large capital and property investments.

4.5 TE TAUTOKO I NGĀ WAWATA O TE MĀORI SUPPORTING MĀORI ASPIRATIONS

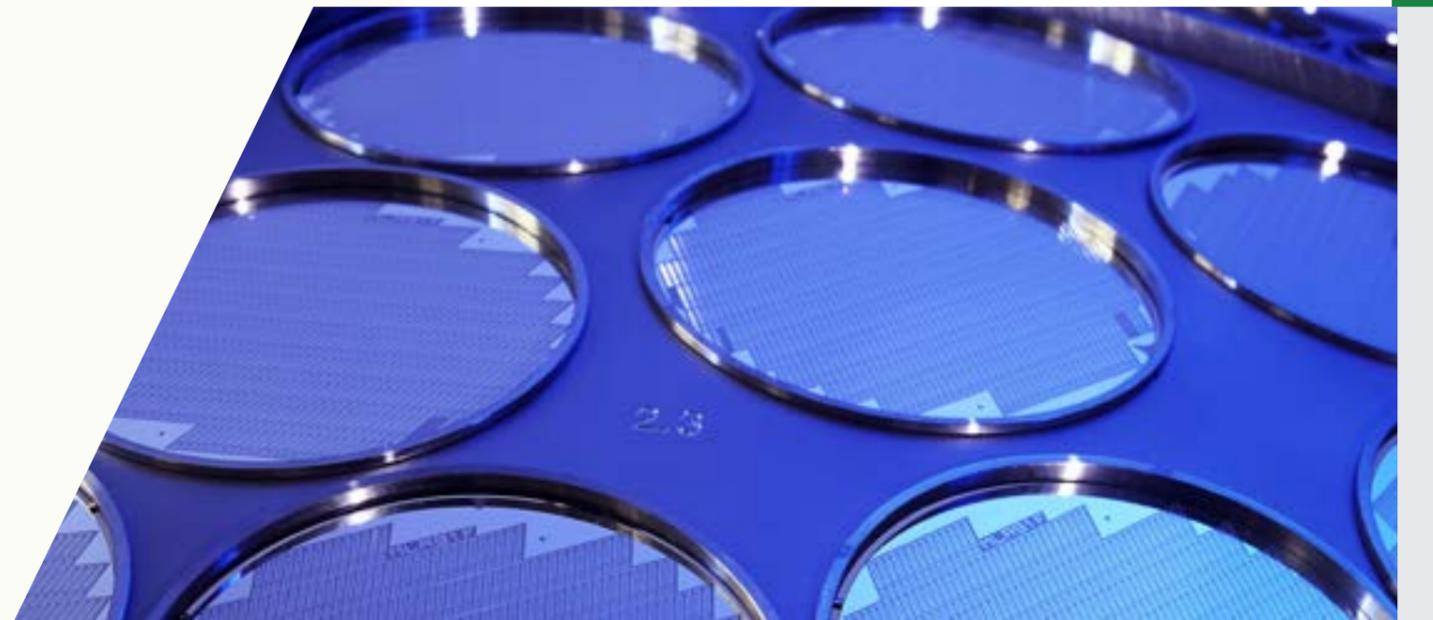
KEY QUESTION 12: How do we design Tiriti-enabled institutions?

We discuss in previous chapters our proposed approach to strengthening the RSI system to achieve outcomes for Māori and elevate the aspirations of Māori within it. This includes honouring obligations to and opportunities of Te Tiriti in the RSI system, better enabling mātauranga Māori and the interface with mātauranga Māori, measuring and monitoring the impact of investment in RSI for Māori and other activities in the research system.

Here we are considering how to design institutions to give effect to Te Tiriti, or how institutions can be better enabled to create enduring and meaningful partnerships with Māori and meet Māori aspirations.

We would like to explore how we design institutions within our research system in partnership with Māori, and what Tiriti empowered research institutions would look like.

We are interested in feedback on what partnership and co-development should look like in institutional design and how we enable institutions to listen to voices and views from across Te Ao Māori.



4.6 NGĀ PĀPĀTANGA PAI AKE – TE WHAKAWHITI MŌHIOHIO ME NGĀ PĀPĀTANGA RANGAHAU BETTER IMPACT DELIVERY – KNOWLEDGE EXCHANGE AND RESEARCH IMPACT

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

We want the research system to achieve greater impact. By impact, we mean a change to the economy, society or environment beyond a contribution to knowledge and skills in research organisations.

Through its 'Impact of Research' work, MBIE has sought to define and implement a measurement framework for research impact.¹⁷ As part of its agenda for research impact, MBIE asked public research institutions to renew their focus on supporting researchers to explicitly plan for and increase impact from their work. CRIs have formed the Impact Planning and Evaluation Network, which is developing training and upskilling to both grow an impact culture and improve the magnitude of research impact. The University Research Offices New Zealand group is also promoting and progressing impact work within the university system. Figure 3 outlines our proposed channels of knowledge exchange between research organisations in the future.

Figure 3: Channels of knowledge exchange



Impact can be achieved through successful knowledge exchange. This exchange occurs as a result of relationships with research end users (represented on the right of the diagram), which are mediated through various channels (in the centre of the diagram).

- › **People/workforce** – the flow of personnel to and from the research system and those of end users.
- › **Research commercialisation and knowledge management** – the use of publicly funded research outcomes by end users, and arrangements for managing and disseminating outcomes for use, including commercial use, such as licensing, and non-commercial use, for example, by government.

17 Ministry of Business, Innovation and Employment. (2019). *The Impact of Research: Position paper*. www.mbie.govt.nz/dmsdocument/6983-the-impact-of-research-position-paper-october-2019-pdf

- › **Platform technologies** – tools that are becoming standard in some end-user sectors, such as 3D printing, cloud technology and services, and the mRNA platform.
- › **Collaboration** – how stakeholders from the research system interact and engage with each other and end users, for example, research–industry research partnerships.
- › **Education and training** – most obviously, this is the role of TEOs. Co-creation of human capital and research in TEOs is one of their most powerful aspects. However, this could also include direct sharing of information that occurs through activities like 'executive education' or other training programmes offered by research organisations, consulting services offered by researchers to industry, the public sector and non-governmental organisations and through 'applied research' conferences and 'science communication'.

Impact is achieved through a system of channels. Many of these channels have been addressed in other chapters of this document so we focus here on research commercialisation and knowledge management. Government interventions can support the commercial and non-commercial use of research outcomes, but broader issues also exist on how institutions treat the use of their research as part of their strategy and culture, how researchers are recognised and rewarded, and how that influences researchers' attitudes and priorities.

We are asking for feedback on how to use our priority setting, funding and institutional design levers to incentivise best-practice research commercialisation, knowledge management and transfer to end users. We want to explore the extent to which institutions consider the commercial and non-commercial use of their research as a key part of their strategy and a mechanism for achieving research impact.

We are keen to investigate how to shape incentives for researchers to align their research with end users and facilitate its commercial and non-commercial use. We would also like to explore to what extent institutions recognise and reward researchers for research that aligns with and is used by end users. We would like to hear how institutions, researchers and end users would like to be engaged in processes that facilitate strong connections.

We also want to design research institutions for strong connections and dynamic, two-way exchanges between the institutions and end users, aligning research with industry, government and society. We would like to understand the barriers to industry in actively engaging with and valuing the research system as a producer of useful knowledge, and how to design institutions to overcome these barriers.

Several other countries and research systems have standardised approaches to intellectual property (IP) protection and ownership by research institutions and researchers, particularly with regards to the results of research that is publicly funded. These include policies around open access, open data, and public good distribution of research findings, as well as the ownership of any commercial aspects of IP.

We want to consider whether such approaches could be helpful in New Zealand. We are interested in helping foster a research system that facilitates commercial use but does not hinder non-commercial 'public good' use of research. We want to see institutions make timely decisions on commercial and non-commercial use of their research outcomes, informed by past successes and failures, with appropriate ownership and/or release arrangements for success. We want to establish regimes that encourage research institutions to make the best use of IP, where both organisations and individual researchers are appropriately rewarded for optimal decisions in predictable and equitable ways.

We would also like to improve further the connections between research and formation of policy. Are there design features, characteristics or modes of engagement that facilitate stronger two-way relationships between research knowledge and the formation of policy?

Ngā ara whakaarumoni Commercialisation pathways

The recent *Te Pae Kahurangi* report found that CRIs' approach to commercialisation is fragmented and subscale. It noted that, to varying degrees, each CRI has built a commercialisation capability and is pursuing opportunities but that individually these commercialisation portfolios lack the scale and diversity to manage risk and build end-to-end excellence. The report recommended (p 5) "pooling commercialisation opportunities to diversify risk and build end-to-end excellence in commercialisation capabilities".¹⁸

Commercialisation of research refers to research that can be exploited for commercial revenue, commonly through licensing or spinout companies. We have successful examples of government support for research commercialisation, including the Commercialisation Partner Network, which builds commercialisation capability in publicly funded research organisations and individual researchers, and the PreSeed Accelerator Fund, which supports research commercialisation projects. The Government's technology incubator programme also helps build start-ups based on publicly and privately funded research. We are interested in whether there is a case for scaling up some of these types of support.

We are also interested in whether an argument can be made for diversifying how we think about commercialisation pathways and therefore the kinds of support we have in place.

For example, government procurement is not typically thought of as 'commercialisation' but government is a significant user and purchaser of the resulting products and services. New models and approaches to procurement might be needed to allow government to invest in new or riskier ideas coming out of the research sector. Examples of alternative commercialisation models could include collaborations, partnerships or joint ventures with businesses, and entrepreneur residencies inside research-sector organisations.

We would like to understand whether current commercialisation supports are at the right scale and how we can enable greater collaboration and pooling of commercialisation expertise and opportunities across the research sector. We would like to consider what the most effective ways are of pairing scientific expertise with commercial expertise, and what the alternative commercialisation pathways are (to spinouts or licensing) that we may want to support in the research sector. We are keen to hear what a more collaborative model for people starting with an idea outside of the research system might look like, and what support the research system could provide in these cases.

Te puna rato ariā Ideas pipeline

Feedback on the RSI system has highlighted concerns about a knowledge gap that exists between the new and good ideas generated within the research sectors and the rate these ideas are used or implemented – either turned into new products, services or even business models, used to inform public sector approaches or services, or otherwise translated into impacts by their use.

In terms of research system impact, we are aware of various potential barriers:

- › Not all research findings are capable of being operationalised outside of the research environment. Sometimes this is temporary, that is, the right piece of enabling infrastructure or companion technology is not yet available, or sometimes it is permanent, that is, what works in a laboratory does not work outside of one. It can be prohibitive or sometimes impossible to establish whether this is the case early in a research programme. Some 'failed' ideas will occur. This risk is an accepted part of most research funding.

¹⁸ See *Te Pae Kahurangi: Positioning Crown Research Institutes to collectively and respectively meet New Zealand's current and future needs*, above note 12.

- › We have heard concerns from research organisations that funding contracts make them feel constrained to hold IP tightly rather than take a wider view of what the best use of the IP, both commercial and non-commercial, might be.
- › A lack of absorptive capacity and capability could exist among various groups of end users. For example, the public sector has struggled to develop and implement specialised procurement policies in respect of new technologies.
- › A lack of a regulatory pathways or accepted standards exists in some areas, which makes it difficult for some ideas to gain traction. For example, while drug development is well regulated for safety, sectors with less regulation have more varied paths to market and product acceptance that are sometimes difficult to navigate.
- › Resources are lacking, human and funding, dedicated to knowledge pathways once research is completed.

It seems these barriers are not specific to New Zealand or its research system, although there may be reasons why some are more acute in New Zealand.

However, despite these problems, we are aware that a 'pipeline' conceptualisation of the route to research impact relies on a linear model of innovation that starts with idea generation in the research system and ends in the hands of end users, typically with a focus on commercialisation. It also tends to be 'extractive' and focuses on how to get ideas or knowledge out of the research system as efficiently as possible, rather than recognising that the process of generating impact is a complex, dynamic interaction between the research system and end users that is often ongoing. It ignores te ao Māori and the need to protect and support the obligations inherent in the relationships iwi, hapū and whānau have with their mātauranga and other taonga. Finally, it leaves out important future-focused sectors where an end user or recipient of knowledge may not yet exist, along with the possibility of building deep ecosystems of capability that will support future frontier firms.

We are interested in exploring the extent to which the commonly used pipeline framework has to tell us about knowledge exchange, given its common use despite its conceptual drawbacks. We could consider if any further barriers exist to getting ideas out of the research system and into the hands of end users that we have not canvassed above. We would like to know how we might identify these barriers and mitigate them.

We would also like to understand further the ideal role for research institutions in knowledge exchange and generation of impact. End users and firms also have an important role in mobilising knowledge and technology; the responsibility should not and cannot sit solely with research organisations. We also need to consider cases where there might not be any current end users, and what role research institutions have in supporting and establishing the technologies and industries of a future New Zealand.

We would like to understand what processes and structures could establish clear and appropriate roles for all parties in knowledge exchange.



5

TE HUNGA MAHI
RANGAHAU RESEARCH
WORKFORCE

5. TE HUNGA MAHI RANGAHAU RESEARCH WORKFORCE

This chapter discusses how the research system can better support the development and retention of the research workforce, and offer attractive and flexible careers and career pathways.

5.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

Our aspiration is for a research system that is more connected, diverse and dynamic, that attracts and retains excellent talent. We want to ensure the research workforce can be offered attractive and flexible careers and career pathways.

The current system does not have a strong focus on funding mechanisms that explicitly support research workforce development following qualification. The general lack of information about the RSI workforce means it is difficult to assess progress regarding career stages, demographics, employment terms and fields of research. This makes it difficult to robustly evaluate issues, and we do not have a strong evidence base to assess the effect of policy interventions or measure progress towards achieving workforce goals.

We are developing an RSI workforce survey that will help inform our policy development on workforce issues and opportunities. In the context of the Future Pathways programme, we will be able to use the survey to consider responses to issues such as:

1. Equity, diversity and inclusion

Equity, diversity and inclusion are vital to a thriving research system. We need a system which has no barriers to entry or advancement for women, Māori, Pacific peoples, people with disabilities, and members of LGBTIQ+ communities.

There is strong evidence that women, Māori and Pacific peoples experience greater barriers to participation and progression in the RSI workforce than male European colleagues. This is particularly clear for senior roles and leadership positions, with PBRF data showing a significantly smaller proportion of women, Māori and Pacific peoples in these roles at universities, compared with the proportion of those gaining research degrees or in early career positions.

These issues affect retention and cannot simply be resolved by hiring greater numbers of women, Māori and Pacific peoples. Researchers from diverse backgrounds can feel undervalued or tokenised in the workplace. In particular, the *He aronga takirua* study details that Māori are often expected to work a double shift: as a researcher and as a cultural expert.¹⁹ This can result in unreasonable workload expectations and career burn out.

¹⁹ Haar, J and Martin WJ. (2021). He aronga takirua: Cultural double-shift of Māori scientists. *Human Relations*. <https://doi.org/10.1177/00187267211003955>



Career precarity for early career researchers

Recent papers from the Royal Society and New Zealand Association of Scientists have noted that early career researchers are particularly vulnerable to career uncertainty and precarity. While career precarity varies by field and organisation, it can limit retention of talent and disproportionately affects women, Māori and Pacific peoples who are more likely to be in early career roles.

In addition, relatively few funding mechanisms exist for early career researchers, such as post-doctoral fellowships, so these positions can be particularly dependent on the results of competitive funding rounds.

New Zealand has generally followed the traditional international model where post-doctoral roles are fixed-term positions before progression to permanent senior positions. We are interested in your views on whether this model is working well. A functioning system should offer sufficient mechanisms to support career progression, such as appropriate development and leadership opportunities, and progression should be achievable within a reasonable timeframe. In addition, career precarity in the form of fixed term contracts should significantly decline following progression out of post-doctoral roles.

2. RSI education pipeline

Making the first step into a research career can be difficult. Significantly more research-related doctoral candidates are coming out of New Zealand universities than permanent public research roles available. We do not assume a mode of study should offer guaranteed employment to all students, but the risk is that the RSI system is losing access to promising talent, particularly because potential opportunities to pursue research careers outside of academic institutions can be unclear.

We are interested in engaging with the tertiary education system to identify how we can better support the training pipeline for different types of RSI careers. We want to ensure New Zealand is training in the right skills for its research needs, in addition to drawing on valuable international expertise.



5.2 NGĀ WHAKAAROTAU ME TE HUNGA MAHI RANGAHAU PRIORITIES AND THE RESEARCH WORKFORCE

KEY QUESTION 14: How should we include workforce considerations in the design of research Priorities?

We are asking for your feedback on the research workforce issues that we will need to consider when designing the national research Priorities.

Our working model is that the research Priorities will, by default, span multiple organisations and disciplines. We will need to ensure the research workforce has the skills and experience necessary to deliver on the national research Priorities now and into the future. This will require a combination of talented specialists and those who can work well in complex multidisciplinary areas and across organisations and domains.

In particular, we will need to have, attract and grow research leaders who excel at working in multidisciplinary and multi-organisation environments, to draw researchers together to deliver excellent and impactful research. The current RSI system does not support the development of new leaders as well as it could. Some of the system's financial incentives, and global norms around research careers, reward researchers more for publishing papers than for their leadership roles in research programmes or the impact of their work.

We are seeking feedback on how we could design the approach of national research Priorities to better support capability development, attraction and retention, from early to late career researchers. We want to ensure researchers are empowered to collaborate across the RSI system and internationally. We also want to explore incentives to develop research leaders and ensure succession planning is well supported.

3. Movements within the research system

Researchers moving between different types of organisations (eg, shorter term secondments, joint appointments, or changing roles) can be hugely beneficial to career and capability development. Public research institutions could be incentivised in various ways to support such movements.

4. International connections

International connections are critical to an agile, diverse and dynamic research system. Links between New Zealand-based and international researchers and innovators support the exchange of knowledge and allow New Zealand to access knowledge developed elsewhere. These links take time to develop, a process complicated by the uncertainties of the COVID-19 pandemic.

We would like to explore the significant challenges and opportunities for the RSI workforce that should be addressed through the Future Pathways programme. For example, how do we make research careers more flexible, attractive and supportive? What types of action (both from government and on the ground) could be the most effective?

We are also interested in specific considerations for improving career pathways for Māori researchers. In particular, we are interested in the recruitment, management and retention of a Māori workforce, and we want to understand how we might support clearer career pathways for Māori in RSI.



For most if not all research Priority areas, Māori researchers and research teams skilled in Māori engagement will be critical. We need to understand how we can better support capacity and capability development for Māori. We need to look at how we can guard against unfair expectations, and aronga takirua, for Māori researchers to fill the roles of researcher and lead on Te Tiriti considerations, tikanga and Māori engagement.

5.3 NGĀ PŪTEA ME TE HUNGA MAHI RANGAHAU FUNDING AND THE RESEARCH WORKFORCE

5.3.1 He aha te pāpātanga o tētahi tahua tūāpapa ki te hunga mahi rangahau? What impact would a base grant have on the research workforce?

KEY QUESTION 15: What impact would a base grant have on the research workforce?

Provision of a base grant could offer opportunities to address potential problems in the research workforce, including reducing precarity, increasing diversity and providing high-quality career pathways.

The simple provision of a stable grant may let research organisations offer more attractive, flexible and diverse roles and employment conditions than they do at present. It may also allow them to offer more diverse career pathways (such as movement between academia, industry and government). One of our aspirations for the base grant is that increased funding stability could support institutions to put a greater focus on training and developing people and capabilities.

A further opportunity for change could lie in funding conditions or performance expectations tied to a base grant. Any grant offered by government will inevitably have conditions for use and performance expectations of some description that will apply to organisations in receipt of the grant. It may be valuable to set some of these expectations, to reflect our aspirations for a future research workforce.

We are asking for feedback on these ideas. Will a base grant mean improved conditions and opportunities for the research workforce? Should the Government set performance expectations related to the workforce? What considerations would you take into account if choosing whether we should or should not adopt these proposals?

5.3.2 Ngā tikanga tuku pūtea hou New funding mechanisms

KEY QUESTION 16: How do we design new funding mechanisms that strongly focus on workforce outcomes?

We have noted that many overseas research systems have a serious approach to talent development, resourcing, attraction and retention, with a strongly international mindset. Many research systems support early to mid-career researchers, with pathways to establish programmes and teams, and have dedicated schemes for attracting and retaining outstanding researchers to establish research programmes. New Zealand currently has few such schemes, and they are small compared with other aspects of the RSI system.

We are asking for feedback on whether we should seek to adopt more such schemes, and, if so, should we pursue any particular types of scheme. We would like to examine how we should balance funding mechanisms focused on workforce outcomes with other forms of funding like national research priorities.

We are also interested in your views on whether reforms are necessary to MBIE's existing funding mechanisms, to encourage stronger workforce outcomes. Could MBIE's funding applications and decision criteria be improved to support greater contributions by researchers from diverse backgrounds? How might proposals be assessed in a manner that upholds Te Tiriti and will genuinely involve and benefit Māori?



6

**TE HANGANGA
RANGAHAU RESEARCH
INFRASTRUCTURE**

6. TE HANGANGA RANGAHAU RESEARCH INFRASTRUCTURE

This chapter discusses future funding, governance and ownership arrangements for national research infrastructure, and how we can maximise our infrastructure investments.

6.1 HE AHA TE RARURARU, ARAWĀTEA RĀNEI E HIAHIA ANA MĀTOU KI TE WHAKATUTUKI? WHAT PROBLEM OR OPPORTUNITY ARE WE TRYING TO ADDRESS?

Research infrastructures, such as laboratories, equipment, and collections and databases are essential inputs into research activities and science services. They are a tool of the trade, enabling researchers and innovators to test, experiment, record, model and explore. Investment in research infrastructure supports high research performance, but New Zealand's investment in national scale infrastructure is small, and lacks sustainable support.

6.1.1 Te korehua o te tuku pūtea, te whakaruruhau me ngā whakaritenga kaupuri mō ngā hanganga rangahau ā-motu **Ineffective funding, governance and ownership arrangements for national research infrastructures**

New Zealand's national research infrastructures have faced several issues over recent years, including a lack of financial sustainability, delays or an inability to upgrade or support the ongoing operation of the facility, and dissatisfaction and frustrations from research institutions that the research infrastructures are not good value for money and do not provide equality of access.

In addition, *Te Pae Kahurangi* has suggested that while CRIs have been able to invest in important research infrastructures for their researchers, there is an opportunity for increased efficiency through co-location or shared use of infrastructure resources, such as IT systems, to make more efficient use of capital investments.

Underlying these problems are ineffective funding, governance and ownership models that are often quite devolved and decentralised and struggle to balance system, user and institutional needs with priorities as well.

New Zealand's large national research infrastructure mostly relies on joint funding, where government shares the costs with research institutions or, in some cases, users. However, these models are unstable and vulnerable to changing research technology advancement, user requirements or costs, particularly with varying needs across the research system. If research institutions and users do not feel they are receiving fair value relative to the cost of 'membership' they become dissatisfied. At a minimum, this creates tensions in the system, and, if a user leaves, it can create a funding gap for the facility.

We hear dissatisfaction from research institutions about not being able to influence direction. And we see institutions naturally focusing on their institutional priorities over system benefits and sometimes trading off infrastructure investment against other priorities.

6.1.2 Te whakamōrahi i te uara mai i te haumi ki te hanganga rangahau **Maximising the value from investment in research infrastructure**

Problems with funding and other arrangements have resulted in attention that focuses on the sustainability of existing research infrastructure at the expense of maximising the value of future infrastructure as an input to research. Without incentives to invest in research infrastructure, and in a context of limited resources, investment in research infrastructure has not been high priority.

If research infrastructure is a key tool of the trade for researchers, it seems reasonable that better tools will yield better results and more efficient processes. We know New Zealand's investment is small, given its small research system, but it also has relatively small dedicated research infrastructure funds as a proportion of its research spend, compared with other countries. While we know New Zealand has world-class facilities, we have also heard that New Zealand researchers do not always have access to the quality of infrastructure available overseas.

Research infrastructure can also include key data infrastructure. This includes scientific databases, such as those containing weather or environmental data, and invaluable social research data, such as the results of existing cohort studies and the ability to commission new cohort studies. Lack of specific ongoing funding can mean some of this data infrastructure struggles with maintenance over time. Research infrastructure can be highly variable in terms of standardisation, accessibility and interoperability. Improvements in these areas create the potential for greater use of data, and greater social, environmental and economic value to be realised from these valuable resources.

We do not currently have a mechanism to identify where focused investment in research infrastructure would deliver more value for New Zealand. This includes understanding where the potential is to partner internationally, where research infrastructure allows stronger links between research and innovation, or has potential to support knowledge and technology transfer.

We think an opportunity exists to make and leverage infrastructure investments to move New Zealand to a higher performing research sector.



6.2 NGĀ MĀTĀPONO HOAHOA MŌ TE HANGANGA RANGAHAU DESIGN PRINCIPLES FOR RESEARCH INFRASTRUCTURE

6.2.1 Te hanganga rangahau āpōpō Future state for research infrastructure

We believe a case can be made to rethink the funding, ownership and access models for future research infrastructure, and to take a more active strategic approach to managing New Zealand's future portfolio of research equipment and services.

We want a future:

- › where researchers can access the infrastructure they need to operate at the frontier of research; and where access to research infrastructure is enabling and supports excellent, impactful research, increased connections and an efficient research production process.
- › where healthy coordination occurs within research infrastructure, and ownership and funding arrangements effectively balance system objectives, institutional health and user needs.
- › where investment in research infrastructure is planned, ongoing and sustainable, with clear frameworks for reinvestment and disinvestment.
- › where we are effectively leveraging research infrastructure to connect and integrate across the research system nationally and internationally.
- › where we are confident we are using our limited resources well, targeting the right areas for infrastructure investment that deliver value for New Zealand.
- › where smart decisions are made about where to locate and co-locate research infrastructure, to ensure both efficiency and reduce critical redundancy in the system.



6.2.2 Ngā kōwhiringa hoahoa matua mō te tuku pūtea ki te hanganga rangahau Key design choices about research infrastructure funding

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

Three main design choices need to be considered for the future state for research infrastructure funding.

1. When government, rather than research institutions, should assume a role in funding infrastructure

Institutions and research groups are often best placed to decide what type of research infrastructure will support excellent and impactful research. When institutions can fund and manage the infrastructure over time, this works well.

Government has a role in considering the research portfolio as a whole and where investment will deliver benefits to the public and the research system.

But where do we draw the line between what institutions best manage alone and where government should take an interest and invest? This is not simply about the scale of investment, because expensive infrastructure is not always of national interest, and affordable infrastructure can be useful across the system. Understanding the different roles of institutions and government will help us determine whether and how infrastructure funding should be included in a base grant.

Possible factors to consider include:

- › strategic priority and the importance of the research, capability and services that the infrastructure supports or will grow, taking into account the Government's research priorities and core government research functions.
- › the potential value of research infrastructure to support high research performance, including research excellence, high impact, connection and increased productivity.
- › the scale or long-term nature of investment required and whether it is beyond the reach of an individual organisation.
- › the nature of use and whether multiple users could benefit from access, or whether multiple users are required to achieve value from the investment.
- › resilience and sovereignty, including data sovereignty and if the research infrastructure is needed onshore.
- › opportunities to support international cooperation, integration and attraction, including support and use of international research tools, such as foreign research vessels operating in New Zealand.
- › efficiency and the potential to make better use of capital by coordinating and sharing research infrastructure rather than duplicating investment.

We are asking for feedback on which of these factors, if any, we should take into account.

2. How we should decide what infrastructure is important

As we outlined for deciding national research priorities, we also need a process for deciding national research infrastructure priorities that is responsive to system needs and strongly linked to the national priorities and their research strategies. This process would be informed by agreed criteria, and be predictable, transparent and sufficiently flexible to respond to opportunities and emerging priorities.

It would allow for appropriate input from Māori, industry, government agencies and key stakeholders. It would be integrated, strategy led and include analysis, consultation and appropriate expert or executive decision-making.

We are asking for feedback on the type of process that should govern research infrastructure investment.

3. How we should support sustainable, efficient and enabling investment in research infrastructure

Effective models for research infrastructure would appropriately balance system, institution and user needs, and support the sustainable operation of and access to infrastructure. To drive high research performance, we also want to see investment at sufficient scale and targeted to high priority areas.

To create the right model, we need to consider the appropriate funding mechanisms for infrastructure at a national and institutional level and how we create the right incentives to encourage coordination and user responsiveness both with and without government funding. We want to ensure the cost of access is reasonable and services are what users need.

For national level research infrastructure, if we pursue a national infrastructure fund, we need to consider how we would design, operate and maintain this fund, including how we would fund the capability required and how the infrastructure portfolio might be governed and monitored.

Who owns and operates centrally funded research infrastructure is important. We want organisations receiving funding for national infrastructure to be incentivised to encourage coordination and deliver to system and user needs. We need to consider when it would be appropriate for research institutions to own and operate national infrastructure versus a standalone integrated research infrastructure entity, and whether a common ownership model would work across different types of infrastructure.

We are asking for feedback on the future funding, , ownership and operational models for research infrastructure.

HE KUPUTAKA GLOSSARY

Multiple frameworks and technical terms are used for describing technological and innovation activities across the research system. The Ministry of Business, Innovation and Employment definitions used in this document are sourced from the *National Statement of Science Investment 2015–2025*, the Draft Research, Science and Innovation Strategy 2019, and definitions used for the R&D Tax Incentive. They may differ from international practice in some circumstances.

Applied research – an original investigation undertaken to acquire new knowledge but that is directed primarily towards a specific practical aim or objective. Findings of applied research can be applied to resolve issues.

Basic research – experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. This research may develop background context and theories on how to address issues or understand phenomena.

Commercialisation – the commercial use of publicly funded research outcomes by end users, and the arrangements for managing that use.

Excellence – Excellence is the ongoing pursuit of the best thing possible in the context in which research takes place, and can apply to all types of research, including basic, applied, strategic and experimental development. It is well-designed, well-performed, well-reported research, recognised as such through a variety of different ways, including peer review and mātauranga Māori. It is also context specific. Excellence will be assessed differently for different types of research, fields of research and different activities.

Experimental development – Systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Innovation – Innovation is the process of doing something new. An innovation may be a new or improved product, process or function. Innovation is a process that leads to new or better ways of creating value for society, businesses and individuals. The value of innovation arises from the use and implementation of an idea. The value created may be commercial, social or environmental. Innovation may be unplanned or even accidental, but it does not have to be.

Impact – A change to the economy, society or environment, beyond contribution to knowledge and skills in research organisations.

Knowledge transfer – The transfer of publicly funded research outcomes, such as expertise, learning, technology and skills, by end users, including industry, government, community and Māori.

Mātauranga Māori – The body of knowledge originating from Māori ancestors, including the Māori world view and perspectives, Māori creativity and cultural practices. (Note: this is provided as a general description and not as an authoritative Crown position or definition.)

Research – For the purposes of this green paper, when we refer to ‘research’ as a stand-alone term, we are referring to activities for gathering, organising, generating, understanding or recording knowledge. We intend this definition to be read in its broadest sense, to include science, social research, research into the arts and humanities, and any other activities that may be commonly understood under the term.

Research and development (R&D) – The systematic approach to activity taken with the purpose of creating new knowledge, or new or improved processes, services or goods that has a material purpose of resolving scientific or technological uncertainty.

Science – a particular way of conducting research (‘research’ as defined above as a standalone term). Science resists a strict definition, but can usually be characterised by features such as structured testing of hypotheses, use of data derived from direct observation, and systematic experimentation.

Strategic research – Research activities conducted to support long-term ‘national needs’ and directed into specific broad areas in expectation of useful discoveries or providing the broad knowledge base necessary for solution of recognised practical problems.

Research infrastructure – The facilities, resources and services used by the research, science and innovation community to conduct research, foster innovation and engage at the global frontier of knowledge. It includes working environments, cutting-edge equipment, technologies, vessels, computing systems and communication networks, and collections and databases.

Transformative research – Research that has the capacity to revolutionise existing fields, create new subfields, cause paradigm shifts, support discovery and lead to radically new technologies, such as the opportunities offered by mātauranga Māori methodologies, that consequently generate discoveries that lead to step-changes in our understanding and abilities.

NGĀ WHAKAPOTO ABBREVIATIONS

CRIs	Crown research institutes
GDP	gross domestic product
IP	intellectual property
NSCs	National Science Challenges
MBIE	Ministry of Business, Innovation and Employment
PBRF	Performance-Based Research Fund
R&D	research and development
RSI	research, science and innovation
TEOs	tertiary education organisations

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