agresearch
āta mātai, mātai whetū

Te Ara Paerangi

AgResearch Response

The time for change is here. Our rapidly changing world is facing significant risks and opportunities such as climate change, pandemics, supply change disruption, cyber conflict, changing demographics and new ways of doing business.

The sense of urgency for science to deliver solutions has significantly increased. Science is critical for future-proofing New Zealand's ability to respond, adopt and seize known and unknown threats and opportunities. The view is that the "nice to have" Research, Science & Innovation (RSI) system of a decade ago must now be replaced by a new RSI system that is much more active in future-proofing New Zealand's ability to respond, adopt and seize opportunities. A system where clusters of expertise with deep technical understanding are central and New Zealand can accelerate the impact of our RSI.

We need a more flexible and efficient way to assemble the system-wide teams needed to tackle the challenges we now face. What we face as a nation in the 2020s is quite different from those of the 1990s when the CRI model was conceived. Back then, the belief was that our future lay in enabling the sectors (agriculture, horticulture, forestry, fisheries, natural ecosystems etc) to perform better, so it made sense to structure the CRIs around these sectors.

While these sectors are still important in the 2020s, research is increasingly being asked to address bigger, cross-sectoral challenges like climate change, biological invasions, pollination, agrichemical impacts, biodiversity and ecosystem function. At the same time CRIs are increasingly working alongside and integrated with central and local government and mana whenua.

It is increasingly apparent that the future will rely on research that is co-ordinated across sectors, across the boundaries imposed by the CRI framework, and across the opportunities new technologies and food supply systems offer New Zealand. As the challenges get bigger and more cross-sectoral, our research tools become more powerful, and our end-users have become more diverse and influential. This requires our research teams to also be more diverse, multi-disciplinary, more agile and to work beyond sectoral boundaries.

Recommendations

Key Recommendations

Priorities	**Quadruple helix approach** Government's process uses a quadruple helix approach of Government; Industry and/or Communities; Research and Māori.
Funding	**Government supports impact** Government provides more nuanced RSI funding, supporting discovery through to applied research, development and extension to ensure New Zealand is maximising impact from its investment. Nuanced funding should help incentivise and support the private sector and communities to participate with their own funding and resources. **Bespoke funding for Mātauranga Māori** Bespoke funding for Mātauranga Māori led research that is in proportion to the quantum of Māori population, with Te Ao Māori framework or measuring science and excellence.
Institution	**Single combined institution around biologically-based industries** Establish a single combined institution around biologically-based industries and environment delivering more integrated research and greater impact for New Zealand. (For example: France's INRAE, which is a newly combined institute focused on agroecology; biodiversity; climate change and risks; bioeconomy; food; global health; society and regional strategies). We believe this would bring more efficiencies while focusing on priorities, facilitating knowledge exchange, impact and providing the ability to build careers. **Open Science** Government establishes 'National Research Data Infrastructure' (NRDI) as a natural extension of NeSI (computing) and REANNZ (network).

Recommendations on ongoing Te Ara Paerangi process

Broader systems approach – not limited to Vote RSI	We recommend MBIE takes a broader systems approach to this review. For our RSI system to optimally contribute to the significant national and global challenges, any changes need to provide a seamless path between others making vital contributions such as: • Stakeholders from the private sector and communities – their perspective is currently absent • Education system – for example the universities are embedded and integral to the New Zealand RSI system and have an essential role to play, and • International connections.
Future focused	We encourage MBIE to take a future-focused approach – visioning various plausible scenarios for what the future could hold so that any changes to New Zealand's RSI system are maximised to provide the flexibility to respond appropriately to whatever the future holds.

Co-design approach	We believe the questions posed in the Te Ara Paerangi Green paper are best addressed through a richer, co-design approach bringing in different perspectives and testing throughout. As MBIE develops options for the White Paper, we encourage workshopping ideas with others to bring a diversity of perspectives. AgResearch can help link MBIE to people with valuable experience and perspectives from our organisation, amongst our stakeholders and international networks.
Focus on critical changes	A number of critical changes were identified in the Te Pae Kahurangi report and previous CRI taskforce reports. In the exploration of future systems, it is important to ensure that a full costing is incorporated to help determine how big the gap between ideal and pragmatic is. For example: what is the carrying capacity of the best RSI system New Zealand can have? We need to understand the key functions so that we can allocate sufficient resource. Any changes to the RSI system will need to weigh up costs and benefits and be worth the inevitable disruption that comes with change.
Increased investment	Focus on ways to generate increased investment in New Zealand's RSI system from Government, the private sector and others. Increasing RSI investment to 2% of GDP is an ambitious target set out in Te Ara Paerangi and any changes to the RSI system needs to ensure they are incentivising others to invest appropriately according to their means.

1. National Research Priorities

1. *What principles could be used to determine the scope and focus of national research Priorities?*
2. *What principles should guide a national research Priority-setting process? How can the process best give effect to Te Tiriti?*
3. *How should the strategy for each national research Priority be set and how do we operationalise them?*

Key principles

Multigenerational, globally significant priorities to contribute national goals

AgResearch enthusiastically supports the concept of nationally agreed and transparent priorities focusing research efforts within the RSI system on long-term, globally significant priorities that Government champions. Many of these will need funding for at least 10 years to provide direction and certainty, while retaining the ability to flex and change within those priority areas.

Inclusive and participatory prioritisation and design process

To determine the priorities is essential for ensuring that a diversity of opinion is considered, properly informed decisions are made and buy-in is maximised. A process like that used to establish the National Science Challenges would contain the key elements for achieving this. However, this should not be seen as a standalone process. Rather, it is the first step in a transdisciplinary process which progresses into the design of themes and programmes of work within the agreed priorities. Priorities can only be agreed and kept current though continual dialogue across all levels of activity, between political process, scientific community, Māori, stakeholders and the community. The process should be transparent and open, with a strong focus on public good.

Integrative, transdisciplinary mission led

A mix of top-down, interdisciplinary and outcome-focused approaches. A dedication to the "big picture" and integrative research design aimed at meeting broad societal outcomes and bottom-up researcher and stakeholder ideas.

Transformational, Transdisciplinary:

AgResearch is developing tools, methodologies, facilitation, training and a community of practice in the conduct of integrative, transdisciplinary and transformative research. We are happy to share the direction we are heading and progress to date.

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How can the process best give effect to Te Tiriti?

The national research priorities process should first and foremost recognise Treaty relationships with iwi, hapū and whānau. It needs to ensure that Māori are involved at all levels in the process from decision making, planning, development and delivery of research outcomes.

National priority setting should leverage off long standing iwi and business relationships that the CRIs already hold with Māori. We recommend MBIE also ensures meaningful engagement of the National Iwi Chairs Forum, those outside this forum and Māori agribusiness leaders.

Operationalising National Research priorities

Forward looking and flexible research priorities

Research priorities should be set using foresight as the outcomes may not be producing benefits for 5, 10 or 20 years. Priorities should set direction but workplans should be regularly reviewed to build in flexibility and keep to the best pathway for outcomes.

Collaborative initiatives like the National Science Challenges can be more agile and experimental in nature as they are not limited by the need to maintain key capabilities. For instance, making clear use of stop/go points to promptly identify failures and pivot funding (with support from high quality science advisory panels and experienced Boards).

Priority focused budget

Each Research Priority must be allocated an indicative budget: Without a budget there is no way to develop an implementation workplan which makes the goal harder to reach.

Distinct types of priorities may need diverse types of support

Different funding and delivery models are likely to be needed depending on the nature of those priorities. For example: some priorities may focus more on novelty, building new capabilities and new sectors. Others have

greater focus on accelerating research impact to address New Zealand's current challenges. One size does not fit all.

AgResearch has developed a portfolio of large, integrated programmes of work. These include: Integrative Initiatives, which are research programmes addressing significant missions such as mitigation and adaptation to climate change, and developing the digital bioeconomy; and Enabling Platforms, which harness and develop tools, methodologies and approaches to underpin delivery to systems-based science, such as systems biology.

This broad distinction between the "what" and the "how" has worked well in terms of providing the right focus for both missions and their enablers, without being overly prescriptive about the type of work that can be conducted in each. No two programmes have the same set of requirements.

Other critical attributes

From our experience with and learning from National Science Challenges and other collaborative research initiatives – other critical attributes include the following.

Getting science results into policy and practice

This approach is more effective where users are part of multi-stakeholder partnership, involved in design, co-production and delivery of research and appropriately resourced to participate; and where the initiative is proactive at distilling and communicating its science and its findings. Anecdotally, policy makers who have experience of working with the best initiatives described them as talking louder and are much more proactive in 'selling' their science.

Ensuring high-performing networks

Where there are strong relationships between the multi-disciplinary components of the scientific team, industry and Government; where the initiative is constantly seeking outside advice and opinion on their strategy, design and progress. External relationships must continually be reinforced between all parties to the collaboration by the directors, CE and management – where most of the effort of the directorate focuses on relationship building.

Leadership is key

The best collaborative initiatives are led by strong collaborative leaders building strong transdisciplinary teams and networks.

Excellence in governance

Well-functioning, collaborative initiatives appear to be built upon strong and well thought out governance structures. The best Boards are those with considerable governance experience. Experienced directors say they see science as one of the most challenging activities to govern because of the depth and breadth of knowledge and experience required. Experienced boards are more comfortable handling the risks emanating from the structures underpinning the most successful collaborative initiatives. Scientific expertise on boards does not necessarily need to be specific to the science focus of the platform but does need to be deeply versed in scientific method and increasingly familiar with Te Ao Māori.

Proactive governance interactions between host and initiative

Collaborative initiatives are usually hosted by an existing scientific organisation. The host organisation is expected to provide a range of administrative services for the collaboration. The best collaborations appear to be those where the host CEs are in regular communication with the leadership of the initiative. This is reinforced where the strategic objectives of host and initiative are aligned. Successful hosts are those that recognise their role as a background, intelligent purchaser of science rather than promoting their own profile.

Other critical attributes

Value of Food and Fibre R&D

World demand for food is expected to double from 2009 to 2050. This is partly because of population growth but mostly because of economic growth in the developing world and demand for more high value foods (nutrient-dense sweeteners, fruits, vegetables and, especially, animal products) (Fukase &Martin 2020).

New Zealand is well placed to help solve this global issue, and to benefit economically from it. Total food and fibre exports are expected to reach $50.8 billion in the year to June 2022, growing to 82% of our total goods exports (MPI 2021). Our export-oriented pastoral and horticultural industries have grown massively over time with the support of publicly- and privately-funded research and development. This R&D has enabled high productivity growth (Robertson 2010).

However, while New Zealand benefits from past research there is risk of complacency. Research investment must grow to keep up in a competitive global market. The supply and demand of food and fibre products is increasingly dynamic. Important factors include:

- Changing consumer and export demand — agricultural products are prone to swings in prices/terms of

trade and the industry must be ready to change its production to accommodate these

- Threats from climate, pests and disease: conditions on-farm are changing faster because of climate change and globalisation
- Advances at the 'technological frontier': with new biological, computing and other tools, industry must keep up or risk being left behind using lower productivity systems, and
- New environmental constraints: farming is an essential activity but there is increasing need to limit the negative impacts from farming activities.

These issues constantly introduce more questions for researchers to address. New Zealand must stay nimble by not only investing in research to enhance what we already do well but also anticipating change. This is supported by international studies on the economic internal rate of return of public investments in food and fibre research. Estimates range from 19% to 67% (Alston 2010, Jin and Huffman 2014)—well above typical social returns the New Zealand government requires in making investment decisions.

Fast tracking alignment of RSI to existing globally significant priorities

In theory, co-ordinated national research priorities would be determined as part of an overarching national strategy. In practice, there are some clear, globally significant priorities that Government has already identified and committed to where the RSI system is an integral part of the solution(s).

For example, Climate Change. The performance of the food and fibre sector will be an important driver of both New Zealand's climate change performance and the performance of our economy – urgent and accelerated action is required. Specifically, it is important that the food and fibre sector continues to grow. At the same time, the sector must dramatically reduce its carbon footprint and improve its overall sustainability.

In some areas, the Te Ara Paerangi process may need to respond more rapidly to new ways of aligning government investment in RSI activities but take a more structured approach to setting and developing other priority RSI areas for New Zealand, beyond current horizons.

2. Te Tiriti, Mātauranga Māori and Māori aspirations

4. *How would you like to be engaged?*
5. *What are your thoughts on how to enable and protect Mātauranga Māori in the research system?*
6. *What are your thoughts on regionally based Māori knowledge hubs?*

Engagement

To be effective with engagement MBIE should recognise that Te Tiriti o Waitangi underpins the relationship between Māori and the Crown. Therefore, Te Tiriti o Waitangi principles are relevant across the engagement process and throughout the redesign of the RSI system. It will be critical that the Crown demonstrates a willingness to champion changes that will lead to a positive impact on the growth and wellbeing of Te Ao Māori.

Te Ao Māori principles that equally apply include:

- **Rangatiratanga/Mana motuhake:** Recognising Mātauranga Māori as a knowledge system equal to Western science. Recognising the right of iwi/Māori to determine the research outcomes most appropriate to deliver to their social, environmental, cultural and economic (SECE) priorities in the context of Te Ao Māori priorities.
- **Manaakitanga:** The RSI system embracing the needs of Te Ao Māori and delivering to those needs in the context of social, economic, cultural and environmental outcomes and to community wellbeing frameworks. The significance of research is in its ability to contribute to iwi, hapū and marae. Therefore, the framework for assessing Māori research (kaupapa Māori and mātauranga Māori) requires an adjustment to recognise those priorities and aspirations more appropriately.
- **Mahitahi:** Enabling collaboration and inter-agency intelligence-sharing between CRIs, government funding and delivery agencies, sector good groups, sector and industry training organisations, and Māori working towards SECE and community wellbeing.

On a more practical note, engagement should enable Māori to respond in an informed and timely manner. This requires resources to discuss, explore, seek clarification, respond to and refine the proposal over time. To enable more open, honest and culturally appropriate engagement, allowance should be made for engagement to take place in a format and venue convenient for those engaged e.g. marae, rūnanga and Trust Board facilities.

Enable and protect Mātauranga Māori

Equitable share of investment

Kaupapa Māori and mātauranga Māori research and research that addresses Te Ao Māori priorities (including the institutes and research units which undertake this research) should receive an equitable share of investment into kaupapa Māori, mātauranga Māori, and Māori-led research programmes. An equitable share should be determined in terms of the Crown obligation under te Tiriti o Waitangi and be proportional to the quantum of Māori population.

Investment should recognise the complex and intergenerational nature of many of the challenges that Te Ao Māori faces and what they are trying to achieve through research. Therefore, the quantum and term of the commitment for investment should be suitably reflect the circumstances. This requires a separate discussion with key Māori leaders and experts.

Enable and empower

Enable and empower iwi/Māori to participate independently on their own terms. Currently in the CRI system, Māori participation is overwhelmingly on the terms of the partnering CRI and MBIE requirements of co-funding.

Grow a research workforce

Actively grow the number of Māori researchers with capabilities in Mātauranga Māori and Kaupapa Māori and in Western science disciplines. This would grow a research workforce that understands the principles of working with Mātauranga Māori, Mātauranga Māori experts and the concepts that determine how success is acheived in both Te Ao Māori and the RSI structure.

Policy and process to protect

Ensure policies and processes are in place to protect Mātauranga Māori, the communities where mātauranga is generated and the people working in that environment. Those policies and processes should be consistent with the findings and recommendations in the Wai 262 report. This includes the protection of indigenous intellectual property rights that support benefits flowing to the community

of origin; having processes, tikanga and culturally safe practices that recognise the significance to Māori of taonga species.

Involvement

Māori should be involved throughout the process of research proposal development and implementation. The review should recognise that co-design from the outset, building a workplan together and co-governance throughout are essential procedural and structural elements that will enhance an RSI system that delivers outcomes critical for Māori to succeed.

Regionally based Māori Knowledge Hubs

Support and strengthen the capabilities of existing kaupapa Māori and Mātauranga Māori research institutes that are iwi, hapū or whānau based (for example, wānanga, STEM and STEAM academies) to leverage off existing centres of Mātauranga Māori. Support and strengthen capability within CRI Māori research/partnership units where practical experience working with whānau, hapū and iwi Māori communities and business already exists. These structures should be underpinned by an independent central governing body that:

- Is culturally equipped to determine and understand Mātauranga Māori and kaupapa Māori research relevant to Te Ao Māori research priorities intended to provide social, environmental, cultural and economic outcomes for Māori communities, and
- Is resourced adequately to enable long term Mātauranga Māori and kaupapa Māori research at scale. This includes the investment capability to support regional Māori knowledge hubs to work alongside the RSI system.

3. Funding

7. *How should we decide what constitutes a core function and how do we fund them?*
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?*

Mechanisms

Funding mechanisms are critical to driving the future RSI system and we recommend that MBIE:

Takes a broader view of the funding system than outlined in Te Ara Paerangi paper. Vote RSI is only one component. Other Government agencies, along with the private sector and communities are critical parts of New Zealand's RSI system, both in co-investing in R&D and delivering impact.

Ensures funding is future-proofed

RSI funding needs to be future-proofed and be able to respond to changing economic levers. For example: factor in inflation, flexibility around cost increases and supply chain issues.

Funding along the spectrum

Is required from:

- **Priority setting** where a diversity of participants is resourced to help set and co-design priorities and the R&D required to deliver them
- **Co-innovation** during the programme, including resourcing the ongoing participation of key stakeholders and fostering agile approaches within the programme of activities
- **Pathways to impact** – government funding needs to be more flexible in supporting the pathway to impact (for example: applied, proof-of-concept and knowledge exchange activities), particularly where there are few/no large end users to fill the gaps.

Use a broader range of mechanisms to incentivise others to participate and/or invest

Additional investment from both Government (as funders and users of RSI) and the private sector is required to accelerate impact from national priorities.

Government needs to consider a broader range of mechanisms for incentivising others to both participate and invest. For example: resourcing Māori, Small Medium Enterprises (SMEs) and communities to participate in setting direction, designing research, being involved in research activities and helping achieve impact.

Government needs to recognise a broader set of contributions from the private sector as part of incentivising more co-investment. For example: it may be easier for the private sector to come with capital to bear.

Bespoke funding for Mātauranga Māori led research

That is in proportion to quantum of Māori population, with a Te Ao Māori framework for measuring science excellence and impact.

Base grant funding models

Base grant needs careful consideration

Changing from full cost funding to base funding is likely to require significant effort. The costs and benefits of doing so (including unintended consequences) need to be carefully considered. For example: experience from one of our international research partners indicates that while baseline funding provides some certainty for key researchers, it can reduce career progression opportunities for early career researchers. It is also not clear what the implications are for delivery of research objectives.

AgResearch can connect MBIE to an international collaborator whose organisation has been through such a change and can share the pros and cons of doing so.

4. Institutions

9. *How do we design collaborative, adaptive and agile research institutions that will serve current and future needs?*
10. *How can institutions be designed to better support capability, skills and workforce development?*
11. *How should we make decisions on large property and capital investments under a more coordinated approach?*
12. *How do we design Tiriti-enabled institutions?*
13. *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?*

Form should follow function

A focus on institutional form should come after getting clear national research priorities that New Zealand's RSI system can rally around. The other key driver is the support to deliver on those priorities. Government's signals through its funding are powerful levers for change – it should provide clear accountabilities, with appropriate funding mechanisms that reward collaborative, adaptive and agile science and a stronger focus on delivering impact rather than academic knowledge creation.

Scope to combine

There could be value in combining some CRIs into a single institute around biologically based industries and the environment to deliver more integrated research and greater impact for New Zealand. An example is France's INRAE, which is a newly combined institute focused on agroecology; biodiversity; climate change and risks; bioeconomy; food, global health; society and regional strategies. We believe this would bring more efficiencies while focusing on priorities, facilitating knowledge exchange and impact, and providing ability to build careers. This should only proceed if benefits exceed costs though. There are significant institutional and financial challenges with combining organisations, melding organisational cultures, processes, and systems, building the integration and in rebranding (particularly internationally).

An alternate Idea: Overarching parent company

We could reconstitute the CRIs as subsidiaries of another parent Crown Entity. The parent entity could focus on planning for collective infrastructure investment across CRIs, and better pooling of shared services such as finance, IT, human resources and legal functions. As a group of companies with a common parent the focus could be on the collective being profitable.

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Critical elements to retain

For any future institutional arrangements, we believe there are several critical elements including:

- Maintaining connections with stakeholders, including those that co-invest, and other end users is vital
- Harnessing international perspectives – international collaborators and companies
- Enabling balance between longer term future focus and more immediate government and industry needs
- Independent governance accountable for maximising value and performance of entities and enabling access to specific expertise, networks and relationships.

Good governance adds value, expertise, networks and relationships

In a dynamic, ever-changing world, Boards of directors maximise value and performance by leading the strategic and overall direction of the entity, setting and role-modelling the culture, monitoring performance and ensuring effective risk management and compliance. Through delegation of operational responsibility, good governance enables good management decisions to be made.

A Board with directors, appointed for the skills, experience and attributes most relevant to the organisation, brings diversity, expertise, and independence to their responsibilities. Good Boards comprise directors who can contribute individually and collectively. Skilled chairs harness the collective power of their Boards.

Good governance recognises and respects the accountability relationships between the entity, the Board and (in the case of CRIs) the Ministers and Parliament. Company directors have a fiduciary duty to act in good faith and generally in what they believe to be the best interests of the company. The Institute of Directors Code of Practice for Directors provides that directors should adopt policies governing the management of relationships with key stakeholders that are consistent with the nature of the company, its mission or purpose and the interests of its stakeholders.

From the AgResearch Board

Property and infrastructure

We support in principle a more centralised approach to large property and capital investments, and have significant experience with challenges and opportunities arising from co-ordinating large property investments. For example: with our new joint facilities with Massey University (our food science facility Te Ohu Rangahau Kai and the joint Dairy Research Farm) and our long journey with our new building on land purchased from Lincoln University. We are happy to share our learnings.

Te Tiriti enabled institutions

AgResearch's Te Ara Tika strategy outlines some key principles we believe are useful.

He Hononga ki Te Ao Māori: What is it to partner in Te Ao Māori?

- Social, economic, cultural and environmental outcomes driving community wellbeing – driving our science
- Honoring our commitment to our Tiriti o Waitangi partners and aligning our values systems
- Addressing the barriers for Te Ao Māori partners working with science and science with Māori
- Improved outcomes for all our customers and end users.

As part of transforming AgResearch with Te Ao Māori we have committed to:

- Embracing Mātauranga Māori as an equal knowledge system and infusing Mātauranga Māori thinking throughout AgResearch to stretch our thinking in everything we do
- Bring people on the journey: Harness champions, project base learning, develop and grow our partnerships. Connect everyone to the belief that we can move beyond our current way, that adding perspectives, ideas and knowledge improves us
- Be impact focused and deliver to Māori land, businesses and communities. Introduce the Māori worldview to the world and apply it. Create ways to drive change by this new way of being – for our sector, generally, as well as for Māori specifically.

A te Tiriti-enabled organisation would have strong Board commitment to te Tiriti-based relationships, including more than one Māori Board member; clear KPIs for the CE and senior leadership team; Māori in leadership positions where they can oversee initiatives that create a Mātauranga Māori-centric culture within the research environment; credible career pathways for kaupapa Māori and Mātauranga Māori.

Gaining momentum

AgResearch is gaining momentum through committing to long term relationships with key Māori partners recognised in formal relationship agreements. From these we find different ways of working together, for example, a focus on lifting capability, resourcing our partners to participate on an equal basis in recognition of their Mātauranga Māori knowledge contributions and resource constraints, secondments of staff into our partners' research programmes, building transdisciplinary teams of researchers, business and community members.

Increasing our Mātauranga Māori SSIF allocation to $2.2M for FY2021/22 (5% total SSIF portfolio) with investment decision-making devolved to our Māori leadership team to invest alongside our Māori partners.

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Knowledge exchange and impact generation

Maximising impact requires system level change:

The CRI Impact, Planning & Evaluation Network (iPEN) is a professional and evolving network (including MBIE and other stakeholders) which was built off AgResearch's original Adoption and Practice Change programme (Beyond Results). iPEN has been helping CRIs enhance impact by:

- Becoming more deliberate about delivering impact through planning and all other research stages
- Better understanding and utilisation of the Māori world view of impact
- Better using evaluation for the purposes of learning how to increase impact
- Building capacity and culture.

iPEN identified key system-level changes that are required to enhance impact including:

- Value academic excellence AND impact equally: alongside other knowledge systems
- Te Ao Māori understood and valued across the RSI system contributing to greater impact with and for Māori
- Training: scientists trained to deliver impact while achieving science excellence
- Recognition: scientists and science providers recognised for contributing to impact
- Funding mechanisms: talk and walk impact
- Contracts focus on outcomes and impacts and resource partnerships, collaboration, impact planning and monitoring and evaluation
- Monitoring and evaluation for learning/ improvement and demonstrating impact.

Please refer separate iPEN submission

Learnings from new approaches to Innovation: Building on this, AgResearch has been trialling new approaches to innovation which show several common elements are needed for impactful science, particularly for research addressing complex societal issues. These are:

- Focus research on social value by contributing to solving problems that provide a wider social, cultural and environmental benefit
- Holistic and integrative perspectives by bringing together knowledge from multiple scientific disciplines and stakeholders. Systems thinking looks at overall structures, patterns and cycles in systems rather than solely specific events in the systems. This helps identify root causes that science could address or which need to be addressed for science to realise impact.
- Active participation of customers and users in research projects to provide insights regarding the problem, their needs and knowledge to develop solutions
- Reflexivity, i.e. joint evaluation, learning and reflection on implications of what is being learnt as research progresses
- Facilitating structural change to potentially influence root causes of a problem being addressed by research.

Key insights include:

- Put time and resources for design and engagement up front
- Understand partner and stakeholder engagement through co-design approaches ('who's in the room and why' from the beginning, particularly with Māori partners)
- Integrate different forms of knowledge
- The importance of organisational leadership to support new ways of working (multi- and trans-disciplinarity; agile innovation; design approaches).
- Need different roles within the team (e.g. process coach; monitoring and evaluation specialist; integrator; communicator/ translator; those that understand and can design participatory processes etc).

Commercialisation considerations

Government funding of R&D should primarily be aimed at priorities where there is market failure. This would mostly include H2 and H3 research but also H1 research, which is ready for delivery but also needs to negotiate the so called 'valley of death' (the phase between development activity and to commercial reality).

Commercial delivery of applied research to improve economic, social and environmental outcomes has been poorly managed and co-ordinated both within and across research entities, with some notable exceptions. Within AgResearch, a licensing model has been effective in delivering plants (cultivars) and microbial (bioprotectants) technologies in both the horticultural and pastoral sectors. However, the licensing process and management has been very different for these two sectors. In microbial technologies, this has been carried out as an activity within AgResearch, and in plants through a stand-alone, wholly owned subsidiary (Grasslanz Technology). The latter provides increased flexibility, opportunities for leverage and speed to delivery but does require the research entity to 'let go' of a revenue stream so that it can be focused solely for ongoing commercial delivery investment.

If CRIs were to merge then a possible model for improving impacts through commercial delivery of science discoveries and benefits would be through a centralised commercial 'wing'. This could establish joint ventures as Plant & Food Research has done with Zespri, and AgResearch/Grasslanz has done with PGG Wrightson Seeds (Grasslands Innovation Ltd) and unincorporated Endophyte Innovation; or start-ups (such as Grasslanz had considered with Biopesticide NewCo).

There is an opportunity to bridge the 'valley of death' with larger and more targeted pre-seed funding for national priorities. For example, methane emissions reduction and climate change adaption – picking the top three to five technologies and accelerating these with urgency and focus will give New Zealand a greater chance of halving its net greenhouse gas emissions by 50% by 2030.

In some cases, industry has not established the infrastructure or absorptive capacity for new product development or technology deployment, for example, green hydrogen technology. These are the types of market segment failures that institutions need to lead / co-lead with industry and push to pre-commercial readiness for industry to then lead. Technology transfer is often a slow, sophisticated burn and inevitably costs more and takes longer than expected. Too many technologies end up in the 'valley of death' while industry weighs up the risks and costs and institutions struggle to bootstrap funding and, in some cases, maintain viable patent life.

See separate submission from: Vikki.yeomans@agresearch.co.nz – Commercialisation Manager & John.caradus@grasslanz.com – CEO, Grasslanz Technology

Commercialising biotechnologies, particularly GMOs

The suggestion of "pooling commercialisation opportunities" in the Green Paper may be one option for improvement. However, organisations that have successfully commercialised GM crops have highly focused and significant teams that address all aspects from R&D, regulatory, product integrity, legal, market delivery and marketing.

Key principles: develop an IP portfolio and a strategy for its management – requiring a high level of expertise and resourcing; explore alternatives (start up, joint venture, licensing etc) including seeking outside expertise with proven track records – one size does not fit all; acknowledge the process is likely to be lengthy and requires a team effort; and establish a hand-over process that maintains some continuity within the team but enables new skills at appropriate places in the process.

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5. Research Workforce

14. *How should we include workforce considerations in the design of national research Priorities?*
15. *What impact would a base grant have on the research workforce?*
16. *How do we design new funding mechanisms that strongly focus on workforce outcomes?*

We are delighted to see a focus on workforce in Te Ara Paerangi. New Zealand's RSI workforce is dedicated and hardworking, and something of a scarce resource. The RSI system needs to protect and enhance New Zealand's hard working, dedicated workforce, and better harness their skills and commitment as well as revaluing researchers (who are highly trained yet, compared with other tertiary trained specialists, comparatively poorly paid).

Key principles

Look forward

In redesigning the RSI system it is important to look to the future. Science will be different, and will require different capabilities and skills, so the broader RSI system needs to ensure we are training for the future.

RSI workforce is broader than just researchers

A range of skills that are necessary for translating and communicating our research into impact. These other professional skills need to be acknowledged and retained in the RSI system. For example, within the future workforce the business leaders of our organisation will be crucial, embedding best practice on stakeholder management, and bringing their business development expertise which includes leadership, analytics, high degrees of interpersonal skills and applied business collaboration. Career progression of non-science skills within RSI system is also important consideration.

Seamless pathways for talent are critical

For growing and nurturing talent through schools, universities, institutes of technology, wānanga and research organisations into private sector and communities. This is particularly true for people underrepresented in New Zealand's science staff such as Māori, Pasifika and women, amongst others. These groups bring different perspectives, knowledge, emphases and biases – all of which strengthen the diversity of thinking and scientific discovery.

Early Career researchers are looking for a RSI system, that will:

- Improve integration from undergraduates through into research organisations
- Provide clearer career pathways and more funding certainty, for example longer post-doctorate or fixed term contracts
- Standardization of conditions and support structures across organisations such as flexible and agile working arrangements
- Facilitate connectivity including through networking, placements and secondments
- Broader learning and development opportunities at the early career stage. For example, through hybrid roles with a research component and working in science support (such as business development or outreach).

Reach earlier into schools to grow Māori in RSI system

Support programmes that link primary, intermediate and secondary (STEM schools and academies) with universities, CRIs and others to create career pathways based on Mātauranga Māori for Māori students. This can be complimented by more certainty of employment of Māori researchers within the RSI system.

An RSI system that will enthuse and retain mid-career staff is critical. These staff often have additional demands on them in caregiver roles so flexible work environments are key. Fluid and flexible career paths are also important.

Workforce of the Future

At AgResearch we have started reimagining what the future RSI workforce will require including: Equity, Diversity & Inclusion – strengthening the foundations; Capability mapping – of technical and soft skills; Science vitality – a broader view of science excellence; Role of research organisations in transformative research; More diverse career pathways.

Please see our separate Thought piece on Workforce of the Future.

6. Research infrastructure

17. How do we support sustainable, efficient and enabling investment in research infrastructure?

Science is capital intensive, so a good RSI system needs to provide long term certainty for significant infrastructure investments. It is vital that we can balance protecting and enhancing long term research infrastructure, such as collections, databases and longitudinal studies, while ensuring it is future-proofed as science, context and infrastructure needs change.

Biological Collections are critical infrastructure for New Zealand's future

Alongside other CRIs that hold biological collections, AgResearch has one of the biggest and most active collections of grassland and native species flora (Margot Forde Germplasm Centre) in New Zealand. Biological collections such as this will be central to future research involving understanding of DNA sequence variation, evolution, phylogenetics, plant breeding, genomics, metabolomics, genetics and epigenetics, population structures – to enable New Zealand to respond to changing climate and other drivers. So it is critical to retain strong connections between the research community and the Collections and Databases.

Support a more joined up approach

Collections require additional investment to modernise and make them more resilient. For example:

- Prioritising digitisation and service improvement across the Databases and Collections (including digital information and service support) with sufficient, future-proofed investment for maintaining (and sequentially improving) the Databases and Collections.
- Expanding use of existing technologies or infrastructure across CRIs (such as utilising Plant and Food's tissue preservation facilities alongside AgResearch's seed storage).
- Meeting te Tiriti o Waitangi obligations: Most CRIs hold collections and databases which relate to taonga works and species over which Māori have expressed indigenous and data sovereignty interests. This provides a good starting point for working through requirements and a co-governance model of indigenous data (across the institutions) into the future.

Research data infrastructure

The problem of how to make maps, models, tools, national collections and databases publicly available via a stable, easy to navigate digital platform has yet to be solved in New Zealand. All such data platforms are either short-lived, lacking resources to update and maintain them, or severely constrained by data quality control, resourcing and proprietary or privacy issues (Our Land and Water 2022). Examples include the National Science Challenge databases and tools, and the CRI National Environmental Data Centre (NEDC).

As community-sourced data are collected in greater abundance, and open sourcing of science information becomes more common, this must be addressed if the data and tools are to be more widely and effectively used. This represents a sizeable challenge which, as an RSI sector, we need to face-up to. This will require Government support.

Proposed solution

Under the banner of 'open science for New Zealand', we think there is a need for Government assistance in the establishment of a 'National Research Data Infrastructure' (NRDI). This would be a natural extension of what has already been successfully established with NeSI (computing) and REANNZ (network).

There are proven examples of established NRDIs in Australia, Germany, Europe and the United States. All are sponsored via central government funding and operate with a set of defined principles and an appropriate governance model. Following the outcomes seen from these overseas examples, we propose the NRDI will also deliver for New Zealand infrastructure:

- Where all publicly funded, transdisciplinary research data, databases and digital collections are hosted
- That defines New Zealand's national metadata catalogue for public research data
- Where Māori data sovereignty is recognised and curated per te Tiriti o Waitangi obligations.
- Where the public can access and apply data science techniques to transdisciplinary and big-data
- Where we can measure the value of the insights we have generated from publicly funded science
- Which provides data bridges to connect the transdisciplinary datasets
- An organisation which provides a comprehensive professional development programme for researchers who generate public research data.

The NRDI should be supported by an entity that has stability of funding, and an appropriate governance model underpinned by aligned national and institutional policies.

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Idea: Regional scaling

Expensive instrumentation, sometimes as suites/ hubs (e.g. Australian Synchrotron) and sometimes as an access network (e.g. Biomolecular Interaction Centre), is a common model internationally and historically because it makes sense economically and collaboratively. Capability dedication (e.g. Synchrotron) means that there are often opportunities (between large or paying jobs) to enable exploration and access from groups which, because of lack of established connections or money, are unconventional users.

Structures require careful geographic scaling. Some capabilities are essential within commuting distance, others are nationally unique and worthy of planned travel (even with our increasing focus on reducing carbon footprints). In New Zealand and Australia we are good at setting up shared facilities but often very poor at maintaining them (as shown through a lack of commitment to instrumentation maintenance, application support and infrastructure maintenance).

A regional structure could be one way to address this including: co-investment in key equipment by regionally based partners (eg: Food HQ partners – such as AgResearch, PFR, Massey University and Fonterra are sharing capex plans to identify shared opportunities); permanent technical positions; committed minimal operating funds; common systems; clear access and priority agreements.

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Asset management entity

One of the main strategic enablers to providing good research is infrastructure – land, buildings, plant, equipment and technology. Infrastructure is generally the most expensive institutional asset. Because infrastructure is a high-value asset, it also incurs opportunity costs. Capital tied up in RSI infrastructure means it cannot be utilised in alternative ventures, so any benefits from the alternative use of this capital cannot be realised.

As the provider of a public good, opportunity cost incurred will not necessarily mean that resources are diverted into a better paying investment. However, recognising the opportunity cost of infrastructure holdings should also be factored into investment decisions and any analysis of organisation viability. RSIs that hold substantial debt free assets are much more likely to generate an accounting profit than those that need to lease infrastructure. However, the opportunity cost of holding assets for RSI purposes will be much higher for organisations that own their assets, and this cost should be factored into any analysis.

There are advantages and disadvantages of organisations owning their assets.

Some advantages are:

- Organisations can apply the assets as they choose, and so can take a long-term view on how best to utilise them
- Assets that are owned can be more easily disposed of and replaced as required to adjust to the strategic direction of the organisation
- Assets can be liquidated to cover any shortfall in revenue or cost overruns.

Some disadvantages are:

- Infrastructure held by separate organisations requires each organisation to have its own infrastructure management team, systems and processes
- Infrastructure underutilised by one organisation may not be available for use by another
- RSIs do not have the size and scale to develop individual expertise to provide high quality asset and facilities management
- Ownership of infrastructure spread across a number of RSIs does not consistently recognise the opportunity cost of holding infrastructure.

Alternate option

Asset management entity owns and manages RSI core infrastructure (not including research data infrastructure). This would centralise asset management into an entity with the expertise required to manage a large property and plant portfolio. It would require RSIs to lease property from this holding entity, which would have the effect of determining the opportunity cost of science work.

By centralising property ownership into the hands of one entity, it would mitigate the likelihood that asset transactions occur that benefit the individual organisation but are suboptimal from an overall Government-owned RSIs perspective. An asset management organisation would also be better placed to deal with assets that are currently not required. This could include leasing assets to third parties for commercial gain or retiring assets and utilising the funds to improve or add to existing infrastructure.

Plant and equipment related to specific science work undertaken by RSI entities should continue to be owned and maintained by those entities, as the specialised nature of these resources means that they are better maintained by the operators.

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