# MPI submission on draft RS&I Strategy

***Question 1:*** *Where can the RSI system make the greatest contribution towards the transition to a clean, green, carbon-neutral New Zealand?*

The system should encourage alignment of science effort and the government is already quite clear about what it wants from the science system, such as a low carbon economy and clean waterways. The same level of clarity is needed in terms of how operational science is needed to deliver this. This statement about transition is too broad – we need to publish clear, articulated science priorities for these areas that are set by a representative group. The Strategic Science Advisory Group model could be used for this (as has been used successfully for kauri dieback and myrtle rust science plans). As a starting point there are already existing priority documents such as the Primary Sector Science Roadmap, and Science Plans for biosecurity incursions and 1 Billion Trees. These were written with significant stakeholder input and can be referred to in the RSI Strategy as indicators of research priorities. Collectively decided priorities for mission-lead research with sufficient ring-fenced funding will facilitate the transition.

*Areas of contribution*

From an NRS point of view we could point to areas such as agricultural greenhouse gasses, water quality improvement, biodiversity enhancement, biosecurity control, renewable energy, waste and transport innovations. Additionally, there should be funding that supports investigation and development of new economic opportunities in clean, low carbon sectors as part of the transition. However, funding is limited and to achieve the best value for investment there needs to be direction to guide researchers towards the most important research priorities, encourage collaboration in priority areas, minimise transaction costs, and reduce any duplication of effort.

From an MPI point of view, while we support the transition to a clean, green carbon neutral NZ, what can or will support/replace the primary industries? The strategy is largely silent on the huge contribution made to the economy by the primary industries and their need for under-pinning research and applied research, including on mitigation of environmental consequences.

***Question 2:*** *Where else do you see it making a major contribution?*

The public RSI system should underpin and help to deliver on all key government policies. The RSI strategy should also clarify expected roles in the system – where government has more or less of a role, and where we expect to see market led investment.

To name a few areas where RSI will make a major contribution from an NRS perspective, priorities for investment should include RSI that focuses on water, environmental and green

technologies, climate change mitigation and adaptation, agriculture, marine and food. Underpinning this is research on materials, IT, nanotechnology, measurement and genomics technologies.

***Question 3:*** *What else could else the RSI system be doing to accelerate the progress towards the Government's priorities*?*

The RSI system needs to include a funding mechanism that is more directly linked to government priorities that can be accessed by all government agencies (for singular or collaborative projects) for research that supports direct, operational, near-term government needs. confidential advice to Government

Additionally, the RSI system needs to support fundamental infrastructure (including collections databases and capability) in a stable, secure manner that accounts for inflation and increasing and changing needs.

*Endeavour considerations*

Researchers and departments perceive some Endeavour decisions as 'random' and/or not optimised for impact. MBIE's impact assessment process could be improved. As some of the impact assessment issues relate to difficulties in ensuring that assessors have both sufficient expertise and knowledge of the New Zealand operating context, one solution to provide better consistency and priority consideration to Endeavour would be to involve the DSAs/CSAs in the impact assessment.

We feel that it is the excellence criteria that creates the bigger problem as there has been a push by providers to more fundamental research as a proxy for excellence and as emphasised by Universities being more successful. As excellence is assessed first, most projects that may have impact but moderate excellence are cut out of the system.



## Researching and innovating towards the frontier

***Question 4:*** *Do you agree that the RSI Strategy should be focused on innovation at the "frontier" (creating new knowledge) rather than behind the frontier (using existing knowledge to improve the ways we do things)?*

No, we strongly disagree with this. This strategy needs to capture the full RSI system and therefore needs to have a better balance between these two concepts than currently indicated. Suggesting that 'behind the frontier' belongs exclusively in the industry strategy leaves a significant gap in terms of applied science, extension, and commercialisation for the benefit of non-industry groups. While on page 18 you state that applied research can be 'innovation at the frontier', this is not apparent in the rest of the document.

On page 18 it states "innovation behind the frontier is about adopting things that are new to an organisation". We would query your specification of organisation – what about community groups, government, NGOs and passive stakeholders such as the environment? The industry strategy is not concerned with 'innovation behind the frontier' for these types of organisations. This definition also does not clearly capture 'known science that is applied in a new way' or applied in a comprehensive way, e.g., national coverage of soil or land coverage mapping.

Also, throughout this strategy there is the assumption that the impact of science is felt by the adoption and diffusion of knowledge. Research will not have a significant impact or be able to be applied if you only consider 'adoption' and 'knowledge transfer'. End-users often need to be involved from the beginning of the RS&I process – you can't develop a solution without first understanding the problem. Involvement of the end-user shapes the research questions and a research programme can take a very different route if the end users are involved from the beginning. This strategy needs to include more detail about extension, and send clear signals about the importance of co-design, co-development and co-implementation (especially when partnering with Māori).

In addition, there are types of 'frontier' research that are required for 'behind the frontier' innovation, such as social research about adoption, barriers to uptake, social licence and impact. The RSI strategy could look at whether New Zealand has the right platforms and funding to support this. Note there is no CRI or SSIF platform focused on social research.

Our comments here are supported by your own statement on page 20 that 'NZ has been less successful in converting this research into products or public services'. This clearly indicates that applied science and 'behind the frontier' innovation needs to be focused on in the RSI strategy. The RSI strategy provides no decisive incentive for researchers to connect with end-users. **There is no strengthening of accountability to deliver knowledge or products.**

We also note that the strategy disproportionately emphasises innovation and economic development, to the detriment of focus on research and science and addressing NRS issues. Innovation alone will not achieve the Government's priorities.

Finally, the tone of the document indicates that through innovating at the frontier, investment should be about international reputation rather than impact for New Zealanders.

***Question 5:*** *In which research and innovation areas does New Zealand have an ability to solve problems that nobody else in the world has solved? Why?*

***Question 8:*** *What RSI challenges are unique to New Zealand, that New Zealand is the only country likely to address?*

***Question 6:*** *In which areas does New Zealand have a unique opportunity to become a world leader? Why?*

*As these three questions have some overlap, we have provided a single answer to avoid repetition.*

New Zealand has a unique history and socio-political context and economy. We also have highly diverse and endemic flora and fauna and unique ecosystems. It is up to us to create the RSI to understand our environment now and into the future, support decision making about how we use and manage our environment, find solutions for environmental challenges and opportunities, and evaluate how we are tracking towards our priorities.

New Zealand scientists will naturally often focus on our own environment – land-use, water quality, endemic flora and fauna, unique ecological systems (including Antarctica), biosecurity and adaptation to climate change. This is because New Zealand scientists are best placed to find solutions (or lead teams to find solutions) to these challenges given their understanding of cultural context and significance.

Areas we're uniquely placed to become a 'world leader' include:

- Sustainable use of our natural resources and environment (including use by primary industries and tourism)
- Environmental law: granting one of our rivers its own legal status was a world-first and has since been taken up by other countries (e.g. India and the Ganges) RMA and outcome-based approaches to environmental Law
- Geothermal and hydro-energy: NZ was once leading the world's research (and application) in those areas. If we want to become carbon-zero by 2050 and 100% clean energy by 2035, we need to remember we've nearly achieved that once before.
- Rapid adoption of research into public policy: due to NZ's small size and ability to "have conversations across many government levels", some research gets taken up rather quickly by policy and legislation (compared to larger countries where issues are spread across local, regional, state and federal boundaries)
- Social research around behavioural change: NZ's social anthropologists and related social researchers are good at developing hands-on frameworks that other countries gladly take up to encourage and drive social change (e.g. the Energy Cultures Framework taking off in Scandinavia and UK).
- Connecting with different worldviews and appropriate incorporation of Mātauranga māori – we are increasingly seen as world leading in how we reconcile western science and Mātauranga māori.

Our current economy is largely built on sustainable use of our natural resources and the environment. Also research that will benefit our society and economy, such as sustainable production of food (producing more with less impact, novel bioproducts, and livestock and

ruminant agriculture throughout the value chain) and how we transition to lower GHG emissions economy in general.

New Zealand is already world leading in aspects of primary sector science, as above this is largely due to our economic dependence on primary industries. We can continue down this route and be considered world leaders in ruminant agriculture, reduction of environmental greenhouse gasses, marine ecology and fisheries, biosecurity and pest control. There are also opportunities to support RSI that diversifies our economy into low carbon (and low environmental footprint) sectors).

***Question 7:*** *What do you consider to be the unique opportunities or advantages available to the RSI system in New Zealand?*

New Zealand is a small country and our industries and public sector should be able to leverage effort, be flexible, agile and fast moving, and have the ability to rapidly diffuse knowledge and adopt new approaches and technologies. We need to understand why this is not (always) the case so that changes can be made to facilitate this.

***Question 9:*** *What are the challenges of innovating in the public sector? How do they differ from those in the private sector?*

Currently there is limited funding that can be efficiently directed towards policy needs, and there is a non-collaborative environment that does not facilitate effective sharing of resources (not only funding, but also data, procured research, etc). There are also large gaps in our fundamental understanding of our environment and in baseline monitoring data (see PCEs latest report on environmental monitoring and reporting), which results in gaps in the information the public sector has to inform advice and policies. Access to research and timely, fit-for-purpose information remains a problem.

The information needs of the public sector/policymakers to innovate and provide advice are often incompatible with conventional science production cycles – particularly when working with short timeframes.

Limited resources constrain the ability of departments to integrate and adapt research carried out in other parts of the RSI system to make it useful to them. This means that the potential value of much research goes unrealised and is underutilised.

There are very strong concerns about stable, very long-term funding for RSI infrastructure, including for collections and databases, especially those that are outside the designation of 'nationally significant collections and databases' (which themselves are very insecure and poorly funded). Loss of this infrastructure would severely impact on public sector innovation. We are also not looking ahead far enough as to a NZ Inc approach for **new** collections and databases – e.g. seedbanks or a database for environmental data. This is a public good problem.

For example, New Zealand's biosecurity relies on collections and databases of plants and animals to understand presence of pests, there distribution, host range, etc. To not maintain these inputs places New Zealand at risk of biosecurity incursions and the associated trade impacts.

Infrastructure not only needs to be maintained but allowance for both inflation and innovation e.g. for digitising collections, and for the expertise to manage and use them to their best advantage, needs to be addressed.

There are large gaps in our fundamental understanding of our environment. For example, national environmental monitoring datasets are ad hoc and fragmented, inconsistencies in coastline mapping, and large gaps in our understanding of what species we have (taxonomy and biodiversity). This results in gaps in the information the public sector has to inform our advice and work.

Extension of publicly funded science is a significant challenge. Current funding mechanisms largely focus on completing research projects and not the next steps of what will be done with research beyond a contract's lifespan, such as application and the social science needed for its successful implementation.

Finally, our research institutions – mostly CRIs and universities – rely on funding from the public sector and face constant challenges in funding security. CRI's are using contestable funding to maintain core capability, which takes focus away from the actual RSI that NZ needs to progress (and is not the focus of contestable funding). Science capability is not a tap that can be turned on and off – capability lost due to changes in priorities or insecure funding will be very hard to get back and is not considered in any national strategic context.



### Our key challenge – Connectivity

***Question 10:*** *Do you agree that a key challenge for the RSI system is enabling stronger connections? Why or why not?*

**Purposeful** connectivity (not only between scientists but with end-users and between institutions) should be valued in balance with impact and excellence. The value of connections will vary between projects and research areas, as will the types of connections required (e.g. some areas will require more New Zealand based connectivity such as supporting priorities that are unique to New Zealand (e.g., our unique history, environment, biodiversity and economy)).

As currently stated, the measure of international connectivity appears overly constrained to Small Advanced Economies (SAEs). Many of these SAEs do not share the same challenges of geography, demography or economy as New Zealand.

Good people attract good people so we first need to work on making our RSI system attractive to our current capability (i.e., connect good people to NZ). We need to both retain our scientists and allow them opportunities to further develop their careers. The first step is

to fund research organisations in a way that enables them to offer stable remuneration that is on-par with other countries but that also incentivises connection and collaboration, and increases security of tenure. Currently our baseline funding platforms (such as SSIF) have not grown in funding to match inflation so we essentially have decreasing funding platforms for capability with inadequate remuneration and **job security**.

This becomes especially apparent in highly specialised areas that have been de-prioritised in the RS&I system in the past, such as soil science and taxonomy. RS&I in areas such as these are vital to our natural resource sectors.

Strong core capability is fundamental to supporting meaningful collaboration, which in turn will contribute to growing capability.

New Zealand has a large proportion of international scientists who bring a wider focus and context into our research organisations. Ensuring that the RS&I system enables better international connection would be key to further expanding the focus for NZ scientists. Current funding levels result in tight restrictions on travel for scientists and organisations often have a lack of recognition that taking part in international conferences and working groups are vital to the professional development of scientists and national science prestige, as is domestic travel to stakeholders.



### Guiding Policy – Excellence

***Question 11:*** *Do you agree with the definition of excellence presented here as the best thing possible in its context? Why or why not?*

No, we do not agree. All science should be excellent, it should be a given, not a criteria. Any framework for excellence must be flexible to ensure against bias towards some disciplines, knowledge bases, and priorities.

Additionally, the global focus is not relevant to all research contributing to New Zealand's priorities (e.g., soil mapping, indigenous biodiversity, climate). Focussing on global runs the risk that we get further and further behind in some areas that have aspects unique and of significance to New Zealand (e.g. Mātauranga).

*Applied science*

There needs to be better support in the criteria to show how applied science is also excellent. On page 18 it is stated that applied research can be 'innovation at the frontier' and thus in the scope of this strategy as it is currently written. However, the focus of the excellence criteria thus far has resulted in researchers always striving for something (entirely) new. There is a significant need to place equal value on 'behind the frontier' – as continuing a line of research or improving existing knowledge is of critical importance as part of the pipeline from researcher to end-user. For example, we have used 1080 for a long time but new operational research has led to huge leaps in delivery of efficiency and outcome performance – much of this is incremental but vital.

The excellence criteria also need to include an extension plan and impact evaluation plan for some research. There are many cases where RS&I can only be excellent if it is conducted with the end-user and impact in mind from the beginning.

***Question 12:*** *How can we achieve diversity within our research workforce? What are the current barriers preventing a diverse range of talent from thriving in the RSI system?*

Diversity can be viewed in many ways. From the NRS perspective, we see enabling Māori to engage in the RSI system within a Te Ao Māori framework as being critical for improvement in diversity needed for the progress of NRS RSI. We also consider supporting our current scientists to develop further is an important aspect of achieving a more diverse range of talent thriving in New Zealand.

We need to ensure we have a pipeline of scientists, and to understand how different parts of the New Zealand population connect with science. This is about understanding where the barriers are for particular groups (ethnicities, genders) in science – is it schooling, university, post-graduate or early career research positions? Our science community should reflect (and benefit from) the full diversity of New Zealand. Additionally we need to understand if we have succession issues in some areas of science (e.g., an aging taxonomy workforce was identified in the recent RSNZ report).

New Zealand needs to develop a better enabling environment that includes supporting government to become more literate in Te Ao and Mātauranga, including ensuring that researchers applying for funding and research bid assessors truly understand the meaning of Vision Mātauranga, Te Ao Māori and Mātauranga māori. For example, within this document the 'towards extended vision Mātauranga box' does not often use the terms 'māori-led' or 'partnership' and leaves the definition/description of Mātauranga to the end. This in itself dismisses the importance placed on māori as part of the RSI system and immediately creates a barrier to achieving diversity.

In terms of supporting the RSI capability that we already have, the first and most significant step is to enable research organisations to have secure permanent science positions from early career through to retirement, remunerate staff sufficiently, and to employ enough staff so that our RSI experts have the capacity and opportunity to develop, and for succession to occur.

Where capability does not currently exist we need to work on both growing the capability (for instance, promoting STEM from primary school level onwards) and developing ways to share and best use capability across the RSI system in the meantime.

***Question 13:*** *Do you agree that excellence must be seen in a global context, and draw from the best technology, people, and ideas internationally? Why or why not?*

Concentrating on the international context needs to be balanced with looking at the NZ context and background. While we are a global citizen we need to ensure our RSI has impact

for New Zealanders. Many unique NZ research areas are most appropriately judged on their value to NZ, with an NZ-centric lens, and not the rest of the world.

***Question 14:*** *Do you agree that excellence is strengthened by stronger connections? Why or why not?*

This would need to be judged on a case-by-case basis. Excellence can be strengthened by stronger connections, so long as they are the right connections (purposeful collaborations). Collaborating for the sake of meeting criteria will not necessarily lead to better science (or efficient and effective research spend). It may also result in exclusion of early career scientists, as there may be a perception that a bid will be more successful if researchers connect to well-known, established as 'excellent' RSI professionals.

Strong connections with end-users, from development to implementation, is fundamental for uptake and use of science.



## Guiding Policy – Impact

***Question 15:*** *How can we improve the way we measure the impact of research?*

We need to develop fit-for-purpose, specific, tangible criteria to measure impact, and ensure that these can be reviewed and re-developed on a regular basis in order to stay current and relevant.

Measuring impact can include criteria around demonstrated connection to end-user – this is where rewarding co-development and co-innovation can be placed. A pragmatic start would be developing the impact measures in collaboration across government, with treaty partners and the stakeholders that benefit from the research. Any criteria should be based on both international evidence and New Zealand stakeholder needs.

The CSA network could be well-placed to have a role here and should be used as much as possible.

## Guiding Policy – Connections

***Question 16:*** *Where do you think weak connections currently exist, and what are the barriers to connections at present?*

*Weak connections: in-person collaboration*

Some connections are physical, and in many instances true collaboration requires meeting and collaboration in person. However New Zealand is large with a small population and core funding for research institutes is not sufficient to support regular travel between agencies that are located in different regions. Digital communication methods are not sufficient to bridge this gap.

*Weak connections: pipeline support*

There is no real support that focuses on the full pipeline of science and innovation, from basic research to commercialisation. Support is fragmented and focus on one small part of this pipeline will not automatically lead to other aspects falling into place.

There are poor connections between the outputs of science and the stakeholders who might best use them. The key barrier is that there is no dedicated funding mechanism and resource to carry out this activity in the science system. Further, there is no encouragement for extension or real co-implementation of science at scale, which should be an inherent part of the process, from the very beginning (i.e. not separate). This issue is compounded by a general gap in RSI funding for social science; social science has the potential to support understanding and the implementation of research.

***Question 17:*** *What actions will stimulate more connectivity between parts of the RSI system?*

Stronger focus on the entire pipeline in the policy settings, from basic research to commercialisation and from researcher to end-user would stimulate connectivity. Purposeful (and appropriate) connectivity needs to be specifically encouraged and rewarded (through successful bids), and there needs to be a clear signal regarding expectations for use of co-design and co-innovation methods – not just knowledge transfer and adoption. Involving stakeholders and end-users in the entire pipeline is critical, and this must be considered in the cost of research.

One option is a funding mechanism for the establishment of collaborative projects or best teams approach at the front end of projects whether they are successful or not in the contestable system.

Another options could be to set up research hubs that allow cross-functional and transdisciplinary research discussions to occur prior to bid writing. These could also become part of the selection process, where if a researcher hasn't connected to a research hub at least 6 months prior to the bid deadline they will not be eligible for certain funding streams.

The most important point is more stable and secure ongoing funding. There is a lot of effort and fatigue from connecting during funding bid processes that would be better served collaborating on enduring, ongoing projects.

***Question 18:*** *How could we improve connections between people within the RSI system and people outside it, including users of innovation, and international experts, business communities, and markets?*

*Much of the previous questions answers relate to this.*

Greater funding support at all levels – country to country, organisation to organisation and scientist to scientist. Greater use of science exchange networks e.g., https://www.scienceexchange.com/

## Actions – Making New Zealand a Magnet for Talent

***Question 19:*** *How can we better nurture and grow emerging researchers within New Zealand and offer stable career pathways to retain young talent in New Zealand?*

Pay them better, fund institutes better, ensure that investment in capability grows to both meet inflation and allow growth. More secure and stable funding, secure jobs and project areas.

Ensure scientists in New Zealand are able to establish a career path in the first 10 years of their science career and thereby limit the requirement for contestable research in their early career, which will allow them to focus on building networks, developing their skills and producing research. Ensure their salaries are competitive on a global scale.

When focusing on attracting and retaining world class talents, the most frequent reason for them leaving again is not necessarily that we didn't look after their career, it's also because we didn't look after their family. One key to retaining talent is to have a spouse integration and career programme that really works.

***Question 20:*** *How could we attract people with unique skills and experience from overseas to New Zealand?*

The idea of "attracting talent to NZ" is so strong in this document that it is almost demeaning for the NZ-born talent who is potentially not supported or exploited. The impression from reading the document is that talent must come from overseas. It is a fact that it is happening but we need to attract more New Zealanders into STEM and research domestically (as well as attract international talent where there are gaps/opportunities).

However, when it is needed - offer them a secure attractive career in NZ with plenty of opportunities to associate with their overseas institutes – see our answer to question 19.

***Question 21:*** *What changes could be made to support career stability for researchers in New Zealand? What would be the advantages and disadvantages of these approaches?*

CRIs and other research institutes need to be able to offer long-term stability, such as procuring staff for a guaranteed minimum period (such as 10 years) with the guarantee underwritten by MBIE but subject to performance criteria.

Funding for secure stable research, fundamental infrastructure and for the support of early career researchers. We need to fund mechanisms and initiatives that enable better career mentoring and succession planning. We also need to understand our diversity and capability needs better, through monitoring of scientists and career trajectories – when and who do we lose, where do they go, and why?

***Question 22:*** *Do you agree with the initiatives proposed in the Strategy to support and attract talented researchers and innovators? Are any changes needed for these initiatives to be successful? Are there any other initiatives needed to achieve these objectives?*

No, we do not agree. None of the actions to 'make NZ a Magnet for Talent' include increasing funding to ensure that we can:

- appropriately and competitively remunerate our great scientists and the further talent that we wish to attract,
- provide our scientists with security of funding and jobs
- support the fundamental infrastructure and scientific research to enable them to do world leading research.

This funding increase should be the first and foremost action.

### Actions – Connecting Research and Innovation

***Question 23:*** *What elements will initiatives to strengthen connections between participants in the RSI system need to be successful?*

There is a need for trust, commitment, resources and sufficient capital to be successful.

Less of a competitive market – more stable funding for fundamental infrastructure and research. The churn of project proposals and bidding is exhausting for everyone and has significant opportunity costs.

***Question 24:*** *What elements will initiatives to strengthen connections between participants in the RSI system and users of innovation need to be successful?*

Our system needs to enable collaboration between researchers and innovation stakeholders.

There is a need for greater capital and for commitment by the researchers and users to work together and be equal partners in the risk of making the research work in practice. Security of funding also comes in here, and there should be budget for workshops and domestic travel to connect end users with researchers.

***Question 25:*** *What elements will initiatives to strengthen connections between participants in the RSI system and international experts, business communities, and markets need to be successful?*

Use of co-innovation and co-design is one approach to bring in the user at an early stage, which can increase changes of success. This is resource intensive and needs to be funded if it is desired.

Funding mechanisms need to recognise that new technology needs to be linked to processes and organisations that have the capability to bring a product to market (i.e

partnership funding, co-funding), such as the Sustainable Food and Fibres Future approach does (administered by MPI).

If MBIE is serious about ramping the **international collaboration** amongst our researcher up, then funds need to be made available to **pay overseas researchers' salary** to come here and collaborate. This is often a barrier for overseas researchers to truly commit to a project that is done mainly on NZ ground.

***Question 26:*** *Are there any themes, in addition to those proposed in the Strategy (research commercialisation and international connections), that we need to take into consideration?*

Research commercialisation and international connections are not the first steps in connection. Before we can focus on these two themes, we need to have healthy connections internally. We also need evidence to be able to make statements such as this, so we need action around monitoring the diversity of our science capability and the pipeline into science careers.

*General comment on this section – how will we take a regulatory systems approach to policies governing ownership, etc? And why doesn't this section again reference Wai 262 and implications therein?*



### Actions – Start-up

***Question 27:*** *How can we better support the growth of start-ups?*

Early start up free advice, early education in schools about entrepreneurship, more hubs.

***Question 28:*** *Do the initiatives proposed in the draft Strategy to support growth of start-ups need to be changed? Are there any other initiatives needed to support start-ups?*

***Question 29:*** *What additional barriers, including regulatory barriers, exist that prevent start-ups and other businesses from conducting research and innovation?*

The understanding of IP and the various options to take at least cost. Greater financial management skills for innovation and commercialisation, when and how to expand and to what countries, who to collaborate with, international expansion and the finance to do this.

### Actions – Innovating for the public good

***Question 30:*** *How can we better support innovation for the public good?*

Need to increase focus on applied science. confidential advice to Government

By giving free advice, mentors, ensuring that public money is repaid in some form, such as in public goods or financial repayment when successful.

Funding fundamental infrastructure (taxonomy, data and collections, ongoing environmental monitoring, as well as physical infrastructure and science capability).

Public good require a public that understand and are engaged with science. More effort to connect the public with the wonder of science, particularly those sectors poorly represented in the science workforce.

***Question 31:*** *What public-good opportunities should our initiatives in this area be focused on?*

A set of principles including fairness, trust, value for money, widespread public benefit (eg employment, tax, repayment, conservation and environmental gain, health benefits).

Refer to the government priorities and identify what priorities for New Zealanders will not be addressed by the market – i.e. diffuse benefits, etc.

### Actions – Scale up

***Question 32:*** *What is the best way to build scale in focused areas?*

To look at market opportunities, customer preferences, agree on the business model, be disruptive and innovative, look at what others have done, what are the gaps, secure sufficient capital for expansion.

***Question 33:*** *Do the initiatives proposed in the Strategy to build scale in focused areas need to be changed? Are there any other initiatives needed to build scale?*

Do our current commercialisation facilities work? What are the key factors limiting expansion? We need to know that before we establish more.

How, through what mechanism, can MBIE support larger scale government-research-industry partnerships, etc?

### Scale up – Choosing our areas of focus

For this draft iteration of the strategy, **we seek input on the selection of possible areas of focus**. We will consider establishing around five focus areas, but, depending on the eventual selection, are likely to introduce them over time, rather than immediately. In addition to the criteria set out in the Strategy document, we invite stakeholders to consider the following factors in their suggestions –

- The ambition of this strategy to focus efforts in the RSI portfolio at the global frontier of knowledge and innovation.
- Ways in which the RSI system can accelerate progress on the government's goals.
- The focus areas already determined by *From the Knowledge Wave to the Digital Age*.
- Work already underway where we are already seeking to build depth and scale in the RSI system.

The following areas could be a useful start, and are highlighted in *From the Knowledge Wave to the Digital Age:*

- **Aerospace**, including both autonomous vehicles and our growing space industry.

New Zealand is unlikely to be a major part of the global frontier of aerospace knowledge and innovation. This area has major global investment and New Zealand will only be able to come up with limited innovations. Also the ability to get to market is extremely costly. We have few natural advantages and a thin science base to exploit this area. **Instead** we should focus on exploiting the imagery that is acquired by other nations' satellites and build expertise to do this cost effectively to meet our natural and economic needs through transformative uses.

- **Renewable energy**, building on recent investments in the Advanced Energy Technology Platform.

This should be refined further. New Zealand has experience in this area through Hydro Electric Power and Geothermal which are areas to build on. In other types of renewable energy, such as wind and Photo Voltaic, we will not have a competitive advantage compared to the resources being poured in globally in these areas. The other is marine energy which we have significant resources for and could exploit more.

This should also be accompanied by research into conserving energy; realistically we will struggle to deliver the electricity needs for an electrified transport system, unless we significantly reduce wastage in other areas of electricity use. This is a complex system problem that is not just about technologies. We need to exploit of grid systems as well to limit the energy transportation losses.

- **Health technologies** to improve delivery of health services and explore opportunities in digital data-driven social and health research.

This should not be an area of focus. After defence, health technology has the greatest global investment and New Zealand will only be able to come up with innovation in limited areas. Also the ability to get to market is extremely costly due to the need for human trials and may necessitate New Zealand needing to sell offshore to get sufficient capital to commercialise. An area that does require more focus is public health research particularly health service delivery for Island and Maori groups. Issues such as reasons for lack of vaccination, obesity need addressing.

**We invite comment on these suggestions and welcome input on other possible focus areas.**

**There should be a primary industries area of focus as it is by far one of our biggest areas of RS&I.**

**Supporting the transition to a low carbon economy – either within sectors or between**

**Adapting to climate change**

**Social sciences is a current gap.**

**These should link to long-term government priorities and the future needs of New Zealanders, determined through consultation with all relevant RS&I system stakeholders.**

## Actions – Towards an Extended Vision Mātauranga

This section of the draft Strategy signals our intention to consult and collaborate further with Māori stakeholders to co-design our responses and initiatives. From that perspective, we consider the signals in the draft Strategy to be a start, rather than a set of final decisions. Nonetheless, we are keen on initial feedback in the following areas.

***Question 34:*** *Does our suggested approach to extending Vision Mātauranga focus in the right five areas? If not, where should it focus?*

No. It does not focus enough on partnership with Māori and Māori-led research. Māori are not stakeholders they are partners with the Crown. This entire section needs to be redrafted in true partnership, it needs to be longer (at least equal lengths to the others) and brought forward to be number 2 as it makes sense for this action point to sit between attracting/developing talent, and building connections. Also see our response to question 12.

This document sets out a starting point for an extended Vision Mātauranga. We acknowledge this as an early starting point, in the right direction. The intention to consult with Māori stakeholders to co-design will be an important next step. While the intentions are good, more detail is required about the barriers and actions for progress to support Māori aspirations and progress.

The RSI system must be relevant to Māori, delivered by Māori, link to and strengthen Māori leadership, and be informed by Māori aspirations. This includes ensuring Mātauranga is acknowledged as a knowledge system, and investment and decision making within it is done in an appropriate way.

The RSI strategy presents an opportunity to support more flexible frameworks for the assessment of excellence and impact of different disciplines. Acknowledging that excellence and impact in Mātauranga may look different than in physics or biology or economics or social sciences may ensure that we don't inadvertently bias our RSI system between disciplines.

***Question 35:*** *How can we ensure the RSI system is open to the best Māori thinkers and researchers?*

We need to grow them, there is currently limited capability and the only way forward is to take a long-term approach and get active in the early years to encourage young Māori towards STEM subjects (and other relevant areas) and careers. This needs to be combined with initiatives that provide funding, career advice and pastoral care to support young māori to move along a career pathway from school into our RS&I system and capability pipeline.

We need to understand when and where and why we lose Māori participation – primary school vs secondary vs tertiary vs post graduate, etc., and then we can target our interventions.

We also need to work together to address the gap while we try to fill it in a more long-term way.

There is currently a limited number of Māori engaged in the RS&I system and they are in high demand. There is also significant competition for the best Maori thinkers to run māori businesses which are intent on becoming global players.

The system needs to recognise and understand in a way that allows Māori to 'speak their language' – no in terms of te reo but in terms of the Te Ao Māori world view. The system needs to allow flexibility around how to tell a story, the assessors need to be the right people that can understand this.

Government itself needs to upskill and become used to using Te Reo words and concepts in official documents.

***Question 36:*** *How can we ensure that Māori knowledge, culture, and worldviews are integrated throughout our RSI system?*

See response to question 12.

There is an opportunity for MBIE to lead the way in "understanding and articulating the Crown's role in supporting or protecting this system of knowledge". They should be working **with** Māori to determine principles for what successful, culturally appropriate use and investment in Mātauranga looks like. They should also be working to support the general public, science community and science users to understand Mātauranga and their role/responsibility towards it.

***Question 37:*** *How can we strengthen connections between the RSI system and Māori businesses and enterprises?*

This is happening already with a range of programmes throughout government.

### Actions – Building Firm Foundations

***Question 38:*** *Do the current structures, funding, and policies encourage public research organisations to form a coordinated, dynamic network of research across the horizons of research and innovation? What changes might be made?*

No they don't.

A culture of competition still exists between organisations, although diminished from previous years. We need to emphasise that the "best teams" or "right teams" are based on connection, cohesiveness and willingness to be open minded to different points of views. Often projects are supported that do not have the core experts in them.

This includes CRIs – due to the SSIF funding model not increasing to meet the needs of inflation, let alone growth, the CRIs rely on contestable funding for some of their core

functions and human resourcing. This has led to an environment of unconstructive competition between CRIs and puts CRIs at risk to lose capability or not invest in new capability if the finances are under pressure due to lack of success in bidding rounds.

***Question 39:*** *Is the CRI operating model appropriately designed to support dynamic, connected institutions and leading edge research? What changes might be made?*

It needs better long-term focus.

The CRI model is appropriate to do this but the current assessment system for contestable projects appears to favour the University sector. The problem with the science system is that that the Universities do not have the requirements to meet all the elements that the CRIs do through their statements of core purpose. As above, the reliance of CRIs on contestable funding for some of the core capability needs and science functions has led to unconstructive competitive behaviour and restricted the ability of organisations to be dynamic, connected and able to keep up with the leading edge in RS&I.

The CRIs that have a role in training should also be able to participate in the PBRF. The Universities have an unfair access to all funds but CRIs do not have access to the PBRF.

We need more long term and secure funding for CRIs, independent of project bids to support fundamental infrastructure and capability. We should also consider whether the current mix of science platforms funded by the CRIs is setting us up for a transition to a cleaner, greener low carbon economy. For example there is no platform devoted to social science.

In terms of delivering RSI required by Government, the CRI model is not working well. CRIs, in an effort to meet commercial targets, are not servicing their core government clients optimally. There are perverse intractable drivers in the model: public good science vs commercial returns. Quality and timeliness of science outputs from CRIs are a concern in some areas.

The CRI model creates many layers of double-handing and substantial costs to the science system through multiple Boards of Directors, Audit and Risk committees, Stakeholder Reference Panels, rolling reviews, external auditing and so on.

As a direct consequence of cost pressure on government departments and ministries, critical operational science for health and regulatory purposes is being lost as CRIs exit essential services to meet their commercial objectives. For instance, ESR – the unique national reference laboratory for foodborne illness bacteria is cutting back its service to well below internationally acceptable standards, which could affect detection and management of outbreaks and disease and also affect NZ's international reputation. This situation is untenable from an NZ Inc perspective. The RSI Strategy is silent on these crucial outcomes for NZ.

***Question 40:*** *What additional research and innovation infrastructure is necessary to achieve the goals of this Strategy? What opportunities are there to share infrastructure across institutions or with international partners?*

Increases to baseline RS&I funding.

There needs to be a clear forward plan for infrastructure including new buildings and equipment. Institutes cannot be world leading if they do not have this, e.g., fisheries and oceanographic vessels to address our huge EEZ, containment facilities for biosecurity and GM material, and infrastructure funding for collections and databases beyond what are currently considered 'nationally significant'. Even nationally significant databases are woefully underfunded. Infrastructure, including environmental monitoring datasets are critical for our enabling scientific research and innovation, and ultimately meeting our government priorities.

**Question 41:** What elements will initiatives in this area need to be successful?

Up to date equipment and buildings and planned replacements, trained specialists to use the equipment, shared where necessary with overseas institution targeting areas of greatest importance to NZ.

Secure and ongoing funding inflation adjusted of physical infrastructure, collections, datasets etc, and funding the expertise to ensure best use of the infrastructure.

## Actions – General

***Question 42:*** *How should the Government prioritise the areas of action, and the initiatives proposed under each area?*

- National and international impact
- The ability and capacity to do science in NZ and if not the ability of international science to progress NZ needs
- The capability to carry out the science including the infrastructure
- The capability to transfer and exploit the science

The government needs to work in a connected, collaborative way to develop priorities and oversee implementation. A group that includes representatives from several government agencies, Māori partners, representatives from research organisations and representatives from industry needs to be developed in order to prioritise areas of RS&I action in a way that is fair, representative and creates a sense of community and ownership.

Recognising and using existing documents such as the Primary Sector Science Roadmap, the Conservation and Environment Roadmap, the Kauri Dieback Science Plan, etc., would be a good start.

## General

***Question 43:*** *Do you have any other comments on the Strategy which have not yet been addressed?*

- Throughout the strategy the research being referred to is mostly blue-sky, curiosity-driven research rather than the solid operational science required to form the evidence base for national regulatory practice. The CRIs who are supposed to provide such science are not delivering as they pursue blue-sky research funds. There is a heavy university research-style focus with CRIs not being mentioned until page 38 of the document.
- The strategy needs to have a funding commitment from current and future Governments to reach the targets that have been identified – including that of reaching the target of 2% GDP, as recognised in para 22 of the Cabinet paper releasing the document states that:

  > Even if we are able to increase business spending by 10 per cent per annum, we will need to continue to grow our publicly-funded R&D to complement private investment in the order of an additional new $150 million every year, to an estimated total annual new spend of $1.5 billion by 2028. In aggregate, this equates to a ten-year new spending commitment of $8 billion. Any reduction in our existing R&D efforts will mean we will be unable to achieve our two per cent target.

- There is a lack of a significant infrastructure plan for science in NZ, which is needed to complete or complement this document (infrastructure includes both physical structures and electronic resources).
- There is limited comment on science communication and society's acceptance of science.
- In its current form the draft RS&I strategy is relatively dense, hard reading, with a very extensive front-end. This may act as a barrier to engagement with the Strategy and the RS&I system. In addition, a significant amount of critical information about the RS&I strategy is currently sitting in Appendix One. We recommend that the final version of this strategy should be written with the reader experience at front of mind. We recommend:
  - Moving information about the RS&I system from Appendix One to the front of the document, as Part One, and reducing the length of this information to two pages.
  - Condensing the information that is in parts 1-3 as much as possible
  - Expanding Part 4 - actions
  - Bringing more prominence to part 4 by referring readers to specific actions in relevant parts of the preceding sections

- Consider the order of the actions, especially where 'towards and extended Vision Mātauranga' is placed, and how one action may lead to another.

- Annex Two – indicators of success – these seem to be very output focussed, rather than on the change the strategy is trying to drive.
- Investment (diagram p16): most of Govt funding seems to be on the left of the diagram, between "investigator-led" and "mission-led research". This is very focused on MBIE administered funds and does not include funds administered by MPI. The User-led research (operational/tools) is rather depleted (except for the "R&D tax incentive" circle, which is unlikely to reflect much government operational research and innovation such as biosecurity).
- Regarding government connections in RSI - p12 "Projects where different agencies share an interest will be jointly governed by those agencies, and those governance structures will have shared responsibility for delivery on the project" - this implies that only once projects have been accepted by MBIE for funding do the other agencies get together to steer the projects. It also means that MPI could be responsible for delivering impact from a project it would have not necessarily funded. The idea of joint governance is great but the connections need to start before allocating research funding.

**Comments on social science:**

- Social and economic research are generally absent from the strategy, with no discussion of facilitating substantial research into new economic and social systems.
- There is currently a lot of rhetoric about collaborative, multidisciplinary approaches to research, but the strategy, as it reads, is very biophysical sciences-centric. If you want to exclude social science, be explicit about it. However, it should be given more prominence if this strategy is to be comprehensive across the system with people at the centre.
- If social science is to be included, make it clear that the use of the kupu 'research' includes social research and think about how to target funding accordingly.
- Examples of where social research is crucial:
    - behaviour change (e.g. in extension projects, climate change)
    - if people are at the centre of the system, understanding attitudes, motivations, barriers etc
- Need to explain if the 3 horizons in the diagram on p2 include social research (or does it need another layer across the bottom showing that social research supports all three horizons?