From:	no-reply@mbie.govt.nz
To:	Research, Science and Innovation Strategy Secretariat
Subject:	Late submission on draft RSI strategy
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Are you making your submission as an individual, or on behalf of an organisation?
Organisation

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Which of the below areas do you feel represents your perspective as a submitter? (Please select all that apply)

If you selected other, please specify here:

Gender

Ethnicity

Name of organisation on whose behalf you are submitting, if different to the organisation named above
GNS Science

In which sector does your organisation operate: (Please select all that apply)
Research

If you selected other, please specify here:

How large is your organisation (in number of full-time-equivalent employees)?
422 FTE

Please indicate if you would like some or all of the information you provide in your submission kept in confidence, and if so which information.

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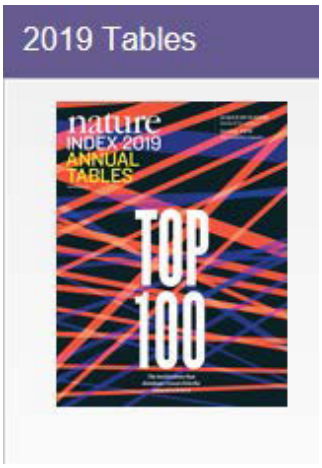
GNS Science submission

GNS Science, Te Pū Ao, is New Zealand's national institute of geological and nuclear sciences. As a Crown Research Institute, GNS Science is strongly mission-led. Through world-class science, GNS is focused on delivering economic, environmental and social benefits for New Zealand from natural processes occurring in the Earth's crust.



We deliver excellent science across the full science value chain, from fundamental research to applied research, knowledge-translation and science communication to communities across Aotearoa New Zealand. For the second year in a row, GNS Science has been internationally-recognised for its research excellence, with the 2019 Nature Index ranking GNS as the top-ranked corporate institution in the world for its publications in Earth and environmental sciences.

As an institution with strong connectivity with research collaborators and end-users alike, GNS Science is well placed to consider the breadth of matters discussed in the New Zealand Research, Science and Innovation Strategy Consultation Draft.

Overview comment

GNS Science welcomes the opportunity to comment on the New Zealand Research, Science and Innovation Strategy Consultation Draft. As a Crown Research Institute, we take seriously our role as a **partner to the Crown** in the delivery of science that benefits New Zealand. Impact-led investment underpins the development of science that is useful, useable and used.

Like other CRIs, we ensure the stability of **nationally-important science expertise** – a 'backbone' of national capability that we invest in and develop for the country. While GNS's science leadership role in responding to significant geological hazards and events is particularly visible to New Zealanders, our wider activity - across the gamut of groundwater, climate, energy, isotopic, and underpinning land and marine geological sciences - is also strongly directed to national needs, and can flex as national priorities demand.

GNS therefore strongly endorses **a strategy-led approach to Crown investment** across the suite of investments made in support of New Zealand's Research, Science and Innovation system. Clarity on areas of strategic priority will enable more adequate resourcing and capability investment in priority areas for future generations. This is also key to delivering on the anticipated benefits from NZ Inc's science spend. Outcome-led investment is particularly critical to *optimising* the delivery of multiple, stated benefits to New Zealand society. As a country, our science and innovation system needs to achieve a workable way of balancing shorter-term priorities with the need to invest in longer-term science programmes which will utltimately create new, and sometimes higher, value for New Zealand in the longer term.

Strategy-led and prioritised investment is particularly important in respect of **research for public-good benefit** - as with all CRIs, GNS Science is predominantly funded by the Crown, whether directly from MBIE or via other publicly-funded science investments. True market failure exists for a wide range of science that publicly-funded agencies need to operate to their full potential. The PCE's recent report on State of Environment reporting highlights one such example. The wider ecosystem working together to identify and agree national priorities, approaches and methodologies will not only save the country money through reduced

duplication and more targeted science spend, it will also enable the various investments (for example, across SSIF Platforms, CRI and IRO SSIF, PBRF, and National Science Challenges) to better align to lift science value-creation and delivery for New Zealand, including through development of agreed/shared models, tools and other pathways to impact.

GNS Science also endorses the proposed strategic focus on deliving New Zealand's unique needs through **pursuit of transformational change**. Through world-class research, science can and regularly does *inform* national priorities, as well as *reflect* priority needs and objectives in both public-good and sector-good spheres. This is particularly important in the case of emerging science insights, which have the power to fundamentally transform pathways for New Zealand's future. Optimising the future choices that New Zealand society makes - and can make - is of growing relevance in a world facing a number of economic, political, societal and technological disruptions.

In summary, **GNS Science supports the direction and priorities outlined in the Consultation Draft**. We would particularly like to comment in support of the following aspects:

Greater impact and connectivity

- The areas proposed for focus across the national research, science and innovation system
- The proposed addition of a new 'building stronger connections' investment pillar to reinforce the existing dual pillars of 'excellence' and 'impact'
- An increased focus on international connectivity.

Attracting, developing and retaining critical talent

- The focus on nurturing and growing emerging researchers within New Zealand, supporting career stability for critical expertise, and attracting talented researchers and innovators to New Zealand
- The importance of long-term, stable funding to attract/retain nationally-important talent
- Support for a focus on achieving greater diversity and inclusion in the RSI workforce.

Science of value to Māori

- The development of new initiatives and policies to extend the reach and scope of Vision Mātauranga through close consultation and collaboration with Māori stakeholders
- Support for matauranga Māori approaches to be integral to New Zealand science.

The need to resource implementation of the Strategy

- Raising R&D expenditure to two percent of GDP by 2027. We would like to recommend a closer timeframe for this target (2025), given the gap between New Zealand and other OECD country levels.

In making this submission, GNS Science is both drawing on and supporting elements of the following submissions on the Consultation Draft:

- Science New Zealand
- Resilience to Nature's Challenges National Science Challenge
- Te Ara Pūtaiao, the pan-CRI network of Māori leaders
- KiwiNet.

GNS would welcome further discussion with MBIE on our submission.

Contribution of Research, Science and Innovation (RSI)

Question 1:	Where can the RSI system make the greatest contribution towards the transition to a clean, green, carbon-neutral New Zealand?
Question 2:	Where else do you see it making a major contribution?
Question 3:	What else could else the RSI system be doing to accelerate the progress towards the Government's priorities*?

* see list of the Government's twelve priorities included in Part 1 of the draft Strategy.

GNS supports the Resilience to Nature's Challenges National Science Challenge comments on this section. That is, we note positively the reference to the essential role of the RSI system in supporting New Zealand's approach to climate change mitigation and adaptation. New Zealand has a clear and urgent need to mitigate these issues in order to achieve its aspirations to be a resilient nation, achieve its international commitments, and meet the expectations of New Zealanders, particularly younger-generation New Zealanders. This is also important if as a society we wish to support Māori aspirations and achieve a longer-term view of our roles as intergenerational kiatiaki of the natural world.

In respect of Question 2, we would like to record that climate change is often an *amplifier* for many natural hazards (for example, rainfall-induced landslides, drought, storms and other extreme weather events). The impacts of climate change on New Zealand will also directly reflect the specific geology, biodiversity and landforms that exist here. There is therefore strong rationale to ensure that natural hazards sit alongside climate change as areas where science will (and does) play a central role in mitigating risk and ensuring future resilience for New Zealand. This broader focus also aligns to the National Resilience Strategy (2019), and the Living Standards Framework (2018), which both recognise that intergenerational wellbeing and resilience are first and foremost dependent on physical and mental safety. As one example, through the Christchurch and Kaikoura earthquakes, New Zealand experienced the significant impact of natural hazard events on resilience and wellbeing.

We therefore recommend that the RSI system includes a deliberate focus on incentivising research, science and innovation that achieves policy, regulatory and investment decision-making that will improve New Zealand's long term resilience to both climate change and wider natural hazards.

We agree with others that it would be helpful to make clearer the alignment between the CRI and NSC investments and wider (e.g PBRF) investment mechanisms, and the proposed Government priorities. For example, in the case of the Resilience Challenge and the Deep South Challenge, supporting 'healthier, safer more connected communities' is a common aspiration, and one which can only be achieved through greater understanding of, planning for, and mitigation of, climate change impacts.

GNS Science would like to endorse the views of others in national prioritisation of research,

science and innovation that will make most difference to the living standards of New Zealanders, including research in line with the Vision Mātauranga policy. Increasingly, science is becoming more central to everyday community decision-making, and we accept the responsibility for its benefit to apply in ways that are equitable.

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)?
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 6:	In which areas does New Zealand have a unique opportunity to become a world leader? Why?
Question 7:	What do you consider to be the unique opportunities or advantages available to the RSI system in New Zealand?
Question 8:	What RSI challenges are unique to New Zealand, that New Zealand is the only country likely to address?
Question 9:	What are the challenges of innovating in the public sector? How do they differ from those in the private sector?

GNS Science supports research, science and innovation prioritisation of investment in areas that New Zealand science has a recognised global leadership role – from climate change, to Southern Ocean and Antarctic science, to geological sciences.

These examples provide just a few areas where investment by the research, science and innovation system would leverage greater overall benefit from investment (across many dimesions, including capability development, leveraging global co-funding investment, accessing international research infrastructure, accessing technology, know-how and science knowledge horizons more readily to New Zealand benefit, among others). For the avoidance of doubt, we are not arguing against investment in the many areas of research, science and innovation that New Zealand needs for its own reasons, to solve its own unique priorities and problems, and which are a priority for reasons beyond science (*see paragraph below*). But if all other things are *equal*, investment in areas of global leadership makes sense, particularly if we wish to promote New Zealand as a global R, S & I destination (*see Talent Magnet section*).

Conversely, while there are many areas where New Zealand may want to act as a fast-follower, an R, S & I 'taker', and/or build on the knowledge frontier of others, in some areas of global growth and demand, we see advantage in prioritisation of 'homegrown' R&D. Examples include the hydrogen economy, wherein New Zealand has to take into account its wider energy security and economic development interests, as well as science returns, when it considers the impact, value for money, capability development and

connectivity of its R, S & I investment.

We therefore support a focus on innovation at the frontier, but agree with Science NZ, Te Ara Pūtaiao, and the Resilience Challenge submission in recognising that important innovation and insights also occur '*behind the frontier*' through developing new ways of integrating existing knowledge, bringing a new interdisciplinary perspective to bear on 'old' problems in order to find a solution to them. We recommend that while a focus may well be on frontier science, it is critical to also seek to improve science 'impact' and progression of science value along the *full* value chain. In other words, we suggest a balanced approach is important to get the best from national R, S & I investment (of all types, across the suite of Crown investments, and including CRI SSIF investments).

In terms of particular areas of science leadership, New Zealand's unique geographic/geological position astride an active plate boundary in the South West Pacific and Southern Oceans gives us a globally-recognised strategic advantage in understanding subduction zone hazards, as well as present and past climate. GNS therefore supports the RNC view that *our high societal and economic vulnerability to a wide range of damaging natural hazards requires us to invest in our own research capability to understand and better manage these risks as a nation. The combination of our natural challenges, unique cultural attributes and regulatory environment, and existing capability mean we are already leaders, and with continued support and focus, have an exciting opportunity to be a world leader in developing innovative solutions to climate change and other disaster resilience issues*

A related strategic advantage is the strong attraction of international research consortia to the unique 'natural laboratory' of New Zealand, that, if well facilitated, can significantly leverage New Zealand's own science investments, support and grow our excellence in science, and ensure New Zealand can build on its strengths to truly become a well-connected 'magnet' for global talent.

Question 9

As with other submitters, GNS would like to see greater recognition of the critical role that central and local government plays in innovating and creating impact in relation to economic productivity and environmental sustainability, including in the spheres of regional development and supporting Māori aspirations for co-management of many natural resources. Under the Resource Management Act, Local Government Act and Civil Defence and Emergency Management Act, many of the country's decisions on matters which have lasting (in most cases effectively permanent) implications are made by councils as statutory decision-makers. Ensuring investment that aligns effectively across the R, S & I system to support local, regional and central government policy-setting and resource management decision-making has been an ongoing challenge for New Zealand over the years, particularly given the current MBIE Endeavour assessment lens which typically prioritises national approaches and needs. We therefore recommend that the RSI Strategy provide a greater recognition of the role and science needs of our local, regional and central government gencies. This suggestion spans a number of agencies, entities, policy and regulatory areas, as well as science domains.

In addition, as identified by the Minstry for the Environment, Ministry for Primary Industries and the Department for Conservation, and primary sector stakeholders, there is a clear need for more integrated research on water, climate and land-based pressures. This activity is both important to New Zealand's long-term sustainability, and significant in terms of the order of magnitude of the task. As the recent PCE report on Overseer, nutrient budgeting and on-farm management points out, there is no clear source of

funding for this work, despite clear alignment to the Government's priorities. In this respect, we point to the R, S & T Strategies compiled by regional councils, the various research roadmaps and sector-led research strategies – all of which signal this area as a known gap in coordinated science effort. These significant bodies of work also highlight other priorities facing the natural resources and primary sectors, and have often been developed collaboratively with CRI and University science input.

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?

GNS supports the inclusion of connectivity as a key priority for the RSI Strategy. As a highly-connected institute with more than 150 years of international and domestic collaborations, we strongly link across the tertiary, CRI and private sectors to better deliver value from our research. However, this connectivity can at present be both costly and made difficult by a variety of funding sources (Votes) and instruments (investment mechanisms). In essence, high-value collaborations can cost real money, and the current investment mechanisms do not appear to easily support this activity (c.f. the research outputs that derive from it). We note that knowledge translation and science communication also suffer from unclear pathways.

The Consultation Draft states that *Our level of business investment into research by higher education institutions is also low compared to the OECD, although this is offset to a certain extent by our business investment into government research (through CRIs) being higher than many other countries; which is partially a factor of our unique CRI model*. The Consultation Draft then states that enabling stronger connections is likely to make the greatest difference to the performance of the RSI system. However, it is silent on how the CRI system might be supported to retain or grow the benefits it provides through existing and new connections and links. We consider that further thought could be given to expanding on this in the RSI Strategy and we stand ready to offer thinking into this process, along with other CRIs and Science NZ.

One example of very high-value and dynamic connections being made and where organisations have worked together to achieve significant new benefit and value for New Zealand is in ocean research. Through International Ocean Discovery Programme (IODP) membership, the New Zealand Earth Science community has been able to access infrastructure, research collaborations of high-value, international knowledge frontiers and new capabilities, while in return using our own leadership to drive international science in this area.

GNS endorses the Resilience Challenge submission that *connectivity is at the core of the operating principles for the National Science Challenges - in terms of connections across science disciplines (nationally and internationally), across institutions, with key partners such as Māori, and with other research users. We are encouraged by the recognition given in the strategy to this issue as it reinforces the value and benefit of the NSC model for enabling greater effectiveness and impact from the wider NZ RSI system. We note however that the system sends some mixed messages – with highly competitive research allocation processes (e.g. Marsden and Endeavour) sitting uneasily alongside the collaborative and negotiated mechanisms (such as the NSCs)*.

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?
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?
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?
Question 14:	Do you agree that excellence is strengthened by stronger connections?

As a world-leading research institution, GNS Science is clear that excellence can and does occur along the full value chain. If the national investment focuses only on traditional peer reviewed metrics, we run the risk of losing important value from earlier and current investments along the wider value chain.

We strongly support investment along the value chain, including applied research, knowledge brokering and science engagement and communication. As discussed in earlier sections of this submission, these activities are critical to delivering impact, value to New Zealnd, and to ensuring optimal uptake from the country's science spend.

We support the Science NZ submission that we are concerned that the benefits from science flagged as important in the Consultation Draft, particularly for business and Māori, will not be achieved if the communication, transfer and application of knowledge is inadequately funded. There is also a growing need for funding which bridges the gap between fundamental research and the applied research that users are expected to invest in (see earlier comments on market failure, and 12 month limits to science investment from a number of key public sector end-users).

GNS supports the RNC submissions statement that *the characteristics of excellence outlined in the RSI Strategy (People, Global outlook, Partnership) are well aligned with the principles of excellence that underpin the National Science Challenge model. We endorse the notion that stronger connections support strengthened excellence*.

Guiding Policy – Impact

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

GNS supports the focus that the RSI Strategy places on impact and welcomes MBIE's recently published position paper on The Impact of Research, which establishing principles and approaches to measuring the impact of research.

We also strongly support the Science NZ submission that states the premise that research, science and innovation will (and must) play an increasing and central role in delivering a productive, sustainable and inclusive future for New Zealand.

As signaled in the Science NZ submission, the Consultation Draft would appear to signal that Vote Research Science and Innovation may, in future, predominantly fund the generation of new knowledge and leave the application of existing knowledge to other portfolios.

If so, this would be a major shift in New Zealand RSI funding policy. As with other CRIs, we are potentially concerned that such a shift would:

- **leave a significant gap in funding along the science value chain** (ie. reduce science impact), particularly where Crown Votes have no 'headroom' for science investment (and cannot generate this given the way Vote budgets are set).
- **reinforce the current limitations of annual Crown Vote budget-setting cycle**, whereby even if Vote headroom exists, it is most typically limited to less-than-12-month (departmental Vote) investment under RfP arrangements due to inability to contract beyond budget lifecycles. A potential solution would be non-departmental allocations which may enable longer-term science investment. An important concept here is that public-good research to inform public policy and regulation is often quite fundamental - and can typically 9-13 years from initiation to effective impact.
- **take some time to fill the gap** (as proof of impact requires application of knowledge as well as its generation).

GNS endorses the KiwiNet submission that seeks better articulation in the Strategy of the role that research commercialisation in delivering impact from publicly funded research.

We endorse the span of expected benefits of doing so:

- Help the broader RSI community to understand and value commercialisation, how it works and how it delivers impact so that they can engage effectively
- Enhance participation of the research community with commercialisation
- Distinguish different impact pathways that are typically available in broad terms such as publication, commercialisation, contract research, engagement with policymakers etc.
- Make it clear to the RSI community that commercialisation brings new innovations into the world that provide solutions to national and global challenges, including those that will aid our transition to a clean, green, carbon-neutral New Zealand.

GNS also endorses the Science NZ submission that the proposed approach to IP arising from publicly-funded research appears to be "one-size fits all." Our experience as science enterprises well-connected with private and public sector end and next-users of science research, is that there are many different pathways to implementation of the research, including but not limited to IP commercialisation. A one-size fits all pathway will likely lead to unintended consequences. It also seems to run a little counter to the MBIE Impact

Framework issued recently. We therefore support the current case-by-case evaluation, supported more effectively by guidance, greater system-coordination, and more consistent approaches/investments/signals across the wider R, S & I ecosystem.

The recent release by MBIE of its Impact paper is timely and useful. The paper provides insight into how MBIE views that guiding principle of the strategy and will improve the ability of research to realise benefits to New Zealand. The CRIs have been working with MBIE for some time on a framework to plan for, measure and recognise impact through the iPEN project and we look forward to continuing this work.

Guiding Policy – Connections

Question 16:	Where do you think weak connections currently exist, and what are the barriers to connections at present?
Question 17:	What actions will stimulate more connectivity between parts of the RSI system?
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?

We support the introduction of Connections as the third guiding principle. Research connections and collaborations are vital to support excellence and connections with industry, policy, Māori and the wider community are important to achieve impact.

The Consultation Draft recognises the importance of international connections for New Zealand's small and relatively geographically isolated research system. We agree that international research investments should be made at scale. The final document should broaden the range of international partners listed. We hope to also see a broader range of initiatives connecting New Zealand with global leaders in their research fields as well as with researchers who happen to be close by.

GNS would like to endorse Connectivity across the ecosystem as a priority to get best value out of wider ecosystem investment (beyond MBIE). At present, it's difficult to pinpoint why the system is experienced as fragmented or divided depending on whether the primary value-chain is private- or public- or sector-facing.

GNS supports the Science NZ submission comment that the Consultation Draft (in our view erroneously) effectively 'disconnects' the purpose and role of MBIE-stewarded research funding from that funded by other government agencies. While other agencies have been increasing their own funding for some types of research, many have not been able to do so. We consider that such a shift will leave a significant gap in funding for some research areas most likely to have impact. MBIE has, outside this Strategy development process, acknowledged the gap and that it needs to be bridged. CRIs are concerned that there will likely be a loss of capability even if arising only from uncertainty while the funds are found.

In the context of connection across the NZ R, S & I ecosystem, and across the science value chain, GNS feels it appropriate to endorse in this section the Science NZ submission comment as follows:

The split between 'frontier' and 'behind frontier' appears relatively arbitrary and has the potential to undermine two of the three guiding principles of the strategy, *Impact* and

Connections. GNS supports other CRIs in recommending the following:

- Solving problems in the economic, social and environmental sectors very often involves application of existing knowledge or a mix of existing and new knowledge. So, not funding 'behind the frontier' research will likely lower potential impact.
- Industry, Māori, and policy end-users of research are typically working to tight timeframes and want solutions that can be applied quickly, particularly in the early stages of a relationship. This usually requires application of existing knowledge. So, such groups will be less likely to work with frontier researchers which appear to be MBIEs priority.
- Innovation at the frontier that will extend the boundaries of what we are capable of doing requires research of all types. It is about generating new knowledge, applying existing knowledge, and adopting and adapting knowledge from offshore to new areas.
- Applied research attracts more private sector investment, creates stronger connections between researchers, end users and Maori, and is more likely to have impact in the short to medium term compared to fundamental research. The difference, if any, between applied research and innovation behind the frontier (using existing knowledge to improve the way we do things) is not clear in the Consultation Draft.

Page 18 addresses researching and innovating towards the frontier. The first paragraph states that *the focus of this strategy is on innovation at the leading edge of what the world knows and can do – i.e. the 'frontier' of knowledge and its application. (*We underline the conjunction 'and' to endorse and highlight the significance of both these attributes).

The paper then goes on to to indicate four areas in which, for New Zealand, this is most likely to happen:

- *solving problems that nobody else in the world has solved, such as how to reduce agricultural emissions,*
- *capitalising on new opportunities where nobody else is yet successful, such as civil use of space*
- *making the most of our unique opportunities, such as our unique geology, biodiversity, and our heritage of Mātauranga Māori,*
- *investigating areas where New Zealand is the only country likely to do so, such as questions arising from our unique population and greenhouse gas profile.*

We agree that these are useful broad descriptors in helping define where New Zealand places its R, S & I resources to benefit New Zealand. We recommend that the final document should emphasise that the four descriptors are not mutually exclusive, and that each will necessarily require a mix of new knowledge and the application of existing knowledge.

GNS would also like to endorse the submission of KiwiNet, which signals that early-stage commercialisation of publicly-funded research in New Zealand can be viewed as highly desirable cross-system connectivity, impact-led activity, and which itself constitutes *Innovation at the Frontier*.

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

See earlier sections of this submission.

The heading "Making NZ a Magnet for Talent" leaves the impression that talent should be imported. We suggest that this element of the Strategy be reworded to make it clear that we want to develop, support and retain research and entrepreneurial talent within New Zealand as well as attracting talent from overseas. Both are going to be needed to ensure a thriving, successful and ultimately effective R, S & I ecosystem here.

The capacity to recruit, train and retain research specialists underlies every research area. GNS Science considers that the researcher "pipeline" begins with engagement of students in relevant subjects in primary and secondary schooling, and continues through university *via* training and career planning for all research specialists. New Zealand might also want to explore novel ways to plan for and develop research expertise in a way that will increase the productivity and culture of team-based working of the research workforce, as well as its excellence. In addition, we support investment in future/'now-generation' capabilities such as data science, sensing technologies, nanotechnology, interdisciplinary or 'boundary' expertises, among others.

In support of the need to the systematically address capability pipeline in the RSI system, we also endorse the RNC submission that *career stability and bridging the current gap between PhD and post-doctoral levels within New Zealand are essential and long overdue:*

At present, large investments in capability being made at the PhD level are at risk of being lost from the system due to the limited support for post-doctorates in New Zealand. We encourage the consideration of enhanced investment in a broad based post-doctoral fellowship scheme to support retention and attraction of research talent.

Actions – Connecting Research and Innovation

Question 23:	What elements will initiatives to strengthen connections between participants in the RSI system need to be successful?
Question 24:	What elements will initiatives to strengthen connections between participants in the RSI system and users of innovation need to be successful?
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?
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?

See earlier sections of this submission.

GNS would like to offer further comment on the potential to strengthen realisation of impact from publicly funded research:

1. Pathways to impact require significant resourcing to achieve, of which there is limited funding in the innovation ecosystem to support these activities.
    a. Commercialisation of research organisation IP can access Pre-seed accelerator funding. However, this only captures a small portion of potentially commercialisable IP due to the resource limitations within the research organisations required to support additional deal flow to the ecosystem (such as technology incubators)
    b. Industry investing in R&D can access Callaghan Innovation support and the R&D tax credit.
    c. Other routes, such as enabling public decision making, working with iwi, influencing govt policy or regulation, or out reach do not have sustained funding avenues and therefore often the impacts are not realised.
2. We recommend more sophisticated approaches to recognising that IP management is complex, and a regulatory systems approach is not going to increase the impact of our research. Rather, a set of guidance and principles would likely aid greater understanding and behaviour-change.

Actions – Start-up

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

Improving start-up potential is linked to growing entrepreneurs, and this is reliant on our values and attitudes as a nation. GNS suggests that there is not necessarily a shortage of ideas for startups, but rather a shortage of innovative entrepreneurs. We suggest an element of entrepreneurship be developed and integrated into the Strategy.

Actions – Innovating for the public good

Question 30:	How can we better support innovation for the public good?
Question 31:	What public-good opportunities should our initiatives in this area be focused on?

See earlier sections of this submission.

The relative allocation of funding across the descriptors and across the proposed areas of focus is critical to understanding the Government's strategic prioritisation, and the role of the MBIE-stewarded funding and research funding expected from other Crown agencies.

Given the role and purpose of CRIs as set out in statute, Cabinet-approved Statements of Core Purpose and in Shareholding Ministers-approved SCI, this goes to the heart of the mission of the CRIs. Further discussion is required as to how the suite of proposed changes are intended to better support innovation for the public good. GNS stands ready to provide input and support for this process, as the thinkng evolves.

GNS also supports the RNC submission in response to this section which we consider succinctly sums up specific elements relating to natural hazards research:

The key to supporting innovation in the public sector, and accelerating the take-up of research science into policy changes and other innovations is through development of deep partnerships and long-term relationships of trust.

We note the reference to establishing 'innovation missions' to address public good opportunities - the CRI and NSC mechanisms of collaboration and partnership are well-placed to facilitate development of such an approach to science engagement.

More specifically, we see significant opportunity for innovation in the public sector for world-leading policy development, decision-support tools and governance arrangements that take effective account of natural hazard risks and build national disaster resilience (including climate change and weather hazards). In this regard, we would like to see stronger links between this RSI Strategy and the DPMC National Disaster Resilience

Strategy (2019).

Actions – Scale up

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

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?

Note: see following page to comment on possible areas of focus

The two percent commitment and implications

GNS supports, along with other CRIs through Science NZ, the aspiration to reach 2 per cent of GDP being invested in R&D. This is a minimum if science is to deliver the transformational changes needed to ensure a more productive and sustainable New Zealand into the future.

While the 2 per cent target represents a considerable increase in funding, it still lags the OECD average. The Strategy should also be clearer on, and separate out, the figures for expenditure on, funding for, and support of, R&D.

In addition, the Strategy will need to be clearer on the associated challenges of the commitment to the significant increase in R&D spending. The most critical and the point of constraint is the number of skilled R&D people. Considerable effort will be needed to develop and attract R&D personnel to meet the country's needs. The implications arising from the Consultation Draft, applied to the StatisticsNZ 2018 R&D survey, are that the Government Sector will need an additional 1,300 R&D staff, and the Business Sector more than 14,000.

The CRIs have considerable experience in R&D staff development across a broad range of areas. We are most willing to work with government, and others, to develop a strategy to increase New Zealand's talent pool.

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.
- **Renewable energy**, building on recent investments in the Advanced Energy Technology Platform.
- **Health technologies** to improve delivery of health services and explore opportunities in digital data-driven social and health research.

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

See earlier sections of this submission.

Along with other CRIs through the Science NZ submission, GNS supports the **four generic areas proposed for focus** in New Zealand's R&D efforts.

As the national Energy CRI, we also have a specific interest in the proposed renewable energy focus area, but would also recommend (as per other sections of this submission) other areas of focus where New Zealand science has global leadership such as climate change science, Antarctic and Southern Oceans science, and Vision Mātauranga.

The relative allocation of funding across the areas of focus is critical to understanding the Government's strategic prioritisation, and the role of the MBIE-stewarded funding contrasted to the research funding invested by other Crown agencies. Given the role and purpose of CRIs as set out in statute, Cabinet-approved Statements of Core Purpose and in Shareholding Ministers-approved SCI, this goes to the heart of the mission of the Crown's research institutes. Further discussion is required.

GNS also supports the RNC submission in response to this section, particularly the recommendation to include risk/resilience as a focus area:

More specifically, we see significant opportunity for innovation in the public sector for world-leading policy development, decision-support tools and governance arrangements that take effective account of natural hazard risks and build national disaster resilience (including climate change and weather hazards). In this regard, we would like to see stronger links between this RSI Strategy and the DPMC National Disaster Resilience

Strategy (2019).

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?

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

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

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

GNS strongly supports a kaupapa for redesign of the Vision Mātauranga policy that acknowledges and supports Māori as co-designers This is essential to it being effective.

We also support the approach in the Consultation Draft in relation to mātauranga Māori, and the development of new initiatives and policies to extend the reach and scope of Vision Mātauranga through close consulation and collaboration with Māori stakeholders.

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?
Question 39:	Is the CRI operating model appropriately designed to support dynamic, connected institutions and leading edge research? What changes might be made?
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?
Question 41:	What elements will initiatives in this area need to be successful?

See GNS's introductory comments to this submission for some early comment on some of the issues raised in this section.

We also support the submission by Science NZ as follows in respect of two foundational issues:

Workforce

The CRIs strongly support the importance of growing diversity and inclusion in the research workforce. CRIs identified several initiatives in their joint report-backs to Minister Woods on Maori Engagement and Workforce Planning, and how the CRIs aimed to work collaboratively to improve diversity in their scientific workforce. We look forward to working with the Ministry on the issue.

Developing, attracting and retaining top talent is an ongoing challenge, globally. So New Zealand must be a highly attractive place for highly mobile talent. A key element is supporting researchers to have the time to focus on and make progress on complex and challenging problems. This requires long term stable funding from which the new ideas that drive dynamism can be developed and the expertise to solve industry's problems in a timely fashion can be built up.

In this regard we welcome:

- *the commitment to an investment framework that encompasses a range of funding time frames;*
- *the commitment to targeted strategic funding.*

Economic vs other outcomes

The draft strategy includes commentary on several matters which we address below and suggest for clarification or review in the final strategy document or in subsequent policies.

- *Other than in the introductory sections, the draft strategy is mainly economically focussed. The final strategy should ensure in its discussion better recognition of the role of research-based innovation in solving issues in the environment and social areas. This will complement the discussion around the role of research-based innovation in the development of 'products and services' that are new to the world.*

- *New Zealand publishes more papers per dollar invested in R&D than the OECD average, and even more so than the small advanced economies. This is often celebrated as an example of 'productivity' of New Zealand's scientists. It is however, a troubling indicator in that it may signal why business in New Zealand is less willing to invest in R&D with institutes of higher education: publication has primacy over industry engagement.*

On the question of research infrastructure, GNS agrees with other submitters that national planning for science infrastructure (including Nationally Significant Databases and Collections) will be important if the best value and impact is to be achieved from national R, S & I investment in future. Similarly, we recommend that the current review process also considers, as proposed, areas of national need/priority where clear gaps exist. Nationally important memberships – such as the IODP mentioned earlier – provide evidence that a more nationally-consistent approach to priorities for connectivity, research leadership, international collaborations and infrastructure investment can deliver significant benefits to New Zealand.

Similarly, GNS supports NIWA in the case for a refreshed operating model for the RV Tangaroa, a national science asset that currently may not be utilised optimally for the benefit of New Zealand.