Science System Advisory Group Report

A pathway to the future: New Zealand's science and innovation system

April 2025

Science System
Advisory Group

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The Science System Advisory Group (SSAG) was established by the Ministry of Business, Innovation and Employment (MBIE) in March 2024 to advise the Government on strengthening the science, innovation, and technology system.

This document is the second of the panel's two reports. The first, submitted in July 2024 and released in January 2025 alongside related cabinet decisions, focused on the principles for the sector and provided preliminary advice and largely structural recommendations.

In February 2025, following relevant Cabinet decisions, the panel undertook further consultation and work to inform and complete the second report. This second report offers additional recommendations and guidance on longer-term adjustments to ensure the future success of New Zealand's science system.

In our reports, 'science' is used in the broadest context to include robust knowledge systems in accordance with the definitions used by UNESCO and the International Science Council. This view encompasses the natural, social, health, technological, and data sciences and related humanities focused on developing reliable understandings of the observable world. The term 'research' is intended to include the humanities and creative disciplines.

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Preamble

On January 23, 2025, the government announced initial changes to New Zealand’s science, innovation and technology system, as informed by the Science System Advisory Group (SSAG)’s first report. These changes include:

- The establishment of the Prime Minister’s Science, Innovation and Technology Advisory Council.
- Refocusing New Zealand’s seven existing Crown Research Institutes (CRI) into three areas: bioeconomy, earth sciences, and health and forensic science services.
- Establishment of Invest New Zealand (INZ).
- Disestablishment of Callaghan Innovation.
- A new advanced technology public research organisation.
- A decision to develop a national policy for managing intellectual property for science, innovation and technology-funded research.

The second SSAG report builds on the matters identified in the first report and takes account of the government's decisions following our initial report. It also includes extensive further consultations with the research community, the private sector, innovators, and entrepreneurs. Additional international consultation and expert input have also been sought.

The SSAG has conducted extensive consultations, with discussions and presentations across all universities and CRIs, CRI boards, vice chancellors, Callaghan Innovation, New Zealand Trade and Enterprise (NZTE), officials across multiple ministries and agencies, and a wide variety of private sector interests including small companies, large companies, high-tech companies, venture capital firms, the chairs of previous reviews into the science system, etc. and received many written submissions in two rounds. In addition, the SSAG has consulted domestically with many officials and internationally with science and innovation system experts and senior officials in Singapore, Denmark, Israel, the UK, Ireland and the OECD. The SSAG has primarily conducted its meetings virtually.

In the second phase of consultation, two messages became very clear. The first is the fragility of a chronically underfunded science system, and the second is the absence of clarity on supporting the ‘IP to IPO’ stage.

The SSAG would like to acknowledge Oren Gershtein from Identity Roads, who was engaged to provide expertise and advice on the innovation sector. This work included extensive stakeholder interviews and discussions with key stakeholders across the sector, accompanied by Hema Sridhar. The SSAG acknowledges the significant and constructive assistance and input provided by officials in the Ministry of Business, Innovation and Employment (MBIE) throughout this review.

Sir Peter Gluckman
Chair
Science System Advisory Group

Contents

Recommendations

The SSAG notes:

i. Research, science, and innovation will play an increasingly critical and essential role in developing a more productive knowledge-based economy in the national interest; however, grasping this opportunity will require further investment to optimally achieve global competitiveness.

ii. Science and technology, economic growth, security and diplomatic interests are more closely intertwined than previously, and there are many social and environmental challenges, both domestically and regionally, that cannot be ignored and where science has enormous potential to assist.

iii. Providing high-quality research, science, and innovation is necessary to ensure economic, environmental and social gains and position New Zealand well in challenging times.

iv. New Zealand's science system is fragile due to decades of relative underfunding. Government support for a potentially vibrant innovation system is inchoate and needs to be focused on enterprises with a high potential for rapid export-oriented growth.

v. Having the same minister overseeing both the science and innovation, and university sectors now enhances the opportunity for much more synergistic developments. The SSAG views this positioning as a first step toward further integration, as the first report recommends.

vi. The science and innovation system changes must be carefully managed to ensure no further loss of needed capability and to give certainty to stakeholders, including those in the private sector.

vii. Restructuring of the CRIs into Public Research Organisations (PROs) should not simply be treated as a merger of extant organisations but must be strategically driven such that existing capabilities within the current CRIs are clustered where appropriate but managed and delivered within a singular PRO.

The SSAG recommends that:

1. The government gives priority to completing the restructuring of the research, technology, and innovation system, recognising its importance to our economic and broader national interests and acknowledging that it is a core component of the government's economic growth strategy.

Specific recommendations

The SSAG consequently makes several specific recommendations related to the science system, innovation and knowledge-based economy, and the enablers that allow both to be impactful.

The science system

The SSAG notes:

i. The core roles of the Prime Minister's Science, Innovation and Technology Advisory Council (PMSITAC) are distinct from those of the Prime Minister's Chief Science Advisor (PMCSA). PMSITAC has a key role in setting national research priorities at a high level, but contestable research decisions must be made independently of political processes.

ii. A knowledge economy requires investment in discovery and downstream applied research.

iii. The importance of stewardship research in advancing New Zealand's national interests and assisting policy development. Stewardship research spans a broad range of environmental, social, and technological domains.

iv. In areas involving multiple governmental stakeholders acting over time, the value of research road maps would allow a more coherent and strategic approach. It would be a valuable addition to priority-setting processes in the national interest.

v. The government is the largest user of publicly funded research, and there are several ways to improve its purchase and use.

vi. The deficits in the government's needs in science and innovation for foresight and technology assessment suggest that addressing these gaps should become a priority.

vii. Artificial Intelligence (AI) will significantly impact how governments collect, analyse, and use data, and issues in capacity, capability, oversight, and social license need to be addressed in a joined-up way across the whole government.

The SSAG recommends:

2. ***The science advisory system, comprising the Prime Minister's Chief Scientific Advisor and departmental science advisors, is sustained and reinforced with standard conditions of appointment for the latter.***
3. ***The Marsden Fund, the Endeavour Fund, the Catalyst Fund, the Health Research Council (HRC), and other contestable or allocative Crown funds (including components of the Strategic Science Investment Fund (SSIF)) are merged into a single National Research Council (NRC). The NRC assumes the role of balancing different types of research investment to allocate available funding across individuals and research programmes.***
4. ***The component of the SSIF other than the core support of PROs is administered via the NRC.***
5. ***Evaluation of funding requests be based on excellence and potential impact. It should also always consider why the research should be conducted in New Zealand and why public money should fund it.***
6. ***The NRC be organised around distinct pillars, including one to support research in the social sciences and humanities and another to support activities with a mātauranga Māori focus or where the specific matters of interest directly focus on Māori.***
7. ***The NRC provide procurement services on behalf of government agencies when requested to do so, provided the agencies agree to fund it.***
8. ***The system promotes open science, including research undertaken by government agencies, acknowledging the realities of security and commercial interests.***
9. ***The future science system ensures that early-career researchers have sustainable opportunities, that careers are available in both the public and private sectors, and that opportunities for rotation between these sectors are supported.***
10. ***A coordinated and integrated approach to providing expensive research infrastructure.***

The innovation and knowledge-based economy

The SSAG notes:

i. An innovation economy requires a set of processes by which the risk taken by the private sector grows as the innovation matures, but in the earliest stages, the Crown must take the dominant risk.

ii. Several steps are involved in managing the inherent market failure and risk that occurs between Intellectual Property (IP) filing and commercial exit. This stepped structure requires integrated resourcing and expert entrepreneurial management. Following international best practices, a single agency that meets the broader needs between IP development and commercial exit is best suited to address this need, thereby facilitating development in advanced technologies.

The SSAG recommends:

11. ***The technology transfer organisations (TTOs) adopt the UniServices model, which shares characteristics with the 'Waterloo model', including entrepreneurial education and support, an investment-driven approach, and control and ownership vested in the inventors. Universities and PROs may need to work together to develop scale and expertise.***
12. ***Establishing the New Zealand Innovation and Advanced Technology Agency (NZIATA) as a PRO that will meet the broader needs between IP development and commercial exit, thereby facilitating the development of innovations with high growth potential, especially in areas involving advanced technologies.***
13. ***The NZIATA focus only on emergent enterprises with high growth and export-focused potential.***
14. ***The NZIATA should not undertake research or service provision itself but ensure an expert-led, holistic, and integrated range of services to address the market failures inherent in the early commercialisation of knowledge and ensure that the necessary advanced technology capacities exist.***
15. ***The NZIATA should encompass several current functions in the IP to Initial Public Offering (IPO) phase, including overseeing the technology incubators and R&D support mechanisms. NZIATA should have a close relationship with New Zealand Capital Growth Partners (NZCGP). It should have a managerial and strategic liaison with Invest NZ to assist in the essential attraction of multinational corporations and foreign investment to undertake R&D in New Zealand and to invest in New Zealand's innovation sector.***
16. ***The NZIATA operate through a 'hub and spoke' model. The hub would provide IP to IPO support for high-growth, high-potential innovation and fund strategic research capabilities in public and private entities across New Zealand. The spokes would provide the research and development activities through contractual arrangements with the hub.***
17. ***The NZIATA has a core role in ensuring access to large-scale technologies and facilities in areas such as supercomputing, quantum and the advanced life sciences.***
18. ***Where appropriate, industry support grants should be replaced with contingent loans, repayable by royalty on success and forgiven on failure.***

System enablers

The SSAG notes that:

i. The future economic growth of any country will depend on its capacity for a range of advanced technologies. In many of these, New Zealand is falling behind, and in some cases, it will not have the necessary capacity on its own.

ii. New Zealand is a small country and needs strategically developed partnerships to grow its knowledge and technology capabilities. Such development includes investing more in strategically planned international science and technology partnerships and promoting and leveraging science diplomacy.

iii. New Zealand is largely absent from international science policy meetings affecting areas of direct interest.

iv. Science and innovation rely on multiple forms of infrastructure, but most of all, the human infrastructure is key.

v. Efforts must be increased to enhance the quality of school science education.

vi. New Zealand must attract entrepreneurs and investors to support its development. Successfully developing the innovation pipeline will require competencies that are not widely available in New Zealand.

vii. Changes to the foreign investment fund (FIF) regime and the Overseas Investment Act (OIA) would be essential to attract talent.

viii. There is potential for more rationalisation to achieve better utilisation and coordination of large-scale research equipment, much of which cannot meet a formal business case in economic terms when purchased.

ix. The potential exists for campus consolidation across universities and the PRO sector over time.

The SSAG recommends:

19. Research undertaken for, or by, central or local government should be proactively in the public domain, unless national interests require confidentiality to be maintained.

20. Expert anticipatory foresight and technology assessment processes are needed to serve both PMSITAC and NZIATA.

21. Using science envoys to advance our interests and partnerships.

22. Future ministerial and prime ministerial missions are planned with scientific input.

23. All parties, including universities, PROs, NRC, and PMSITAC, must give greater attention to the critical need to train, sustain, and retain the workforce needed in science and innovation systems.

24. Greater attention should be paid to achieving social license for applying big data approaches and AI on government-controlled data, including the Integrated Data Infrastructure (IDI), which needs distinct support and oversight to ensure the public's confidence.

25. Government procurement practices are reviewed to enhance opportunities to increase commercial science and innovation capability.

26. Establish a Research Infrastructure Advisory Committee (RIAC) comprising key stakeholders to advise the government on purchase needs and ownership arrangements. This committee must include representation from NRC, NZIATA, and New Zealand University Council (NZUC) (as recommended by the UAG).

27. RIAC works with PROs, universities, and the private sector to develop mechanisms for ensuring public and private sector access to high-cost underutilised research equipment.

28. The PROs and universities seek to consolidate co-located activity with joint appointments and joint programmes, develop novel governance arrangements, and encourage the co-location of private sector activity.

Executive summary

1. This second SSAG report should be read in conjunction with the first SSAG report, as it expands and clarifies certain topics from the first SSAG report, taking account of the government's decisions since the release of the first report and considers further deliberations and consultations by the SSAG. This second report uses the same taxonomy as the first report, particularly for the research categories.
2. This second report elaborates on several issues identified in the first SSAG report, specifically regarding the government's use of science, the role of science advice, the need for a more effective international strategy, and more details regarding establishing the NRC. It addresses the significant gap that exists in converting scientific and technological developments into economic benefits.
3. The remainder of this report will, therefore, be presented in several distinct sections as follows:
    a. Commentary on the Government's response to the SSAG's first report
    b. The science system
    c. The government's use of science
    d. The innovation and knowledge-based economy
    e. Essential enablers
4. This report's primary focus is to ensure that New Zealand gets the full social and economic benefit of its actual and potential capacities in research and innovation across both the public and private spheres.
5. In this rapidly advancing technological age, economic growth, security, knowledge and influence are all linked. As the country seeks foreign investment, the importance of our reputation as an advanced technological country will matter to investors. Innovation investment is very distinct from infrastructure investment. In the first SSAG report, we used the metaphor of building a hydroelectric dam to generate power. The reality of that metaphor is clear – there is a need to develop the whole system from knowledge generation to application by the end-user and long-term gains are not possible if there is insufficient investment in the upstream components.[1]
6. The consequences of New Zealand's long-standing public underinvestment in research and development (R&D), which has flow-on effects on the economy, society, and the environment, are now very clear. The lack of adequate investment in science, innovation and technology (SI&T) has played a significant role in our sluggish productivity and declining position relative to other small, advanced countries.
7. The issues are now urgent as rapidly emerging technologies such as artificial intelligence, quantum computing, and progress in life sciences-related technologies are placing New Zealand at greater risk of no longer being credible as an advanced economy, with multiple consequences to our future.
8. No single challenge exists in any sector of our society and economy where science could not assist further.

1 In the first SSAG report, we used the metaphor of building a hydroelectric dam to generate power. To be effective, it needs water in the river and transmission lines to the user, not just the dam. Metaphorically, discovery science is the water, technology transfer is the equivalent of the turbines, and the innovation pathway of seed funds, incubators, and co-investment is the power lines; the private sector, government, and the public are the consumers.

9. A core theme of the first SSAG report was to highlight that while it is understandable that there is a strong focus on science to drive economic growth (noting that it is one of the current government's five economic goals), it is equally essential to recognise that science is also critical to our social and environmental development and the effective development of public policy. Environmental and applied social sciences are essential to the stewardship responsibilities of government and policy-making. They are crucial in translating technology into value, along with the creative sciences and the humanities. Human factors play a significant role in determining the success of technologies introduced into the marketplace.

10. It is essential to appreciate the importance of public investment in science in its core roles in assisting central and local governments with their stewardship responsibilities, supporting policy development, and providing the essential fuel for new knowledge and innovation.

11. A wealth of academic and economic analysis demonstrates the critical role of discovery science in fuelling economic growth. Yet, policymakers across the political spectrum have not adequately addressed this evidence over successive decades. The consequences of that neglect are becoming increasingly apparent. However, the initial responses to the first SSAG report might suggest that the tide may soon turn. While the focus of the two SSAG reports must be on structural reform, it must not be seen in isolation from the need for adequate investment in the SI&T sector and the university sector.

12. The New Zealand science system is particularly fragile, and continued fragility will compromise the nation's future as an advanced economy and society.

13. We recommend integrating an overlapping set of Crown funding agencies into a single entity, the NRC. This amalgamated body would encompass components of the SSIF, the Endeavour Fund, the Marsden Council and the Health Research Council (HRC), plus other contestable elements such as the Catalyst fund.

14. Prioritisation within public funding of the science system involves complex trade-offs between individuals, projects, and mission-led approaches. At the highest level, PMSITAC has a role in helping the government balance research investments. The NRC is where actual funding decisions between different approaches must be made, and there must be a well-maintained balance between discovery, applied, and developmental research.

15. The Crown is arguably the biggest science user across every ministry. Many ministries also fund significant amounts of research both within their own agencies and by contract. This report discusses at length how the value and use of this type of research might be strengthened.

16. The importance of stewardship research and research to support policy development cannot be underestimated. Much of this activity requires environmental and social science, and government agencies, either directly or indirectly via the PROs and universities, undertake much of it.

17. All research funded by the Crown should meet the test of "Why should it be done in New Zealand and be funded by public money?" There are many ways of answering such tests, whether it is for blue skies research or very applied research, in the humanities or in deep technology.

18. In a world where big data and AI will play a greater role in government decisions, business and civil society, New Zealand needs to build on its investment to date in the integrated data infrastructure (IDI) and reinforce its capacities. However, the public needs to be assured that their data is being appropriately curated. There is a need to achieve greater social license and provide confidence-building oversight over the government's use of big data and AI.

19. The importance of robust science advisory processes to government agencies cannot be underestimated. The role of the science advisory system is distinct from that of developing policies for science and innovation. In that regard, PMSITAC has a different function from that of the Prime Minister's chief science advisor (PMCSA) and departmental science advisors: roles that must be regularised and strengthened. The advisory system has a key role in assisting departments in deciding on their own research needs and incorporating the results into policy formation.

20. New Zealand is a small country, and in terms of R&D, it is naive to think we can achieve the promise of and gain from, research and development in isolation. Yet New Zealand has not appropriately used science in its international relationships. It needs to enhance its efforts, and the SSAG makes specific recommendations to achieve this end. New Zealand will need extended international partnerships in areas of advanced technologies. In turn, a greater international profile will help attract international investment to New Zealand.

21. In economic terms, so-called market failure provides the intervention logic for why governments must invest adequately in research and its application. Indeed, the investment needed in public-good-focused stewardship research and monitoring and related services is the primary justification for PROs globally. This rationale has also been true for New Zealand, at least historically. It would be unfortunate if this core function were submerged in narrow commercial expectations on the PROs. For example, environmental research is critical not only for public good but also to assist export industries in a warming world.

22. The PROs also serve industry sectors through precompetitive research, which can later lead to commercial exploitation, and in direct industry partnerships, but in doing so must not displace private sector investment.

23. Inherent market failure is the primary reason governments must support translating research from early concept to full commercialisation. Every country supports this process. Much of this report focuses on the reality that the private sector will not invest until the level of risk is reduced. This transition is not abrupt but rather a gradual shift from the need for governmental support to private sector involvement.

24. There are challenges and issues in converting knowledge into applications for private good, and the translational processes require sophisticated mechanisms that are well-linked and as frictionless as possible. The first SSAG report identified and addressed many of these issues. In this second report, we pay great attention to the phase between intellectual property (IP) and initial public offering (IPO), recognising that inherent market failure occurs and that the Crown must also share risk with the private sector. We make several recommendations to enhance the system, address technology transfer and discuss the need to build an integrated system to support the IP to IPO phase for high-potential innovation, particularly those that involve advanced technologies, irrespective of where they originate.

25. This IP to IPO phase is complex and requires sophisticated professional leadership and expertise, as well as a variety of tools in the toolbox. It varies by type of invention and has undergone significant changes due to advancements in deep and advanced technologies in both the digital and life sciences. This recognition has led to an evolution of our thinking, as reflected in this report, to accelerate New Zealand's ability to be globally competitive in the technological age. Given its importance, we expand on this phase at length, yet it remains poorly understood.

26. The government's response to our first report included further consideration of technology transfer, and we have addressed this with identification of a suitable approach and further detail. We recommend that the University of Auckland's UniServices model be used as a template.

27. The first SSAG report recommended two organisations: one focused on the IP to IPO phase, which we termed Enterprise New Zealand (ENZ) and one focused on advanced technology (FTI). Further consideration, consultation with officials and experts, and reflection have led us to the recognition that these two functions can be combined into what we now term the NZIATA.

28. The NZIATA will combine a hub facilitating entrepreneurial innovation and ensuring advanced technology capabilities with research-intensive spokes delivered through other entities. The hub's role is not to undertake primary research but to support the high-growth IP to IPO phase, coordinate and facilitate. The hub will coordinate and fund the spokes.

29. The lessons from Callaghan Innovation and offshore highlight the need to separate services and empirical research activities from strategic considerations. The actual research should occur in universities, other PROs, and the private sector, often under syndicated mechanisms similar to those used previously, especially in the National Science Challenges (NSCs) and Centres of Research Excellence (CoREs).

30. NZIATA cannot meet its promise without significant investment. The available support for IP to IPO activities is inadequate, and significant gaps must be filled to develop both the hub and effectively support the spokes. Highly skilled scientists, technologists, and innovation leaders will need to be recruited.

31. The SSAG cannot overstate the urgency of New Zealand's commitment to strategically considering its future in a world increasingly shaped by science, technology and innovation. The current levels of investment will not serve New Zealand well.

32. It is essential that the science and innovation system is inclusive and beneficial to the diverse fabric of New Zealand society. Māori have a particular relationship with the Crown. The SSAG acknowledges this when making its recommendations, noting that the recommended institutions would need to comply with the government's policies regarding the Te Tiriti o Waitangi/Treaty of Waitangi.

33. Key enablers of an effective science and innovation system include a greater focus on science diplomacy and the use of science in developing strategic regional and global partnerships. New Zealand continues to be largely outside important discussions where science and innovation will affect our future.

34. In these troubling and rapidly changing times, security interests in financial systems, domestic security and defence will be increasingly dependent on access to rapidly emerging AI and quantum technologies as well as space and other deep-tech technologies. The concept of dual-use technologies is now much more complex and expanded. We cannot overlook these dimensions as we explore how New Zealand must respond more promptly to the evolving technology landscape.

35. Science and innovation are ultimately human endeavours, and far greater attention must be given to the training of scientists and entrepreneurs, and their retention within the New Zealand ecosystem. The state of the human infrastructure in the public science domain is fragile. We will need to recruit from offshore, particularly in areas of high need and potential, such as in the advanced technologies, innovation and entrepreneurial investment domains. Both the FIF and overseas investment regimes need to be reviewed as they inhibit the recruitment and engagement of the skills and investment needed.

36. A Research Infrastructure Advisory Committee (RIAC) is suggested to identify and ensure coordinated investment and access to key infrastructure.

37. The ministerial rearrangement that places universities, research and innovation under a single minister is welcomed. It offers opportunities for greater integration and synergistic activity in the national interest in the future, which would become even more effective under a single ministry.
38. Our recommendations and commentary create a human and organisational infrastructure for the nation's science and innovation system, which, with investment, could position New Zealand in a better place and drive economic growth.

Commentary on the government's response to the first SSAG report

39. Informed by the SSAG's first report, the government announced significant changes to New Zealand's science, innovation and technology system in January 2025. The SSAG makes the following comments in response to the proposed changes.

40. Establishing PMSITAC will be a significant step forward, provided the membership is not driven by politics but by the need for effective strategic advice linked to the highest levels of decision-making related to science, technology and innovation. Membership will be key to its success.

41. PMSITAC cannot replace the role of the Prime Minister's Chief Science Advisor and Departmental Science Advisors. This report focuses on the need for scientific advice to support policy formation, while PMSITAC's key role is to provide advice to Ministers on actions and policies to advance science, technology, and innovation.

42. The first SSAG report highlighted the desirability of bringing universities, research and innovation under a single ministry. The move to bring these two groups of activity under a single minister, albeit still in separate agencies, is a first step along such a path, and will ultimately pay significant dividends.

43. Much of this second report relates to matters not yet addressed, as they depended on the second phase of the SSAG's work. However, the decisions already made have influenced our current considerations. We highlight the following points:

    a. Firstly, while the government has accepted our recommendation to reform the CRIs, the two larger PROs (bioeconomy, earth science) formed by the amalgamation of extant CRIs must be defined by function and capability rather than simply by merger without reorganisation of activities from the current CRIs. Many activities in the affected CRIs[2] could fit into either cluster, meaning that unless there is a willingness to transfer activities from one parent PRO to the other cluster, we will end up with the exact duplication, inefficiency, inflexibility and failure to integrate capabilities that we identified as being the primary problem in the current situation.[3] We advised separately on how the transition should be strategically considered. Cross-representation on each of the two PRO boards would significantly assist, which we suggest is essential given the speed of transition. The goal must be to create capability groups that align with one of the PROs, rather than spreading them across multiple ones. This re-alignment requires careful evaluation of what is functions are needed in the New Zealand public research system – we emphasise that much of what PROs should undertake fits in the class of stewardship research, be it in environmental sciences, the science of land use, water quality, or that of natural hazards and biosecurity research.

    b. Secondly, the scientific system is currently weak due to chronic underinvestment, both in absolute and relative terms, over the past decades. Consequently, the transition must be carefully planned so that further essential capacities and capabilities are not lost. The low priority given to science by past administrations and the poor state of school science education underscore the critical importance of workforce considerations.

2 ESR is not affected directly by the mergers proposed for the other CRIs.

3 Where some environmental science sits exemplify the problem: a simple merger will leave environmental science in a divided state.

c. Thirdly, the announcements to date have not considered the key IP to IPO phase, an area where Callaghan Innovation has had some responsibility. Given the government's decisions regarding Callaghan Innovation and Invest NZ and its reporting lines as well as the need to avoid multiple entities, we have further considered the related issues of the IP to IPO phase and advanced technology. In the first report, we had proposed Enterprise NZ (ENZ) as a separate entity as well as a Future Technology Initiative (FTI) and had seen Innovation NZ (INZ) serving to attract multinational corporations (MNCs) and foreign investment into the New Zealand innovation sector. Provided the proposed advanced technology PRO operates with a hub and spoke model, with the hub acting as a facilitator and the spokes operating as the science and innovation providers, it is possible and indeed desirable to envisage a consolidated entity that delivers these functions that could operate more effectively and with less risk of duplication. Thus, we now recommend what we term the NZIATA. This structure must be urgently resolved for practical reasons associated with the announced closure of Callaghan Innovation and to give confidence and certainty to the entrepreneurial and innovation sectors.[4]

d. Fourthly, we applaud the Government's commitment to a more effective TTO system. In this report, we identify how one institution in New Zealand, the University of Auckland's UniServices Ltd, has already developed a system that meets the government's goals and could serve as an exemplar for others.

4 Several functions formerly with Callaghan would move to NZIATA, others to the PROs, and some potentially to the academic or private sector.

The New Zealand science system

44. Every economically healthy, small, advanced economy has invested significantly more heavily in research over many years compared to New Zealand. The first SSAG report highlights the sad reality that New Zealand's exceptionalism has caused an increasingly damaging self-inflicted wound, with one of the very lowest investment rates in science and innovation of all advanced nations and significantly below that of nations to which we would want to be compared. As a result, over the last thirty years, our productivity has fallen increasingly behind that of comparator countries, as shown in figure 1 below.

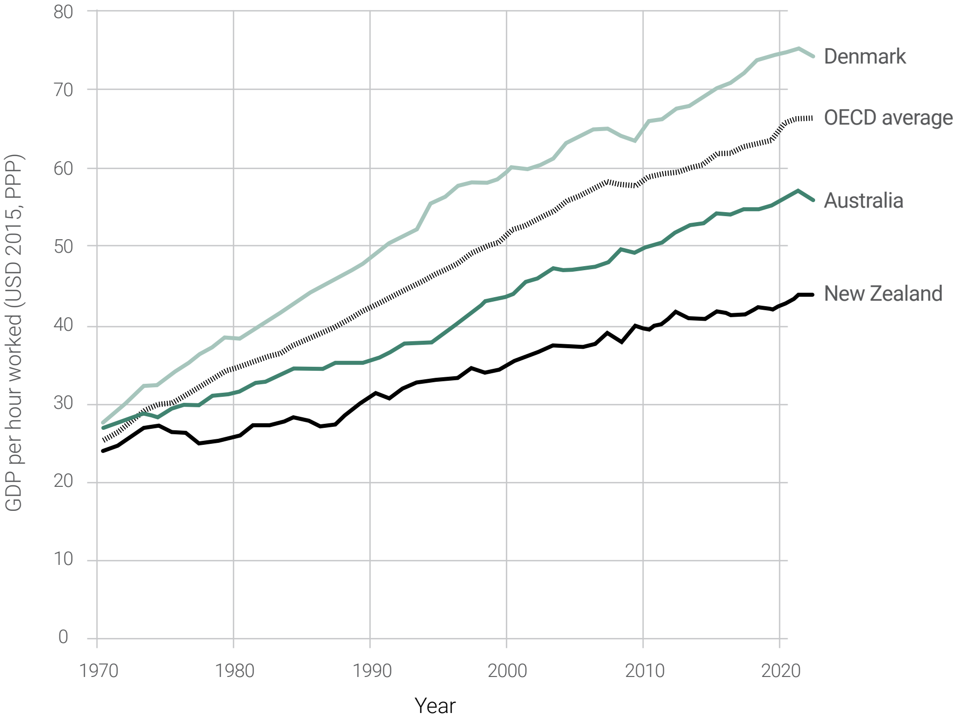

Figure 1: GDP per hour worked (Source: OECD, Auckland Council Chief Economic Unit).

45. The first SSAG report analysed New Zealand's investment in R&D relative to other comparable countries. While much is made of the percentage of gross domestic product (GDP) as a comparator figure, we primarily focused on the dollar investment per capita, as national GDP vary enormously. But either way it was analysed, investment in R&D is as low now as it has been for many years. Most European democracies and the Eastern 'tiger economies' have set GDP targets of about 3% research intensity, 1% from governmental sources and 2% from the private sector. The two are closely linked and, as shown in our first report, it requires government investment to reach a certain level before private sector investment starts responding disproportionately. The 2024 Statistics New Zealand Research and Development Survey data[5] suggests that the Crown spends 0.57% of GDP on R&D and the private sector spends 0.97% of GDP, for an overall research intensity of 1.54% of GDP.[6]

46. Private-sector-focused research is critically important, but, as we made clear in the first report, so are the other research classes. It would be naive and counterproductive to our national interest not to consider all four classes as critical (see box 1).

5 Stats NZ. (2025). Research and development survey: 2024. Retrieved from https://www.stats.govt.nz/information-releases/research-and-development-survey-2024/

6 Interpreting these levels is complex given how different countries treat tax incentives, how higher education is supported etc.

Box 1: Four categories of research

Stewardship research describes the research necessary for a government to ensure its basic stewardship obligations. It includes:

- Basic data and research must be collected and processed, often over the long term, to protect New Zealand's core human, social, economic, and environmental assets.
- Provides the backbone services or critical information needed by all well-functioning, modern economies to operate, enabling an economy or general society to function.
- Underpins government decision-making.
- It is a critical investment to ensure the resilience of nature, communities, infrastructure and the economy.
- Classified as 'public-good research', its results are often widely available.
- Anticipating the future and addressing, where possible, identified stresses and shocks.
- Does not offer immediate or significant commercial value.
- The government must support such research, primarily through a non-contestable fund.

Policy-focused research is needed or desirable to meet the central and local government's needs to make informed policy decisions. It includes:

- Evidence-informed decision-making is needed to enable the government to be clear about why and where it is spending money.
- Operational research that a government should undertake through its agencies to improve the efficiency and effectiveness of its agencies.
- High-quality data-informed research informed where appropriate by policy trials and the use of implementation and evaluation science.
- A clear understanding of the need for the research, the questions that need answering, and ensuring a methodology and analysis appropriate for that.
- Discovery and implementation research directly related to policy priorities
- Funding is generally a mix of in-house and externally commissioned research.

Knowledge-generating research is a class in which the primary driver is to produce new knowledge. It has a number of characteristics.

- It is primarily driven at its earlier stages by curiosity.
- It overlaps and has a fuzzy boundary with the other three types of research and is a common thread across the whole research and innovation system.
- It often unexpectedly spills over to become highly impactful through its public utility or seeding the commercialisation path.
- It has multiple purposes, from an improved understanding of some aspect of our world to explaining how this knowledge can be applied in a particular context.
- It generates a flow of innovative ideas that can be exploited by end users, whether the community, government or, particularly, the private sector.
- New Zealand has several funding mechanisms, notably the Marsden Fund, the Endeavour Fund, the Health Research Council, CoRE, SSIF and PBRF.

Exploitable research describes research that is directly pertinent to commercial interests and often involves the application of results. It is:

- Characterised by being 'closer to market'.
- Relies on the novelty inherent in research discoveries.
- The role of government is not passive - some degree of risk-sharing is appropriate.
- New Zealand has used a mix of agency support (e.g. NZTE, Callaghan Innovation, NZGCP, seed funds), grants and tax incentives to support this type of activity.

47. Stewardship research, research to advance public policy, and knowledge-generating research all need significant investment. It has been repeatedly demonstrated that discovery research is the wellspring of future innovation.[7] Indeed, it is well established that much innovation arises unexpectedly from discovery research.[8] The UAG report highlights the essential value of a broad range of research-related activities to the health of a democracy. Much in the innovation pipeline arises from so-called basic science, often in areas well removed from its most obvious and direct intent. An innovation economy cannot exist independently of a healthy research system funded by the public sector and, to a much lesser and narrower extent, by philanthropy.

48. A country of only five million people cannot do everything, so priority setting is key to the research system, even in very large systems. Deciding on priorities is not easy; there are compelling arguments often pulling in different directions against an inevitably limited budget.

49. The panel is also conscious that the New Zealand science community has been at the forefront of exploring the interface between science and other knowledge systems. This has not been easy and at times contentious. It has been a time when the place of Te Tiriti o Waitangi/ Treaty of Waitangi remains contested. However, it is clear that Māori knowledge and perspectives are critical not only in a historical but in a living sense. Many aspects of New Zealand science apply to both people and the environment, and this interface deserves special attention without attempting conflation of knowledge systems.

50. There will be major changes in the shape of the New Zealand research workforce in the coming years because of demographic changes. As discussed in the UAG report, it is unfortunate that educational disadvantage has disproportionately impacted Māori and Pacific people. The science, innovation and education systems must work together to ensure greater progress. On the positive side, the Māori economy is growing rapidly and includes science-based and innovation-based developments and applications extensively in this renaissance.

Publicly funded research priority setting

51. Priority setting occurs at multiple levels and must not be too narrowly defined to avoid inhibiting innovation from unexpected areas. Hence, adequate support is important for basic and interdisciplinary science. At the highest level, PMSITAC should advise the government on the general shape of the country's research and innovation needs. As discussed later in this report, ministries must also consider their responsibilities in purchasing the research they need. Research provision by the Crown thus comes through a mixture of agency-purchased research as defined by ministries and through the contestable and institutional mechanisms discussed below.

52. Much research, particularly for stewardship purposes, must be supported and strategically managed over many years and involves multiple actions to meet national needs. Often, downstream activity is contingent on earlier activities. However, such research should be planned and managed over extended time frames. Similar considerations may also apply to upstream research that extends towards downstream exploitation (acknowledging that this process is neither simple nor linear).

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7 European Commission, Directorate-General for Research and Innovation, & Mazzucato, M. (2018). *Mission-oriented research & innovation in the European Union: A problem-solving approach to fuel innovation-led growth.* Publications Office of the European Union. https://data.europa.eu/doi/10.2777/360325

8 In the book *Retrospectoscope*, the famous American physiologist Julius Comroe highlights a New Zealand example: Sir Graham (Mont) Liggins unexpectedly made a finding that effectively founded modern neonatology when he discovered that giving women steroids in late pregnancy changed lung development, allowing premature babies to survive. There are many other examples from New Zealand science.

53. Two mechanisms exist to manage such challenges. The first is long-term mission-focused research using a model akin to the National Science Challenges, but without the problems that accompanied these initiatives in the past.[9] They would need very clear missions and a focused management structure. The alternate mechanism, particularly suited for stewardship research and research which involves multiple actors, both public and private, over time, is to create mission-focused research roadmaps. The Conservation and Environmental Research Roadmap,[10] developed in 2017 at the request of government agencies, was an example of what could be developed. However, it failed because the funders (MBIE and ministries) did not accept ownership and did not commit to it. These roadmaps could become very valuable mechanisms for research prioritisation.[11]

54. As detailed in the parallel UAG report, universities are critical researchers and, as a group, the largest providers of publicly funded research. The UAG recommends changes to the Performance Based Research Fund (PBRF) system to focus on rewarding their research intensity, as reflected in research degree graduations, public good and private good research income, and research performance measured by accessible proxies. The SSAG was engaged in those discussions and supports the UAG's recommendations.

55. As we discussed in our first report, it is not an issue of whether social science or humanities research is essential[12] or whether soil science is important or not; the key inquiry that should inform prioritisation is why Crown should fund any particular research project or programme. Thus, the core questions in funding are: *Does the research suggested add value to New Zealand, and should it be undertaken in New Zealand?*

56. The answers to these questions are multiple and diverse[13] but every researcher receiving public funds or an agency proposing the need for such research should be able to answer positively, irrespective of whether they are doing fundamental or very applied research, whether it is within the humanities or concerns advanced technology. We recommend this as a core test for all public funding of research.

57. No matter how large, every country must make choices in its science investments. And even where budgets are huge, difficult choices are necessary. At the highest level, the Crown must decide how much to spend on research, across the whole of government (both in ministries and in the research funding mechanisms). The Crown must align its research investments with national needs, but as we have pointed out, these are broader than just immediate economic purposes. Much science looks to the future in documenting the current state to inform government, civil society and the private sector in multiple ways.

58. The intervention logic for public investment in R&D relates to the 'market failures' inherent in some essential types and stages of research. Most research does not provide a financial return in the short term and the risk profile of research changes as knowledge develops towards application. This disconnect provides the rationale for the Crown's investment, which

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9 The NSCs were compromised by not having an agreed-upon, clear mission and regular review to keep them on mission and a subsequent decision to effectively create them into mini-funding agencies. They all showed mission creep. There was inadequate tension because of the lack of responsive external periodic review.

10 Ministry for the Environment & Department of Conservation. (2017). *Conservation and environment science roadmap.* Retrieved from https://environment.govt.nz/publications/conservation-and-environment-science-roadmap/

11 Parliamentary Commissioner for the Environment. (2020). *Environmental research funding review.* Retrieved from https://pce.parliament.nz/publications/environmental-research-funding-review/

12 Unfortunately, this approach was not considered when changes were made to the Marsden Fund.

13 The External Advisory Group on Health Research, reporting to the ministers of health, science, innovation, and technology, listed possible responses to such questions in its report in 2019.

is universally agreed upon in every economy. However, the implications of public funding create problems in deciding what to support. Externalities like COVID-19 will drive some decisions, but most research involves investing for the future.

59. It is generally accepted that prioritisation below the highest level is an expert, *not* a bureaucratic or political judgement: such judgements are informed by expert peer review. This approach is core to the scientific process and has been encapsulated as the "Haldane Principle",[14] a viewpoint adopted by many countries, including the UK, Australia and the USA. Over time, criteria other than scientific evaluation, such as relevance or potential impact, have been added to such funding decisions, but scientific peer review remains central to the process.

60. Thus, in practice, all advanced countries allocate significant funds to contestable research, which is allocated according to tests of excellence along with some test of relevance, potential impact, or justification of need (i.e., as we now suggest *'Why do it in New Zealand? Why should the Crown fund it?'*). These decisions must be separated from politics; expert assessment mechanisms must be established. Ensuring quality by peer review is challenging, especially for a small country.

61. New Zealand is unusual because Ministers claim 'ownership' of funding decisions by making specific funding announcements (e.g., about Marsden grants). While there is no evidence of significant intervention in New Zealand, the involvement of politicians in the machinery of grant decisions is widely seen as problematic overseas. In Australia, for example, such concerns led to the recent passage of the Australian Research Council Amendment (Review Response) Bill.[15]

62. The Ministry (currently MBIE) and funding systems have not been completely independent from each other since 2012. This lack of independence has led to unease about perceived conflicts of interest. For example, the income of the CRIs, which are crown companies under MBIE's supervision, is highly dependent on success in applications to the Endeavour Fund, which is also administered by MBIE. This setup does not reflect best practice in distributing contestable research funding."

63. The small size of New Zealand's funding agencies creates inefficiencies and duplications. The funding envelope alone limits their options for investment in early-stage or later-stage career sustenance, coordinated long-term programmes or missions. Such limitations extend to the Centres of Research Excellence (funded by the Ministry of Education and subject to extensive comment in the parallel UAG report) and the recently terminated National Science Challenges (NSCs).[16]

64. Further inefficiency in the contestable science system derives from the onerous and expensive submission processes. These costs are compounded by the very low award rate of our funders, well below the generally accepted rate of ~20% that peer review can accurately address.[17] In recent years, there has also been shifting of extant funding by the granting agencies to equity initiatives given the changing demographics without adequate new investment in the overall funds available has further compromised the opportunities in the funding system.

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14 The UK's Higher Education and Research Act (2017) defines the Haldane Principle as the principle that decisions on individual research proposals are best taken following an evaluation of the quality and likely impact of the proposals (such as a peer review process).

15 Australasian Legal Information Institute. (2024). AUSStaCSBSD 2024. Retrieved from https://www.austlii.edu.au/cgi-bin/viewdoc/au/other/AUSStaCSBSD/2024/3.html

16 There are many lessons to learn from the NSCS – they would have been assisted by a more clearly defined mission, focused external review and oversight and the avoidance of mission creep.

17 In general, international experience suggests that assessment systems find it relatively easy to identify the most meritorious 20% of a set of research grant applications that meet all the funding criteria. Still, it becomes rather arbitrary how to rank within that 20%. With low funding rates, many meritorious applications remain unfunded.

65. Some estimates are that for a million-dollar grant, which has less than a 10% chance of being funded (less than the generally accepted target of a 20% success rate) and effectively will support one researcher for three years,[18] it may have cost the academic system significantly more than that, given the average nine or more unsuccessful applications in staff time and effort.

66. The PBRF is not a solution to these issues. It has never been a research fund, and it is a misnomer.[19] The PBRF is a mechanism to adjust tertiary (usually university) funding for the costs of research, which are far greater than in a teaching-only institution and which are not recovered through full-cost funding. In some ways, the PBRF is the equivalent of the SSIF core support for CRIs.

67. The four major research funds in New Zealand are the SSIF, the Endeavour Fund, the Marsden Fund and the HRC, but there are also smaller sources, including Lottery Health and Catalyst grants. In addition, as discussed later, several ministries fund research directly in significant quantities.

68. The SSIF is primarily designed to provide capacity and infrastructure support, mainly in the CRI/PRO sector. It provides them and some private research institutions, such as the Cawthron Institute, with base funding. But SSIF funding also covers several strategic research platforms[20] and significant infrastructure.[21] But there is no robust mechanism for deciding on this allocation.

69. The processes related to SSIF funding merit review. While those related to base funding of PROs and private research organisations should be a matter for the Ministry, the functions of SSIF concerning strategic platforms could be managed through the proposed NRC and the proposed RIAC. A matter which needs consideration by MBIE is how to balance base funding for PROs with contestable and contract funding. In turn, this balance relates to the missions and mandates that are given to each of the PROs, and in turn will define their overhead costs, which are at the moment excessive and inhibitory.

National Research Council (NRC)

70. We recommend integrating the three major competitive funds (Endeavour, Marsden, and HRC) along with components of SSIF. There are compelling reasons to bring these along with smaller funds, such as the Catalyst Fund, into a single funding agency, namely the NRC. There are other contestable funding mechanisms across government undertaken by other agencies, such as ACC and MPI, and later we consider how these might be assisted.

71. It is important to note that the Royal Society Te Apārangi/New Zealand currently uses the overhead margin from administering the Marsden Fund to support its other activities. If the NRC is created, the annual support to the Royal Society from the Crown would need to be revised upwards to avoid any loss of key functions provided by the Royal Society. The value and cost of those functions would need to be evaluated.

72. The most obvious reason for integration of the funding agencies is to generate efficiency – in a small country, one expert agency managing selection processes makes sense. Other countries – even those with considerably larger funds, ranging from the UK to Ireland have

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18 Assuming full cost funding.

19 The UAG report recommends a name change and a calculation simplification.

20 This includes Advanced Energy Technology, Genomics Aotearoa, Antarctic Science, Data Science, Infectious Disease Research, the Agricultural Green-House Gas Research Centre, Combatting Kauri Dieback and Myrtle Rust, RNA Development, and Natural Hazards and Resilience.

21 Advanced Genomics Research, the Australian Synchrotron, Enhanced Geohazards Monitoring, Longitudinal Studies, Mission Operations Control Centre, National eScience Infrastructure (NeSI), Nationally Significant Collections & Databases, Research & Education Advanced Network New Zealand (REANZ), and the Research Vessel Tangaroa.

also integrated funding and in doing so have protected discovery (or 'blue skies') research. Importantly, prioritisation is more effective when the whole scope of public funding can be seen within a single oversight mechanism. Having one funding agency may also reduce the tendency of researchers to submit multiple applications covering the same work, effectively shopping between different funders in some areas.

73. The growth of interdisciplinarity and, particularly, transdisciplinarity of new modes of research provides a further argument for a single funder model.

74. The most obvious downside of having a single funding agency would be if the Crown mistook this merger as a reason to shift the balance of research investment to the innovation end of the spectrum at the expense of discovery science, perhaps in response to an understandable but misplaced desire to see a faster payoffs to research. Discovery research, which meets the suggested generic tests of excellence and can be justified to be funded by public money, is critical to a robust knowledge economy and healthy democracy. Indeed, the recent *Australian Policy Review of the National Competitive Grants Program* states that every dollar invested in research by the Australian Research Council, which largely funds "early-stage" blue-skies research over the last 20 years, has returned an estimated $3.32.[22] Treasury estimates of agricultural research in New Zealand, between 1927 and 2001, much of which would have been considered at the time it was conducted early stage research, showed an annualised return of 17%.[23] These considerations were discussed at length in our initial report. Thus, the NRC must ensure appropriate investment across all three research components of Pasteur's quadrant.[24] Perhaps the NRC should require a minimum commitment to discovery research across its portfolio to assure the research community.

75. Research funding decisions are inevitably complex and multidimensional. Our mechanisms have become bureaucratic, with much unnecessary or irrelevant information sought in some applications, which burdens unsuccessful applicants. Many countries or foundations use much simpler applications, leaving much of the contract detail until after the scientific and funding decisions have been made. The Marsden Fund's triage process, in which a shorter initial application round precedes an invitation-only full second round, is a start. But there may be problems here where the perception has become that applications with appealing titles are favoured irrespective of content. While it is not the role of the SSAG to define the details of research applications or assessment processes, the NRC must be established with expert input to create a more straightforward, effective and transparently fair system.

76. The challenge is that whatever the system, the NRC must consider the kinds of research modality, and the research domains needed. There is not one singular right answer to this complexity, but manifestly wrong answers need to be avoided.

77. Most obviously, the funding system must avoid funding that is too narrow in its a range of topics. While New Zealand cannot do everything, our research must encompass a genuine breadth of subjects. Striking the appropriate balance will be critical. Moreover, we must ensure the research community's skills are developed and harnessed efficiently. This goal entails career development and equity considerations without compromising those of excellence and potential impact.

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22 ACIL Allen (2023). *Impact assessment of ARC-funded research summary report*. A report for the Australian Research Council.

23 Hall, J., & Scobie, G. M. (2006). *The role of R&D in productivity growth: The case of agriculture in New Zealand* (1927–2001). New Zealand Treasury Working Paper 06/01. The Treasury. https://www.treasury.govt.nz/sites/default/files/2007-09/twp06-01.pdf

24 Pasteur's quadrant is a classification of research according to the answers to two questions: (i) Is the research aimed at a fundamental understanding? and (ii) Is the researcher concerned about the end-use of the results? Respective answers "Yes" and "No" correspond to pure, basic research (exemplified by the search for subatomic particles); "No" and "Yes" correspond to pure, applied research (as was carried out by the inventor Thomas Edison); "Yes" and "Yes" is use-inspired basic research (such as that carried out by pioneering microbiologist Louis Pasteur). "No" and "No" is not research.

78. The quality of peer review must be ensured. Expert reviewers who are not over-conservative in their evaluations but have the insights to identify intellectually innovative applications are needed. Peer review is a judgment on the researchers, the question and the methodology. Less experienced reviewers tend to focus on the latter to the detriment of innovative projects. This bias is particularly observed in over-competitive and underfunded systems. Indeed, underfunding is well understood to lead to more conservative research projects being submitted, often adding little to the knowledge space but researchers know that this predictability makes it more likely they will be funded.[25] In a small country, interests and biases can influence review outcomes, and many other small, advanced economies[26] therefore use only international reviewers on large-scale grants. The potential for AI to play a part in research review is emerging, and thus, greater adaptability may be needed in assessment and decision methodologies.

79. Science is changing in ways that funding mechanisms must consider. Firstly, the emergence of AI is fundamentally changing knowledge production and potentially its synthesis and reporting. Secondly, classic measures of research performance based on bibliometrics are now understood to create several disincentives, and there is a shift away from using them internationally.[27] Thirdly, more and more science crosses disciplinary boundaries, and sophisticated assessment is required to avoid any disadvantage inherent in traditional assessment processes that favour disciplinary depth. Fourthly, how knowledge is turned into actionable knowledge has led to the emergence of transdisciplinarity as a distinctive new modality of science. Transdisciplinarity[28] involving non-academic stakeholders needs quite different assessment processes, as the way transdisciplinary research is undertaken determines its succes.[29] Moreover, the time domain is very different to research that does not involve end-user stakeholders from the outset.

80. Designing the NRC is beyond the scope of the SSAG, but we comment on the needed design features. A partial answer to the design challenge would be to follow the example of other jurisdictions and compartmentalise applications into research-domain pillars, as suggested in the first SSAG report (page 31). We recommend that the NRC be organised around distinct pillars, including one to support research in the social sciences and humanities, another in transdisciplinary approaches, and one to support activities with a mātauranga Māori focus or where the research is directly related to Māori interests. To support greater effectiveness and efficiency, Māori consultation requirements should be required where Māori interests or communities are relevant or impacted rather than being required across all application classes.

81. The governance of the NRC is critical. It needs an experienced and astute governance board. Its Board must have highly respected individuals who understand the scope of public research and its potential. A mix of academics and innovation leaders is needed. Conflicts of interest will be difficult to avoid in a small ecosystem. However, as in Singapore, using international members on either the board of governance or on a strategy advisory board or as panel chairs would seem desirable. It would seem logical for the chair to be a member of PMSITAC.

25 The dynamics of research assessment are such that when the system is underfunded, reviewers are forced into looking for reasons not to fund, rather than reasons to fund. This leads some reviewers to focus on issues of the type that the trial-and-error inherent in research would have resolved.

26 For example, Ireland, Israel.

27 International Science Council. (2024). *The future of research evaluation: A synthesis of current debates and developments*. Retrieved from https://council.science/publications/the-future-of-research-evaluation-a-synthesis-of-current-debates-and-developments/

28 Transdisciplinarity is defined here as research framed with end-users engaged as equal partners from the outset. These may be policy makers, businesses, community groups or iwi/hapu. It has very different characteristics as it is the engagement to frame the question and to build understanding and trust between the actors that is key to success (where success is defined not in academic papers but in translation to actionable knowledge.

29 Kaiser, M., & Gluckman, P. (2025). Are scientific assessments and academic culture impeding transformative science? *Sustainability Science*. Retrieved from https://link.springer.com/article/10.1007/s11625-025-01631-9

82. In general, research evaluations will occur through distinct pillars with domain-specific assessing committees, as is now the case in the HRC. Each pillar would require its own expert panels for assessment, and the expertise needed for each would be different. Prioritisation would include establishing the balance between these pillars, considering PMSITAC's perspective. However, the NRC governing board must make individual funding decisions, protecting science from political interference.

83. A further challenge is how to promote the most innovative research. When funding is excessively tight, peer reviewers inevitably pull to fund conservative, derivative research and the most intellectually high-risk research is not funded. Yet it is from the latter that the most breakthroughs come. Too often, only large groups with multiple funding sources can try out ideas rejected as 'out of the box': a funding system needs to consider this fact.

84. Another factor that needs to be considered is collaboration beyond national boundaries. International collaboration is a key part of the small New Zealand science endeavour. Current settings do almost nothing to encourage international collaborations outside their partnership with the European Commission. The NRC should consider this aspect when evaluating projects.

85. Experiments in novel funding forms, research assessment, and peer review exist globally. For example, the NRC should be linked to these by joining the Research-on-Research Institute (RoRI),[30] which is led out of the UK and Europe.

86. If, following the closure of Callaghan Innovation, residual individual granting schemes that are currently operated by Callaghan remain to be maintained, these could be managed through an industrial pillar of the NRC with representation of NZIATA on the evaluation panel.

87. As discussed later, the NRC could assist in managing government-agency-funded research, such as policy-focused and stewardship research. It could provide the purchasing and monitoring arm for that research when it is large or has other procurement risks, and is requested to do so by the relevant agency.

88. The NRC could also, as discussed later, manage major research equipment support on the advice of PMSITAC, the RIAC, and NZIATA.

89. While primarily for commentary by the UAG, the Centres of Research Excellence Programme is administered by the Ministry of Education using the Royal Society Te Apārangi/New Zealand as the managing agent. Consideration might be given as to whether the NRC best manages the selection process or whether the processes developed by the CoREs might inform how mission-led research is developed and supported by the NSC.

90. Science's core value is its openness, which is essential to its validity and trustworthiness. There is a general move internationally toward more open science and data. However, there are also issues of protecting security and economic interests. Thus, the OECD Ministerial meeting in 2024 focused on the mantra of "as open as possible, as closed as necessary."[31] Multiple considerations exist, including issues of so-called dual-use technologies and ensuring proper and early protection of intellectual property. But the default position, as in other jurisdictions, should be that government-funded research is reported in ways that make it accessible, i.e., through open-access journals and open databases.

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30 The Research-on-Research Institute (RoRI) is dedicated to improving research systems' efficiency, effectiveness, and impact worldwide. https://researchonresearch.org/

31 Organisation for Economic Co-operation and Development. (2024). *Declaration on transformative science, technology and innovation policies for a sustainable and inclusive future*. Retrieved from https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0501

91. Research is a fundamentally a human endeavour supported by the provision of appropriate facilities and technologies. Between the NRC, universities, the PROs and industry, there is a need to focus on how we ensure the most promising early-career researchers are mentored and supported into careers and middle-career researchers with excellent track records and key opinion leaders are not lost to the system. Internationally, there are many models. There is a growing argument to invest a more significant portion of research and higher education budgets in schemas that support an individual's career development and maintenance.

Government's own need for science, research and data

92. The government expends ~41% of the nation's GDP and is the country's biggest employer, directly and indirectly, through its agencies and entities. Around the developed world, there is a growing sense that governments need to use data, robust evidence and research more effectively. There is not one aspect of government decision-making and operations where robust research cannot help better decision-making. Indeed, there is a strong case and much commentary that research and scientific knowledge are core to the democratic process.

93. The government is arguably the biggest producer and user of data and public good research. Every department and agency has many obligations that depend on science and research. Yet, that knowledge is poorly identified, curated, and purchased, and its use is highly variable.

94. In the SSAG's work, we have met with departments and agencies, had discussions with other governments and governmental advisory processes and explored New Zealand agencies' purchase and application of evidence and research. We have highlighted the value of considering research purposes more functionally than traditionally used. In particular, it is important to point out that from a public policy perspective, it is valuable to consider research as having one of four functions (see box 1). Each of these four classes has different drivers and likely different purchase mechanisms, although the distinction is not absolute. In considering government needs for and use of science and research, the first two categories (stewardship, knowledge to advance policy making) are the focus in this part of the report.

95. Stewardship of our people, culture, society, infrastructure, economy and the environment is a core responsibility of Government and its agencies. Stewardship research is that broad canvas of knowledge generation and science needed to manage and protect our social, human, environmental, and economic assets. This category includes routine data collection for example through the census and for environmental monitoring; it includes taxonomic work to inform biosecurity; it includes natural hazards research; it includes climate and weather monitoring and prediction; it includes some aspects of cyber research such as cybersecurity and protecting people from harm and it includes public health surveillance. Government agencies must be clear as to what they are responsible for within this category and government as a whole must ensure there are no gaps; for example, when the national risk register was first prepared in 2015–2018, several risks were identified that could have fallen between departmental silos or for which no planning had been undertaken.

96. Data and its synthesis can often have multiple utility across agencies, and there remain major issues in sharing data between agencies, as discussed below. For example, data on youth crime is relevant to health, education, social investment, Oranga Tamariki, and housing, as well as to the justice, corrections, and police ministries.

97. Many aspects of stewardship research receive little focus or attention. For example, there have been ongoing issues over the maintenance and stewardship of national collections, yet as the nation confronts many sustainability challenges, greater risks of biodiversity collapse, and biosecurity incursions, those collections have critical ongoing value as well as their essential historical and cultural value.

98. It is clearly important that the government has good oversight of that stewardship research, which is necessary to protect our assets. In economically challenging times, it is easy for agencies to cut back on such activity, thinking it can be deferred until better times. But in many cases this

response is counterproductive, leaving holes in essential data and knowledge bases; for example, the integrated data infrastructure (IDI), which was seen as being an innovative and critical step forward in government use of data for policy making, has been compromised by funding restrictions following issues with the 2018 census reducing its utility and now requiring significant reinvestment to meet its promise. On the other hand, the traditional census itself may become increasingly problematic with declining compliance, perhaps reflecting a loss of institutional trust.[32 33]

99. Stewardship research may be undertaken within ministries (for example, the census), by CRIs (indeed, this is their primary justification, for example, weather and climate forecasting[34]) or may be contracted to consultancies or universities. The issues around different ways of contracting stewardship research are discussed below.

100. In many cases, the government needs data and robust evidence to support a policy choice or direction. For example, we have limited choices ahead in meeting our Nationally Determined Contributions (NDCs) under the Paris Agreements. If we do not find a way to reduce methane emissions from pastoral agriculture in a manner that does not lead to unacceptable domestic economic and social costs, we face a significant financial penalty. It is thus appropriate for the government to give priority to research that will tackle this concern. Another example is the use of the IDI by the Social Investment Agency (SIA). Its basic premise is that by integrating data from multiple agencies and treating many so-called wicked problems as multidimensional it will be possible to devise better strategies to deal with a broad range of social and human issues.

101. The government operates some very large sectors of the economy: health, education and social welfare being the most prominent. In each case, the sectors are somewhat devolved (to hospital administrators, school boards of trustees, a range of third sector providers, etc.) and are data-rich. However, they are also challenging in that they are unlikely ever to be able to meet citizens' expectations fully. This gap is perhaps inevitable for health, particularly as medical science advances so rapidly. These are areas where political and societal interests inevitably collide – robust evidence can help get beyond rhetorical debate and allow more effective solutions to be moved forward.

102. Core to these sectors is using the available resources most effectively and efficiently. Operational research, which takes accumulated data and looks at better ways of delivering in alignment with strategic goals defined by the policy process, is key. Yet data curation[35] and operational research is somewhat obscure in many departments, and levels of investment in it appear lower in some cases than might be expected.

103. The government has much data that can assist it in policy making, particularly in the social, environmental, and planning sectors. However, there are issues of social license and public acceptance of how governments use citizens' data. The importance of oversight that extends beyond privacy concerns should not be underestimated. This concern will grow as AI is used more within government agencies. The ongoing issues of data sovereignty with Māori are effectively matters of trust and transparency over the appropriate use of data.

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32 Gluckman, P., Spoonley, P., Bardsley, A., Poulton, R., Royal, T. A. C., Sridhar, H., & Clyne, D. (2023). *Addressing the challenges to social cohesion*. Koi Tū: The Centre for Informed Futures. Retrieved from https://informedfutures.org/challenges-to-social-cohesion/

33 The census may be an expensive way to collect data, which now might be better collected through the smart use of databases—a matter that would be improved by the single use of identifiers for all government services for residents and citizens, as has long been the case in other countries.

34 The panel supports the integration of MetService into the PRO system.

35 A key scientific issue is collecting data in standard ways which are useful proxies for the long-term intended outcome. Data must be properly curated to be sure it is valid and data standards are needed. Too much effort can be expended on data which is not useful in either managing the system or does not reflect the goals of the programme. Epidemiological, big data, implementation and evaluation science is needed to support ministries.

104. The IDI has enormous potential but needs a distinct budgetary allocation and oversight. Developments in AI will allow much enhanced operational research, provided a whole-of-government approach is taken and issues of social license are properly addressed.

105. Much government data is valuable outside government, to researchers, the private sector and others. The IDI data is made available beyond government according to tight and world-class protocols. However much other data is collected by other agencies and research reports filed; their availability is limited even to other agencies. This lack of accessibility is an issue in both the local and central government.

106. A further aspect of operational research is programme design, piloting, and evaluating for impact. Impact and evaluation science is poorly used, yet without high-quality impact and evaluation science, the Crown ends up funding programmes that may be ineffective or even have spillover negative effects that outweigh any positive effect claimed. The politics of stopping ineffective programmes is difficult, and robust operational evidence is needed to justify this to interested stakeholders.

107. It has been a feature of New Zealand public policy to introduce programmes, often without piloting. Particularly in the social sector, it is important to first identify whether the programme delivers in the way it is intended before taking it to scale. Yet, compared to other developed countries, policy trials are poorly used in New Zealand. Impact cannot be assessed if baseline data are not collected and decisions made proactively as to what should be measured as evidence of or proxies for the desired impact. Little analysis is done on who might benefit and in what context to ensure more effective targeting. No programmes should be started at scale without a priori designing the programme's implementation in a way that allows for evaluation and modification if necessary, yet in some areas, such as in mental health, such approaches are scarce.

Knowledge brokerage

108. The relationship between evidence and public policy making has several distinct steps. First is the collection and generation of new data and evidence. This step is generally the responsibility of the broader scientific community. However, the core issue for the Crown is understanding the available evidence and incorporating it, if appropriate, into policy formation.

109. Every year, enormous numbers of research papers are published – depending on definitions, perhaps more than 4 million papers a year, on top of which there can be, especially in areas relevant to public policy, a myriad of reports and other publications reflecting potentially new evidence of variable quality. The challenge is how to extract from this enormous amount of evidence, that information which is relevant and of sufficient quality to help inform policy development. This task is not easy – the traditional evidence synthesis models tend to focus on a singular domain and are not pluralistic in terms of the range of disciplines that can contribute to understanding the problem. There is always the risk of cherry-picking reflecting the biases of either those commissioning the work or those undertaking the synthesis. These issues can be overwhelming, yet governments rely heavily on evidentiary synthesis. A further concern is the time such syntheses can take. On one hand, there is a danger that a non-scientifically qualified official may think a simple Google or Chat GPT search is sufficient, or on the other hand, a scientific group such as the Royal Society might take far too long to produce a highly academic report which is not very useful to the policy maker. As discussed below, there are key roles here for governmental science advisors.

110. Recently, the potential of AI to assist in evidentiary synthesis has come to the fore. The UK government is amongst those nations developing AI-led approaches to rapid and comprehensive evidentiary synthesis. This development is clearly an emerging opportunity that might significantly enhance policy development, but at this stage, there are important limitations.

111. The mechanism by which knowledge is incorporated into policy making is often termed knowledge brokerage.[36] This step is highly skilled as generally policy decisions must be made in the absence of complete knowledge. Science can provide the evidence[37] base on which to devise policy options, but the policy choice must take into account considerations beyond science including fiscal and legal in making recommendations to the minister. The politician then studies the options through a different lens, considering how different groups of stakeholders will be affected by any choice. This process is not linear; there is always an interplay between these three different perspectives. But unless evidence is available and presented appropriately, it is more likely that ineffective choices will be made.

112. New Zealand agencies are very variable in size and responsibilities. This review focuses primarily on the major agencies, each of which undertakes or supports research through different processes.[38] Many issues were identified in the Prime Minister's Chief Science Advisor's report of 2015[39] when a formal assessment of government agencies' and ministries' attitudes to science and it use was explored; they remain to be fully resolved.

113. Ministries and agencies often have domain experts within the staff who as analysts are familiar with the data. The extent they are trained in evidence synthesis is unclear. This training is becoming more important given the issues of disinformation and cognitive biases and the current state of AI. Some agencies seek outside contracts for evidence synthesis either through consultancies or occasionally thorough academia or the national academy, the Royal Society of New Zealand/Te Apārangi. But too often the synthesis provided does not really align with the question at hand and cannot provide the policy maker and politician with what they need. It is also important that the level of analysis is appropriate to the question and is provided in a form that is clear to the intended audience. Evidence synthesis is not about making recommendations but summarizing what is known and what is not known or is uncertain on the question at hand.

114. Several of the major ministries (MPI, DoC, MfE, MSD etc.) have their own scientific teams either involved in evidence synthesis and analysis, data collection and monitoring, serving regulatory functions and in some cases undertaking or contracting active research.

115. Many departments directly contract research from CRIs, universities, and often from the generic consultant industry. We heard very differing perceptions among ministries who contract CRIs and universities on the quality of their relationships. Some agencies thought they were expensive, slow and driven by their own interests. If this is so it arises at least in part because CRIs are incentivised to focus primarily on their institutional rather than national interest, a matter discussed in our first report. But as is the case globally, much of the problem arises if neither the contracting party nor the research provider is necessarily aligned with the project's purpose. Further, much of this activity is not subject to the type of planning and evaluation expected of other government expenditure.

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36 Gluckman, P. D., Bardsley, A., & Kaiser, M. (2021). *Brokerage at the science–policy interface: From conceptual framework to practical guidance*. Humanities and Social Sciences Communications. Retrieved from https://www.nature.com/articles/s41599-021-00756-3

37 It must acknowledge the uncertainties and the gaps in knowledge.

38 In preparing this section of the report, we have had multiple meetings with officials and science advisors.

39 Gluckman, P. (2017). *Enhancing evidence-informed policy making*. Office of the Prime Minister's Chief Science Advisor. Retrieved from https://www.dpmc.govt.nz/sites/default/files/2021-10/pmcsa-17-07-07-Enhancing-evidence-informed-policy-making.pdf

116. The decision to seek external research is one for the agency, but many agencies are not well equipped to define the project needs well. They tend not to seek competitive bids and thus can create procurement and performance risk. Some other countries recognise the issues that can emerge and ensure a contracting and management relationship is conducted by a body for which research contracting is core business—the research funding agency.[40] The ACC has done this with the HRC to some extent.

117. If a NRC is established as recommended, one arm of that could be to manage agency-driven research contracts when requested by ministries. They would have the expertise to ensure the project is well defined and that the proposal is responded to in a way that meets quality and performance criteria and is reported promptly and in a way that meets the agency's needs. In some cases, this process might be competitive; in other cases, even when there is a single competent provider (e.g. a PRO), the same disciplines of research-contract management are essential. Discussions with some agencies suggest such a process would be welcomed for projects they evaluate as meeting as criteria of scale or risk.

118. Whatever the source of evidence and data, it needs to be reported to the ministry and or minister (and to the public) in a way that is informative and accessible. Poor communication between the researcher and the agency can lead to misunderstandings, confusion or a rational decision to ignore the evidence. This is an area where competent 'brokerage' within the agency is key, and smart contracting can make a significant difference.

119. An issue identified globally in transmitting evidence to policy is poor communication of uncertainties and probabilities. Another is the inappropriate use of limited mathematical models in assisting decisions making in complex situations.[41] Again, competent brokerage has a core role to obviate these risks.

120. In both local and central government, much research has been undertaken, yet the results are unavailable to other departments or external parties. This siloing leads to the research being not utilisable or duplicated: both are wasteful consequences. While there may be good reasons from some research to be confidential, it is generally more effective and efficient if the reports from research funded by central or local governments are publicly available.

121. Government agencies have a particular role in defining priorities in stewardship research and research to support policy development. In general, they will continue to be the primary funders of such research, but they must feed their priorities into the overall priorities of government—PMSITAC will have a key role. This process generally must involve multiple agencies. The use of research roadmaps as a guide to what research the Crown needs over time seems logical and can help assign responsibilities that cross agencies, research funders, and providers.

122. Research roadmaps cannot be developed without stakeholder engagement, including other agencies, NGOs, the academic community, and civil society. They are particularly valuable in areas such as social or environmental issues where complex systems must be considered, and no single solution is likely. Departmental science advisors and the PMCSA may be best placed to work with agencies to support their development. AI will likely lead to new ways of exploring complex systems, which would assist.

40 This is a trend in European countries such as Slovenia.

41 An example might be previous controversy over the use of Overseer in farming decisions related to climate change.

Data and the digital world

123. Data is the mainstay of much that a government does. Across the government, there is a large amount of data collected each year. But in general, less attention is applied to the curation of that data to ensure its quality. As data analysis becomes more automated, the issues of data curation grow. There is a growing pressure to have clear standards in governmental data collection globally. Much of this data is also of value to civil society and business. The IDI has set good standards on how government data can be released for broader use. Yet, surprisingly, there remain huge issues between agencies in sharing data, and a growing need is for protocols and processes that allow for more effective data sharing. The arguments beyond security issues that are used to block sharing are not obvious.

124. A deeper issue may be the lack of trust the public has in the government's use of data. This mistrust has been identified across the developed world and was highlighted during the COVID pandemic. Surveys showed that the public was more comfortable with the private sector and the platform companies having their data than governments. This paradoxical observation reflects both declining institutional trust and a lack of communication from governments as to why they collect data and how they use it. The issues of concern to the public extend well beyond privacy issues: a significant step forward in building trust would be to have an independent oversight process across government use of data led by trusted New Zealanders and including a remit of ensuring social license and addressing some of the complex issues such as Indigenous data sovereignty.

125. But data is largely handled computationally and increasingly AI will manage computation. There are major concerns over the state of AI understanding across the government. Yet the potential for it to significantly increase government efficiency is real. It is a form of computation that allows for very rapid data processing, seeking relationships and patterns in very large data sets. But whatever AI suggests needs expert human evaluation for credibility and relevance. Artificial Intelligence itself creates additional ethical and other concerns. The government's use of AI should be subject to oversight by the same organisation that provides legitimacy to the use of data. Given the intimate relationship between data and the digital infrastructure, having the oversight roles separated with a chief digital officer (the CE of DIA) separate from the chief data officer (the CE of Statistics) creates an unnecessary functional barrier.

Foresight and technology assessment

126. Stewardship of the future requires that governments and citizens understand the range of possible futures and make choices now that make the desired range of futures more likely. Foresight must take account of both known stresses and trends (e.g. demographic change, climate change) as well as known risks (e.g. an earthquake, a pandemic).

127. Anticipatory foresight does not try to predict the future, but rather considers the weak and strong signals that might affect the future with a view to making decisions that both mitigate against or adapt to the negative and take advantage of the positive. New Zealand has minimal capacity for foresight, and there are gaps in our risk assessment and management processes. A solution is difficult for the government for many reasons, but stewardship obligations make this critical both in civilian areas as well as in the security and defence sectors. Indeed, resource issues and climate change in particular are likely to make this distinction less relevant.

128. Anticipatory foresight is an important component of science, including but not limited to technology foresight. It is extensively used in other jurisdictions and by the multilateral system[42]. It is also an essential part of risk management. Treasury, NEMA and Defence both have some capacities in foresight but overall, this is a poorly developed part of New Zealand's policy framework. It is particularly lacking in the advanced technologies, and this is discussed further below; the NZIATA has a core role here.

129. The gaps in technology foresight are critically concerning. Yet technological developments will determine the future of societies, their economic and geostrategic positions. Other countries (for example Singapore) have sophisticated but small foresight units especially focused on technological futures and this deficit needs to be addressed and might be a core role of NZIATA supporting PMSITAC. The NZIATA also needs access to expertise in technological intelligence. Some of this role can be outsourced.[43]

Science advisory mechanisms

130. New Zealand, like the UK and several other countries, mainly in the Anglophone world, has adopted a model of a chief science advisor and departmental science advisors to take on the brokerage-focused roles. The New Zealand approach has had international recognition.

131. It is concerning that there remains a lack of clarity as to the future of the Prime Minister's Chief Science Advisor. The PMCSA's role is largely independent of PMSITAC, although the office could also serve to support PMSITAC. PMSITAC will be primarily concerned with high-level strategy for investing in and using science and innovation, not with using science to assist decision-making across the whole government. These are distinct activities.

132. The role of the PMCSA is to ensure that science and robust evidence assist the PM and senior officials in making their choices. Critically, the PMCSA is neither a political appointment nor a traditional civil servant reporting to a chief executive. He/she should report to the Prime Minister. Otherwise, their critical role as an honest broker can be compromised. Often the PMCSA becomes effectively the 'red team' in critiquing advice coming through departmental channels. This can be important in brokering between different stakeholder groups by focusing only on the evidence. The role relies on trust with both politicians, the policy community, the science community and the public and perceived independence.

133. It is key that the PMCSA can act as a bidirectional conduit to key experts. Report writing is not the main role – primarily, it is one of discussion and interaction. In emergencies, the PMCSA has a more direct role in both providing actionable advice and ensuring the decision makers understand the evidence and options. It requires access to networks both within and beyond New Zealand.

134. The PMCSA has a secondary role in science diplomacy, which has sadly been largely lost. In recent months, there has been growing international focus on the importance of science diplomacy as the issues of the global commons grow.

135. The PMCSA and the office are necessary and identifiable points of entry both domestically and internationally on many matters related to science, technology, and innovation.

136. The role of the chief science advisor at ODESC[44] is unlike others in the committee who have management responsibilities in a crisis. The CSA's role is to look holistically at the issues and help reach out locally and globally where expert help could be needed.

42 United Nations Environment Programme. (2024). *Navigating new horizons: A global foresight report on planetary health and human wellbeing*. Retrieved from https://www.unep.org/resources/global-foresight-report

43 In Switzerland, the Federal Government partially funds GESDA to take on this role.

44 ODESC is the national crisis management committee, comprised of the chief executives of relevant agencies, for any major civil or security emergency.

137. The PMCSA has an essential role in ensuring coordination across ministries by chairing meetings of departmental science advisors (the Science Advisors' Forum). This task is vital as departmental science advisors act as an important and relatively informal liaison group, improving horizontal integration across ministries.

138. The SSAG's view, supported by feedback from the Public Service Commission, agency CEs and the DSAs themselves, is that the departmental science advisory system needs attention. DSAs should have the independence that the PMCSA has. This positioning might need to be statutorily protected if direct hire as civil servants becomes the norm rather than secondment from CRIs or Universities (or the private sector).

139. Each DSA needs similar terms of reference (see box 2),[45] and the Public Service Commission (PSC) should be asked to produce a singular and standard set of terms of reference. An issue needing resolution by the PSC is to whom the DSAs report. Reporting lines are currently very variable. Some DSAs report to the CE of the department but others report further down the hierarchy, at tier 2 or 3 where their role becomes more limited. The DSAs' value is best if they are part of the senior leadership team with sufficient independence to speak 'truth to power', to be engaged at all stages in the policy cycle and, in particular, decisions over departmental science activity. A key role for DSAs is to ensure that proposals and cabinet papers do not misrepresent science and the evidence.

140. If the government is to improve the effectiveness and efficiency of its own needs in knowledge and research, then the DSAs have valuable roles. Consequently, they should have input or responsibility for the scientific decisions over a ministry's internal and external research activities. Some departments (e.g., DoC, MPI) have large internal research activities, but the DSA is a distinct role and should not manage internal scientific teams; rather they should have oversight over the quality of their activities.

141. In all cases there needs to be a due process for the appointment of a DSA with the selection involving people with expertise in this boundary. The need to train and induct people into such roles has been reinforced in recent years internationally. It is particularly relevant as currently we have little or no way of exposing scientists to policy making and vice versa. As to the number for DSAs, clustered responsibilities may make sense. Not every agency needs its own science advisor. For example, the Justice DSA also has responsibility for advice over corrections and police: the social welfare DSA could encompass several other agencies, including SIA.

Box 2: The Departmental Science Advisor (DSA)

The Departmental Science Advisor is responsible for ensuring robust and credible science is at the core of decisions in the Ministry/Department/Agency's activities. They work with, and build, networks and relationships in the state sector, academia, and the broader research community in areas of interest to the Ministry/Department/Agency. The role should encompass:

Providing science-based advice to the CE, senior leadership team and staff within the Ministry/Department/Agency.

Assisting the Ministry/Department/Agency to identify issues and questions that would benefit from scientific input.

45 The panel acknowledges the input of the Chief Science Advisors Forum to this description.

Performing an independent challenge function to the Ministry/Department/Agency, ensuring that science evidence and advice for departmental policies and decisions is robust, relevant and credible.

Coordinate science advice during crises, ensuring effective communication of risk and uncertainty. In common with overseas counterparts, existing relationships between CSAs was used to mobilize quickly to support effective response during acute crises such as COVID-19, volcanic eruptions and cyclone events.

Ensuring the purchase of research either from within or beyond the agency meets necessary standards; that the questions are posed right and the results effectively communicated. Assuming the panel's recommendations are accepted, advising, based on scale and risk, whether the research should be purchased through the National Research Council.

Maintaining a horizon scan and watching brief on scientific work being undertaken in New Zealand and overseas with implications for policy, operations or regulations.

Working collaboratively and building relationships with key experts in domains of high interest to the Ministry/Department/Agency and facilitating the engagement of these experts in providing advice on scientific evidence and developing research roadmaps.

Preparing and providing oversight on briefings, reports and presentations on scientific findings of importance for the senior leadership team, ministers, and other key stakeholders and to the public.

Enhancing the overall capability of the Ministry/Department/Agency through guiding and mentoring ministry staff in the use of scientific evidence and establishing communities of practice.

Through the Chief Science Advisors Forum, working with other departmental Science Advisors to share good practice across government and maximise the collective expertise of the CSA network to connect across Ministry/Department/Agencies to identify and resolve cross-departmental issues.

142. The Chief Science Advisors Forum, which brings the PMCSA and the DSAs serving major departments together with the government statistician and the chief economist of the Treasury, should be maintained. It has a distinct role from PMSITAC. The Forum's purpose is to create a community of practice and peer support for science advisors across government and in particular to:

   a. Promote the use of robust science to inform policy development, practice, and evaluation.
   b. Promote a coordinated whole-of-government approach to science advice and identify cross-government research needs.
   c. Provide thematic/subject-matter advice (e.g. risk, data, gene technologies) which crosses departments.
   d. Offer science input into specific budget proposals (as requested by Treasury) and emergency responses.
   e. Assist with the peer review of advice from any of its members when requested.
   f. Strengthen cross-government collaboration in priority and transdisciplinary areas.

The innovation and knowledge-based economy

143. For New Zealand, developing a more intensive knowledge economy (see box 3) is a critical imperative. Without it, the country risks falling behind in the global innovation race, losing economic resilience, and diminishing its ability to compete in high-value industries. Globally, leading economies, even small economies such as Denmark, Finland, Austria, and Singapore, are driven by innovation, advanced technology, and the ability to commercialise research effectively. New Zealand faces an urgent need to strengthen its knowledge economy to remain competitive. By integrating knowledge-based industries into its core economic strategy, the country can generate high-paying jobs, attract global expertise, and foster innovation-led enterprises, ensuring a sustainable and prosperous future for future generations.

144. The shift towards a more intensive knowledge-based economy is a critical necessity. Relying heavily on traditional economic models centred around natural resources and primary industries is not a viable long-term strategy for national prosperity. With increasing global competition and mounting environmental, regulatory, and technological disruptions, the country must transition to a knowledge-driven economic framework to remain competitive globally. This does not mean abandoning our primary sector, where advanced technologies could radically improve productivity and economic returns. However, it requires increased investment in discovery science, R&D, stronger public-private collaboration, and policies that support commercialisation.

145. The relationship between academic research and a knowledge economy is not only strong but is also bidirectional. Countries that invest significantly in basic and applied research tend to achieve higher levels of technological innovation, increased global competitiveness, and sustained economic expansion. This interdependence is particularly evident in the world's most successful knowledge-based economies, such as Singapore and Finland, where government policies, private sector investment, and academic institutions collaborate to foster innovation and progress.

Box 3: A knowledge economy

A knowledge economy is one in which economic growth is primarily driven by the creation, distribution, and effective use of knowledge and information rather than relying on traditional resources such as land, labour, and capital. This type of economy is characterised by several key features:

- Human capital development – A strong focus on education, lifelong learning, continuous skill development, alongside investment in research to cultivate a highly skilled workforce.
- Innovation and research & development (R&D) – A commitment to fostering innovation through substantial investment in basic and applied R&D, driving technological advancements and new discoveries.
- Digital and information infrastructure – The establishment of advanced communication networks and digital systems that facilitate the rapid exchange and application of knowledge.
- Intangible assets – A shift in value creation from physical goods to intellectual property, expertise, and innovative ideas, emphasising the importance of knowledge-based industries.

In a knowledge economy, the ability to generate, apply, and commercialise knowledge is the key driver of sustainable economic development and global competitiveness. By prioritising innovation, education, and digital transformation, nations and businesses can enhance productivity and maintain a strong position in the evolving global marketplace.

Oren Gershtein, Identity Roads

146. As global technological advancements accelerate, delaying this transition to a technology-intensive economy will only widen the gap between knowledge-driven economies and those reliant on traditional industries. This growing disparity is being shaped by rapid innovation, shifting policy landscapes, and the transformative power of AI and automation. To remain competitive, New Zealand must take a proactive approach, implementing policies that drive AI adoption, digital transformation, and innovation-led industrial growth. This requires targeted investment in science, technology, engineering, mathematics (STEM), education, R&D, advanced infrastructure, and alongside policies encouraging private-sector innovation and entrepreneurship. Without decisive action, the country risks falling behind in an increasingly digital and interconnected global economy.

147. The urgency cannot be overstated. The cost of inaction today will only compound in the future, making it even more challenging to close the gap. A forward-thinking, innovation-focused strategy is essential to ensuring New Zealand remains competitive, resilient, and ready to seize future opportunities. A common misconception is that only wealthy nations can establish a successful knowledge economy. However, smaller economies that take a strategic approach by leveraging agility, smart policy frameworks, and strong public-private collaboration can gain a distinct advantage over larger nations often constrained by bureaucracy. This must be underpinned by appropriate investment. In reality, nations that act decisively and embrace advanced policy tools can turn their size into a powerful competitive edge.

148. Countries such as Israel, Singapore, Denmark, Austria, Finland, and Ireland have shown that small economies can outperform much larger nations by adapting rapidly to technological advancements, investing in knowledge-driven industries, and fostering dynamic public-private innovation ecosystems. These nations prioritise technology transfer, encourage venture capital investment in early-stage innovation, and create regulatory environments that actively support entrepreneurship and high-growth businesses.

149. In many countries, government procurement policies have helped assist early-stage innovations get to market quickly. Clearly, there can be an advantage to the company in export mode to demonstrate the product in the home market. Perhaps government procurement policies need to emphasise the broader benefit to the innovation sector that can come from domestic purchase.

150. Limited early-stage ventur e capital, fragmented commercialisation pathways, and weak links between academia and industry hinder the development of a robust knowledge economy. Governments are critical in addressing these market failures by providing funding mechanisms, creating regulatory certainty, and fostering collaboration between research institutions and businesses. Here we detail core elements in a knowledge economy, explore the issues regarding technology transfer (see box 4) and make specific recommendations based on our first report and the government's response. We then discuss the issues in the phase between the emergence of intellectual property and its effective commercialisation (what we term the IP to IPO phase) and the need to give urgent attention to establishing an innovation agency.

Box 4: Technology Readiness Levels (TRLs)

Technology progresses from its first conception in science through various technology readiness levels (TRLs). Typically, nine levels are described,[46] and until a TRL level 4 is reached, there is unlikely to be any commercial interest as the inherent commercial risk is too high. However, until TRL level 7-8 is reached, the balance between reduced risk and investor interest is not achieved. Until then, the reality of market failure must be accepted, and hence, the government has an essential role if an innovation-based economy is to develop. These are gross simplifications, as the market potential may influence how the investor views the opportunity. However, in the TRL 3-7 phase, the government must act, utilising multiple tools within its power and technical domain, to ensure effective transfer to the private sector occurs.

Technology Transfer Offices (TTOs)

151. TTOs are central in linking academic and PRO research with commercial opportunities, but face several structural and operational challenges. These gaps hinder the commercialisation of research and limit the country's ability to maximise the economic potential of its research institutions. In our first report, we discussed the issues related to technology transfer. This report builds on that discussion, subsequent decisions by the government and further consultation. Greater engagement with industry and international investors will be necessary to strengthen commercial pathways and ensure New Zealand's research has a broader economic impact. We conclude that New Zealand can establish a more efficient and commercially viable technology transfer system, ensuring that publicly funded research yields economic impact and long-term national benefits.

152. A key issue is the lack of a cohesive regulatory framework for IP management. Policies on IP ownership, licensing, and researcher incentives vary across universities and CRIs, creating inconsistencies in commercialisation processes. Researchers and institutions have limited motivation to engage in commercialisation activities without a standardised national approach.

153. Operational inefficiencies and issues of scale further impact the effectiveness of TTOs in New Zealand (except for the University of Auckland's UniServices). There is no consistency in how these offices function, leading to stark differences in their structure, resourcing, and performance. Some operate with disproportionately large staff numbers that do not correspond to the scope of their commercialisation activities or results, while others only have part-time CEOs. They are inconsistent in IP ownership policies, limited incentives for researchers to engage in commercialisation, gaps in expertise within TTOs, and a cautious and institution-focused approach to IP management, as discussed in our first report, which slows or prevents commercialisation efforts. Weak industry connections—particularly with venture capital firms and technology incubators—result in missed opportunities for commercialisation. Addressing these disparities will require a more structured and coordinated national framework to ensure that TTOs can effectively fulfil their role in the innovation ecosystem.

154. Addressing these challenges requires a national regulatory framework to standardise IP policies, incentivise researcher participation, encouraging more researchers to enter the private

46 Office of the Under Secretary of Defense for Research and Engineering. (2023). *Technology readiness assessment guidebook*. Retrieved from https://www.cto.mil/wp-content/uploads/2023/07/TRA-Guide-Jun2023.pdf

sector if spinouts are created, and aligning commercialisation efforts with economic priorities. The fragmented structure of commercialisation units across the seven CRIs contributes to inefficiencies. Structural reforms should consolidate TTO operations to improve resource allocation and reduce duplication.

155. How PRO and university researchers are incentivised depends on the nature of commercialisation. There is an increased focus on spinout activity except in a few areas where licensing and royalties are more appropriate (see box 5). The major focus of our discussion will be on forming spinout companies and creating pathways for researchers to follow their discoveries into the innovation sector.

156. However, universities have long addressed support for academics who create income streams, such as royalties or sales of IP, and this should continue, creating a revenue share between the institution(s), research unit(s) and inventors. PROs will also produce revenues in different ways, and, their relationship to industry is different. However, the same principles of incentivising teams and researchers who make particular discoveries that are sold or commercialised without spinout should continue to be developed by their Boards. Insofar as possible, there should be seamless arrangements between PROs and between PROs and universities to encourage collaboration and joint development. Master agreements would reduce expensive and slow legal processes.

157. In response to the first SSAG report, the government announced its intention to review the Intellectual Property Rights model and referenced the University of Waterloo. This model is known for granting researchers ownership over the intellectual property they generate while encouraging commercialisation through structured support mechanisms. In reviewing the commercialisation landscape within New Zealand's universities and overseas, it became evident that UniServices, a subsidiary company of the University of Auckland, has developed and implemented a model that aligns with the cultural and structural requirements of the country's innovation ecosystem and meets the goals of the government's decisions.

158. Auckland UniServices has recently evolved its commercialisation approach to one which might be considered *"Waterloo on steroids"*, to suit better the maturity of New Zealand's innovation ecosystem and the need for more agile technology transfer processes. Their model integrates researcher ownership of IP while also accelerating commercialisation pathways by ensuring that business structures support fast, efficient deal-making in alignment with industry norms for venture capital and deep technology firms. It includes developing a full commercialisation ecosystem within the university, fostering an entrepreneurial culture, guiding researchers through the commercialisation process, and prioritising equity-based transactions over traditional licensing models. The model also incorporates early-stage investment, with small initial investments and continued co-investment with the private sector where necessary. A structured analysis of how this model operates in practice and its impact on commercialisation outcomes could provide valuable insights for the broader New Zealand research and innovation ecosystem.

159. The UniServices approach (box 5) incorporates two essential features that distinguish it from traditional technology transfer models and align with the Waterloo approach.

    a. Developing an entrepreneurial campus – This involves leveraging both curricular and extracurricular programmes, typically run by a Business School Centre for Innovation and Entrepreneurship, to foster entrepreneurial thinking among students, PhD candidates, and postdoctoral researchers. The objective is to build human capital by encouraging individuals to consider entrepreneurship as a viable career path. Many universities in New Zealand have similar centres or initiatives, though their scale and impact vary.

b. An investment-driven approach to technology transfer – Instead of focusing solely on licensing intellectual property, UniServices employs a structured investment strategy that includes technical development support and targeted funding to bridge the 'Valley of Death' — the gap between early-stage research and commercial viability. This model enables faster commercialisation by aligning technology transfer with venture capital principles, ensuring that promising innovations receive the necessary financial and strategic backing to progress toward market adoption.

Box 5: The UniServices approach – Technology transfer vs. rent seeking for IP

When IP arises (that isn't owned by the payor of research) as technology products become more complex, it is increasingly difficult to attribute a particular product feature to a single or small family of patents and charge royalties. Fewer companies take "raw" patents and put them into a product development process. Acquisition of spinouts is a more common form of innovation for industry globally. Thus, there is only a few occasions where a license is appropriate or possible in technology transfer. This is where the product is the patent (typically in a drug, diagnostic or plant variety). Of increasing importance is where patents are enough to encourage investors to invest capital generating products and other forms of IP (know-how, business models etc.) in a spin-out company.

In addition, technology needs human capital to develop into products. Therefore, there needs to be appropriate incentives for academic inventors to become "founders" in their spinouts, especially those who will not have research careers (the majority of PhDs and post-doctoral fellows). They are uniquely placed to be deeply involved in the development of their own technology with complementary talent.

This requires a change of approach of a TTO from simply developing IP on its own and trying to sell it to the highest bidder, to better aligning interests and rewards for contributions past and future.

Allowing the research organisation to act as an "investor" in its own spinouts enables this.

When UniServices receives an invention disclosure, it is assessed according to four criteria:

1) Novelty – is it clever?
2) Is the problem (market) it solves large and growing?
3) Is there some time bound monopoly that exists (IP)?
4) What do the inventors (and their students) want? Do they want to be involved in a spin-out?

If the answer is yes to all these questions the following occurs:

The inventors start a company which they own 100% of the company. The research organisation exclusively licenses any interest it has in IP for 10% ordinary equity. The company is then responsible for protecting and developing the IP. To support the company, we use a generous convertible note (uncapped, small discount to future price) to support the company. The TTO then works with the company/founders to seek third party investors. These investors "price the company" and validate our investment which converts to the same share class as incoming investors. We can do two rounds of convertible note but if a third party isn't found after two rounds, the company is wound up and IP published and made available to all. We can invest alongside third parties dependent upon our ability to do so and thus buy equity just as others do. Our target is to have inventor/founders working in the business with majority shareholdings though multiple rounds. We make returns from the investing activity rather than just extracting rent for the license.

To make this work, it is critical that PROs have some assistance in the creation of on campus "gap funding". This intervention has already been successfully operating in New Zealand (The Pre-Seed Accelerator Fund) and this should be retained.

Will Charles, UniServices

160. It is recommended that the UniServices model be adopted across all commercialisation entities in New Zealand. Indeed, we would favour a common set of rules and a master agreement across all the TTOs to encourage greater collaboration. The model has demonstrated its ability to align with the needs of the local innovation ecosystem by striking a balance between researcher ownership of intellectual property and streamlined commercialisation processes. However, implementation should not be enforced; it should be encouraged through appropriate incentives supporting commercialisation offices in transitioning to this model.

161. A key barrier to broader adoption is the capital required to implement the model effectively. UniServices, which has successfully developed and applied this approach, was able to do so using funding accumulated from its previous commercialisation successes. Other TTOs have not had the success or scale to develop their own financial resources for proto-enterprise support, thus limiting their ability to replicate the model. To address this issue of scale, a clustered approach using perhaps a single TTO across the three research-delivering PROs and encouraging university TTO mergers would make sense.

162. Ownership of the TTOs should remain with the sourcing entities. The Crown should also provide financial support to enable the transition. This could take the form of targeted pre-seed funding[47] or other mechanisms that ensure commercialisation offices have the necessary capital to build an effective ecosystem, support early-stage investment, and facilitate structured equity-based transactions.

163. The above discussion has focused on start-up activity arising from universities or CRIs. However, much start-up activity arises from outside these publicly funded sectors through private sector entrepreneurship.[48] Rocket Lab would be the most well-known and successful example, but many others exist in the New Zealand ecosystem. The government must be prepared to assist embryonic or evolving enterprises that flourish irrespective of their origin and have high growth and export potential: generally, these are in areas of advanced technology. It may be that a university's or PRO's TTO could assist some of these early-stage ventures, but in many cases, the pattern of commercial development and the nature of founders will have passed that initial stage.

From Intellectual Property (IP) to Initial Public Offering (IPO)

164. An innovation agency (legally established as PRO) to streamline government support for research commercialisation, venture capital investment, and the founding and scaling of deep technology startups is essential. It cannot be operated from within a government department: the perspectives, skillsets and needed credibility with stakeholders are very different. Many countries with successful knowledge economies—such as Israel, Singapore, Finland and Ireland—have implemented specialised agencies that coordinate innovation policy and investment strategies.

165. As we evaluated the need for an innovation agency, we recognised that there were two options. One option was to have an innovation agency (what we termed Enterprise NZ in our first report) and a separate Advanced Technology PRO (ATO). The second option was to combine both in a single agency. We identified that there were compelling arguments to combine several extant functions, including some derived from Callaghan Innovation, along with the ATO, into a singular agency, the NZIATA. This would eliminate duplication and ensure clear separation of sector support from empirical and service activities. It was that later confusion of roles that profoundly damaged the potential of Callaghan Innovation. The panel, therefore, has proceeded based on the preferred second combined option.

47 This could be in the range of $500,000 to $1 million per entity, depending on the degree of the merger.

48 We received many submissions highlighting the low support level for such enterprises relative to other countries.

166. Box 6 details the typical life cycle of innovation companies from IP to IPO, from its pre-commercial stage to its fully commercialised phase, which may be an IPO or other form of exit. Given New Zealand's need to strengthen its knowledge economy, supporting technology companies at each life cycle stage is paramount. This requires a coordinated approach integrating government incentives, private-sector investment, and academic collaboration to cultivate an environment where technology firms can thrive and drive long-term economic growth and transformation. This section focuses on matters only briefly considered in the first report, as consultation and analysis were underway. As a result, it was not highlighted in the government's initial response. It is clear to the panel that the highest priority must be given to addressing this phase of the innovation path.

Box 6: Lifecycle of a technology company

The development of a technology company involves numerous components. Technology companies progress through a distinct life cycle, marked by phases of innovation, commercialisation, scaling, and, ultimately, either sustained growth or market consolidation. Each stage presents unique challenges and opportunities, necessitating targeted support mechanisms to ensure the successful development of a robust innovation ecosystem. Understanding this life cycle is critical for policymakers and investors seeking to foster high-growth, knowledge-based enterprises.

Ideation and research: The inception of a technology company often originates in research institutions, university labs, or entrepreneurial ventures exploring novel ideas. At this stage, foundational scientific research, proof-of-concept validation, and initial intellectual property (IP) development are prioritised. However, market failures frequently arise due to the high uncertainty associated with early-stage technologies, which often require public funding, university technology transfer support, and pre-seed capital to bridge the gap between research and commercial potential.

Seed and early-stage development: Following the validation of a technological concept, startups enter the early-stage development phase, where product-market fit, business model refinement, and initial customer engagement take precedence. Early-stage venture capital, angel investment, and government-supported incubators play a crucial role in de-risking innovation by providing financial resources and strategic mentorship. In New Zealand, the role of technological incubators and accelerators is particularly significant in guiding startups through this high-risk phase.

Growth and market expansion: Companies that successfully validate their solutions progress to the growth stage, focusing on scaling operations, expanding market reach, and enhancing production capabilities. Access to venture capital, corporate partnerships, and government-backed R&D incentives becomes critical in supporting international expansion. Many technology firms at this stage require strategic alliances with MNCs or entry into global supply chains to sustain their momentum.

Maturity and sustainable growth: Once a company establishes itself within the market, it must continuously innovate to maintain competitiveness. Mature technology firms often reinvest in R&D, engage in mergers and acquisitions (M&A), or diversify their product offerings to sustain long-term viability. In knowledge-driven economies, sustained public-private collaboration ensures that firms remain agile and responsive to emerging technological disruptions.

Exit and market evolution: The final stage of the life cycle involves either a successful exit, through acquisition, initial public offering (IPO), or strategic partnerships, or market consolidation, where companies unable to achieve sustainable growth are acquired or cease operations. A well-functioning investment ecosystem ensures that capital recirculates into new ventures, fostering a continuous innovation pipeline.

167. While leading knowledge economies, including small economies such as Singapore and Finland, have successfully fostered innovation, many countries struggle to develop thriving innovative ecosystems. Market failures often hinder the commercialisation of research and the scaling of new ventures, preventing promising ideas from reaching their full potential. Box 8 summarises significant challenges to a successful innovation system.

168. The success of leading knowledge economies such as Israel, Ireland, Denmark, and Singapore highlight that innovation-driven economic growth depends on strong investment in research, education, and entrepreneurial ecosystems. However, market failures—particularly the limited availability of early-stage venture capital—create significant barriers to transforming academic research into commercially viable enterprises.

169. Overcoming these challenges will require targeted policy interventions (see boxes 7 and 8), including a standardised approach to intellectual property ownership and remuneration across all research institutions. Public funding must be reinforced through committed policies that promote public-private partnerships to support early-stage research, development, and commercialisation efforts. Establishing robust incentive policies is essential to actively encourage investment in emerging New Zealand technologies from both global corporate and traditional venture capital firms.

Box 7: Factors that influence the success of an innovation ecosystem

For an innovation ecosystem to thrive, there must be a clear distinction between public-sector policy leadership and private-sector execution. The government's role is to set overarching policies, ensure continuity in funding, and establish a regulatory environment that fosters innovation. Still, the private sector must drive the strategic, business, investment, and technological decision-making. This division of responsibilities ensures that innovation initiatives remain market-driven and commercially viable, rather than hindered by bureaucratic inefficiencies. Private-sector management of commercialisation processes, venture capital allocation, and technology scaling allows for greater agility. It ensures that companies grow in response to global market demands, rather than domestic policy cycles. The NZIATA must be structured to reflect this balance, allowing the government to focus on policy consistency and long-term vision, while entrepreneurs, investors, and industry leaders drive execution.

For New Zealand to develop globally competitive high-tech firms, support for research and development must not be a one-time intervention but a continuous process throughout the life of a company. Innovation is not linear—companies require different types of support at various stages of development, from early-stage IP generation to commercial scaling and IPO. Currently, funding and policy mechanisms often target only startup or early-stage ventures, leaving a gap in support for mid-to-late-stage companies seeking to scale globally, commercialise breakthrough technologies, or expand into new markets. A dedicated innovation authority must implement a structured support framework, ensuring that companies receive the necessary backing, from fundamental research to global expansion, without encountering funding gaps hindering their progress. This continuity is a defining feature of successful innovation economies and is crucial to building high-value technology companies in New Zealand.

New Zealand cannot afford slow, incremental learning curves in critical areas where local expertise is lacking in a rapidly evolving global economy. Where gaps in knowledge and capabilities vital to national economic interests are identified, the priority should be to bring ready-made expertise from global sources and create "shadow" learning processes for New Zealanders. Instead of developing competencies from scratch, which can take years and delay competitive entry into high-growth sectors, New Zealand should strategically recruit global experts, establish structured knowledge transfer programs, and embed local professionals alongside them in a “learn-by-doing” model. This approach allows for immediate impact and long-term capability building. Countries like Israel and Singapore have successfully used this model to accelerate sectoral expertise in cybersecurity, AI, and deep tech. This ensures that local talent is rapidly upskilled to drive national innovation initiatives forward.

Innovation policy must shift towards a model where the public sector plays an active role in shaping the direction of economic and technological development. This approach does not mean the government selects individual companies to fund, but rather that it sets strategic national priorities and directs resources towards sectors and technologies with the highest potential for long-term economic transformation. New Zealand must move away from neutral, one-size-fits-all innovation policies and instead take a bold, forward-looking stance in identifying critical technology domains – such as renewable energy, biotech, artificial intelligence, and advanced manufacturing – where public investment can catalyse private-sector growth. Focusing on high-impact areas rather than individual businesses, the government should drive systemic innovation, create new industries, and position New Zealand as a leader in selected global markets.

170. Stronger coordination between universities, government agencies, and private industry will be necessary to ensure a cohesive innovation ecosystem. Developing innovation clusters with geographical co-location can further connect research institutions, startups, and corporate investors, fostering collaboration and accelerating the path from research to commercial success.

Box 8: Challenges to address in developing a vibrant innovation ecosystem

Public goods characteristics of basic research: Basic research, by nature, is non-rivalrous and non-excludable, meaning that it lacks direct market incentives. Without public funding, there is little motivation for private investors to support long-term scientific breakthroughs. As a result, critical advancements in knowledge and technology may not receive the necessary investment to progress beyond the research phase.

Information asymmetry: Investors, entrepreneurs, and researchers often operate with different levels of information, creating a disconnect in understanding the commercial potential of early-stage technologies. This knowledge gap can lead to poor investment decisions, missed opportunities, and a reluctance to back high-risk, high-reward innovations. Without mechanisms to bridge these gaps, valuable research may struggle to attract the investment required for development and commercialisation.

Coordination failures: A successful innovative ecosystem relies on seamless government, academia, and industry collaboration. Technological progress and commercialisation efforts can be significantly delayed when policies, incentives, and strategic initiatives are fragmented or misaligned. Effective coordination ensures that research, investment, and regulatory support work harmoniously to accelerate innovation.

Network externalities and the importance of clusters: Innovation thrives in well-connected clusters where knowledge, funding, and resources circulate efficiently. Strong networks enable the exchange of expertise and capital, fostering the conditions necessary for startups and research-driven ventures to scale successfully. Without well-established clusters, even the most promising research initiatives may fail to reach the critical mass required to compete globally.

The lack of early-stage venture capital: One of the most complex and least understood market failures in innovation ecosystems is the shortage of early-stage venture capital. Despite being termed "Venture Capital," most funds prefer to invest in later-stage startups with proven technologies and validated business models. This preference reduces risk and increases the likelihood of returns for investors but creates a significant funding gap for early-stage technologies, particularly those emerging from academic research. At this critical stage, innovations require more than just financial backing—they need business expertise, market validation, and strategic guidance to transition from research concepts into viable enterprises. Many promising innovations struggle to reach commercial viability without sufficient early-stage funding mechanisms—such as public-private incubators, government-backed seed funds, and specialised early-stage venture capital firms. Bridging this gap is essential for building a dynamic and self-sustaining innovation ecosystem.

The New Zealand Innovation and Advanced Technology Agency (NZIATA)

171. The challenge is not only to catch up with leading knowledge-based economies but to establish the right structures to sustain long-term science and technology-informed, innovation-led growth. In an era where innovation increasingly defines economic strength, New Zealand cannot afford to remain on the periphery of knowledge-based economies like Singapore, Denmark, Israel, and Ireland. These nations have demonstrated that strategic investment in R&D, venture capital, and human capital drives GDP growth, productivity, and global competitiveness. New Zealand risks economic stagnation, declining global relevance, and an inability to retain and attract top-tier talent without a decisive shift towards a high-tech, innovation-led economy.

172. New Zealand's innovation ecosystem has fallen behind global leaders, as evidenced by key macroeconomic indicators. The country invests only around 1.4% of its GDP in research and development (R&D), well below the OECD average of 2.7% and significantly behind innovation-driven economies such as Israel (5.6%), South Korea (4.8%), Denmark (3.4%), and Singapore (2.2%). Finland has a bipartisan agreement to reach 4%. Limited venture capital availability and a lower density of high-growth startups further constrain the scalability of emerging technology companies. Additionally, New Zealand lags in patent output and the commercialisation of research, reducing its ability to compete in high-value, knowledge-intensive industries. A shortage of STEM professionals, compounded by talent migration to more lucrative markets, weakens the country's innovation capacity. Meanwhile, it's standing in the Economic Complexity Index (ECI)[49] reflects a continued reliance on primary industries rather than advanced technology sectors.[50]

173. A critical question is whether the country requires a dedicated innovation entity—one that operates independently and strategically—or whether this function can be effectively managed within an existing government department. The arrangements in place until recently via Callaghan Innovation and a variety of other entities, including NZTE, were inchoate, and we concluded in our first report that the architecture needed fundamental restructuring to ensure an effective innovation system. The shortcomings of Callaghan Innovation included a confused and conflicting mission, which must not be replicated. This must not be a bureaucratic approach but driven by smart, experienced entrepreneurial managers, of which New Zealand has a deficit. Critical to an effective agency will be a holistic approach that encompasses the broad range of tools to be applied in different circumstances, smartly and effectively.

49 The Economic Complexity Index (ECI) ranking assesses countries based on the diversity and sophistication of their exports. Countries with higher rankings tend to have more complex and knowledge-intensive economies. Harvard Growth Lab. (n.d.). Economic complexity index rankings. Retrieved from https://atlas.hks.harvard.edu/rankings

50 This is also reflected in WIPO's unpublished analysis of New Zealand's performance relative to IP formation and exports.

174. The government concurred with this assessment and has indicated that Callaghan Innovation would close, but subsequent events highlight the urgency of developing a definitive solution. A well-designed, independently managed innovation authority could streamline R&D investment, facilitate commercialisation, and ensure New Zealand's innovation ecosystem remains globally competitive.

175. A dedicated innovation authority is essential to ensuring that New Zealand's innovation ecosystem operates with strategic cohesion and efficiency. Unlike a fragmented approach spread across multiple government departments, a single agency with a comprehensive view of the technology sector, from IP creation to IPO, ensures that innovation policies and funding mechanisms align with high-growth companies' real needs. By consolidating research, commercialisation, and funding support under one roof, the risk of inefficiencies, delays, and missed opportunities is significantly reduced. This structured approach maximises the impact of public investment, ensuring that government funding directly contributes to the success of knowledge-intensive enterprises, rather than being lost through bureaucratic gaps or disjointed programmes.

176. The agency would also enable dynamic coordination across innovation initiatives. It is crucial to have a central authority that can continually assess and adapt policies to shifting technological and market realities. This oversight function allows for optimised resource allocation, ensuring that R&D funding is directed towards high-impact projects and that different programmes complement, rather than duplicate, each other. By managing the evolution of various initiatives within a unified strategic framework, the agency can enhance innovation policies' economic and business outcomes, thereby improving productivity and national competitiveness.

177. An innovation authority must be structured to leverage specialised expertise across legal, business, social, and technological domains. Innovation policy's complex, cross-sectoral nature requires leadership and governance that extend beyond traditional bureaucratic structures. If these responsibilities are dispersed across multiple entities without a dedicated legal and operational framework, the risk of inefficiencies and policy failures increases significantly. Establishing an independently managed authority, with private sector expertise at its core, ensures that decisions are driven by market knowledge and industry best practices rather than administrative constraints. This model, successfully implemented in leading innovation economies, would give New Zealand the agility and expertise necessary to remain competitive in the global innovation landscape.

178. A dedicated innovation agency must also be capable of building and maintaining strong relationships with parallel agencies worldwide, ensuring that New Zealand remains an active player in the global innovation landscape. Innovation-driven economies do not operate in isolation; they thrive through international collaboration, knowledge exchange, and cross-border investment opportunities.

179. Unlike organisations focused on primary industries, which play a vital role in promoting the sales and marketing of New Zealand's local products worldwide, an innovation agency must function within a dynamic, fast-paced ecosystem where strategic partnerships, research alliances, and access to global technology markets are essential for success. The activities of such an agency — engaging with international R&D hubs, securing participation in global technology consortia, and facilitating foreign investment in high-tech ventures — require a specialised skill set and an agile approach to policymaking. While primary industries focus on enhancing global demand for New Zealand's agricultural and natural resource-based exports, the innovation sector

operates in a different paradigm, where success depends on integrating into global technology ecosystems, securing venture capital, and positioning New Zealand as a key player in the knowledge economy.

180. By fostering these international connections, the agency would enable New Zealand innovators to access global funding, talent, and commercialisation opportunities, ensuring the country remains competitive in the high-tech sector. While traditional economic bodies advance the country's primary industries and export trade, the complex and rapidly evolving nature of technology-driven economies necessitates a dedicated agency with the expertise and global perspective to drive innovation-led growth.

181. The above analysis presents a strong case for a New Zealand innovation agency previously referred to in our first report as Enterprise New Zealand. However, subsequent analysis of the needed functions of both it and the proposed Advanced Technology Organisation (we termed the Future Technology Initiative) showed such a level of overlap that logic suggests that rather than proceeding with developing two distinct organisations, a singular structure is advantageous. We term this agency the New Zealand Innovation and Advanced Technology Agency (NZIATA). Both innovation and advanced technology need to be in the title, providing clarity to clients both nationally and internationally.

182. There are two important caveats. First, the NZIATA must focus on entrepreneurial activity that develops high-growth, export-focused innovations and intermediate TRLs. Second, it must not show mission creep into providing technical services or undertaking empirical research directly. Provided these two caveats are addressed, there is strong logic for combining the innovation aspects with advanced technology support. The level of overlap makes this a leading-edge, innovative approach.

183. A dedicated agency is also crucial in mitigating the country's exposure to technological colonialism—a phenomenon where nations become overly dependent on foreign technology, expertise, and infrastructure, leading to a loss of sovereignty over critical economic and security-related systems. It occurs when a country cannot develop, control, or fully understand the technologies it relies on, leaving it vulnerable to external influence, economic dependency, and limited bargaining power in global markets.

184. This risk is particularly pressing for New Zealand in frontier technology sectors such as biotech, AI and quantum computing. These emerging fields will shape the global economic and security landscape in the coming decades, and a failure to develop domestic expertise in these areas will leave the country beholden to foreign technology providers. Reliance on externally controlled AI models, quantum infrastructure, and critical algorithms could limit New Zealand's ability to compete in high-value industries, safeguard its digital sovereignty, and secure national interests in cybersecurity, defence, and economic strategy.

185. To counteract this risk, it is proposed that the innovation agency be integrated with the facilitation of developments in AI, quantum computing, and other advanced technologies, including synthetic biology, as the fourth PRO. The NZIATA would be responsible for developing national capabilities in these transformative fields, ensuring New Zealand is not merely a consumer of foreign technologies but an active contributor to global advancements.

Structure and functions of the NZIATA

186. It is important that NZIATA only focuses on innovation with high growth and export-aimed potential, most of which will be in science-based technologies. It must operate under a strategic framework that balances public policy leadership with private-sector execution, prioritises sustainable funding models, ensures continuous innovation support, leverages global expertise, and adopts a forward-looking approach to economic development. Its role would encompass oversight of all the activities needed to get ideas from IP to IPO, including various industry support mechanisms and liaison with NZCGP, and include the necessary broader policy advice, educational, intelligence, foresight, and diplomatic activities.

187. To create a sustainable and scalable funding model, New Zealand should move away from traditional government grants[51] for companies with high growth potential, and implement public-private collaboration through mechanisms such as redeemable contingent loans. Unlike grants, which often create dependency and do not guarantee long-term economic returns, redeemable contingent loans ensure that public funding is invested in high-potential ventures while allowing for capital recovery if those ventures succeed. This model aligns incentives between the public and private sectors, as companies benefiting from state-backed funding repay it once they reach a profitable stage, enabling reinvestment in future innovation. Such a revolving innovation fund ensures that government support is not simply an expense but a long-term investment in national economic growth. This approach has been successfully implemented in several innovation economies, ensuring efficient allocation of resources while maintaining strong public oversight.

188. Structural reforms—transitioning from grants to redeemable contingent loans, providing continuous R&D support, acquiring critical expertise through targeted knowledge transfers, and adopting a more proactive "Entrepreneurial State" approach—will be fundamental to its success. These changes reflect best practices from leading innovation-driven economies and ensure that New Zealand's innovation policy is strategic, adaptable, and globally competitive.

189. The government's decision to cease the operations of Callaghan Innovation was made for all the right reasons, reflecting the need for a more effective and streamlined approach to fostering innovation in New Zealand. However, the absence of a clear alternative has created considerable uncertainty for the private sector, which relies on consistent public-sector engagement and support.

190. Over the past decade, Callaghan Innovation has accumulated dedicated systems, databases, and insights into New Zealand's technology ecosystem, including local companies, investors, and venture capital funds. This data and information infrastructure represents a significant national asset, built over many years with substantial financial investment amounting to millions of dollars. With the liquidation process now underway, it is imperative that this transition is managed with precision and foresight. Ensuring the professional handling of Callaghan Innovation's data systems and computing infrastructure is critical to preserving institutional knowledge and preventing the loss of key assets that have been instrumental in fostering innovation. We must avoid fragmentation or irretrievable loss of valuable resources. A well-structured approach to knowledge retention and transfer will be essential in safeguarding the continuity of support for New Zealand's innovation ecosystem.

51 Any residual requirement for pre-commercialisation or early-stage grants should fit within the proposed NRC.

191. One of the key principles of successful public-private partnerships (PPP) is the certainty and transparency that the public sector provides to private investors and businesses. When structural changes are made without a well-defined transition plan, it undermines investor confidence and creates hesitation in long-term strategic commitments. Given that innovation-driven economies depend on predictable, well-structured policies to attract and retain investment, the current situation calls for rapid decision-making and clear communication from the government. Ensuring that private-sector stakeholders have visibility over the next steps, along with a stable framework for innovation funding and support, will be essential in maintaining momentum in research, development, and commercialisation efforts. The risk of prolonged uncertainty is not just a pause in activity—it could lead to capital flight, talent drain, and lost opportunities in high-growth sectors that New Zealand cannot afford to miss.

192. To restore certainty to the private sector and ensure the continuity of New Zealand's innovation ecosystem, it suggested that the government urgently approve and implement the establishment of NZIATA. This should be designed to align public-sector policy direction with private-sector execution, ensuring that research, development, commercialisation, and international collaboration are managed efficiently and effectively. To prevent further disruption, it is crucial that the government acts swiftly to define the NZIATA's mandate, governance structure, and operational framework, ensuring seamless support for private-sector partners and continued investment in high-growth technology sectors.

193. NZIATA would operate under a "hub and spoke model" (see box 9). If it is not adequately funded to take on both hub and spoke roles it will fail. The model has much similarity to the Fraunhofer model developed successfully in Germany.

194. The hub would undertake metascience, analytical, foresight, and facilitation services for the public sector, companies, and entrepreneurs, providing innovation support services to potential high-growth activities. In the first instance, this would be the administration of all start-up and scale-up support activities currently provided by the Crown, including pre-seed funds, industry support grants, and support for the technology incubators. However, the NZIATA is expected to work with the Ministry to review these and develop a more appropriate and adaptable set of support mechanisms for different industry sectors at different stages of development. In particular, it will need to review the relative role of government-supported versus private sector incubators and the merits of redeemable loans versus grant support. It would also advise the government on related policy developments. Importantly, it would advise on advanced technologies' necessary capability and capacity needs. However, another major function beyond innovation support would be to support a series of strategically defined spokes.

195. This agency's staffing must be skills-based and requires a mix of corporate expertise, entrepreneurial expertise, technology foresight, and scientific expertise at the hub. International expertise will likely be needed in the early stage to maximise its promise. New Zealand could be attractive to fill obvious skill gaps in the current geostrategic context.

196. The spokes would support applied developments in advanced technologies. The focus would be on those aspects of advanced technologies where a strategic path to effective scale and economic return could be identified. For example, how AI could be used to create economic advantage from large New Zealand data sets. In this context, economic advantage also extends to how the Crown could be more effective in its own expenditures. In general, spokes would be formed through RFPs and would often focus on consortia arrangements between public sector and/or private sector entities.

Box 9: The structure of the NZIATA

NZIATA's headquarters would be best located in Auckland, where the innovation economy is most intensive. It must be a distinct entity from any current stakeholders. It will coordinate core activities and manage stakeholder partnerships and funding of the spokes.

The hub will have a small but expert staff of scientists and experienced entrepreneurs led by a world-class innovation expert and a Board with deep expertise appropriate to its functions. It must have very high-speed, high-capacity data linkage access.

The spokes would be science and technology-led, not administratively burdened.

The Hub:

It would have a close liaison with the NRC and PMSITAC.

It would undertake advanced technology assessment and foresight.

It would be the entry point for enterprises seeking advice and support in the start-up phase and to potential investors.

It would assist in the diffusion of technology to the private sector.

Oversee and integrate government support of enterprise development that meets the criteria for support in that the innovation reaches TRL 4, has high growth and export potential, and has an identifiable route to market.

It would liaise with TTOs and provide agreed pre-seed assistance.

- It would supervise seed and incubator activity and administer government support to them.
- It would administer grants and/or preferably redeemable loans to nascent developments.
- IT would liaise with NZCGP.
- It would have input to the Research Infrastructure Advisory Committee on advanced technology developments.
- It would assist MBIE in negotiating needed access to international or private sector large scale infrastructure.
- It would coordinate with Invest NZ.
- It would identify the need for spokes, issue RFPs for such and oversee the contracts for their delivery.

The spokes:

- Each spoke would have an applied focus in a high-potential, high-growth area.
- Spokes would generally be syndicated activities involving universities, PROs and/or the private sector.
- Spokes might have international partners.
- Spokes would need to have very clear long-term product development missions.
- Some spokes would also provide national capacities to other parts of the research and innovation system.
- Spokes would receive long-term funding but would be subject to regular review by the Hub as to progress.[52]

52 Several spokes would likely build off current activity – for example, the Dodd Wall Centre, a CoRE, could be the nidus of quantum development. OpenStar, a deep technology start-up working with a novel approach to nuclear fusion, is linked to technologies that emerged from the Robinson Institute. Induction technologies emerging from the University of Auckland are the basis of the extensive Apple research facilities in Auckland are other examples that might indicate how spokes might emerge.

The innovation support components

197. Currently, multiple mechanisms of variable success support New Zealand's R&D support landscape, including KiwiNet, TTOs, technological incubators, R&D grant programmes, and the NZGCP. The findings from overseas comparisons and stakeholder meetings suggest a need for increased private-sector involvement in funding decisions, enhanced governance frameworks, and a stronger focus on commercialization outcomes. While existing programmes have contributed to advancing research translation and startup development, there are gaps in execution that limit their effectiveness. There is also considerable confusion as to who does what, and some have seen entry into the system as difficult.

198. Thus, we recommend that the NZIATA absorbs the functions of pre-seed funding (now undertaken by Kiwinet) and continues to support the technology incubators with some adjustments to funding mechanisms and investment structures. The R&D grants offered by Callaghan Innovation (the R&D Experience Grant, R&D Career Grant, New to R&D Grant, Ārohia Trailblazer Grant) need to be reviewed – some may be better placed with the NRC. In particular, we recommend that, where possible, industry support grants should be replaced with contingent loans, repayable by royalty on success and forgiven on failure. Israel has shown that this has multiple advantages.

199. The NZCGP should remain a distinct entity but well-linked to the NZIATA: it has particular roles and functions well (see box 10).

200. One concern is the rather slow uptake of technologies in some parts of the New Zealand ecosystem. We do not think the NZIATA should take on the role of mentorship and educational support. Still, there may be a case for it or PMSITAC indicating to universities, the Institute of Directors, professional and industry groups, where deficits lie and suggesting how they might be remedied.

Box 10: New Zealand Capital Growth Partners

New Zealand Capital Growth Partners (NZCGP) is a Crown-owned investment entity that supports early-stage capital markets by facilitating investment in technology ventures. It was established to address funding gaps for startups and scale-ups and to increase the availability of capital for high-growth businesses.

Since its establishment, NZCGP has contributed to the expansion of New Zealand's early-stage investment landscape. The Elevate fund has facilitated over $1 billion in private sector capital since its inception. However, challenges remain, including limited institutional investor participation, funding constraints at the seed stage, and the long-term sustainability of government-backed venture investment

NZCGP manages two primary investment funds:

Aspire: A seed-stage co-investment fund that invests alongside private investors to support startups at early development stages. It provides funding for proof-of-concept, pre-seed, and seed-stage ventures, with a focus on sectors that require longer development timelines and capital-intensive research. As the Aspire fund reaches the end of its lifecycle, it remains unclear whether it will be extended or replaced with a successor programme. This uncertainty presents a challenge for long-term planning and for startups that rely on seed-stage investment to progress towards later funding rounds. A more in-depth examination is needed to determine whether continued government support for early-stage investments is necessary and in what form it should be provided. If a funding gap remains at the seed stage, the continuation or adaptation of the Aspire fund could be considered as part of the broader strategy for strengthening the country's startup investment landscape.

Elevate: A fund-of-funds programme that invests in venture capital (VC) firms backing companies at the Series A and B stages. The objective of Elevate is to expand the availability of growth capital and strengthen the venture investment ecosystem by attracting private sector participation.

NZCGP should continue operating as part of New Zealand's early-stage and capital market framework. Its role in supporting venture capital investment through the Elevate fund has contributed to expanding the availability of growth capital, while the Aspire fund has provided early-stage investment to startups at the seed stage. Given the ongoing development of the domestic venture ecosystem, maintaining NZCGP's activities will support the commercialisation of research and the growth of high-potential businesses.

The advanced technology components

201. The need for urgent action and investment in this area is clear. New Zealand could foreseeably slip out of the first rank of nations if it does not accelerate progress in these domains. Advanced technologies such as AI and quantum are fundamentally changing the way societies will operate and business progresses. Unlike past technological developments, which took many years to diffuse, allowing following societies to respond adequately, this phase of technological development is moving at a remarkable pace. The consequences will be profound, with countries that fall too far behind likely unable to sustain the first-world status and the associated levels of economic development. There is not one aspect of public or private sector activity that is not affected by these rapid technological changes. Yet New Zealand has badly underinvested and has been slow compared to other small, advanced economies to understand that the government has a key role to play in ensuring that these developments are rapidly incorporated into public and private processes in a way that magnifies the opportunities and manages the risks.

202. Even within the public sector, the lack of coordinated understanding of the impact of AI on policy analysis and development and the inchoate and limited approaches taken across government have already become evident. AI has much more to offer the public service than is generally realised. Still, the use of AI requires understanding its limits, ensuring social license for its appropriate use and expertise in its application. In the private sector, there are green shoots. Still, international evidence suggests far greater productivity gains are possible with deeper diffusion of current tools, and new ones are only at the start of the technology journey. Big data analytics will allow governments to make better choices in many aspects of the social economy – an area in which New Zealand was once a leader, but is no longer. The likely development of stable e-currencies and digital currencies and broader use of blockchain could reduce transactional friction in the economy with immediate productivity lifts. In the security and defence sectors, AI and quantum technologies are becoming central to security, cybersecurity and military preparedness.

203. Progress in the life sciences with advanced technologies will profoundly influence many aspects of the biological economy, including agriculture, food production, medical applications, and environmental management. The Gene Technology Bill, if passed, in substantially its current form, would change the range of options open to New Zealand.

204. It also needs to be acknowledged that few countries will have technological sovereignty, and a country such as New Zealand will increasingly need to seek partnerships in developing and exploiting these technologies. Some of these technologies have large infrastructure costs and will require a significant increase in human capital. New Zealand cannot take advantage of these technologies without urgent, sufficient, and coordinated investment. There will need to be recognition that a significant component must also meet New Zealand's security needs.

205. NZIATA must help create an advanced technology ecosystem, meeting New Zealand's national interests in using and exploiting advanced technologies and assisting the New Zealand government and society to take advantage of rapidly emerging technologies. In doing so, it can support New Zealand's security and defence needs and assist New Zealand companies in exploiting technologies for economic growth and productivity enhancement. It should also develop international partnerships necessary to achieve these missions, ensure foresight in the technology landscape, foster new and existing companies, and consider social license and ethical issues.

206. Priority must be given to the following technologies:

    i. AI
    ii. Quantum
    iii. Advanced genetic technologies
    iv. Synthetic biology
    v. Blockchain applications including digital currency
    vi. Big data analytics
    vii. Space and industrial 'deep tech'

    In many cases, the applications will be in areas of New Zealand's traditional strengths, namely primary production and the services sector. There may be different cadences and levels of investment across these classes of activity.

207. Beyond those innovation activities already discussed, it should assist MBIE and MFAT in negotiating infrastructure access for New Zealand public actors, which may have to be international in supercomputing and quantum computing and ensure facilities exist for synthetic biology and advanced gene technology (see Infrastructure section). It should ensure access, likely through subcontracting for training courses for business and other stakeholders. It should also promote diffusion of technology use in both government and private sectors, as well as activities related to ethics, social license, policy advice, etc., and technology assessment.

208. It will work closely with government actors, including defence and security actors, and with private sector partners. It will need to focus on technological diplomacy to build key and sustained partnerships that overcome the realities of our limited capacities and infrastructure.

209. NZIATA must avoid mission creep into either providing empirical activity or research services that should devolve to the spokes or can be offered by providers such as the Product Accelerator.

210. Governance will require specific expertise in innovation and advanced technologies and a comprehensive understanding of the agency's multiple roles. It must not become a place for inappropriate and unqualified board appointments. Its structure must consider meeting the needs of four major client groups: the public services generally, sensitive public sector components (GCSB, financial sector, defence sector), the public good research community and private sector developers and end-users. Thus, there might be multiple funding streams, but it must have adequate resources to undertake its hub functions and fund the spoke functions, which will be the dominant expenditure.

The broader innovation ecosystem

211. In an era defined by rapid technological advancement, MNCs are playing an increasingly pivotal role in shaping the knowledge economies of nations seeking to establish themselves as global innovation leaders. By establishing R&D centres, these corporations contribute to economic resilience, technological capacity, and workforce capability in ways far beyond their immediate commercial activities. For nations transitioning towards knowledge-based economic models, the presence of MNC R&D centres along with other corporate activities offers a range of strategic benefits that underpin long-term economic prosperity.

212. MNCs are conduits for global technological expertise, introducing cutting-edge innovations and best practices that elevate national R&D capabilities. These centres collaborate with local universities, research institutions, and startups, driving cross-sector knowledge exchange and accelerating the development of homegrown intellectual property. They provide high-value employment opportunities in advanced science, engineering, and digital technologies, fostering a workforce equipped for the demands of a globally competitive economy. Many of these professionals go on to establish startups or take leadership roles within the domestic industry, creating a sustainable cycle of talent retention and development.

213. Countries with a strong multinational R&D presence tend to attract further foreign investment, reinforcing their status as viable destinations for high-tech industries. This integration into global supply chains supports economic diversification and long-term growth. MNCs seek supply from the best and most advanced producers and service suppliers (including R&D) irrespective of location. These relationships build local expertise and infrastructure and provide foreign revenue in a continuous and often accelerating cycle. MNC R&D operations enhance national productivity by embedding global best practices into the local industry. They also contribute to export-driven growth by developing world-class technologies such as artificial intelligence, biotechnology, clean energy, and quantum computing. Multinational R&D investment generates significant tax revenue, both through corporate taxation and income tax from high-earning employees. In turn, this revenue supports further government investment in education, infrastructure, and innovation ecosystems, reinforcing knowledge-based economic growth. A well-structured regulatory and taxation framework is essential for attracting and retaining MNCs in a knowledge economy.

214. Several other bodies and groups foster innovation in the New Zealand ecosystem, and nothing in this report should be taken as any suggestion that they should be undermined. These include groups such as the Angel Investors Association, private incubators like Outlook Ventures, and components of the startup ecosystem like the Ministry of Awesome and The Icehouse. The Product Accelerator provides a critical resource in assisting companies in finding technology solutions.

System enablers

Internationalisation: from New Zealand to the world

215. It is a given that New Zealand needs to work to earn its place, profile and relevance in the world. Other small, advanced economies have long recognised the critical role of science in doing so, but, in contrast, New Zealand has taken a rather passive approach. It is at risk of even greater exclusion and irrelevance as science and technology-based innovation has a critical and converging role in international trade and geostrategic affairs. Increasingly, SI&T are intertwined with strategic, defence, and security as well as economic matters, and these connections are impacting the policies of nations both big and small. How New Zealand uses SI&T will influence its positions with trading and traditional security partners and with our regional interests.

216. It is notable that the role of SI&T is being emphasised in the recent speeches and communiques by the Prime Minister, the Minister of Foreign Affairs and Trade, the Minister of Economic Growth, and the Minister of Science, Innovation and Technology. It is also reflected in the five economic strategic priorities of the current administration, which focuses on the knowledge economy and innovation. The key question thus becomes how we leverage the global shift in the importance and value of SI&T to deliver sustained value, particularly in the economic and political spheres, to New Zealand.

217. In recent years, New Zealand has grossly undervalued the role of SI&T in international engagements and, over time, substantially withdrawn from many notable and relevant engagements.[53] Furthermore, there is very little capability or capacity left in the international components of the science and innovation system in either MBIE or MFAT for relationship management or promoting joint activities or indeed for promoting high technology investment opportunities. This work requires sustained and meaningful interactions with potential international partners. If New Zealand is to meaningfully contribute to any international science/innovation partnerships then it will need to do so strategically with clear purpose and with targets over longer timeframes rather than through *ad hoc*, reactive approaches.

218. Throughout this review, members of the SSAG have been approached by ambassadors and scientists highlighting repeated missed economic and scientific opportunities and their frustration at our self-induced relative isolation. Even on ministerial-led international missions, the focus has been mainly on promoting commodity or educational exports, rather than showcasing our scientific and innovation potential. It is rare for scientists to be engaged in such missions, and even rarer for planning these missions to take advantage of the innovation opportunities and latent partnerships that can grow from existing scientific collaborations. The current lack of a PMCSA limits the ability of the Prime Minister and ministers to get appropriate advice.

Science diplomacy

219. New Zealand is a small, geographically remote country, but ambitious to sustain its future as a high-income developed country. This ambition is challenging in the context of a rapidly changing technology environment. New Zealand is a very small component of the global research endeavour, both in terms of investment levels and in the size of the research workforce: it cannot do everything in ST&I by itself. The country needs to be much more strategic in ensuring

53 For example, New Zealand's formal representation at France's recent and important AI action summit was from the embassy.

relationships with researchers and research elsewhere for knowledge production, knowledge absorption, and diplomatic and strategic purposes. Simply put, in many domains of science, innovation and technology, New Zealand will not be able to thrive without stable partners - we are just not big enough to be 'technologically sovereign'.

220. International science cooperation is the core to leveraging New Zealand's small science footprint. In general, our investment in international science cooperation is not strategic but has been *ad hoc*, based either on the capacity of individual scientists to build relationships and where possible seek international funding (the possibilities of which were expanded by New Zealand becoming a tier 2 associate member of Horizon Europe), or disproportionately from the legacy outcomes of diplomatic visits. The small amount invested via the Catalyst Fund of MBIE cannot meet strategic needs, nor is it allocated on a strategic basis.

221. Science and innovation diplomacy activities can lead to significant and actionable outcomes: this is no different from how other diplomacy or business development domains operate. Other nations with whom we would like to compare ourselves invest much in international science partnerships and science and innovation diplomacy. Strategic partnerships become more essential as rapidly emerging 'deep and advanced technologies' become more central to economic development and thus to security and stability. These need to fit with New Zealand's strategic and diplomatic interests and must be based on our ability to be a genuine partner and align with our overall national development priorities. For example, technology-foresight initiatives like the Geneva Science Diplomacy Anticipator (GESDA)[54] have become central for thinking through the diplomatic (in the broadest sense) issues of future technologies and their trade implications.

222. New Zealand has minimal awareness or engagement with these approaches, highlighting the reality that science and innovation diplomacy is very poorly developed and leveraged compared to other developed and innovative countries, irrespective of their population size. Countries like Denmark, Switzerland, Ireland, Singapore, Israel, Taiwan, South Korea, etc., as well as all major economies, invest in science and innovation diplomacy, albeit in different ways.

223. Scientific and academic communities are arguably the most globally connected part of New Zealand society. Most of our public-sector scientists and researchers have significant international ongoing connections. For example, their value has been demonstrated in how New Zealand used that connectivity more than a decade ago to receive the primary votes of virtually all the African states in its last campaign for membership in the Security Council. We should be thinking about how to leverage these relationships more in target markets.

224. Science diplomacy allows a country to project its relevance and values globally in ways that are not always easily achieved in other ways. SI&T is increasingly central to trade discussions and will become more so as technology issues dominate. Much of the global agenda is concerned with issues of the global commons, such as climate change. New Zealand has both something to offer and, in return, something to gain from more diverse global relationships.

225. International science cooperation has a crucial diplomatic value and merits promotion. It is even more important for a small country of five million people that cannot do or afford to do everything in science, innovation and technology on its own. The development of science cooperation for our benefit with countries, including Singapore and Australia, is obvious. In contrast to Australia, New Zealand has no consistent history of science partnerships with markets such as India.

54 Geneva Science and Diplomacy Anticipator. (n.d.). GESDA Global. Retrieved from https://gesda.global](https://gesda.global/

226. The primary avenues for relevant components of New Zealand's international effort are through MFAT, MBIE (for SI&T) and NZTE (for industry partnership and innovation). Sadly, synergistic cooperation between these agencies, industry and academia for enhancing science diplomacy and partnerships has been patchy over the years. Developments in our aerospace sector demonstrate what can be rapidly achieved when agencies work closely with academia and industry.

227. There are many scientific issues where the primary responsibility appropriately lies with MFAT. Yet New Zealand is a country that stands out for its lack of embedded science expertise within its foreign ministry. Too often, non-experts represent NEW Zealand in important scientific and technological fora. The issues include environmental matters such as the sustainability and climate change agendas, global risks such as pandemics, emerging new technologies, and our interests in ungoverned spaces, including inner and outer space, the oceans and seabed, and aspects of the digital world. All of these are central to our economic and broader futures. Importantly, as the nature of development assistance changes, we will wish to evolve more mature relationships with our Pacific partners. Science offers enormous opportunities to project and sustain liberal values within the region.

228. Small, advanced economies frequently use science to develop both new relationships and deepen extant relations. These relationships aim to both project a country's influence/interests (as New Zealand must in the Pacific), in developing new markets or extending new ones. They must be strategically chosen related to our needs and opportunities. SI&T are essential in development assistance (e.g. energy security, disaster management, climate change adaptation, public health promotion) and increasingly seek to assist recipient capacity building (e.g. the development of the Pacific Academy of Sciences in Samoa).

229. The Small Advanced Economies Initiative (SAEI), led by New Zealand since 2012, initially focused on science and innovation but has spread more widely as a safe space for similar countries to explore a wider range of policy issues. Science and innovation are still a core focus, and the links it created have been central to the development of this report.

230. Increasingly, New Zealand's economic future will depend on both adding greater value to exports and growing a weightless innovation-based economy. Biotechnology will dramatically change the shape of the global food market in future decades, and increasingly, food will be designed for target markets, especially health-related. Advanced AI, synthetic biology and quantum will be major technologies determining advanced nations' futures. New Zealand does have some areas of expertise (especially where we are data-rich) where we could develop a potential advantage. Still, these will need carefully curated international academic and commercial partnerships developed over time, often with partners where synergistic knowledge exists or where there are specific end-users. These must be built around business-to-business, business-to-academia, and academia-to-academia opportunities.

231. Additionally, we need to ensure access to certain technical capabilities that we need but cannot afford or justify—the synchrotron in Australia is an example. But we will need additional infrastructural agreements with strategically compatible partners in areas such as quantum computing. Other forms of agreements may also be needed, depending on the technology, such as in the space sector.

National security and defence

232. The role of SI&T in national security and defence is multidimensional and growing rapidly. Recent events have highlighted that national security and defence considerations cannot be considered in isolation from technology and economic considerations. Dual-use technologies have often been considered to have a clear demarcation between mainstream commercial technology applications and military applications; however, this is no longer practical as nearly all technologies have geostrategic implications.

233. Quantum technologies will become central to the security of a nation's financial system. Issues in cybersecurity for civilian purposes cannot be fully distinguished from capacities required in the intelligence and security systems.

234. Space provides a further dimension where science, intelligence, security, and stewardship interests (e.g., environmental monitoring, fisheries protection) converge. Science plays a significant role in predicting and managing crises, emergencies, and disasters, and this is likely to be a growing concern given the potential consequences of climate change. Climate and energy technology play a critical role in mitigating and adapting to climate change's effects.

235. New Zealand must invest in strategic foresight and capacity development in emerging technologies to navigate the complex economic and geostrategic landscape and assess its implications for our interests.

Antarctica

236. Antarctica and its role in the future needs separate and deliberate consideration as the rationale for Antarctica research is a mix of political (our suspended claim under the Antarctic Treaty), geostrategic (relationships to the USA and other actors using New Zealand as an entry point or active in our region of the Antarctic), defence (given the commitment of the NZDF to provide logistic support and to support our fisheries management, search, rescue and environmental responsibilities in the Ross Sea). In many ways, many of the activities here form a class of stewardship research.

237. Beyond these often less-discussed aspects, there is the underpinning science research itself, where New Zealand is seen as a critical and respected player in understanding the changing nature of Antarctica and the surrounding oceans and its many implications for climate, sea-level rise, the marine food chain, etc.

238. Currently, the funding of our Antarctic programme is split between Antarctica New Zealand (which reports to MFAT), which supports the underpinning logistics (with the aid of NZDF), and MBIE, which supports science endeavours. The funding mechanism is split between two government agencies (including some contestable funding) with complex arrangements around management and decision-making. This arrangement creates inefficiencies as well as confusion for our international partners. The nature of the science in Antarctica will inevitably incur logistics costs and often complex logistics owing to the environment in which the science missions are taking place. It seems more logical to completely assign all relevant activity to Antarctica New Zealand, including administration and decision-making over science programmes, albeit with oversight in its funding processes, including representatives from the proposed national science-funding organisation. They have processes in place to do that, which would place them in a better position to be efficient, match logistics and research, and, importantly, leverage international partnership discussions, which, given changed attitudes of some countries, may become more complex.

Targeting our international effort

239. It is important, given the nexus between security, technology, trade and national interests, that we take a nuanced and granular approach to international collaborations, recognising that countries can be collaborators, competitors and strategic allies/adversaries and that the same country can be all three in different domains of science. This, in turn, supports the professionalisation of the approach to international collaboration.

240. To best achieve the above, and given the current cost pressures within the government, it would be important to develop a focused international strategy that identifies the mechanisms available to achieve the above and considers the economic, social, environmental, and national security considerations. Promoting greater cooperation between ministries (especially MBIE, MPI, and MFAT), perhaps best coordinated through PMSITAC.

241. There is a need to develop a strategy for each of our target markets and identify critical activities to establish relevant relationships. This development should not simply be based on pre-existing diplomatic relationships but instead on what is needed for New Zealand's benefit in the future. Priority should be given to Singapore, Geneva, Silicon Valley, London, Canberra, Paris, New York/Boston, Brussels, and India. Most similar countries have science councillors in key posts around the world. However, this arrangement is very expensive and limited in what it can achieve, although there remain strong arguments for such individuals in Brussels, Washington DC, and perhaps Singapore. New Zealand's current overseas scientific and innovation presence is minimal (MBIE has just three overseas science counsellors) and will not be enough to serve us in the future. We suggest a fundamental relook at what is needed to ensure that it is fit for purpose for New Zealand.

242. International experience suggests that science, as in business, needs a mix of interactions of high-ranking scientists with strategic breadth engaging at a strategic level to build the relationships, identify opportunities, to get access (science is surprisingly hierarchal) followed up by technical discussion with the appropriate policy/ commercial/political engagement as required. This level of interaction is needed both at the early and later stages in the relationship. Thus, it may be more economical and certainly more effective to supplement or replace embedded personnel with part-time visiting science envoys who are well-respected and highly ranked scientists with broader skills and formal appointments to build these relationships at a higher level in science and innovation systems. These science envoys could be given defined target territories or technological domains.

Science and innovation infrastructures

243. In our first report, we highlighted the need for a coordinated approach to physical infrastructure, but we also need such a coordinated approach to our human infrastructure. Progress in science and innovation is impossible without the right people who are appropriately developed. Thus, many components, multiple responsibilities, and coordination are needed. The core elements are discussed here.

244. New Zealand must surpass the excessive parochialism that has impeded proper collaboration between universities and CRIs. Much of our first report and that of UAG has focused on promoting collaboration and removing the barriers to smooth and seamless collaboration. The merger of CRIs and the messages given to promote the cooperation could lead to far better campus-based efforts that cross boundaries. As the CRIs reform into capability groups,

it may be that much closer academic and research ties can be formed more easily. Secondly, as mentioned elsewhere in this report, international partnerships must be fostered and will be essential in some areas.

245. The public must support the transition to an innovative and knowledge-based economy. It is therefore worrisome that the limited investments in museums and similar activities have been compromised. MBIE abandoned the Nation of Curious Minds programme, which was reaching many under-served parts of the community. Public television and media do not support New Zealand science stories, and the state of science and mathematics education in schools continues to be most concerning. Many countries invest significant effort in developing earlier and more robust science education. China may be the most extraordinary example of this approach with a very heavy investment in primary school science education.

246. This report notes the importance of social licence in several places. Many aspects of science confront ethical issues, and the Royal Society Te Apārangi, the universities, and the HRC all have critical roles to play. It will be important that the HRC's key role in ethics is protected when the NRC is formed and that the issues we have discussed related to big data and AI are not overlooked.

247. Global concerns about the relationship between science and society highlight ongoing issues in science communication. While beyond the scope of this report, we note an increasing focus on the training of researchers and the growing importance of science communications as a discipline.[55]

The workforce: scientists and entrepreneurs

248. In our first report, we commented on the state of the workforce, noting multiple issues at all stages of people's careers. Early-career researchers suffer from career precarity and need support to turn their innovative ideas into research agendas. Mid-career scientists must also be supported in their career development and be given more opportunities to rotate into business and policymaking. Finally, we must attract and retain key opinion leaders, crucial to attracting MNCs and investors.

249. There are significant changes in the demographics of our population ahead, and it is necessary to encourage more young people into science and technology careers. This need arises at a challenging time, given that numerous surveys, both here and overseas, find that scientists are increasingly pessimistic about their careers in science. Moreover, the demographic changes here necessitate particular attention to attracting Māori and Pacific peoples into science. Universities have been active in doing so, but the state of high-school science education places many young people at a disadvantage. Nevertheless, New Zealand also has an opportunity to harness the demographic benefits of our relatively younger population compared with those of many other small, advanced economies.

250. Hopefully, as the public system's state improves and the innovation economy's growth becomes obvious, more students will want to enter science. Universities and polytechnics must adjust their offerings, especially in emerging technologies, to meet this need. This adjustment may involve reaching out specifically to Māori and Pacific people to ensure that they enter the researcher workforce in sufficient numbers.

55 At least one University in New Zealand (Otago) has recently closed its Centre for Science Communication.

251. The state of the New Zealand science system and its funding have meant instability at every level in our human capacities, and retention and attraction are a growing concern. The CRIs have shed much capacity, but there are mixed reasons for this. Our fundamental concern here has been the lack of long-term strategic thinking, especially in the CRIs, reflecting their confused missions and incentives (as discussed in our last report).

252. New Zealand continues to rely on international talent as a critical part of our economy. These people will be increasingly needed in emerging areas such as quantum, AI, etc. Our needs will range from early/mid-career scientists to established science leaders and practitioners. There is likely to be intense international competition for researchers with these skills. New Zealand must ensure that it is an attractive workplace (hence the need for a stronger research sector). In addition, New Zealand must appeal as a place to live. Recent events have meant great and active interest is being shown by European countries in attracting scholars and scientists who are concerned by events in the USA. New Zealand could similarly benefit if it had an active programme and a positive approach to science and innovation[56].Strong international relationships are necessary to ensure that New Zealand continues attracting and retaining talent to grow our workforce and support the SI&T system. There are barriers in the immigration and overseas investment space that must be addressed, but these matters are beyond the scope of the SSAG.

253. It is concerning that there is very little flow of innovators and scientists among academia, PROs, the government agencies and the private sector. The industrial PhD schemes are but a small component. In other jurisdictions, the churn across these sectors is far greater and is tacitly or actively promoted. The universities and PROs need to encourage joint appointments, and the public sector must think more about exchanges and sabbaticals with the research community.

254. This report highlights the need to recruit people capable of leading our innovation system through its restructuring and beyond. This need is urgent – as other countries have found, limitations in domestic capacity can be debilitating. The government has already highlighted the need to emphasise attracting investors and entrepreneurs, and we need not make further comments. The review of the FIF taxation regime and the Overseas Investment regime are key components.

Physical infrastructure

255. There are many issues related to research infrastructure. Often, the need for cutting-edge infrastructure cannot be met by a business case in the formal sense because it is needed at the public good or the earliest stages of the TRL scale. Others, such as research vessels, have unique considerations. Further, the currently required depreciation rules create additional issues, which are detailed in the UAG report. There is much evidence that technologies drive innovation in science, and a lack of access is an impediment.[57]

256. On the other hand, much instrumentation in New Zealand is not readily and affordably accessible to users outside the owning organisation. Solving this issue is not easy, but a more collaborative approach is needed. As a starting point, the establishment of a national major equipment inventory in both the public and perhaps the private sector might assist in identifying

56 Examples recently announced include a French platform: https://sciencebusiness.net/international-news/france-creates-platform-attract-us-and-other-disaffected-researchers and a German equivalent:. https://sciencebusiness.net/international-news/germany-could-spend-part-its-eu500b-stimulus-package-attracting-us-scientists.

57 Sarewitz, D. (2016). *Saving science. The New Atlantis*. Retrieved from https://www.thenewatlantis.com/wp-content/uploads/legacy-pdfs/20160816_TNA49Sarewitz.pdf

needs and improving access arrangements. At the international level, we already do this with the synchrotron, and we will likely have to do it in quantum computing. Conversely, we may need to support public-sector access to commercially held supercomputing as AI advances.

257. The restructuring of CRIs and the need for greater efficiency within the university sector offer an opportunity to consider whether the infrastructure of buildings and property suits our future needs. Co-location exists at Lincoln and Palmerston North, but that has not been optimised or strategically developed to its full potential. If the PRO restructuring becomes based on competency groups, consolidation could extend more extensively to governance arrangements. The private sector should also be encouraged to co-locate as is the case in Singapore's Biopolis and Fusionopolis (both components of A*STAR). Paris's Station F, the world's largest startup campus, while much larger and of a different scale, is an example of what can be achieved with imagination and commitment.

258. The digital infrastructure currently provided by NESI and RIANZ has problems, given how it is funded and managed across stakeholders and also needs review. This issue might be best placed under the hub of the NZIATA to resolve.

259. Given these considerations, we believe there is a need for a RIAC to act as a forum to coordinate physical infrastructure, explore needs and efficiency and promote collaboration. RIAC should have an inclusive membership and operate as an advisory and coordinating group for MBIE, NRC and NZIATA. We note that Australia has a national research infrastructure roadmap, which may be a useful starting point.

260. Beyond the contributions of universities and CRIs through their own decision-making and resource allocation, the primary source of infrastructure funding at scale is the SSIF. This fund is currently administered by MBIE and is applied in multiple ways – for example, funding programmes such as Genomics Aotearoa, the Antarctic Research Programme (in part) and providing core support to CRIs. This function might be transferred to the NRC acting on advice from RIAC.

261. It is easy to forget the critical role of databases, taxonomy and other collections, and their curation (which is a specific expertise in itself) is essential to stewardship and areas such as biosecurity (the arthropod collection, etc). This important area was the subject of a Royal Society of New Zealand review in 2015.[58] The issues raised there remain cogent and should be included in the mandate of RIAC.

58 Royal Society of New Zealand. (2015). National taxonomic collections in New Zealand. Retrieved from https://www.royalsociety.org.nz/assets/Uploads/Report-National-Taxonomic-Collections-in-New-Zealand-2015.pdf

The path to the future

262. Since the SSAG was formed in early 2024, the urgency for change has become even clearer. Due to decades of underinvestment, the New Zealand science system is extremely fragile and vulnerable. The effects of this financial neglect are compounded by New Zealand's failure to acknowledge that we must actively participate in the global science endeavour. The government has identified the need for a far more effective innovation system as part of its economic agenda, and this realisation has broad support across the political spectrum.

263. The blunt and inescapable reality is that we are paying the price for 30 years of insufficient investment in science and technology. We will not reiterate all the evidence from our first report; instead, we hope that, in a bipartisan manner, our politicians will accept that New Zealand cannot continue on its current path and must improve its investment strategies.

264. We recognise that the policy of increasing government spending on research could be a challenging 'sell' to a public concerned about more pressing economic and social issues, but we suspect this objection is overstated. The evidence is clear – investment in science and technology is core to economic growth. Indeed, this point is made in the government's five-point economic strategy. However, it is self-evident that an investment of $1 can never achieve what an investment of $10 can do. We must end our national exceptionalism that has previously denied the centrality of knowledge and research in promoting our future – we are paying the price for denying that relationship and thus making inadequate investments over several decades.

265. Innovation does not emerge from nowhere. It requires:
    - A well-educated society,
    - Sustained policy settings,
    - A strong and adequately supported pluralistic science system,
    - A society that accepts failure is part of entrepreneurial success, where risk-taking is part of innovation,
    - A government that understands that market failure is inevitable at the early stages of innovation, and that the Crown must seed and nourish that phase but in turn must leave it to experts not bureaucrats to manage that phase,
    - Institutions that can assist at key phases in the innovation journey,
    - An engaged innovation ecosystem,
    - A society that understands that without adequate research-based new ideas and a steady deal flow of these discoveries to both the public and private sectors, we will not sustain our future.

266. The government's responses to our first report demonstrate that progress can be made, but they also highlight the importance of strategic rather than simply administrative change. Strategy must inform function, which in turn informs structure and form. There is a danger of disruption if change is poorly managed and focuses on form rather than function.

267. We are a small country with many assets but are in danger of squandering them. Our compulsory education system has failed to equip young people with the skills they need to thrive in a technological age; our universities and polytechnics need to adapt so that more young people see their future in New Zealand. We must ensure that our small research funding system focuses on priorities that justify using public money, and we make significant recommendations

to achieve this goal. We must prioritise, as a country of five million people cannot do everything, and recognise that smart, strategic partnerships in science and innovation are essential.

268. Fortunately, the necessary changes are possible and could be made rapidly. We have green shoots in the government's response to our first report and the private innovation sector. But the frustration and many ongoing issues we have highlighted are apparent. We have shrivelling shoots, especially within the broader science system. Government agencies have a long way to go in effectively utilising science and research, and the necessary structures to support this need must be addressed.

269. None of this should be a partisan issue. Both sides of any parliament must recognise that New Zealand's future depends on a robust science and innovation system with four key purposes: supporting the government in its stewardship responsibilities, informing policy development, promoting new knowledge, and fostering innovation. All are related and cannot be considered independently of one another. And despite difficult financial times, investment in research and innovation is central to our path to the future. The SSAG comments here are frank alongside constructive recommendations, because the issues are urgent and cannot wait.

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