Summary of Submissions on the Draft National Statement of Science Investment

2014–2024

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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5 DECEMBER 2014

Contents

Appendices

Tables

Figures

ISBN 978-0-478-43359-3

Introduction

Purpose of this document

1 The *Draft National Statement of Science Investment* (*Draft Statement*) provides an overview of the current state of the public science system and sets out the Government's current and future priorities for its science investment.

2 The Ministry of Business, Innovation and Employment has consulted other relevant government agencies throughout this process and in drafting both the *Draft Statement* and the Summary of Submissions document.

3 The *Draft Statement* proposes the following key priorities for action over the next five to ten years for Government's science investments:

- producing excellent science of the highest quality
- ensuring value by focusing on relevant science with the highest potential for impact for the benefit of New Zealand
- committing to continue increasing investment over time
- increasing focus on sectors of future need or growth
- increasing the scale of industry-led research
- continuing to implement Vision Mātauranga
- strengthening and building international relationships to strengthen the capacity of our science system to benefit New Zealand.

4 This report provides an overview of the submissions received on the *Draft Statement* and identifies key themes for different groups of submitters.

Consultation on Draft National Statement of Science Investment

5 The Government undertook a public consultation on the *Draft Statement* between 28 May 2014 and 22 August 2014.

6 Submitters were asked to provide feedback on:

a The current state of the public science system, including:

- the overall balance of investment in science
- areas of over- or under-investment
- how well different parts of the science system are performing, individually and as a whole
- evaluation and monitoring of system performance

- opportunities to rationalise and simplify the funding environment

b The proposed strategic direction for Government's science investment, including:

- priorities for science investment
- opportunities to improve national collaboration
- opportunities to improve international collaboration and cooperation
- the best way to assess the quality of research
- priorities for human capability development
- implementation of Vision Mātauranga
- the way to increase industry investment and industry-led research
- knowledge transfer and use of research outcomes

c Feedback on specific research funds, including:

- performance of specific funds
- opportunities to simplify specific funding mechanisms
- facilitating access of funds for different types of researchers
- potential changes to eligibility, duration and assessment criteria of funds.

Approach to analysis

7 The Ministry of Business, Innovation and Employment coded submitters' comments against the specific consultation questions in the *Draft Statement*. We have also provided qualitative comments that take into account broader trends from submissions.

Overview of responses received

8 MBIE received 108 submissions on the *Draft Statement*. Submitters were categorised into six core groups as shown below. Appendix 1 provides a full list of submitters.

Table 1: Core-submitter groups and number of submitters per group

Core-submitter group	Sub-categories	Number of submitters
Crown research institutes (CRIs) and independent research organisations (IROs)	• CRIs • IROs	14
Peak science and funding bodies		15
Business-related industry bodies and private sector	• Business-related industry bodies • Private sector	28
Local government and museums	• Local government • Museums	8
Tertiary education		32
Other submitters	• Not-for-profit representative bodies • Other individual submitters	11
TOTAL		**108**

9 All CRIs except one made a submission, as well as Science New Zealand, the representative body for the seven CRIs.

10 Peak science and funding bodies are organisations which either provide funding to scientists, such as the Marsden Fund Council, or actively represent the interests of scientists, such as the Royal Society of New Zealand or the Institution of Professional Engineers New Zealand (IPENZ). Scientific bodies that could have also potentially been included in the business-related industry bodies group are included in the peak bodies group.

11 Business-related industry bodies and the private sector, along with tertiary education accounted for over half the submissions. Auckland University made up nearly a third (10 of 32) of the tertiary education sector's submissions, with various departments and business units making separate submissions.

12 A small number of councils, a single Council Controlled Organisation (CCO) and three museums made submissions. There was also a small number of not-for-profit bodies with an interest in the *Draft Statement*, including Alzheimers New Zealand and the Association for Women in the Sciences (AWIS).

This report

13 The summary of submissions provides an overview of responses received in four sections:

Section A	Overall summary of submissions
Section B	Current state of the public science system
Section C	Future direction for Government's science investment
Section D	Specific research funds

Executive Summary

The *National Statement of Science Investment* aims to set a 10-year strategic direction for the science system and ensure Government's science investments are well aligned. In May 2014, Government published the *Draft Statement* for consultation, to form the basis for an open conversation on what this long-term direction might involve.

The Ministry of Business, Innovation and Employment (MBIE) met with a range of stakeholders in the science system and held workshops with researchers, science end-users and interested Māori groups. We received 108 submissions from:

- 32 tertiary education organisations
- 28 business-related industry bodies and private sector businesses
- 15 peak science and funding bodies
- 14 Crown research institutes and independent research organisations
- 8 local governments and museums
- 11 other submitters.

This *Summary of Submissions* presents MBIE's analysis of the submissions received. The document summarises the key themes and issues raised by stakeholders. Submissions were predominantly highly detailed reports, focusing on areas in which the submitter had a particular interest. A smaller number of submitters adopted a system-level perspective.

Submitters appreciated the opportunity to take part in the discussion and their feedback on the *Draft Statement* was generally positive, and they appreciated the opportunity to take part in the development of the document. They specifically noted that the *Draft Statement* provided a useful overview of the whole science system. Most submitters agreed with the intent of the *Draft Statement* and the seven proposed main objectives for Government's science investment. However, they suggested that the final Statement should contain a greater level of detail on the main objectives and how Government plans to achieve them.

Submitters expressed the view that a long-term national science strategy would provide the needed stability and predictability to a system which they felt had undergone significant change in recent years. While expressing the need for stability, stakeholders nonetheless recognised that further change was needed to raise performance in the science system, particularly to MBIE's contestable sector-specific funds. Submitters particularly welcomed the idea of a plan that would signal change early and indicate Government's science investment priorities and future levels of investment.

Stakeholders expressed a wide range of views on science funding mechanisms and the balance of investment within the system. There was little consensus on whether New Zealand has the right balance between investigator-, mission- or industry-led research or institutional and contestable funding. Most funding instruments, for example, drew both praise and criticism, although the Marsden Fund and the Centres of Research Excellence received positive feedback from the majority of submitters who commented on them.

Despite the general diversity of views, some common themes did emerge around the need for more international collaboration, improved opportunities for early-career researchers and the need to both grow and simplify the science system.

A few submitters drew on quantitative data, but most submissions were based on qualitative statements. A number of submitters commented that there was not enough publicly available data for

them to provide informed comment on some of the consultation questions. This was particularly the case for questions that focused on the overarching structure of the science system, such as the right balance between investigator-, mission- and industry-led research.

There were also notable differences of opinion between industry bodies and researchers. Industry bodies argued for a greater focus on commercialisation and research focused on economic outcomes. Researchers on the other hand believed these goals were too narrow and short term in focus and instead argued for more investigator-led research.

MBIE will use the insights gained from the consultation process and the submissions received to feed into the development of the *National Statement of Science Investment*, which will be published in early 2015.

Section A: Overall summary of submissions

Areas of consensus

14 While stakeholders expressed a wide range of views, some common themes did emerge from submissions. Submitters made specific comments most frequently on international collaboration, funding for emerging researchers, and fragmentation of funding mechanisms (see Figure 1). Other areas to receive specific comments included the Marsden Fund, research and development (R&D) tax incentives, the overall level of science funding, and incentives to collaborate. Each point is discussed below.

Need for more international collaboration (30 submitters)

15 Many submitters largely agreed that more international collaboration would be positive for New Zealand's science system. Some submitters, primarily from the tertiary education sector, were concerned about the limited funds available to attend international conferences, with applications for these funds being particularly time consuming to complete. Conferences were seen as good opportunities to build international networks.

16 Submitters from the private sector suggested that MBIE's sector-specific contestable funding should be open to international firms, who may be able to provide economies of scale and expertise not available in New Zealand. Secondments and exchanges were also identified as ways to improve international collaboration.

Inadequacy of funding for emerging researchers (29 submitters)

17 A common theme across all core-submitter groups was the importance of supporting early career development. Many submitters from tertiary education, business-related industry bodies and the private sector noted the lack of funding for early career development, often in comparison with New Zealand's major trading partners. The discrepancy between postdoctoral opportunities in New Zealand and Australia was regularly cited, with concerns about postdoctoral scientists taking their taxpayer-subsidised education offshore, limiting economic benefits to New Zealand.

18 Secondments were cited as a useful way to improve scientists' understanding of the commercial pressures businesses face, create early career development opportunities, and increase business uptake of research outcomes.

Fragmentation of the science system's funding mechanisms, creating unnecessary administrative costs for researchers (28 submitters)

19 There was a sense that the system was too fragmented and too complicated for New Zealand's size and that greater benefits could be delivered by having fewer funding mechanisms. Submitters argued current funding structures inhibited collaboration, as

competitive funding created different behavioural incentives. Separate institutional funding for CRIs and universities was not seen as incentivising collaboration between the two.

20 The level of restructuring of the government's science investment strategy was a shared concern. Many submitters felt that there had been too many changes in too short a period of time. The responsibility for science policy had shifted three times since 2011, from the Ministry of Research, Science and Technology to the Ministry of Science and Innovation and then to MBIE. Submitters thought this had contributed to a loss of institutional knowledge and specialised human resources, and made it more difficult for researchers to understand what was required of them. Fragmentation was perceived as leading to high compliance and administration costs for applicants when applying for funding.

Lack of incentives for business investment in research and development (15 submitters)

21 New Zealand's level of private sector R&D investment received many comments. Submitters often compared the level unfavourably with other advanced economies of a similar size. However, some felt a fair comparison was not possible as many tax systems created more incentives for recognising R&D than New Zealand's.

22 Some submitters commented on the limited employment opportunities for scientists in the private sector. They felt that this leads to a lack of institutional knowledge of the needs of the end users and a lack of knowledge of public research organisations in the private sector. Secondments were suggested as a way to overcome this issue, noting the limited ability of many New Zealand businesses to employ scientists on a permanent basis.

Low level of science expenditure as a percentage of Gross Domestic Product (15 submitters)

23 On the whole, most believed New Zealand's expenditure on science and R&D was too low compared with OECD averages. Most of the submitters who indicated there was an imbalance of funding considered there was under-investment and a need for increased funding in the sector the submitter was employed in or represented.

Need for better incentives to encourage collaboration (8 submitters)

24 There were several comments on whether the current funding structures incentivise the outcomes government seeks from science investment. Some submitters felt that competitive funding creates barriers to collaboration, as fellow scientists are seen as competitors for limited funding. Others felt this was essentially self-regulation, believing that *forcing* scientists to collaborate is counter-productive and that New Zealand's size leads to collaboration when desired anyway.

25 To improve human capability development and collaboration, submitters from across groups recommended that government consider closer alignment between CRIs and universities. This would provide greater access to future postdoctoral scientists,

engaging them while studying, and fostering higher levels of collaboration between what are two completely separate organisations.

Areas of divergent views

Degree to which potential economic outcomes should guide investment

26 There was division on whether a broad or targeted approach to investment would deliver the greatest economic benefits. A broader approach was advocated to help diversify New Zealand's economy and grow high-value, technology-based sectors. Those in favour of a more targeted approach argued that New Zealand would benefit from focusing its investment on areas where New Zealand already has a comparative advantage internationally, particularly in the primary industries.

27 Submitters were divided on how far economic outcomes should guide investment. Private sector submitters were predominantly in favour of more funding for research that demonstrates economic benefits. Those from tertiary institutions largely favoured science being less linked to short-term economic benefits. Some submitters noted that the best technological breakthroughs arise from 'blue skies' research.[1]

How scientific quality should be assessed

28 There was a split in views on measures of quality. Seventeen submitters were in favour of differentiated measures based on the objectives of funds, while some believed measures should be consistent across funds. Industry bodies and the private sector favoured impact and relevance of research as measures, while peak science and tertiary education bodies supported peer-reviewed publications.

29 Research quality was acknowledged as a key criterion across all funds. Commercially-focused submitters generally agreed that differentiated indicators of quality were required. For example, relevance and impact were noted as being more applicable for industry-led research. There was also concern that academic criteria such as citations of publications were too narrow and unsuitable in a commercial environment, where business wants to protect rather than share intellectual property.

Whether the science system has the right level of contestable funding

30 While some submitters believed the level was right, a number said contestable funding needed to increase as it had diminished over time. Contestable funding was often seen as being a superior funding mechanism to institutional funding – particularly among tertiary and CRI submitters – as the application and funding process provides more accountability and transparency. Contestability is also seen as incentivising desired behaviour.

[1] 'Blue skies' research refers to scientific research undertaken without a clear research outcome in mind. It was also described as 'curiosity-driven' research.

31 Despite this consensus around the benefits, the level of funding was a cause of division. Where specific mechanisms were mentioned, the Marsden Fund was cited as being underfunded, while National Science Challenges (NSCs) were seen as an overfunded, non-contestable, funding mechanism. This is further explored in the section of this report on under-investment.

Right balance of funding between universities, CRIs/IROs and industry

32 Most submitters commented that the overall funding envelope for science investment was too small. However, stakeholder views varied on what the right balance of funding should be. Submitters tended to consider that there was under-investment, and a need for increased funding, in the sector the submitter was employed in or represented.

Make-up of submitters

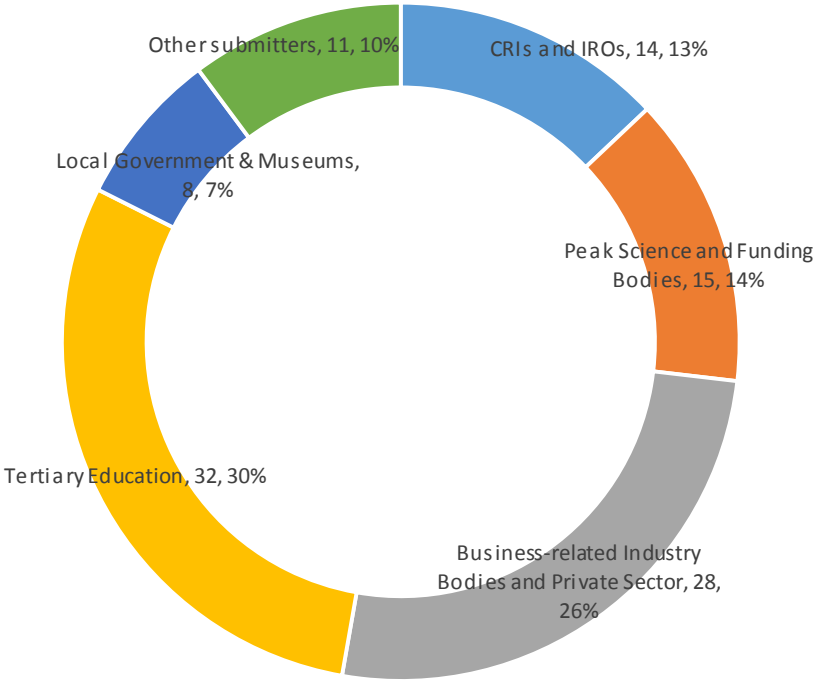
33 The tertiary education sector provided nearly a third of submissions. Business-related industry bodies and private sector submitters were the second largest group of submitters and largely comprised industry bodies, most of them from primary industries (see Figure 1).

34 Peak science and funding bodies, such as the Royal Society of New Zealand and the Marsden Fund Council, were the third largest group. CRIs/IROs, local government and museums, and other submitters made up the remainder of submissions.

Themes based on submitter groups

35 In a number of areas, there was a division of views from submitters. Closer analysis revealed these divisions often fell in line with the submitter groups. The two largest groups, tertiary education and industry bodies, often held opposing positions. For example, business-related industry bodies and private sector submitters agreed that economic outcomes should be more heavily weighted during application assessments. The tertiary education sector did not favour economic outcomes guiding investment.

Figure 1: Number of submissions by submitter group



Priorities for tertiary education (32 submissions)

36 Priorities identified by tertiary education submitters included:

a Ensuring innovative research was not lost to a focus on industry and mission-led research

b Ensuring scientific excellence was a key measure of quality over relevance and impact.

Priorities for business/industry (28 submissions)

37 Priorities identified by business/industry submitters included:

a Increasing the availability of funding for commercial purposes

b Increasing the focus of science investment towards short-run economic outcomes

c Ensuring science investment aligns with New Zealand's areas of comparative and competitive advantage.

38 These submitters generally commented on [potential] synergies between the *Draft Statement* and the Business Growth Agenda's[2] goal of increasing the ratio of exports to GDP to 40 per cent by 2025.

Priorities for other submitters (48 submissions)

39 Peak science and funding bodies, CRIs/IROs, local government and museums, and other submitters were generally interested in the overall balance of science investment and the performance of the science system overall. The interests and opinions of CRIs/IROs were most closely aligned with those of industry and the private sector, while the interests and opinions of peak science and funding bodies were most closely aligned with tertiary education submitters.

[2] The Business Growth Agenda (BGA) is delivering innovative initiatives and policy reforms that will help create a more productive and competitive economy. More information is available at http://www.mbie.govt.nz/what-we-do/business-growth-agenda

Section B: Current state of the public science system

Performance of the science system

40 Eighty-seven submitters commented on the current performance of the science system, offering views on what is working well, areas for improvement, and the mix of public research institutions in New Zealand.

Elements working well

41 Submitters identified effective performance, in particular funding schemes or approaches, including:

a The Marsden fund, identified by both academic submitters and industry-related submitters as a model of effective funding for investigator-led and innovative research that supports the development of researcher capacity and capability

b Centres of Research Excellence (CoREs), identified as effective at leveraging national expertise with their multi-investigator/multi-institutional focus

c Joint CRI and university initiatives, such as graduate schools and joint programmes, viewed favourably by several submitters

d The mission-led focus of the NSCs, seen in principle as providing opportunity for cross-sector interaction.

Elements to be improved

42 The 100 submitters who commented on this topic identified six key areas as needing improvement:

a **More strategic guidance at a system level.** Many submitters identified a need for enhanced strategic guidance and an improved intervention logic. This would link government's overarching objectives to those of the science system and guide investment decision making.

b **Improved measurement of research quality.** Some submitters recommended improvements to how quality is measured. These recommendations are set out in the sections of this report on the evaluation and monitoring of system performance and assessing high-quality research.

c **Greater futures focus.** Some submitters felt that the system currently picks winners based on past performance and is not future focused.

d **More leadership capability in funder organisations.** A number of submitters stated funders need experienced staff and decision makers.

e **Improved integration and collaboration between research institutions.** A consistent theme was that, regardless of the mix of public research institutions in New Zealand, interactions between institutions should be improved. Submitters from all groups identified opportunities to more closely integrate universities and CRIs to increase capability, capacity and scale of research teams.

f **National Science Challenges (NSCs).** Eleven submitters criticised the implementation of the NSCs, specifically asserting high administrative costs and complex governance arrangements.

Overall balance of investment in science

43 Sixty-eight submitters commented on the overall balance of investment in science.

44 Six submitters felt it was impossible to comment on whether the 'right' balance was being achieved, without explicit statements about the Government's long-term goals for development. Eight felt evidence was required to support judgements about the best balance. One submitter commented:

Without comparative metrics of effectiveness, value, impact, translation and uptake of research funded utilising particular investment mechanisms, or how research institutions are performing relative to one another, it is difficult to make any definitive comments or recommendations in this regard.

45 Six submitters believed the divisions between investments as described in the *Draft Statement* were not useful and did not accurately represent how things work in practice. One recommended that New Zealand's science investment be more aligned with the European Union's Horizon 2020 Framework, particularly in relation to the split of investment.

46 There were divided views on whether a broad or narrow approach to investment would deliver the greatest economic benefits. Some submitters argued that a broader approach would help diversify New Zealand's economy and grow high-value, technology-based sectors.

47 One submitter argued for the need to create a 'pipeline' of research, balancing investment in industry-led research with that of basic research.

The intervention logic to justify government investment in research is narrowly focused almost exclusively on innovation and commercialisation to diversify New Zealand's export base. There is no doubt that this is a primary and important goal of public investment in science, but a common mistake is to assume that a singular focus on industry-relevant research and funding tools will achieve this. Indeed most authorities globally would now argue that a strong [basic research] component is essential to create a pipeline for knowledge translation.

48 Those proposing a narrow approach argued that New Zealand would benefit from focusing its investment on areas where it already has a comparative advantage internationally, particularly in primary industries.

Direct funding of institutions or contestable funds

49 Twenty-eight submitters[3] commented on the balance of institutional versus contestable funding.

50 The need for a balance between contestable funding to enhance research quality, and institutional funding to create stability (by supporting infrastructure and capability), was widely acknowledged. Thirteen submitters did not believe the right balance had been achieved, compared with two that did. Other submitters did not express an explicit view on whether the right balance was achieved.

51 Four submitters commented that contestable funding processes were more effective than institutional and collaborative funding. One submitter noted:

> *Contestable processes are generally considered superior to non-contestable as they are more transparent, more independent, attract a greater diversity of ideas (including disruptive, innovative and unconventional ideas), are less susceptible to capture and are associated with lower governance and management costs.*

Tertiary institutions and CRIs/IROs

52 Seven tertiary education and CRI/IRO submitters supported more contestable funding, based on the assumption that competition enhances science quality and innovation. Three indicated a preference for institutional funding to avoid the compliance burden associated with contestable funds.

53 Submitters raised concerns that the decreased funding allocation to contestable processes (as a result of increased institutional allocations) had resulted in the decline of some contestable pools. This had reached the point where low success rates and the high cost of proposal development were imposing an excessive cost on researchers. The Marsden Fund was identified as exemplary in terms of science quality and international status, but some submitters asserted it was markedly underfunded, which led to a low success rate for prospective applicants. Submitters also called for both long- and short-term contestable funding.

Business/industry and other submitters

54 Three submitters felt there was too much contestability in the system; they argued that contest wastes the time of scientists if they don't win funds, and discourages real collaboration. Their preference was for mission-based or direct funding.

[3] CRIs/IROs (14), tertiary education (14), all other submitters (10).

Need to improve institutional funding and stability

55 Seven submitters covering four submitter groups[4] (including those that sought increased contestable funding) supported the need for increased funding to support infrastructure and capability. These mutual demands highlight the call by many submitters for an across-the-board increased investment in science and innovation.

56 Specific groups identified the need for more institutional funding.

a Business/industry called for a stronger focus on institutional investment in industry and infrastructure.

b Social scientists called for direct institutional funding for quality social science.

57 Some submitters suggested the plethora of institutions and devolved research funding had resulted in increased administration and overheads across a range of organisations.

Risk of capture by institutions

58 Four submitters suggested institutional funding, particularly that requiring collaboration, was vulnerable to capture by particular interest groups. This could lead to a negative impact on opportunities for innovation.

59 A common concern expressed by these submitters was that funding CRIs on the basis that they are run like a business means they focus on profit rather than the public interest.

60 One submitter noted that stability may be enhanced if MBIE was more closely aligned with the research sector and took a more active role in administering funds.

> *Maintaining an appropriate balance between stability and introduction of new ideas and talents is not a trivial exercise. One mechanism to achieve this is through institutional funding, although we would note that similar results have been achieved through contestable processes; but this approach does rely on MBIE having strong connections to research organisations and their research and an understanding of end-user needs. With all of the recent changes to the science system and science funding organisations, it appears that MBIE resources have become more focused on research policy and administration to the detriment of connectedness to research organisations and research.*

Balance of funding between organisations

61 Thirty-two submitters commented on the balance of funding between universities, CRIs/IROs and industry.

62 Table 2 shows the broad range of views on the effectiveness of the current balance of funding between these bodies.

[4] This included peak science and funding bodies, business-related bodies, tertiary education and local government.

Table 2: Balance of funding between universities, CRIs, IROs and industry

Submitter perspective	Number of submitters
Better links needed between universities and CRIs or industry	7
Increase CRI funding	3
Increase industry funding	3
Need better data (performance, outcomes) to comment on balance	3
Industry receives too much funding	3
CRIs receive too much funding/are poorly incentivised	2
Right balance currently	2
Balance needs to be understood in terms of responsiveness to government priorities	2
Certain groups (museums, social science) not represented	2
Increase IRO funding	1
Other	4
TOTAL	**32**

63 Creating opportunities to enhance this balance by linking universities with industry or CRIs was an emerging theme, notably expressed by a number of tertiary education submitters. These submitters described the benefits of such links as including increasing research team capability and opportunities for joint training of postgraduate and PhD students.

Balance between investigator-, mission- and industry-led investment

64 Seventy submitters[5] commented on the balance of funding for investigator-, mission- and industry-led research. Only one submitter argued that the balance was right, while 18 believed there was a need for the balance to be changed. Submitters, however, did not agree on what that balance should be. Several submitters commented that a clearer understanding was needed of the government's objectives and long-term strategies for research investment in order to properly assess what the balance should be.

Business/industry

65 Of the 10 business/industry organisations that made submissions on this issue, the majority felt investigator-led research should decrease in favour of industry- or mission-led research. Public sector or university-led research needed to have a

[5] CRIs/IROs (15), peak science and funding (11), tertiary institutions (27), business/industry (10), local government/museums/other (7).

stronger focus on areas of economic benefit to New Zealand. Two submitters thought industry-led research was given too much funding and greater support was needed for investigator-led research.

CRIs/IROs

66 CRI and IRO submitters mostly supported a heavier weighting for mission-led research and suggested better links between investigator-, mission- and industry-led research. One submitter suggested that, rather than segmenting funding pots by type of research, MBIE could adopt a more holistic approach to funding that encourages industry involvement through the entire research lifecycle, from basic to industry research.

Peak science and funding bodies

67 Of the five peak science and funding bodies who commented on this question, all felt that current investment was too heavily weighted to industry-led research and argued increases to either investigator- or mission-led research were required.

Tertiary education

68 Of the four tertiary education submitters who commented, three shared the view there was a shortfall in investigator-led research and considered there was a disproportionate investment in industry research for short-term economic benefits. (One submitter believed the 'mix' was about right.) These submitters argued that investment in investigator-led research had the potential to "support real innovation in the mission-led area" and feed into industry and economic development.

> *There is now a shortfall at the investigator-led end of the spectrum, which is highlighted in Chart 1 on p. 14.[6] Rebalancing the system with new investment into this end of the spectrum is critical if future mission- or industry-led initiatives are to succeed. [We are] very concerned that there appears to be a strongly held perception within MBIE that investigator-led research is somehow inconsistent with delivering tangible outcomes or is otherwise 'indulgent'. Investigator-led research is critical to achieving mission, industry, government and societal goals. It provides the critical feedstock of step-wise insight and capability required to keep New Zealand at the international forefront of innovation and policy making, and in many cases leads to direct and tangible outcomes in its own right. A good example is the significant investment into fundamental genetic discovery through vehicles such as CoREs and Marsden. Such investment into 'basic' investigator-led research has enabled the very same researchers to provide answers to the kiwifruit industry on the origins of PSA and to developing genetic techniques to breed varroa-resistant bees.*

69 The three submitters also supported an increase in investigator-led research, both in its own right and within mission- and industry-led programmes.

[6] *Draft National Statement of Science Investment 2014-2024.*

Further, there should be more space for investigator-led research within the mission- and industry-led programmes, where creativity is often stifled by very prescriptive RfPs written by non-experts in the field.

Comments on definitions used

70 Seven submitters argued the categories of investigator-, mission- and industry-led research were misleading and highlighted that there were inconsistencies with international approaches. Alternative models (inclusion of an education-led mechanism, or a pipeline perspective) were proposed.

With respect to the balance between investigator-, mission- and industry-led funding our preference is for a 'pipeline' rather than a segmented approach, particularly in investigator- and mission-led research… Rather than assign whole contracts to one or other research type, we would prefer MBIE to take a more holistic approach and focus on the processes and mechanisms in a research programme that encourage industry involvement throughout the research lifecycle, including growing contributions from private sector sources as the research project matures. In other words, the emphasis should be on the idea, the team (including industry) partners and robust governance and management plans rather than prescribed rules.

Areas of over- or under-investment

71 Thirty submitters made specific comments on the question of under-investment. Twenty-one submitters commented on general areas of under-investment, while nine commented on specific areas. A few submitters identified specific areas of perceived over-investment.

Under-investment

72 Fifty-five submitters commented on under-investment in the following areas.

Overall under-investment in the science system (6 submitters)

73 Six submitters believed New Zealand's government expenditure on science was too low, compared with OECD averages**.**

Under-investment in specific sectors (10 submitters)

74 Submitters from across all core-submitter groupings called for further investment in particular sectors. Sectors mentioned most frequently included the primary sector, health, social sciences, and museums that hold national datasets.

Under-investment in research capability (20 submitters)

75 Submitter groups generally agreed that New Zealand currently under-invested in new and emerging researchers in comparison with New Zealand's major trading partners. The discrepancy between postdoctoral opportunities in New Zealand and Australia was regularly cited, with concerns about postdoctoral scientists taking their taxpayer-subsidised education offshore, limiting economic benefits to New Zealand. This issue is further discussed in the section on human capability development.

76 Four submitters were concerned about under-investment in research infrastructure such as capital equipment, and support for data collections, visualisation and digital research.

Under-investment by industry (14 submitters)

77 New Zealand's level of private sector investment was subject to much commentary. Several submitters stated business and private sector under-invest in research, although a number of industry bodies stated there was a need for greater public sector investment against which they could leverage private sector investment. Respondents often compared the level of private sector investment unfavourably with other advanced economies of a similar size, while recognising a fair comparison was not possible because many tax systems create more incentives for the identification of R&D research than New Zealand's did.

Under-investment in long-term research (10 submitters)

78 Ten submitters, particularly CRIs, museums and other groups, called for longer-term funding streams.

Under-investment in investigator-led research

79 As previously discussed, tertiary education and peak science organisations identified a perceived under-investment in investigator-led research. Submissions came largely from the tertiary sector, with the Marsden Fund most commonly mentioned as lacking funding.

Over-investment

80 Only five submitters commented on possible areas of over-investment. These can be categorised into three main themes:

Over-investment in industry- or mission-led research:

81 Submitters from tertiary education expressed concerns about:

a The quality of this research given a perceived lack of contestability and/or effective peer review

b Inadequate flow from investigator-led to mission- and industry-led research.

Over-investment in research that focuses on short-term outcomes:

82 One submitter noted:

Good research takes time to produce the maximum impact and excellence. Concerned that the overall focus of the new strategy is to further favour funding of short-term outcomes…To produce research excellence, need to avoid such a strong focus on short-term economic outcomes.

Overlaps between investment funds

83 Several submitters commented that there are overlaps between investments funds, for example:

a between the NSCs and MBIE contestable funds

b between HRC funds and health-related NSCs

c between Callaghan Innovation and NZTE funds.,

d between individual MBIE contestable funds (HVMS, Biological, etc.).

84 The comments tend to suggest that the overlaps have caused unnecessary duplications of efforts and resources and confusion in the objectives of the funds. These comments mirrored some of those more general comments on complexity and proliferation of funding mechanisms discussed later in this report under the section on 'opportunities to rationalise and simplify the funding environment'.

Over-investment in overlapping projects or infrastructure:

85 Several submitters perceived overlaps between funds resulting in over-investment, for example, between the NSCs and other funds through MBIE's contestable funding Round.

Evaluation and monitoring of system performance

86 Fifty-one submitters[7] commented on evaluation and monitoring of the science system's performance.

87 Peak science and tertiary institutions expressed preferences for measuring the rigour and scientific quality of research by way of peer review, while industry was more concerned with the relative impact of research. Five submitters called for system performance to be measured against Government's strategic goals.

Improving monitoring and evaluation of overall science and innovation system

88 Many submitters commented that the way research 'quality' was measured was too narrow. There was a general consensus on the need to differentiate how investigator-, mission- and industry-led research are assessed. One CRI submitter commented that journal citations were inappropriate for commercially-focused research. Economic gains to industry, they suggested, is a more appropriate measure for assessing the value of such research.

89 The monitoring and evaluation framework proposed in the consultation document was critiqued in several ways. One submitter felt strongly that further work and broad consultation were required.

[7] CRIs/IROs (6), peak science and funding (8), tertiary education (14), business/industry (12), local government and museums (5), other (6).

In our view much more work is required to refine both the targets and the indicators, given that the suite of targets and indicators adopted will profoundly shape how science and scientific practice is constituted as investment objects... We suggest that because of the importance of measurement systems in constituting objects, the process needs to be transparent, and the stakeholders in this process need to be widely drawn from both within STEM[8] communities but also beyond. Otherwise we do run the risk of the proposed targets/indicators either being unusable, or more insidiously constituting an object that channels the government's investment in very narrow ways.

90 One peak science body submitter expressed concern that the proposed monitoring framework examines only 'science' performance, rather than examining indicators that more accurately reflect the wider system.

91 Four submitters commented on the need for the NSCs to be actively monitored and evaluated to ensure transparency in funding decisions.

Evaluation of the investments in the National Science Challenges will be very important given the size of the investment in these new longer-term projects. As concerns have been raised over the processes for inviting participants to the conversations that shaped these Challenges, it will be important to provide transparency on the progress and performance of the funded projects.

Improving monitoring and evaluation of science investments

92 Submitters had a range of views on how to improve the monitoring and evaluation of science investments. Several focused on human resources, suggesting that the backgrounds of personnel in monitoring and evaluation were too restricted to government and former CRI employees, or that the monitoring and evaluation capacity of MBIE staff could be improved. The use of international expertise was also explored.

93 One submitter suggested policy instruments (to decide who should receive funding) could be evaluated by comparing the actual outputs and outcomes of projects with their proposed outcomes. If these did not align, the policy instrument was probably ineffective.

A poor overall correlation between the outputs, outcomes and the original proposal's evaluation scores would suggest that the evaluation did not align well with the actual outputs and outcomes, and that there was scope to improve the evaluation system. The outputs and outcomes of projects that received contestable investments could be compared to the outputs and outcomes of projects that received institutional investments to help guide the appropriate balance between investment types. The impacts of projects from each category of investment could be evaluated against the impacts anticipated in their proposals and against the government's goals for the impacts to be created through its investment in research. While the outcomes of a single research project are very uncertain and thus

[8] Science, technology, engineering and mathematics.

inconsistent from project to project, the overall impact of a diverse portfolio of research investments should be relatively consistent.

Improving monitoring and evaluation of research institutions

94 The most consistent theme emerging from submissions on monitoring was the call to consolidate monitoring and evaluation activities. Of the 27 submitters who commented, 13 submitters from across groups agreed that improvements to monitoring and accountability were required, with the proviso that existing inter- and intra-institutional monitoring and evaluation systems be rationalised. Submitters noted that institutions monitor their own performance and many also have their research portfolios externally reviewed.

There is a real opportunity to streamline monitoring and evaluation across all parts of the innovation system. Currently it falls unevenly across a variety of funding mechanisms, and more heavily on some players than on others. Along with this, there is a need to focus more on past performance and track records in an area, rather than the promise of potential investments.

95 A range of submitters expressed concern that new measures would be overly burdensome or meaningless. Several suggested monitoring or evaluation activities should track progress against sector goals and outcomes linked to government strategic goals.

96 Several submitters suggested different measures are required to monitor and evaluate the performance of specific institutions or sectors:

a The research impact of tertiary education institutions could be assessed by tracking the Performance-Based Research Fund (PBRF).

b The return on public funds invested in business/private sector R&D sector should be evaluated according to:

- whether companies, as a consequence of investment, put an R&D strategy in place
- how the funds led to increased long-term investment in R&D by the business
- industry employment of R&D staff
- generation of company-owned IP
- what products were developed
- increased industry co-funding.

Targeting outcomes from research investment

97 Eighteen submitters supported greater targeting of public investment to achieve specific research outcomes.[9]

Business/industry

98 Five submitters agreed with the idea of targeting specific outcomes from funding investment. There were different views on the types of outcomes that should be targeted.

a Nine business/private sector industry bodies and CRIs/IROs argued investment should be targeted at businesses or companies that have the capacity to leverage public funding by co-funding and/or investing in R&D. It was their view that such co-investment and/or collaboration should be a condition of receiving public funds.

b Two business submitters felt outcomes should be targeted at research that supports New Zealand industry and society.

c Five submitters suggested targets should be guided by strategic Government goals (eg Better Public Service goals).

Government should be quite targeted in seeking outcomes from MBIE funding and needs to seek the outcomes required to support/ inform: Government policy; industries with outcomes for industry which benefit individual businesses and where possible also benefit the New Zealand economy/society; work that enables New Zealand-specific problems and opportunities to be dealt with; future proofing industry and society.

99 Three submitters from the tertiary education and the other submitter groups offered a counterview. They argued that targeting specific research outcomes can be overly prescriptive and hinder innovation.

They are already overly prescriptive in the sense that the best outcomes from research may lie outside the targeted area, and the requirement to be within a particular area stifles creativity and can be detrimental to research quality.

100 One individual submitter observed that not all research programmes will deliver the intended outcomes, so targeted investments would require appropriate checks and balances.

[9] CRIs/IROs (2), peak science and funding bodies (2), tertiary education (5), business/industry (5), local government/museums/other (4).

Useful features of the current system for benchmarking or monitoring performance

101 Three submitters identified useful features of the current system for benchmarking or monitoring performance. A further 10 supported improvements proposed in the *Draft Statement*.

102 Useful features of the current system identified by submitters were:

a International benchmarking

b Bibliometric analysis for all areas of science funding

c The current funder-provider split, which makes investment decisions and instruments transparent and relatively easy to evaluate. This is useful for monitoring performance.

Opportunities to rationalise and simplify the funding environment

103 Forty-five submitters,[10] from all submitter groups, saw the current investment system as overly complex and in need of rationalisation.

The current plethora of funding initiatives requires multiple application preparations, assessment of applications, and processing of awards. All this has an opportunity cost to the detriment of the science being done.

104 Only one individual submitter disagreed with this view.

Too many funding mechanisms

105 The current funding system was consistently described as overly complicated for New Zealand's size, with excessive duplication and fragmentation resulting in inefficiencies.

We believe there is duplication in the system, which is minimising the impact of government investment in science through inefficiencies and too much bureaucracy.

For a country with such a small research community (and population), we have a very complex research system. Each of these has its governance, funding and reporting requirements that collectively consume a lot of resources.

106 Related to the funding structure were concerns that the present system incentivises people to conduct science with the goal of obtaining funding, rather than making scientific breakthroughs. Others cited the funding structure as inhibiting collaboration, as competitive funding created different behavioural incentives.

107 Coupled with comments around complexity were concerns about the amount of institutional change in the science and innovation system. Seventy submitters commented that there had been too many changes in too short a period of time. The responsibility for policy had been shifted three times since 2011, from the Ministry of Research, Science and Technology to the Ministry of Science and Innovation and now to MBIE, contributing to a loss of institutional knowledge and specialised human resources. This also created difficulties for the science system in understanding how to apply for funding. Submitters from across groups called for stability within the investment system.

108 Overall, submitters identified benefits in reducing the number of funding mechanisms. Specific suggestions included:

a Aligning CoREs and NSCs; or combining NSCs and the Marsden Fund.

b Aligning CRIs and IROs.

[10] CRIs/IROs (8), peak science and funding bodies (8), tertiary education (12), business/industry (12), local government/museums/other (5).

c Reducing the number of funds and creating bigger pots of funding, thereby reducing administrative costs.

The economies of scale that can be achieved with larger funds are perhaps indicated by the pattern of administrative costs incurred by the Centres of Research Excellence: in general, the bigger the CoRE budget, the lower the percentage spent on administration.

Insufficient funding and gaps in funding framework

109 Eighteen submitters provided comments on the overall under-investment or identified a need for dedicated funds in a particular sector. These included:

a Business/industry submitters, who sought more primary industry investment and more funds for smaller or ancillary industries

b Investment in educational and social science research

c Museum and peak science groups, which sought funds to support core databases and collections and the 'mobilisation' of science.

The funding class that is currently missing (or is only partially addressed through inadequate funding for collections and databases) is a dedicated science infrastructure for New Zealand. New Zealand's core collections and databases, particularly the biological collections, underpin New Zealand's biodiversity, biosecurity and economy. These collections and databases can only be maintained with dedicated and inflation adjusted funding.

d One CRI submission called for a specific applied fund.

A key gap is a regular annual opportunity to propose excellent science that has been inspired by practical problems. Hence our suggestion for an applied fund, analogous to the Marsden Fund, to be introduced. [This would include] a broad-based applied research fund, including mission-oriented goals (perhaps supplied by the National Science Challenges)

e One tertiary education submitter called for a specific fund or panel of the Marsden Fund devoted to economics and business research.

Minimising compliance costs

110 Ten submitters were concerned about high administrative, compliance and transactions costs for their organisations in responding to multiple funding sources.

[A] number of the current instruments such as Centres of Research Excellence, the National Science Challenges, Partnership funds, PGPs and even collaborative contestable programmes like Bioresource Processing Alliance are costly in time and resources for key science staff, both in developing the proposals and in implementation. Additional and overlapping governance adds to the costs over the long term as well (085).

111 Tertiary education submitters saw applications for some contestable funds as too compliance heavy and overly burdensome or time wasting for scientists when the

chances of obtaining funding were small. They called for streamlining of investment processes.

112 Both industry and tertiary education bodies suggested a need to rationalise health funding and current health challenges (NSCs). One peak science body saw the need for one, integrated, institutionally independent funding organisation for all health research, nominating the Health Research Council (HRC) as the principal investment agency for health.

Section C: Future direction for science investment

Priorities for science investment

113 Sixty-nine submitters commented on the prioritisation of science investments, with a predominant focus on whether public science investments should have a greater orientation toward business innovation and economic growth. Responses were slightly more in favour of this focus than not.

114 Submitters broadly agreed that funding mechanisms should have a greater focus on the quality, relevance and impact of research. Views were divided on prioritising enabling technologies or industry sectors, and other priorities were nominated for consideration.

Focus on quality, relevance and impact of research

115 Six submitters agreed there was a need for greater focus on the quality, relevance and impact of research or having a sound pathway to impact and application, and only one disagreed.

Quality is paramount. Given the small size of the R&D community in New Zealand, the vast majority of R&D must be relevant to the issue and problems that face NZ Inc.

All forms of research should be able to show how the research will positively impact New Zealanders and/or the economy and demonstrate the anticipated pathway designed to maximise the impact of the research.

We commend the two priority objectives of the Statement: realising research excellence and impact.

116 Eight submitters agreed there was a strong link between research excellence, relevance and impact, while 13 others suggested that relevance and impact weren't necessarily representative of quality.

117 Peak science and tertiary institutions suggested the relevance and impact focus was more appropriate for industry- and mission-led research than for investigator-led research.

Mission-led and industry-led science should be based on science that has a sound pathway to impact and application, and undoubtedly this is occurring for industry-led research as, without a fixed target, very few industry investors pursue R&D. We believe that there does need to be some flexibility at the investigator-led end of the investment chain with regard to impact and relevance so that researchers can experiment and work in an environment where new ideas can flourish.

118 While supporting relevance and impact in general terms, six submitters disagreed with how 'impact' is assessed or measured, or suggested it cannot be well predicted

in advance. Four submitters observed that linking impact to relevance "for the most pressing needs" was being too short term.

If the measure becomes 'high impact', research institutions will move to areas that achieve this but may have little relevance to achieving our shared vision of the future. High impact is a poor measure in many fields of science where fundamental research might not be recognised for a generation.

Many of these things [quality, relevance, impact] cannot be predicted and lead to stifled innovation and creativity…

119 Concerns were raised across a number of groups that insufficient attention was being paid to the transfer pathway for the impact and application of research. Fifteen submitters agreed that science investments should have a greater focus on research impact and pathway to application, compared with three who disagreed. These findings are largely consistent with, and more fully detailed in, the section on knowledge transfer and use of research outcomes.

While the current set of investment processes provide a reasonable spread of investigation, mission and industry lead research they often fail to adequately support either the development of research outputs through to the point where they can easily be transferred to/be taken up by industry or to support the type of research that many of our primary industry sectors (particularly the smaller sectors) require to deal with new issues, e.g. the arrival of a new pest.

Greater orientation toward business innovation and economic growth

120 Forty-two submitters[11] commented on the orientation toward business innovation and economic growth.

121 Of these, 40 submitters agreed with a move toward business innovation and economic growth, with unanimous support from business/private sector submitters.

…given limited resources, access, advice and funding should be prioritised towards businesses in sectors in which New Zealand is, or can be, internationally competitive. We support the focus on "relevant science with the highest potential for impact for the benefit of New Zealand" and "increasing focus on sectors of future need or growth".

New Zealand is a tiny economy and should focus on meeting its needs and opportunities rather than seeking to contribute to academic knowledge. New Zealand does, however, need to ensure that sufficient investment is made in basic science in areas that are likely to eventually feed into downstream applied science and developmental opportunities.

We need to focus research into areas that make the most of New Zealand's natural advantages, i.e. the factors that naturally provide us with an advantage in overseas markets.

[11] CRIs/IROs (7), peak science and funding bodies (4), tertiary education (14), business/industry (14), other (3).

122 Some submitters suggested the current weighting toward business and industry is adequate, with more than 90percent of contestable funds going to mission- and industry-led science.

The current level of business-economic focus for contestable funding is enough. There is a risk that innovation and creativity and science will be crushed if outcomes and orientation are focus [sic] on a single outcome (business innovation and economic growth)

123 Notably less support came from peak science bodies and tertiary institutions, and reservations or qualifications were raised, even by those in support of a business/economic orientation.

124 Those who disagreed were concerned that such an orientation may focus research too much on the short-term economic outcome and overlook scientific breakthroughs and other science that may enhance public good.

Economic and innovation bias may squeeze out other investment priorities that may contribute to an 'unimagined' future economy.

Niche manufacturing, and from some currently very small enterprises, is currently at risk of not being well served by the policy/process that accompanies some of the funding streams; however it is in this area that often great future opportunity and export revenue value and growth lies.

Prioritise enabling technologies or industry sectors

125 Sixteen submitters[12] commented on whether government's science investment should prioritise certain key enabling technologies or industry sectors.

126 Submitters who agreed with the idea of prioritisation had divergent views on what sector or enabling technology should be prioritised. These included manufacturing, primary industries, agriculture, justice, health, and education.

127 Those who disagreed suggested there was already adequate focus on these priorities. They felt that this thinking is too short term, or that other areas should be prioritised, such as business excellence, export potential, government's broader objectives and public good.

A high proportion of investment already goes into this. The government is subsidising industry, and increasing the public spend even further is not warranted at this stage.

An increasing focus on objectives rather than sectors per se would be of greater and more cost-effective benefit for New Zealand… Sector alignment of funds is less than a decade old, and the previous non-sector-specific funds NERF and RFI were more appropriate and flexible than the sector model, and more likely to support greater transformational innovation than the current sector-based funds.

[12] CRIs/IROs (3), peak science and funding bodies (5), tertiary education (2), business/industry (5), local government and museums (1).

Focus on other high-level outcomes

128 Twenty-two submitters[13] commented on the need to consider other high-level outcomes for prioritisation.

129 The areas mentioned for consideration were varied and included a national vision, areas of strategic advantage, social science and health:

a National vision or strategic advantage

Investment in science and innovation needs to be in line with the overall vision for New Zealand… Government should focus on policy levers and avoid picking winners…[we have] major concerns about the form of investment analysis set out in the Draft Statement and questions its robustness. We propose an alternative model that takes into account all aspects of the nation's capital, measures the different forms of capital equitably and makes investment decisions by looking at the marginal value of further investment in each area.

The science investment needs to meet one or more of four objectives, or not be progressed, i.e. (i) to inform public policy; (ii) to improve the physical and mental health of New Zealanders; (iii) to increase the financial security of New Zealanders; and (iv) to contribute to solving global problems.

Our science needs to fit with New Zealand's strategic advantage…we don't support developments outside of New Zealand's core strengths.

b Social science and health

…if the 'science system' is to effectively respond to 'unique' economic, environmental and cultural challenges, it needs to ensure funding models also engage with social science and humanities research.

The STEM orientation has considerable relevance but only for some of the problems and policy concerns we are likely to encounter in our cities and towns… It must be balanced with adequate resourcing of research in the social sciences and the humanities if a full understanding of urban processes and urban life is to be achieved.

Health is identified as an area for future growth and need with some national priority, yet the public investment in health research isnot clear and there is no single, overarching strategy to guide it.

c Other

Prioritise research where business development may potentially compromise the environment.

Assessing high-quality research

130 Thirty-one submitters commented on assessing the quality of research, and a greater number talked about quality in some way. Views on measures of quality

[13] CRIs/IROs (5), peak science and funding bodies (5), tertiary education (4), business/industry (7), other (1).

were nearly directly split, with 17 in favour of differentiated measures and 14 in favour of consistent measures across funds, assessment processes and sectors. Overall, industry/private sector favoured impact and relevance as measures of quality, while peak science and tertiary bodies favoured measures of scientific quality such as peer-reviewed publication.

Differentiated quality assessment for different funds

131 Seventeen submitters[14] commented on this and tended to distinguish between investigator-, mission- and industry-led research.

132 Fifty-seven submissions acknowledged quality as a key criterion across all funds. Business/industry and CRI/IRO submissions were more likely to agree on the need for differentiated indicators of quality, with relevance and impact being more compelling criteria for industry-led, and to some extent mission-led, research.

Quality should be a consistent requirement across all levels of scientific endeavour. Should be tempered by relevance of outcomes as it moves from investigator-led to industry-led.

Excellence (i.e. fitness for purpose) should be the objective of all research and the process should be independent review, but the review criteria and the expertise of the reviewers must obviously be different.

'Quality' means different things for different types of research – we cannot confine ourselves to narrow academic definitions like citations etc (e.g. quality tsunami research tells us when a wave will arrive and how big it will be – publication of the method is nice, but mainly so others in the world can do the same).

133 Peak science and funding bodies and tertiary institutions suggested quality must be defined by scientific excellence alone (including rigour, replicability) and measured by peer review.

Without a quality and excellence focus, the goals of a national research enterprise cannot be assured… The focus [in New Zealand] on perceived project relevance at the expense of scientific excellence has contributed to the relative decline in our scientific standing worldwide.

Indicators of scientific quality for use in assessment processes

134 Thirteen submitters[15] commented on indicators of scientific quality.

135 Peak science and funding bodies and tertiary institutions favoured scientific robustness and indicators such as peer-reviewed publications, while business and

[14] CRIs/IROs (4), peak science and funding bodies (2), tertiary education (2), business/industry (6), local government and museums (1), other (3).

[15] CRIs/IROs (2), peak science and funding bodies (3), tertiary education (1), business/industry (4), other (3).

industry favoured indicators of impact and relevance. One submission suggested business and industry tend to steer away from publication in order to minimise information sharing and retain their competitive edge, meaning alternative measures of quality may be necessary.

Peer-reviewed publication and presentation records are not a useful metric for determining science quality in the competitive industry-led research environment.

136 Specific indicators of quality that should be used, as suggested by submitters, are assessment processes, financial audit, and peer or panel review.

137 Two submissions outlined basic criteria for any research proposal, regardless of sector.

A good proposal has: a good question, well-posed; a clear and well-formulated route to addressing the question; a complete knowledge of relevant literature and international work and of the relation of the proposal to this; and a track record of delivery. There's no excuse for not having this, in any sector.

No, the basic criteria should be consistent; namely the quality and merit of the idea; the ability of the team (including non-government partners) to deliver the impact promised; and the risk profile is acceptable and understood by applicants.

Distinguishing the assessment of science impact and quality

138 Seven submitters commented on separating the assessment of impact from the assessment of the quality of the science.

Tertiary education submitters emphasised the importance of assessing science quality in all types of research. Relevance or impact will be of higher importance for the mission- and industry-led work, but all should be built on a strong quality base.

139 Comments on measuring impact reflected concerns about how it is defined and measured.

1. Impact assessment needs to be tailored for New Zealand needs.

2. Impact assessment criteria should be clear, concise and compelling.

3. Real world impacts that are meaningful to politicians, communities and researchers should be promoted (i.e. move way beyond numbers of papers published and citation statistics).

4. Where appropriate, researchers and industry partners should be able to articulate the impact of their research in all relevant categories (economic, environmental, social, cultural etc) – and their views should be appropriately weighted.

140 Tertiary education submitters warned against using journal article citations as a measure of impact.

Different fields of research have very different impact factors between journals, slow publication times, and some key pieces of research may take some time to gain a large number of citations. So metrics associated with these kind of measures are inherently

problematic – however, they are very measurable. But I would urge caution in using them as a method to determine the impact and relevance of research.

Differentiated quality indicators across MBIE sector-specific funds

141 In regard to MBIE sector-specific funds, six submitters commented on applying differentiated quality indicators.

142 Two submitters agreed indicators of quality should be differentiated across sectors and sector funds.

[It is] hard to measure 'impact of research' especially in different fields using metrics that appear to be similar. Need to be cautious if these are used to determine impact and relevance.

143 Other indicators should be consistent, although one submitter noted quality should always be assessed in context. Another explained that current processes using different criteria across funds made assessment a highly challenging task.

The current assessment processes are logistically unsustainable and have variable outcomes. The number of panels and referees involved, all working to different criteria, presents these assessors and MBIE with a near-impossible task. For example the differentiation of enabling technologies and targeted research is artificial and unnecessary. Simplification of funding streams would help, but adopting a common and robust assessment process is equally important. The first and most critical criterion is science quality, as downstream factors such as path to market are irrelevant if the science and capability to deliver are not sound. Replacing the scattergun peer reviews with a common panel of external expertise which looks across all funds is one option to address at least this initial threshold problem.

National collaboration

144 Forty-eight submitters across all core-submitter groups commented on collaboration within the domestic science system.

145 Respondents largely supported more collaboration, with comments that collaboration is the only way to allow New Zealand to have the scale required to compete internationally. Collaboration was also cited as increasing innovation by lowering the rejection rate of good ideas when applying for funding.

The big successes and gains are occurring when there is collaboration and cooperation amongst researchers and research organisations. The best examples are the Centres of Research Excellence (CoREs) and a number of sophisticated technology platforms.

146 A recurring theme was whether the right incentives existed for collaboration. There was no clear consensus on what incentivises collaboration. Thirty-two submitters believed contestable funding turned scientists into competitors rather than colleagues.

147 In contrast, a small number of submitters believed contestable funding forced scientists into collaborating. Only through collaboration could they construct the best proposal possible to secure funds.

148 Three submitters identified the potential for better integration of research institutions. They pointed out that:

a Lack of collaboration creates inefficiencies through duplication and a lack of critical mass of skills

b Human capability development benefits are not realised

c Collaboration could help career development as it provides more certainty to research teams in obtaining funding, making science a more attractive career option.

Barriers and opportunities to improved collaboration between research institutions and bodies

149 Submitters generally accepted competition had benefits but saw New Zealand's science system as overly competitive. Limited levels of funding were also believed to cause patch protection. Several commented that universities and CRIs act as competitors, creating unnecessary duplication. The situation also prevents improvements to human capability development that could occur if CRIs had access to students and postdoctoral researchers.

The level of funding competitiveness cripples meaningful collaboration, driving mistrust and lack of openness. The model of running CRIs and universities essentially as businesses is one root cause. The institutions are competing with each other for overly scarce resources and therefore discourage open collaboration.

Recognition of research income as part of the PBRF formula seems to be biased to the lead institute and hence collaboration is discouraged.

150 Some submitters argued the benefits of collaboration between universities and the science and innovation system could extend to better commercial uses of science. For example, making better use of New Zealand Business Schools, it was argued, could translate into greater R&D investment and better insight and expertise on business and economics at Callaghan Innovation and MBIE.

151 Funding mechanisms were also seen to prevent collaboration by being overly bureaucratic and complex. Some submitters felt, for example, that different funding structures for different institutions discouraged collaboration between research institutions.

152 It was stated that, if government wishes to improve collaboration, it needs to undertake some collaboration itself. One tertiary education submitter noted that there was a lack of strategic vision for science between MBIE, the Tertiary Education Commission, the Ministry for Primary Industries and the Ministry of Foreign Affairs and Trade. If a more uniform strategic vision was shared by these agencies, there would be greater potential for collaboration, they argued.

Improving collaborations with knowledge users

153 Eleven submitters offered mixed views on how collaboration between scientists and knowledge users could be improved, including the need:

a For government to improve efforts to link scientists and knowledge users, as it was best placed to address what was essentially an information breakdown

b To address New Zealand's deep-rooted conservative economic culture. New Zealand companies were seen as acting overly conservatively and of being sceptical of the benefits of investing in R&D.

The size of New Zealand's companies was also cited as a barrier to collaboration.

The small size of the New Zealand business-based R&D workforce relative to comparable nations reflects the reality of the challenge that there is very little capability within business for the RS&T provider community to connect and exchange knowledge with … Dominance of SMEs in New Zealand is contributing to lack of collaboration between researchers and businesses.

154 There was a range of ideas on how government should improve collaboration. This included:

a Using investment mechanisms to "coerce" industry collaboration by encouraging investment in research. This could be achieved by "moving competitive advantage from the research component of R&D and placing it on the ability of industries to utilise the technologies and to take products to market"

b Placing emphasis on having “collaborative behaviour and links to industry and users” in funding assessments

c Undertaking further reflection on defining who “knowledge users” are

d Supporting exchanges and secondments

e Requiring better contractual requirements as a condition of funding

f Improving understanding of what constitutes commercial uses of science and good governance.

International collaboration and cooperation

155 Seventy-six submitters commented on aspects of international collaboration. The majority were in favour of increasing international collaboration in order to realise cultural and economic benefits. There was also a range of views on how to improve international collaboration and what current barriers exist.

Barriers and opportunities to enhance international relationships

Opportunities

156 Nine industry body submitters argued that the best way to enhance international relationships was to open New Zealand's contestable funding up to international researchers.

In the same way that New Zealand manufacturing needs international markets, New Zealand R&D and innovation needs to be seen as an internationally traded good, and international linkages actively fostered. International companies can immediately bring new capital, know how, stretch, experience and deep knowledge of pathways to market.

Putting more business R&D incentives in industry hands will get them to purchase more research from the best resource and this will include international providers … Condition international connectivity to funding.

157 Secondments or scientific exchanges were cited by CRIs, tertiary education and industry body submissions as having the potential to improve international relationships. Secondments to research-active companies were highlighted as a particular opportunity that would offer benefits to both the researcher and the company. One industry body noted that New Zealand is an attractive destination for international scientists and government should seek to leverage this to improve workforce capability.

158 Attendance at international conferences was also identified as an opportunity to improve international relationships. The cost of attending was often prohibitive, though, with suggestions that government should provide greater financial assistance to promote greater attendance. Improving the application process was also seen as being potentially beneficial.

Barriers

159 Three submitters questioned whether international collaboration was properly incentivised. Some submitters referenced funding criteria, believing it could be expanded to include requirements to demonstrate international relationships.

160 Four submitters questioned whether MBIE and government had an adequate international strategy, saying the present approach is scattered. One submitter, for

example, said the public sector needs to play a larger role, scoping relevant industry areas and attending conferences on behalf of researchers and companies.

Policy change or new investment mechanisms to support international relationships

161 Consistent with comments elsewhere in this document, submitters described funds as overly complicated when it came to applying. Twenty-one submitters agreed to the statement that there are "too many funding mechanisms", while one disagreed. Further, the funds were administered too bureaucratically, with narrow sets of criteria. Three favoured the amalgamation of funds in order to allow a wider range of activities to be eligible for funding and to create a 'one-stop-shop' for applicants.

162 Four submitters saw existing funds as being overly complicated and diversified. This creates significant transaction costs in applying for funding, which one submitter said did not outweigh the minimal funding provided and led to researchers not bothering to apply.

163 Conversely, some submitters favoured more specific applications of international funding. Two peak science bodies and a local council suggested that potential economic benefits could result from allowing international researchers greater access to New Zealand's science. Specifically, one submitter favoured the government incentivising foreign R&D companies to relocate to New Zealand, citing a lack of capability within the domestic workforce.

164 More funding for researchers to attend conferences would improve international relationships.

An increase in funds to the International Partnership Fund, or some other instrument, to co-fund such initiatives would be a very welcome development.

We support current funding mechanisms for international science linkages, and urge more systematic funding support for key bilateral partners.

The attraction of New Zealand as a place for foreign firms to establish R&D activities could be enhanced by creating more CoREs and Centres of Excellence, and actively promoting their activities and the emerging opportunities.

165 Funding mechanisms for international relationships and research were criticised. One submitter noted that GNS and Australia's CSIRO rarely collaborate, despite having similar research goals. Allowing international researchers to access domestic funding applications was also recommended as an option for MBIE to explore, citing the lack of experts in some areas of research in New Zealand.

Human capability development

166 Forty-six submitters from all submitter groups expressed views on human resource capability in the areas of the:

a Lack of funding available for emerging researchers (29 submitters)

b Adequacy of funding for established scientists (5 submitters)

c Focus and priorities for human capability development (18 submitters)

d Need to place greater focus on developing Māori capability and to devote specific funding to meet this need (4 submitters).

Adequacy of funding for emerging scientists

167 The thirty-six submitters who commented on the adequacy of funding for emerging researchers all believed postdoctoral scientists were inadequately funded. Five commented on the need for New Zealand to harmonise its postdoctoral funding with Australia's in order to retain talent domestically. In line with this view, submitters commented:

There is vanishingly little independent support for postdoctoral fellows and midcareer researchers.

[There is a] significant and protracted shortage of postdoctoral funding.

We believe that an increase from the current five (funded by the Rutherford Trust) to 100+ new postdoctoral (0-5 years post-PhD) per annum would transform research quality, depth and diversity in the way the Minister desires. It would bring New Zealand into line with the nearly 400 postdoctoral fellowships available in Australia.

Another problem for recent doctoral graduates is that there is often little opportunity to continue in paid research positions between submission of doctoral theses and beginning a postdoctoral fellowship.

168 As ways to improve opportunities for postdoctoral fellows, two submitters spoke in favour of greater collaboration and alignment between CRIs, universities and industry. The advantage would be two-fold – it would increase the capability and capacity of research teams and give researchers a greater understanding of the commercial pressures and demands faced by industry. A bonded scheme for young researchers was also proposed, allowing for practical research experience in non-educational institutions.

169 The lack of postdoctoral opportunity was viewed as detrimental to New Zealand's economy for several reasons:

a Study in New Zealand is subsidised by the government, yet a lack of opportunities leads to postdoctoral fellows seeking employment overseas. This results in the investment by government delivering limited economic returns to New Zealand.

b Postdoctoral fellows are often a major source of innovation, as they have a number of ideas following the completion of their PhDs. Without funding and/or opportunities, this source of innovation is lost.

c The low level of funding on a per researcher basis contributes to the decline in the world rankings for New Zealand universities.

Focus and priorities for human capability development

170 Sixty-seven submitters expressed a range of views on what the focus and priorities should be for human capability development for the science system in New Zealand. These included encouraging better human resource practices, focusing more on career pathways, and developing capability through more engagement with, and within, industry.

We are facing considerable loss of capability through demographics and unless we can show science to be a viable and long-term career we face an uncertain future.

CRI and tertiary institutions should be required to ensure that their … human resource policies and practices support the retention and advancement of women in research, in line with good employer and equal employment opportunities.

[We] estimate that the private sector R&D workforce will need to treble to meet the targets for economic growth. This increase does not take into account the losses to the current workforce through retirement, death, moving abroad or the like.

There is a requirement for a more explicit focus on attracting international talent to plug current skills gaps and to foster international relationships.

Vision Mātauranga

171 Thirteen submitters[16] made comments relating to Vision Mātauranga or Māori in relation to the science investment system.

Implementation of Vision Mātauranga

172 Eight submissions commented on the interpretation and implementation of Vision Mātauranga and the need for further efforts to translate the vision into action.

Vision Mātauranga is a new way of thinking – not perfect but the start of a dialogue. Its use, however, is so varied (it is used as a noun, a verb, treated as a policy and also a plan) that we feel that we need to step back and clarify what outcome we are looking for in the long term. This could (should) be part of the vision for New Zealand.

173 Six submitters suggested clearer outcomes needed to be developed; others felt translating the vision into action would be achieved through improved partnership and capability development.

174 Three submitters stated that integration of Mātauranga Māori within science investment mechanisms would contribute to more genuine integration of the Vision within the science system more broadly.

Vision Mātauranga must be further integrated into our investment mechanisms. This will both broaden the impact of science within Māori communities and extend the meaning and cultural significance of knowledge produced by researchers within all disciplines in New Zealand.

175 While eight submissions noted their support for the Vision, other submitters felt the Vision was lacking and marginalises Māori.

1. It focuses on a deficit approach to capability, i.e. making Māori fit the system. 2. It totally underestimates and over-simplifies how capability for Māori needs to be implemented. 3. It is seen as a sop for what looks like an overall science investment of $1.5b – too small to really make a step change to capability, too infinitesimal to be taken even remotely seriously as a signal for researchers and their organisations to do serious work with Māori. 4. It's about capability not about doing the kind of science research that is truly transformational in its outcomes. Requires serious focus from the Ministry to have some muscle.

Māori-related research needs and development potential

176 Two submissions identified the need for specific funds or budget allocations to be assigned to support Māori research and development. Calls were made for:

a Mission-led research specifically focused on iwi development

b The development of a directly funded, national, Māori-led research institute

[16] CRIs/IROs (2), peak science and funding bodies (3), tertiary education (4), business/industry (2), other (2).

c Support for collections of national significance to Māori.

177 Two submissions identified the potential for Vision Mātauranga, if adequately supported and put into action, to lead innovation or guide an overarching vision for New Zealand science.

178 Two organisations identified that the principles of Vision Mātauranga had been useful in their work, one to guide their teaching through incorporation into their mission statement, and the other by including the principles in their mission statement.

Industry investment and industry-led research

Encouraging industry R&D co-investment

179 Forty-eight submitters[17] made comments relating to increasing industry investment or industry-led research.

180 The most consistent response about encouraging industry to co-invest in R&D was the use of economic levers or incentives, including tax breaks. These suggestions came through in 17 submissions from across groups (including from business/industry, CRIs/IROs, and the tertiary sector). Some identified a preference for tax cuts over complex grant applications.

Most levers lie outside the science system. Government micro- and macro-economic policies largely determine the trend of investment in R&D. Policies on taxation, depreciation, and export development, for example, have more impact than any changes

181 In the same vein, one submission identified the need for the research system to better accommodate small to medium-sized enterprises (SMEs) to encourage co-investment.

…we note that small firm size and our industry structure are critical to this challenge. In addition, the New Zealand definitions of R&D and innovation act to restrict the types of investment that can be provided to assist with economic growth and also what is able to be counted in the R&D statistics. There are significant OECD programmes which adopt a broader framework and enable support for innovation and growth in higher proportions of 'mainstream' small and medium-sized enterprises (SMEs).

182 Government partnerships, co-funding or collaborative approaches (rather than contestable) were seen by six submitters as useful methods to cultivate growth in private investment in science.

[17] CRIs/IROs (7), peak science and funding bodies (4), tertiary education (13), business/industry (20), local government/museums/other (3).

183 Five submitters reiterated the need to increase overall funding for research to create a more vibrant research sector attractive to industry investment. This suggestion was also linked to making funds easier to access and reducing red tape.

184 Six submitters also discussed interactions between researchers and industry, suggesting that access to science providers that companies want to use, rather than self-selected providers, could encourage industry investment.

More government R&D money to be channelled through industry rather than directly through the research provider to industry. This will allow industry to decide what research provider they wish to spend R&D funds with. Demand will dictate which research providers and what research services best meet the needs of industry and determine which will expand and thrive.

185 One submitter noted that funding mechanisms need to match industry's needs. It was suggested that industry is cautious about over-engaging with scientific or investigator-led research and prefers funds that support applied research. If the Australian 'Researchers in Business' scheme was introduced in New Zealand, it would have the potential to drive researcher interaction with industry to solve a particular problem or issue:[18]

186 Other themes included:

a A need for longer-term funding, in part to encourage capability development and retention

b Further consultation with industry on why co-investment is not taking place

c The use of loans rather than grants, with incentivising criteria for repayment.

Leveraging private investment

187 Nine submitters commented on whether leveraging private investment should be a more heavily weighted goal for science investment. Opinions were fairly evenly divided.

188 Four submitters[19] agreed government should continue to leverage private investment but argued leveraging ratios should depend on the sector's ability to provide funds and the likely impact of the investment.

189 Five submitters[20] disagreed that leveraging should become more important, because:

a There is a risk of industry agendas driving government investments

b This would likely result in a shorter-term focus, which would also undermine support for capability development

18 http://www.business.gov.au/advice-and-support/other-industry-support/Pages/Researchers-in-Business.aspx

19 CRIs/IROs (1), business/industry (3).

20 CRIs/IROs (1), peak science and funding bodies (1), tertiary education (2), business/industry (1).

c Investment is too risky for SMEs but they could be better linked to applied research providers.

Opportunities to overcome barriers to private investment

Barriers

190 A tertiary sector submitter provided a useful overview of the barriers to private investment.

There are well-known reasons why [increased industry contribution to research and development] will never happen including: economies of scale; no adequate experience of timescale to pay-off; difficulties in capturing benefits; no prior research culture and no technical expertise on most boards of directors; and companies that are owned overseas do their research overseas.

191 The small size of many New Zealand firms or industries was the key barrier identified by submitters. A number of issues that flow from this were identified, including the need to:

a Ensure firms have the resources to undertake their own R&D and smaller sectors have an industry fee-paying levy body

b Refine policies and systems and broaden the definitions of innovation for SMEs

c Have greater flexibility around investment (not a 1:1 requirement)

d Encourage smaller groups to undertake or commission joint research to deliver economies of scale.

192 Three submitters identified lack of return on investment as a barrier to private investment.

Opportunities

193 Some submitters nominated tax breaks or tax penalties as opportunities to overcome barriers to private investment. Opportunities for co-investment were also noted.

194 Improved coordination of research investment processes and providers was identified as a means to enhance private investment, with one industry-related submitter commenting on the complexity of current processes and overlap between funds as a barrier to investment.

195 Two submissions suggested investors lack understanding of particular industries or international markets, which could be overcome through education or by bringing in international investors to create competition.

196 Other opportunities included:

a Establishing criteria for government co-investment, including expectations that this will trigger private investment and improved monitoring of this requirement

b Improving relationships and engagement between private investors and research providers

c Generally encouraging business and industry growth, which in turn enables business to invest in R&D.

Knowledge transfer and use of research outcomes

197 Thirty-three submitters[21] made comments relating to user uptake of research outcomes. One submitter commented that:

…the biggest challenge is transferring information into firms and then securing the returns. Effective technology transfer requires very strong and stable partnerships, and trust. These relationships take time to develop, generally not in the timeframe of a competitive science system.

Barriers to user uptake of research outcomes

198 Most of the barriers to research uptake identified were connected to relationships between science providers and research users. The mismatch between commercial and academic priorities and incentives was noted by both industry-related and tertiary education submitters. Points made included that:

a Research providers don't always have the end-user in sight when they develop research

b The PBRF incentivises basic over applied research because it incentivises academics to focus on getting published in high-impact journals

c Industry sometimes failed to engage with research results

d The high transaction costs associated with researcher-industry engagement fall on both parties.

199 One submitter noted implementation costs are a barrier to research uptake where they exceed market benefits.

Opportunities to improve uptake

200 Involving the end-user throughout the research process, from research strategy development through to implementation and delivery of findings, was identified by 11 submitters as a key opportunity to improve research uptake.

End-users need to be truly embedded in the projects.

[21] CRIs/IROs (5), peak science and funding bodies (4), tertiary education (8), business/industry (12), local government/museums/other (4).

201 Business/industry and tertiary education submitters agreed there was a need to improve collaborations and relationships between research providers and industry. Several potential mechanisms were identified to enhance these relationships, including:

a Providing financial support to encourage the development of research into usable 'products'

Additional funding is required to further develop and to undertake technology transfer to get new innovations across the valley of death.

b Investing in hub models and new technology incubators

c Incentivising relationships by including these as criteria for government funding

d Creating a researcher-to-industry continuum and improving researchers' understanding of industry's needs

e Ensuring the benefits to users outweigh the risks.

Section D: Specific funds

202 The majority of submitters did not comment on a specific funding mechanism, but instead commented on the overall science system's funding mechanisms. Many felt there were too many, creating fragmentation and leading to a loss of efficiency and lack of synergy.

They do not seem to work together. There is no comprehensive framework.

Performance of specific funds

Marsden Fund

203 The Marsden Fund drew significant levels of praise from the 13 submitters who commented on it. A number of submitters, primarily from either tertiary education or peak science and funding bodies, commented that the Marsden Fund produces high-quality science and, as a consequence, its funding should be increased. The system of specialist assessor visits and the simple reporting methods were both recognised for their efficiency and effectiveness. The Fund was also considered partly responsible for making New Zealand a more attractive destination for international scientists.

I think it is important to strengthen the Marsden Fund…it does provide what at the international scale are modest resources for good ideas. But with the current 1-in-10 success rate, the Fund inevitably has aspects of a lottery rather than a just way of supporting science… The Government's goal should be that amongst scientifically-worthy proposals the Marsden success rate should increase to at least 1-in-3.

204 Some submitters noted that, while it did a good job of funding investigator-led research, it did little for industry-relevant research. With specific regard to the Marsden, a few submitters recommended that contestable funding be provided over longer timeframes, as overheads were not cost effective over the shorter term.

National Science Challenges

205 Seventeen submitters commented on the NSCs. Two submitters praised the NSCs' attempt to develop a "collaborative culture" and agreed with the value of having mission-led research focus on long-term national priorities. The other 15 submitters criticised the fund as being too complex, further complicating an already complex science system.

The NSCs are a new area of investment; their processes are very confusing and may not involve rigorous review of individual projects.

One example is the National Science Challenges (NSC), which have introduced a further layer and seem to have diverted time and money from other well-established scientific research. In essence we are generally asking good scientists to do more and more.

Support the intention of NSCs but the process needs improvement and should encourage lean governance/management processes. MBIE should play a larger role in decision making about investment – concern they may be losing capability to do so. Bulk funding is vulnerable to capture.

206 Criticisms of the NSCs included confusion about how investigators could apply for funding, the lack of review mechanisms, a failure to incentivise innovation, a lack of transparency in funding decisions and assessment, being an unnecessary addition to the science system and too compliance heavy, a lack of commitment to Vision Mātauranga, and poor monitoring.

Far too compliance heavy. Could have just used CoREs and CRIs to distribute funds.

207 The administrative costs were of particular concern for three submitters, with some questioning why the 10 NSCs act as separately governed and managed entities. A number believed the NSCs exacerbated an already fragmented science system, introducing another layer of compliance costs for applicants.

208 Despite the majority of comments on the NSCs being critical, one submitter said that the fund would help develop a more collaborative culture over time. Two submitters also believed it was too soon to assess the impact and performance of NSCs due to their relatively recent introduction.

Performance-Based Research Fund

209 Comments on the Performance-Based Research Fund (PBRF) were varied. This is partly because, as one submitter noted, the funds are applied in different ways across tertiary education organisations. There was, however, an overall concern that only a small proportion of PBRF funding was being made available for competitive internal projects.

210 One submitter said the incentives need to be changed, as the PBRF fails to encourage universities to contribute to industry R&D. Another submitter also commented along similar lines, noting that academic incentives often run contrary to commercial ones – having research used by industry significantly reduced the potential for ‘high-impact factor’ publications. This submitter also argued that the perception that PBRF panels hold applied research in lower regard than research published in journals needs to be undone.

211 Two submitters raised concerns over the robustness of the evaluation process, especially in terms of how the system will operate after changes in 2015. Several submitters complained that PBRF criteria have led to an increase in publishing output, without necessarily increasing the level of high-impact science for the wider economy.

MBIE sector-specific funds

212 Similar to criticism of the Marsden Fund, one submitter stated that MBIE sector-specific funds were under-resourced, resulting in a hyper-competitive bidding process that fuelled low success rates.

213 One submitter argued funding should be skewed in favour of sectors that do not have R&D levy schemes via legislation such as the Heavy Engineering Research Levy (HERL) Act. Otherwise some sectors are at a distinct advantage compared with others.

214 One submitter argued MBIE sector-specific contestable funds need to be adjusted. This submitter believed that the timing of contracts was "a legacy of delays". The submitter was also concerned that the funding was too New Zealand-specific, precluding projects that require the resources or scale of international partners for delivery. Submitters were divided on whether MBIE sector-specific funds had good quality assessment mechanisms.

a One submitter praised them for having a transparent process of funding and good assessment mechanisms that ensured only the best contestable research was funded, alongside robust peer review.

b Another was concerned that major decisions around funding allocation were delegated to the Science Board, with members directly appointed by the Minister. This submitter referred to some of the Science Board members as being "lobbyists" and questioned why they should sit on such a premier board.

Primary Growth Partnership

215 Eight submitters commented specifically on the Primary Growth Partnership (PGP), with generally positive comments. Four submitters commented that the PGP programme was successful at engaging end-users in the research selection process, which resulted in research relevant to industry.

216 This mechanism was said to work well for sectors with a "cohesive industry fee-paying levy body", but having a potentially stifling effect on innovation by smaller players in these same sectors.

217 The fund was recognised as having good governance and an investment advisory panel populated with individuals who possessed good knowledge of industry.

Callaghan Innovation

218 There was a mix of largely negative views on the performance of Callaghan Innovation in administering funds. For example, it was questioned why a public research institution acted as the 'broker' of funding for the wider research sector. Another said the "jury appears still out" on Callaghan Innovation's efficacy. A further submitter summarised Callaghan Innovation as "a step in the wrong direction".

We find the periodic announcements of the lists of grant recipients somewhat unseemly. The question has arisen: What else does the organisation do? If the dispensing of grants is its function, we recommend more of this responsibility be contracted to private sector industry organisations which have direct, enduring relationships with their business members.

219 Overall, submitters appeared to be concerned about a lack of links between Callaghan Innovation and industry, believing more effort needs to be applied here. It was, however, recognised that the organisation needed to be given time to build these relationships.

Centres of Research Excellence (CoREs)

220 Centres of Research Excellence (CoREs) received more support than criticism from submitters who referred to them specifically (17 submitters). Support for CoREs focused on their success at promoting researcher collaboration at the research discipline level.

221 Five submitters expressed criticism of the CoREs:

a CoREs lacked strong peer review in relation to the allocation of money, which was particularly concerning for some submitters, considering the size of the funding.

b Governance costs were too high, with separate governing boards.

Crown Research Institute core funding

222 Comments on the performance of CRIs and their funding largely focused on the potential for greater outcomes that could be realised through better integration or alignment between CRIs and universities. Some submitters highlighted the establishment of joint graduate schools between CRIs and universities as a positive step.

223 One submitter specifically recommended that CRI Board performance be monitored by MBIE, to ensure funding "of certain portions of the business does not 'crowd out' new initiatives or partnerships".

APPENDIX 1: LIST OF SUBMITTERS

Health Research Council of NZ	NZAS
The Museum of New Zealand Te Papa Tongarewa	Methyl Bromide Reduction Inc
Research Advisory Panel	Carrie Murdoch
Families Commission/Social Policy Evaluation and Research Unit (SuPERU)	Beef & Lamb New Zealand
Landcare Research	Meat Industry Association
GNS	Federated Farmers New Zealand
Anthony Scott	Organic Dairy & Pastoral Group NZ Ltd/Southern Organic Group
Richard Shaw	Dairy NZ
Scion (New Zealand Forest Research Ltd)	Colin Johnston
AgResearch	Universities New Zealand
ESR	IPENZ
Marsden Fund Council (submitted by Royal Society of NZ on their behalf)	NZ Forest Owners Association
Geoffrey K Chambers	NZBIO
Wood Processors and Manufacturers Association of New Zealand	NZ Geographical Society
Nursery and Garden Industry New Zealand	Centre for Advanced Engineering
Pipfruit New Zealand Inc	Science Advisory Group (representing regional and unitary councils)
Employers & Manufacturers Association (Northern) Ltd	Bay of Plenty Regional Council
Straterra Natural Resources of New Zealand Ltd	Otago Regional Council
Natural Products New Zealand	Auckland Tourism, Events and Economic Development
Plant Market Access Council	Envirolink Governance Committee
Auckland Museum	NZ Federation of Graduate Women
Canterbury Museum	eResearch 2020
Kiwi Innovation Network	Association for Women in the Sciences (AWIS)
Royal Society of New Zealand	Adam Jaffe
SCENZ-IChemE	Foundation for Arable Research
Malaghan Institute	Alzheimers New Zealand
McGuinness Institute	Sarah Eady
Andrew Jeffs	Michael Gazley

Professor David William	Simon Granville
Troy Baisden	Hammond Resource Management Ltd
Health Research NZ Ltd	Solvation Ltd
Dunbier & Associates	Plant & Food Research
Dr Simon Smelt	Biopolymer Network Ltd
Simon Arnold	CRL Energy
Cawthron	HERA
Professor David Penman	Ian Cuthbertson
New Zealand Business Research Deans	Craig Stevens
Auckland University of Technology's Research and Innovation Office	Unitec Research Office and Postgraduate Centre
University Research Offices of New Zealand	Independent Research Association of New Zealand
New Zealand Marine Sciences Society	Engaged Social Science Hui Rangahau Tahi (eSocSci)
Eve Kawana-Brown	Logan Walker
Professor Ian Reid	Faculty of Medical and Health Sciences
Uniservices Ltd	Faculty of Science
Robinson Research Institute	Rutherford Discovery Fellows (39 signatures)
Harvey Perkins	Lincoln Agritech Ltd
University of Waikato	Lincoln University
University of Auckland Leadership Team	Victoria University of Wellington
Massey University	Professor Linda Tuhiwai Smith
University of Otago	School of Medical Science
Associate Professor Mark Costello	Wendy Nelson
William Tobin	Dr Matthias Lein
Dr Richard Le Heron	Dr Kim O'Sullivan
Professor Stuart McNaughton	

Some submitters requested that their names be withheld.