# Science New Zealand

advancing ideas
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OCTOBER 2014

# BRIEFING FOR INCOMING MINISTERS

ECONOMIC DEVELOPMENT
SCIENCE & INNOVATION
TERTIARY EDUCATION
SKILLS & EMPLOYMENT
FINANCE

agresearch ESR GNS Science Te Pū Ao Landcare Research Manaaki Whenua NIWA Taihoro Nukurangi Plant & Food Research Rangahau Ahumāra Kai SCION forests · products · innovation

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delivering results

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# BRIEFING FOR INCOMING MINISTERS

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# A LETTER FROM THE CHAIR

## Ideas and results that benefit New Zealand

New Zealand's science and innovation capabilities are key drivers of economic, environmental and social wealth and wellbeing. They help make New Zealand a place where people want to live.

The Crown Research Institutes support that commitment through our unique focus on science research *that benefits New Zealand.*

The CRI Act mandates that this research must be excellent, relevant, ethical and socially responsible, and make a difference. To deliver on this, CRIs work closely with our clients in the public and private sectors and with colleagues in research associations, universities and other tertiary institutes.

The 2010 CRI Taskforce initiated the most significant changes for the science & innovation eco-system in 20 years.

The CRIs are now in the fourth year of implementing the reforms and outcomes have been very positive. MBIE is now into its third year, the National Science Challenges and further Centres of Research Excellence are in formation, Callaghan Innovation has been established and overall funding in the science and education system has lifted.

We have willingly contributed to these achievements. The scale and duration of these changes are demanding of our senior staff time and have had to be managed concurrent with the delivery of CRIs' SCI targets.

The Government is working to improve the skill profile of the nation's workforce; to improve societal and business engagement with science-based innovation; to improve the quality of and access to national science and innovation assets; and is committed to evidence-based decision making. CRIs are providing practical support in all these areas.

In the midst of this change, the CRIs have continued to deliver outcomes that make a significant difference for New Zealand.

Clearer roles and responsibilities across the science and innovation eco-system, particularly enabled through the CRI Taskforce reforms, have brought improved relationships and better outcomes for New Zealand.

CRIs are keen to continue to play our part in leading, collaborating and linking across areas vital to New Zealand's wealth and well-being; and to see the CRI Taskforce reforms fully implemented.

CRIs have a unique role in being the only entities able to commit at an institutional level to a strategic, long term engagement with sectors and our owner, the Crown. Thus, we are also critical to achieving the outcomes sought through the National Science Challenges.

CRIs are working thematically across the major areas of science research priorities for our sectors and in support of the Business Growth Agenda.

Our key driver is simple: to ensure our Boards, management and staff work closely with our sectors and key stakeholders to efficiently deliver outcomes in line with our statements of core purpose, through excellent, high impact science.

This briefing sets out the key challenges seen from the perspective of the CRIs' purpose, role within the national and global science and innovation eco-systems, and how we work to advance ideas and deliver benefit to New Zealand.

The three most critical developments the CRIs would like to see occur are:

- → A clearly articulated vision for the future of the CRIs within the New Zealand science system including the ongoing importance of the CRI Taskforce reforms and the role of core funding within this;
- → Rapid implementation of the National Science Challenges with associated clarity on CRI governance and lines of accountability, and simplification of the current system complexity;
- → Commitment to growing Research, Science and Technology expenditure to the OECD average, and ensuring science and infrastructure capabilities essential to growing New Zealand's economic wealth, natural capital and managing risk are sustained.

We look forward to working with our shareholder, the Crown.

**Peter Landon-Lane**
**Chairman**

*Science New Zealand is the peak body for the 7 Crown Research Institutes.*

*The Board, comprising the CRI Chief Executives, is supported by a secretariat and pan-CRI groups. The latter also involve non-CRI participants, including Callaghan Innovation and SOEs.*

*Its purpose is to foster appreciation of the value of science and technology in creating economic, environmental and social wealth for New Zealand; provide a vehicle for cooperation and coordination amongst and between the CRIs, and other research providers; and provide policy, organisational, communications and advocacy support for CRIs in their collective championing of the economic transformation of New Zealand.*

# CROWN RESEARCH INSTITUTES: SUMMARY

## The Crown's strategic science & innovation capabilities dedicated to advancing ideas and delivering results that will benefit New Zealand

**The only science research organisations tasked by Parliament to undertake science research that is *excellent, relevant to New Zealand,* and *to translate that research and knowledge into practical outcomes.***

- → CRIs are platforms for creation of wealth and well-being: each CRI provides unique capabilities to service, grow and challenge current and future value areas for their sectors.
- → CRIs prioritise benefit to New Zealand over self-interest, while meeting the requirement to be financially viable.
- → The Core Purpose Statement ensures each CRI has a unique focus, sectoral alignment, and role as steward of national capabilities in their area. This also assists collaboration in addressing multi-disciplinary and multi-institutional issues of importance to New Zealand.
- → CRIs are national-good organisations, supporting existing sectors and helping generate new sectors and industries.
- → CRIs align their science and technology direction and core funding investment with government and industry/sector priorities.
- → CRIs core values include scientific integrity, both in the science research and its explanation for policy or business choices.
- → CRIs work collegially and collaboratively with each other and with other science researchers to deliver practical outcomes for New Zealand.
- → CRIs make science-based success visible, so as to stimulate greater awareness of and investment in science research and science-based innovation and its contribution to the national wealth and wellbeing.

## The CRI Reforms

**The CRI Taskforce set out principles applicable across all sections of the science and innovation eco-system.**

- → The Taskforce reforms commenced 1 July 2011. The momentum and integrity of the reforms need to be maintained. CRIs are keen to work with our owner and partners to do so.
- → Core Funding is an essential element. It has enabled significant shifts in effectiveness and productivity. The Core Funding is due for review in 2015-16, having been unchanged since 2011.

## Governance, accountability and responsibility for outcomes

**CRIs are complex and relatively large businesses, operating within highly contestable domestic and global markets.**

- → CRIs operate with corporate disciplines and within specific government compliance and regulatory regimes.
- → CRI Boards act as investors in an environment requiring highly complex trade-offs, and with responsibility for outcomes. High quality governance and management needs to be fostered and maintained.

The clarity of purpose arising from the Taskforce reforms have created greater collaboration on thematic lines across CRIs, and with other research partners, with each providing an invaluable lens and customer intimacy specific to that CRI.

## Leading in dynamic environments

**CRIs have a history of responding to and initiating change to improve their own productivity and better outcomes for clients and sectors.**

- → CRIs have initiated mergers and structural change.
- → CRIs formed multi-party procurement prior to all-of-government procurement processes.
- → CRI initiatives (some involving non-CRIs) include sharing of back office services, insurances, networks of technology transfer and commercialisation expertise.

## Regional economic development

**CRIs have 50 locations throughout New Zealand; 20 of which are shared with other CRIs, tertiary institutes and research organisations.**

- → CRIs are significant regional employers, bringing highly skilled people (science researchers, technicians) to locations as direct employees and as partners.
- → CRIs contribute to the local economy through human capability development, hubs and networks, as well as through working with local and central government and private sector organisations.
- → CRIs link with local sectors for industry cooperation and development, including R&D testing.
- → CRIs are regionally significant as purchasers.
- → The Hubs (Lincoln and other less formal arrangements) generate multi-disciplinary and multi-institutional approaches and solutions, and provide critical mass for regional development. They also provide national good outcomes and focus for international connectedness.

## Supporting Maori and the Maori economy

**CRIs have longstanding relationships with Maori communities and organisations.**

CRIs commitment to Maori advancement includes developing skills and opportunities, and working with Maori groups to define needs and opportunities and implement solutions.

## Capability Development: from education to engagement and tacit knowledge flow

**Highly skilled people with knowledge applicable to New Zealand needs, are essential.**

- → CRIs outreach programmes to schools and communities foster science interest and awareness, and support promising individuals.
- → CRIs work with TEIs to mentor and co-supervise students at Masters and higher levels. More than 560 (337 at PhD) in 2013.
- → CRIs have joint graduate schools, joint programmes and joint appointments with various TEI, as a means to engage top students on New Zealand-relevant issues.
- → CRIs encourage secondments into and from clients in industry and government.

## International

**CRIs global reach brings intelligence and foresight into New Zealand, with spill-in benefits to sectors as well as science; and informs 'build or buy' decisions.**

- → CRIs engage on several levels: science to science (developing relationships with collaborators overseas in order to advance our science capability); science for New Zealand (relationships to advance interests of NZ Inc, often in conjunction with MFAT, NZTE, MBIE); and assisting MBIE, MPI and others in creating or maintaining linkages for all science research in New Zealand.
- → CRI have a strategic approach: driven by identifying current and future needs of New Zealand, and thus the appropriate linkages a CRI should support.

CRIs are a vital element in an increasingly globalised science community. CRIs enable a committed New Zealand lens on the opportunities for both science research and industry opportunities.

## Commercialisation

**CRIs primarily partner with industry sectors and clients to ensure tech transfer and commercialisation.**

- → CRIs are active in commercialisation networks such as KiwiNet, Results for Science - to test ideas, tech transfer routes and to find investment and partners.
- → CRIs work with Callaghan Innovation and support the National Technology Networks.
- → CRIs were 2014 finalists in Commercialisation Collaboration, Research Entrepreneur, Research & Business Partnership Awards.
- → Private sector spends 3 of every 4 research dollars they commission externally, with CRIs. This proportion has been rising across successive Statistics NZ surveys.

## Key vulnerabilities for CRIs include:

- → the current and future workforce (quantity and profile),
- → global war for talent in areas critical to New Zealand,
- → Crown clients responding to financial constraints on their individual agency by reducing research which develops solutions applicable across multiple agencies,
- → access to critical infrastructure (especially major capital items beyond the resources of any single organisation yet of system-wide value),
- → conflicting strategies,
- → under-funding for mission-led science research.

## Strengths of New Zealand system include:

**Substantial strengths include science excellence, a growing collaborative culture, and high connectivity with critical sectors in New Zealand and globally.**

→ One of the more efficient in the world at producing valuable outputs and outcomes from a given level of investment.

The best way to produce more output and outcomes from an efficient system is to increase the amount of input (primarily financial investment, in the case of the science system), rather than trying to make it marginally more efficient when there is little scope to do so.

# ISSUES FOR MINISTERIAL LEADERSHIP

## A clear national strategy focused on benefiting New Zealand

New Zealand will benefit from the National Statement of Science Investment leading to a clearly stated overarching strategic view with an emphasis on outcomes beneficial to New Zealand. The role of CRIs within that is, of course, critical to determining how we can best continue to contribute.

New Zealand invests in science, technology, engineering and maths (STEM) so as to improve national wealth, health and well-being.

**As a small economy, we must prioritise areas of science research that:**

- → protect and secure the current wealth base for the country;
- → support and build on New Zealand's competitive advantages in the global economy (which includes our natural environment);
- → create knowledge and applications attractive to investment benefiting New Zealand;
- → ensure sustainable, competitively-based diversification across markets, products and services;
- → enable "connectedness" with world-leading research providers in areas of high importance to New Zealand's future economic, environmental and social success.

Priorities should focus on what will best deliver short, medium, and long term benefit to New Zealand. It should include the relative balance between accessing science from abroad, and doing it here (the "build or buy" argument).

Recent reports (such as *CRI Taskforce, Powering Innovation*) and engagements (*CRAG*) provide sound principles as well as recommendations for action pertinent to the whole system.

The principles articulated by the 2010 CRI Taskforce are applicable across all the government's science investment. The Taskforce placed CRIs and the core government agencies as integral parts of a national innovation system.

The principles include accountability for outcomes, sound governance with real responsibility, transparency of investments and investment purpose, and clarity of purpose and role for all entities (including the private sector).

## Improved clarity of roles and responsibilities

**An outcome-focussed approach will:**

- → identify excessive overlap and complexity in the system;
- → improve clarity around the roles, objectives and outcomes with all entities, and each type of entity. It is the experience of the CRIs that this will lessen or remove barriers to collaboration;
- → ensure that tools and expectations mesh with each other, and serve the purpose of delivering clear, measurable benefits to New Zealand.

## Accountability and responsibility to sit at governance level

**Set agreed outcomes for entities, and hold boards or other governance bodies responsible for performance and outcomes:**

→ leads to better informed decision-making;
→ shifts an evaluation culture to performance-improvement.

We welcome Government's commitment to supporting high quality governance:

- Top directors require an environment in which they exercise accountability and responsibility for strategy and outcomes;

- It indicates the Crown's commitment to ensuring that CRIs are given opportunity to fulfil their mission in the manner recommended by the CRI Taskforce.

## Reduction of complexity and enhancement of transparency

A well-functioning science and innovation system must be:

→ integrated, responsive, and collaborative;
→ outcome focussed;
→ supported by a simple and transparent funding system;
→ provide an appropriate degree of stability and continuity;
→ coherent, and not subject to continual creation of new mechanisms;
→ adequately funded from public and private sources.

**Unnecessary complexity:**

→ leads to increased transaction costs for entities and the system as a whole.
→ simplification will be greatly assisted by having clarity of purpose for, and alignment of, funding mechanisms as well as entities.

**Streamlining the monitoring, reporting and performance measurement across the system will be highly beneficial to all involved:**

→ measurement is currently uneven in application across types of entity, and too finely grained.
→ should reflect the high trust, high accountability approach of an outcome-based focus, in pursuit of the BGA as national goals
→ needs to be proportionate and equitable for all funds across all institutions.

## System stability to allow change to embed

There have been significant system changes each two years on average for some 20 years. CRIs believe that Boards and management must, like good scientists, be alert to better ways of doing things and responsive to external environments.

There is change already in progress across a range of entities, most of which involve CRIs – from national science challenges through to hubs. CRIs are leaders – for example, with universities in creating joint graduate schools, joint programmes and joint employment, co-supervision and mentoring of students, so as to develop the human capability New Zealand needs.

These processes need time to work through, and to allow for them to be fully implemented.

Given the high standard of the system overall, Government should reinforce existing strengths in the system (e.g. existing investment mechanisms or institutions) rather than creating new system elements in the hope they will perform better then the best existing elements of the system.

Conversely we should avoid fragmenting the system with additional investment mechanisms and institutions or virtual institutions that add governance cost and make it hard to achieve critical mass.

## Increased investment in RS&T that will benefit New Zealand

The BGA points to the opportunities to extend the scope for value gain from New Zealand's competitive advantage in two highly productive areas in which New Zealand has globally competitive advantage: primary sector and primary sector technologies.

**A strong and resilient economy requires:**

- → defending the current economic base;
- → moving up the value chain;
- → and diversifying products, services and markets in ways in which New Zealand will be the prime beneficiary.

Excellent science cannot achieve the objective by itself. Priority setting requires consideration of elements such as investment and business models; absorptive capacity in the New Zealand economy; comparative economic advantage and time scales; collaboration around human capital development and flow; infrastructure; complementary institutions.

### International

The important role science plays in the international sphere for New Zealand needs additional support – both to increase the science linkages and ensure they are realised, and to extend New Zealand's reach and spill-in capabilities.

### Balance across the spectrum

Providing a balance across the research spectrum should not be treated as a discussion between interested parties for funding. It is a discussion about how New Zealand is to achieve its economic, environmental and social objectives. New Zealand specific (industry or sector-good and companies) STEM research is essential to meeting BGA objectives.

### Reshaping New Zealand's workforce profile

We welcome government's commitment to increasing the number of engineering and science students; and to ensuring they are developing skills and area knowledge that will specifically advance New Zealand.

This is vital if we are to achieve the trebling of private sector R&D capability by 2025, as needed to reach the BGA objectives. Through joint appointments, graduate schools and programmes, as well as co-supervision and similar programmes, CRIs are doing much to support this objective. We remain committed to working with the Crown and others on this vital task.

## Core Purpose Funding

One of the most successful initiatives implemented as a consequence of the CRI Taskforce recommendations has been Core Purpose Funding.

It has provided a stable platform for CRIs to build and maintain key science capability for the nation, allowed for a more agile and responsive approach to supporting research outcomes sought by sectors, significantly reduced administration costs and processes within CRIs and MBIE, and improved private sector engagement and investment .

It is the vital component in CRI Board's strategic toolkit, enabling implementation of the core purpose with an investment approach.

Core Purpose Funding commenced in 2011-12 as a result of the Government adopting the recommendations of the CRI Taskforce.

The sum varies from 9 to 46 per cent of total revenue of a CRI, aggregated from contracts repeatedly won by each CRI.

The real value of the CPF has declined 25 per cent since inception. As some of the contracts originated 5-7 years previously, the decline is even larger. This has put enormous pressure upon internal resources, which efficiency gains cannot match.

The CPF is due for review in the 2015-16 year. CRIs look forward to contributing to that review. In the meantime, we recommend Government consider an increase in the 2015 Budget.

**After three years, the benefits are apparent and becoming increasingly powerful in enabling us to deliver on our purpose for New Zealand:**

- → Faster decision making
- → Increased stakeholder involvement
- → Better governance
- → More strategically-focussed CRIs
- → Improved cooperation
- → Lower transaction costs and greater financial stability

The CRIs welcome an opportunity to present evidence supporting those points at an early opportunity.

# THE CROWN RESEARCH INSTITUTES

## Statements of Core Purpose

### AgResearch

To enhance the value, productivity and profitability of New Zealand's pastoral, agri-food and agri-technology sector value chains, to contribute to economic growth and beneficial environmental and social outcomes for New Zealand.

**Lead areas:**

- → pasture-based animal production systems
- → new pasture plant varieties
- → agriculture-derived greenhouse gas mitigation and pastoral climate change adaptation
- → agri-food and bio-based products and agri-technologies
- → integrated social and biophysical research to support pastoral sector development.

**Contributing areas:**

- → biosecurity, land, soil and freshwater management
- → climate change adaptation and mitigation
- → food and beverage sector (including foods for human nutrition and health, food technologies and food safety).

### ESR

To deliver enhanced scientific and research services to the public health, food safety, security and justice systems and the environmental sector, to improve the safety and contribute to the economic, environmental and social wellbeing of people and communities in New Zealand.

**Lead areas:**

- → forensic science services
- → harm prevention from drugs and alcohol
- → surveillance of human pathogens and zoonotic diseases
- → domestic and export food safety in partnership with the regulator
- → impacts of the environment on human health including groundwater, fresh and drinking water quality and safe biowaste use
- → integrated social and biophysical research to support decision making in the environmental, public health and justice sectors.

**Contributing areas:**

- → assessing and responding to chemical, biological, radiological and explosive events and environmental threats, including adverse human impacts on natural resources
- → biosecurity and freshwater management
- → climate change adaptation and mitigation.

## GNS Science

To undertake research that drives innovation and economic growth in New Zealand's geologically-based energy and minerals industries, that develops industrial and environmental applications of nuclear science, that increase New Zealand's resilience to natural hazards and that enhances understanding of geological and earth-system process.

**Lead areas:**

- → geothermal energy, oil, gas, gas-hydrates (including carbon sequestration)
- → mineral and geobiological resources
- → geological hazards, risk mitigation and societal impacts of natural hazards
- → earth-system processes and landscape evolution
- → groundwater processes and quality
- → the geological component of global environmental processes and climate change
- → application of nuclear and isotope science and ion beam technology.

**Contributing areas:**

- → high value manufacturing
- → freshwater management
- → hazards management
- → ocean floor exploration
- → climate change adaptation and mitigation
- → Antarctica.

## Landcare Research

To drive innovation in New Zealand's management of terrestrial biodiversity and land resources in order to both protect and enhance the terrestrial environment and grow New Zealand's prosperity.

**Lead areas:**

- → catchment-level ecosystems (including wetlands) and related ecosystem services
- → terrestrial vertebrate pest control
- → terrestrial carbon processes and inventory, and other greenhouse gases from soil and land
- → land cover, land use capability and effects, and spatial land information that integrates across sectors and scales
- → soil characterisation, processes and services
- → integrated social and biophysical research to support sustainable land resource management, including natural and urban environments.

**Contributing areas:**

- → biosecurity, land, soil and freshwater management
- → climate change adaptation and mitigation
- → industry and business environmental performance including verification
- → indigenous forestry
- → urban environments
- → Antarctica.

## NIWA

To enhance the economic value and sustainable management of New Zealand's aquatic resources and environments, to provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve the safety and wellbeing of New Zealanders.

**Lead areas:**

- → aquatic resources and environments (with a focus on surface freshwaters and coastal environments)
- → oceans
- → freshwater and marine fisheries
- → aquaculture
- → climate and atmosphere
- → climate and weather hazards
- → aquatic and atmospheric-based energy resources
- → aquatic biodiversity (including biosystematics) and biosecurity.

**Contributing areas:**

- → biosecurity, freshwater and hazards management
- → climate change adaptation and mitigation
- → ocean floor exploration
- → seafood sector
- → urban environments
- → Antarctica.

## Plant & Food Research

To enhance the value and productivity of New Zealand's horticultural, arable, seafood and food and beverage industries to contribute to economic growth and the environmental and social prosperity of New Zealand.

**Lead areas:**

- → novel fruit, vegetable and crop cultivars for the horticultural and arable industries
- → sustainable production and processing systems for the horticultural and arable industries
- → plant and seafood-based foods, ingredients and biomaterials.

**Contributing areas:**

- → biosecurity, land, soil and freshwater management
- → climate change adaptation
- → seafood and food and beverage sectors (including foods for human nutrition and health and food technologies)
- → pastoral forage varieties.

## Scion

To drive innovation and growth from New Zealand's forestry, wood product and wood derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

**Lead areas:**

- → sustainable forest management and tree improvement
- → forestry biosecurity and risk management and mitigation
- → wood processing, wood-related bioenergy, waste streams and other biomaterials
- → forestry and forestry-based ecosystem services to inform land-use decision making.

**Contributing areas:**

- → biosecurity, land, soil and freshwater management
- → climate change adaptation and mitigation
- → indigenous forestry
- → industrial biotechnology and high-value manufacturing.

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