

FROM STRENGTH TO STRENGTH

GOVERNMENT'S
AGENDA FOR
NEW ZEALAND
RESEARCH,
SCIENCE AND
TECHNOLOGY

SUSTAIN

OUR

SCIENCE

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MINISTRY OF
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SCIENCE +
TECHNOLOGY

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NEW ZEALAND
RESEARCH,
SCIENCE AND
TECHNOLOGY

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NOTE FOR READERS

This document relates to New Zealand research, science and technology (RS&T). By RS&T we mean not only research, but also the activities of scientific advice, scientific monitoring and data collection, the development and maintenance of scientific and technological knowledge, skills and networks, and the development and evaluation of RS&T policy and activities.

The Agenda is particularly focused on RS&T in the context of science and innovation. The directions relate primarily to Vote RS&T, but are also aligned with signals for research and innovation investments in other portfolios, notably Tertiary Education and Economic Development. Wider knowledge-creating activities, such as research contributing non-scientific knowledge in the arts, cultural and humanities spheres, are not a focus of this Agenda.

The Agenda was developed by the Ministry of Research, Science and Technology (MoRST) with input from research organisations, individual scientists, sector organisations, individuals from business and the wider community, and government departments. A summary of written submissions received is available on the MoRST website (www.morst.govt.nz).

The Agenda reflects and supports a wide range of government strategies and policies. These are mentioned throughout the document and listed in Annex 1 for further reference.

A glossary of acronyms used in the Agenda appears as Annex 2.

All financial data are presented as GST exclusive.

Contents

5	Minister's Foreword
6	Summary
10	Strengths for our Future
20	Investment
23	Challenges:
25	0.1 SUSTAIN OUR SCIENCE BASE
35	0.2 FOCUS NEW SCIENCE
47	0.3 PROPEL BUSINESS R&D
53	0.4 CONNECT NEW ZEALANDERS WITH SCIENCE
59	Implementation and Measuring Progress
60	Annex 1: Strategies, Funds and Policy Initiatives
63	Annex 2: Glossary of Acronyms
64	Annex 3: Investment Objectives

“Experiment without imagination, or imagination without recourse to experiment, can accomplish little, but, for effective progress, a happy blend of these two powers is necessary.” Sir Ernest Rutherford, British Association for the Advancement of Science, Presidential Address, 1923

Minister's Foreword

Government is taking purposeful action to realise New Zealand's innovation potential. Our economic, tertiary education and RS&T agencies have been aligned under one ministerial portfolio and there have been significant new investment commitments, for example to pastoral and food innovation, through New Zealand Fast Forward, and an R&D tax credit for business. Budget 2008 commits a further \$205 million over four years for RS&T.

These measures recognise that innovation is an imperative for New Zealand and that RS&T has a vital role to play — essential for helping us to adapt to global challenges, such as moving to a low-carbon economy, as well as finding solutions to our own challenges, whether that be reducing pastoral emissions or helping to fight diabetes.

This Agenda charts how RS&T will support innovation for New Zealand. It sets clear directions for RS&T activity, recognising that success rests firmly on the talent, the creativity and the determination of our scientists and researchers.

There are many successes we can already celebrate. Our researchers have developed bodies of knowledge with world-wide influence through, for example, our long-term studies of child health and our sequencing of the sheep genome. New Zealand technologists and engineers have also been part of some outstanding innovations: electric fencing, golden kiwifruit, the Hamilton jet boat, straight-from-the-refrigerator spreadable butter, and 3D sports-graphics systems. Our research activities have also supported our sense of identity with New Zealand, a place of diverse peoples and adventurous discovery.

The Agenda outlines government's commitment to support and build on these strengths. It underlines the importance of our core science capability and shows how this will be supported through more stable funding and ensuring strategic and national capabilities are better assured. Sharpening the focus of the nation's research effort will also help ensure RS&T can deliver in its increasingly complex and changing environment.

This Agenda builds on earlier strategies and has an outlook to 2020. By laying out the path for government support, it enables research organisations to plan further ahead and strengthen connections between the wider research sector and the business community.

In order for this document to have meaningful impact it needs a broad ownership. It needs research organisations working with business and alongside government to help achieve the vision of a science-based future. I look forward to working with you.



Pete Hodgson

MINISTER OF RESEARCH, SCIENCE AND TECHNOLOGY

Summary

New Zealand RS&T has made invaluable contributions to our understanding of the world around us, and to our current prosperity and wellbeing.

Government is acting to strengthen New Zealand's science base, to target and coordinate science resources towards important outcomes, to build R&D capability in business, and to connect New Zealanders more closely with science.

Transformational RS&T (TRST) opportunities have been confirmed in the areas of:

- high-tech platforms
- future foods
- innovation in health delivery
- environmental sensing for real-time resource management
- making renewable energy work for New Zealand, and
- transformational cities and towns.

TRST areas were identified through input from researchers and government and reinforced in the consultation on this Agenda. They will support Government's innovation priorities.

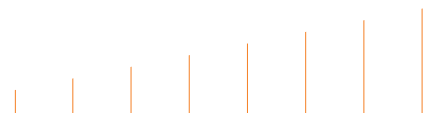
New investment commitments have been confirmed for 2008/12 in Budget 2008. For Vote RS&T, a further \$205 million will be invested over the next four years: for 2008/09, this will be an additional \$44 million and the Government's operating investment through Vote RS&T will be \$725.7 million.

New investment is prioritised toward safeguarding a science capability to support existing sectors and core areas of national importance, such as hazard response, land and water management, primary industries, public health, and biosecurity. Investment in TRST opportunities is second priority but new funds for 'high-tech platforms' and 'making renewable energy work for New Zealand' have been confirmed for 2008/12.

Business- and industry-led R&D will be strengthened through a new tax credit and public-private research partnerships, such as the New Zealand Fast Forward initiative.

This Agenda represents government's expectations of and commitment to New Zealand RS&T. It is a response to calls from research organisations and scientists for clarity about government directions for publicly-funded science. It will support long-term planning and enable more confident collaboration.

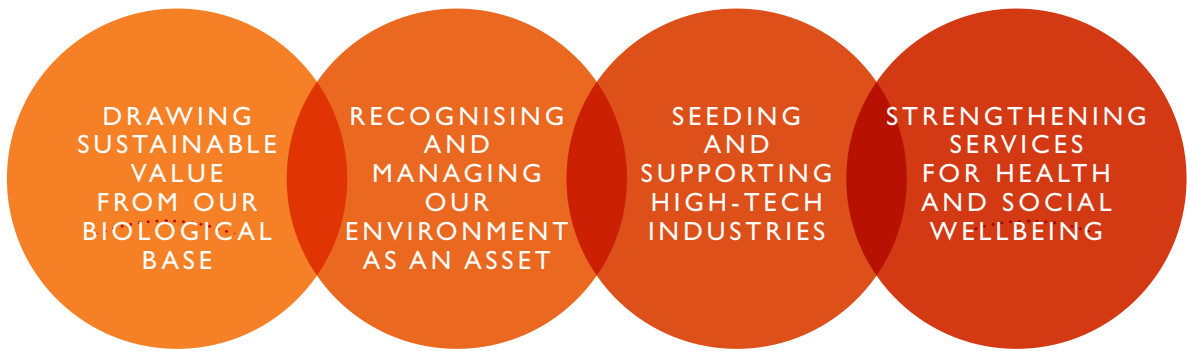
An overview of the Agenda and the key changes it signals follow.



RS&T Agenda Overview

New Zealand RS&T supports economic, environmental, social, health and cultural outcomes

STRENGTHS
FOR OUR FUTURE p10



CHALLENGES

o.3
PROPEL
BUSINESS
R&D
p47

o.2
FOCUS
NEW
SCIENCE
p35

o.4
CONNECT
NZERS WITH
SCIENCE
p53

o.1
SUSTAIN
OUR
SCIENCE
BASE
p25

Summary of RS&T Agenda Challenges and Changes

CHALLENGES	CHANGES	LEAD GOVERNMENT AGENCIES	UPCOMING MILESTONES ¹
<p>o.1 SUSTAIN OUR SCIENCE BASE</p> <p>To create an RS&T system that provides attractive career opportunities for talented people and encourages flexible, collaborative research.</p>	More tailored outcome-focused Foundation funding approaches, as a result of Stable Funding	MoRST Foundation	Extension of Stable Funding approach from July 2008
	Strengthened ability to attract, develop and retain top-performing people in RS&T	MoRST	Advanced Skills Action Plan published by July 2008
	Stronger cross-government capability to engage with and use RS&T	MoRST All departments	NA
<p>o.2 FOCUS NEW SCIENCE</p> <p>To focus and coordinate some RS&T activity toward areas of science strength, New Zealand need and opportunity.</p>	New 'Roadmaps' in food research, sustainability technologies, and health research	MoRST	Food Research Roadmap published 2009; others 2010/11
	Implementation of six transformational RS&T opportunities	MoRST Foundation HRC	Initial two areas implemented from 2008
	More emphasis on science for sustainability	MoRST	NA
	Vision Mātauranga integrated into RS&T and across government	MoRST	NA

¹ Significant milestones are noted where relevant, reflecting either the launch of new policies or initiatives, or availability of new funds. For further information refer to the lead agency listed. Key funds and policy initiatives are also listed in Annex 1 for further reference.

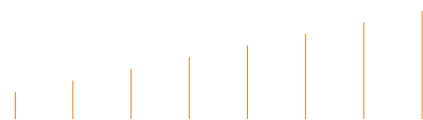
NA: Not applicable – no milestones confirmed; reflects ongoing work from 2008.



CHALLENGES	CHANGES	LEAD GOVERNMENT AGENCIES	UPCOMING MILESTONES ¹
<p>o.3 PROPEL BUSINESS R&D</p> <p>To support New Zealand businesses to be more internationally competitive, by investing in and applying RS&T, and drawing on effective partnerships with public RS&T.</p>	New R&D tax credit available to business	IRD	Available from April 2008
	Strategic RS&T investments matched to government's economic development priorities	MED MoRST	NA
	New public-private partnerships, such as New Zealand Fast Forward	MAF	NZ Fast Forward established July 2008
	A 'no wrong door' approach to government support for business R&D	Foundation NZTE	Relaunch of TechNZ July 2008
	Smarter firm connections with international knowledge and technology	MED	NA
	Better links between public research organisations and businesses	MoRST MED	NA
<p>o.4 CONNECT NEW ZEALANDERS WITH SCIENCE</p> <p>To connect New Zealanders more closely with science, supporting a strong sense of ownership of RS&T and innovation and improving outcomes from RS&T.</p>	Extension of the Science Learning Hub	MoRST	2008
	Development of a Science Media Centre	MoRST	Launched June 2008
	Support for public engagement at early stages of research	MoRST with research organisations	NA
	Online access to research information	MoRST	NA

What are New
strengths in RS
are the **big cha**
and **opportun**
New Zealand faces?
does science play and
government support

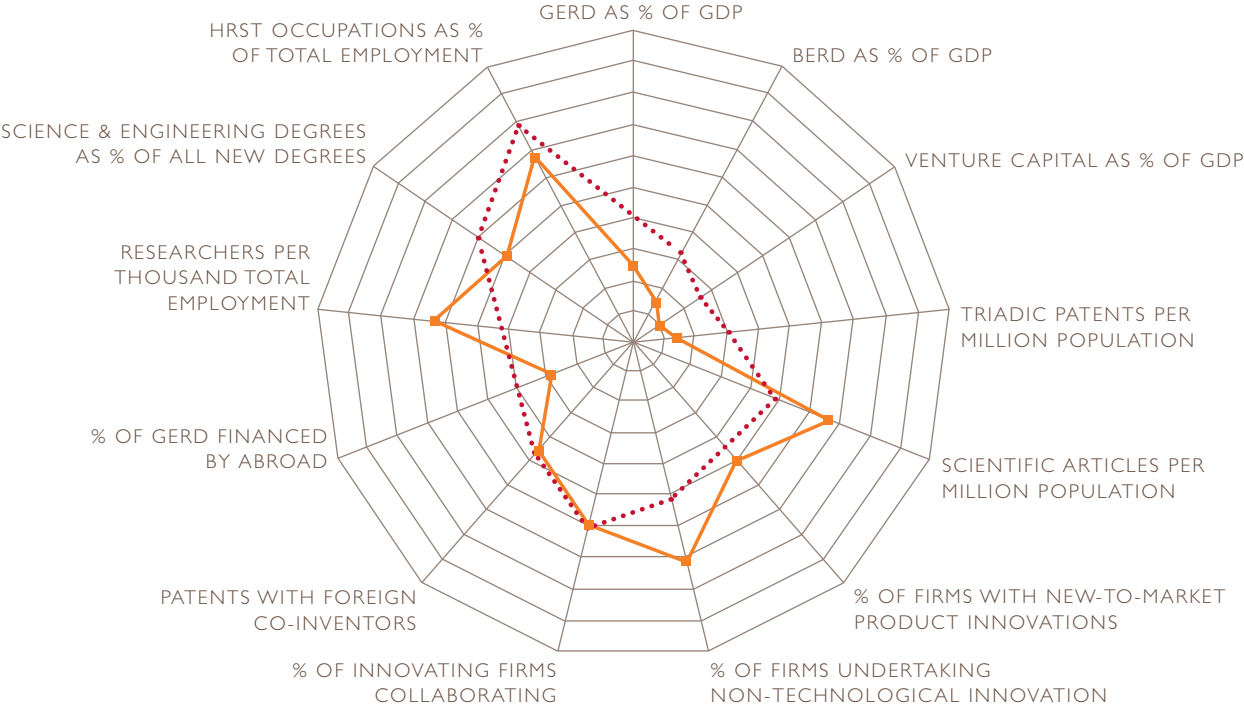
Strengths for our Future



Zealand's S&T? What **challenges** **opportunities** that What **role** and how should **progress?**

These were some of the questions that provided starting points for this Agenda. Here we outline some of the answers that arose during the development of this document. As well as setting the scene, these pages offer a challenge to all those involved in New Zealand's RS&T system: to build on the country's already remarkable RS&T strengths, apply them to today's imperatives, and so give New Zealand a science-based edge for the future.

Science and Innovation Profile of New Zealand



— New Zealand
 OECD Average

EXPLANATION OF TERMS USED IN DIAGRAM:
 GERD: Gross expenditure on R&D
 BERD: Business expenditure on R&D
 HRST: Human resources in science and technology
 Triadic patents are those taken out at the European Patent Office (EPO), the Japanese Patent Office (JPO) and the US Patent & Trademark Office (USPTO) that share one or more priorities

Source: **Science, Technology and Industry Outlook 2008**, OECD (forthcoming)

New Zealand needs 'market-friendly "clever" targeting': neither 'picking winners' nor a pure bottom-up definition of policy objectives is a feasible option, especially in small countries that must make the best use of limited resources. **REVIEW OF INNOVATION POLICY: NEW ZEALAND**, OECD, 2007

A stronger science base

The application of science to problems can only spring from deep science capability and a solid science system. This was emphasised in the responses to the draft Agenda. A diverse and dynamic knowledge base is also needed to support the very wide range of skills and knowledge needs across New Zealand, allow for serendipity, and guard our ability to respond to the unexpected. New Zealand's science system needs to offer fit-for-purpose funding that enables researchers to work in creative and forward-looking ways, and enjoy science careers that are attractive to tomorrow's generation of researchers and to overseas talent.

Ensuring a strong science base is a shared responsibility of government's tertiary education and RS&T portfolios. It is reflected in this Agenda through commitments to ongoing improvements in the funding system and support for research and science capability for New Zealand's sectors and industries, including core areas of national need. Ongoing support for blue skies or untargeted research will complement this.

Science needs long-term commitment. Skills and knowledge take decades to develop, and only with these can research teams conduct medium-term or applied research and, in turn, research that addresses immediate needs.

WITH AN RS&T INVESTMENT HORIZON OF . . .

5 YEARS, you get:	Technical solutions
5–15 YEARS, you get:	 Strategic knowledge and capability 
15–100 YEARS, you get:	 Science and innovation as part of our culture 

There are four areas – distinctive to New Zealand – and **effective innovation are vital** to our future. **RS&T must shine.**

DRAWING SUSTAINABLE VALUE FROM OUR BIOLOGICAL BASE

Agriculture, horticulture, forestry, fisheries and tourism are mainstays of New Zealand's economy. Ongoing productivity gains are needed to maintain global competitiveness, but in many areas we are reaching the limits of the environmental and human resources on which they depend. The need for energy-efficient, low-emission production and business methods is a growing imperative. Our challenge is to step up to a new value-added level of performance that is truly sustainable.

By 2020, RS&T is likely to have supported:

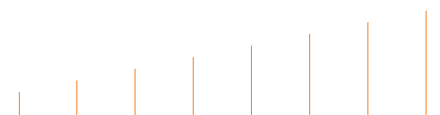
- primary-industry partnerships serving global food markets with high-value, sustainably produced goods
- the export of New Zealand knowledge of and expertise in farming, forestry and horticulture, making Kiwi know-how and can-do in demand around the world
- businesses and decision-makers with a sound understanding of people's eco-purchasing behaviours, and
- iwi-based initiatives demonstrating a 'Māori edge' in the development and marketing of new marine products.

RECOGNISING AND MANAGING OUR ENVIRONMENT AS AN ASSET

New Zealand's location in the southern Pacific Ocean, the distinctive range of plants, animals and ecosystems to which it is home, and its unique landscapes are all sources of Kiwi pride and contribute to the country's international profile and market position. Their value, however, has yet to be fully appreciated, protected and managed. There is also opportunity for environmental attributes to be integrated into the production of goods and services and the branding of New Zealand in world markets.

By 2020, RS&T is likely to have supported:

- the establishment of environmental sensing networks in rivers and forests, across farmland and in cities, helping resource users and managers make informed decisions about natural resource usage
- New Zealand's towns and cities in their efforts to have significantly less impact on the natural environment through energy-efficient housing, transport and waste management in urban and design planning
- more effective and efficient detection and control systems to prevent entry of pests into New Zealand and to improve management or eradication of established pest species, and
- new knowledge of the marine ecosystems, geological structures and mineral resources in New Zealand seas.



with Zealand – where **new knowledge for our success.** In these areas, New

SEEDING AND SUPPORTING HIGH-TECH INDUSTRIES

New Zealand's high-tech industries are already standout export performers, providing niche, high-value products such as software-design tools, earthquake-protection technology, farming technologies, super-yachts and navigational devices. Opportunities exist to strengthen industry clusters and networks, and to more effectively tap into our specialist science capabilities to increase their innovation and growth.

By 2020, RS&T is likely to have supported:

- the development of new or stronger high-tech capabilities in areas such as nanotechnologies, electronics, materials technologies and molecular discovery, supporting multiple applications across a range of industries
- bioengineers working with hospitals and business to develop medical devices and services that meet people's health needs
- New Zealand being a smart 'adopter and adapter' of materials technologies, for example by integrating electronics into new polymers or light metal alloys for niche global markets, and
- life cycle analysis informing and certifying new high-tech products with low environmental impact.

STRENGTHENING SERVICES FOR HEALTH AND SOCIAL WELLBEING

New Zealand is home to a diversity of people, communities and cultures and offers a high quality of life for many. New Zealanders' life experience, our population profile and lifestyles will change markedly over the next few decades. Organisations in government, business and community sectors delivering health and social services will need to foresee and understand these changes and their complex relationships in the New Zealand context, work together, and use evidence effectively in order to make wise decisions and meet people's needs.

By 2020, RS&T is likely to have supported:

- life course studies supporting our understanding of wellbeing, resilience and disadvantage as individuals, families and whānau, within our communities
- the transfer, adaptation and application of new innovations in services for improved business, community and government activities
- strengthened capability in government departments and agencies to support the knowledge needs of their sectors including their understanding of emerging transformative ideas, new science methodologies and technological developments, and
- robust evaluation of new innovations in health, education, social, justice, and labour services, supporting their extension for use regionally or nationally.

““For Science
is a railway
carriage,
rocking with
big ideas ...””

Chris Orsman, from *Making
Waves*, for Maurice Wilkins, 2002

Investment

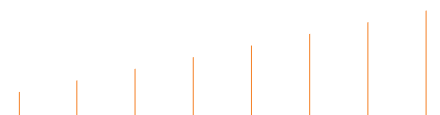
Government is a significant player in New Zealand's RS&T system: it finances 45 percent of all New Zealand's RS&T, owns significant science infrastructure, notably the CRIs, and a number of government departments also carry out science and research activities.

New Zealand's overall investment in RS&T is \$1,825 million per year, or 1.17 percent of GDP (Research and Development in New Zealand 2006, Statistics New Zealand). This total investment is made up of private R&D, university R&D, government R&D (which includes CRIs) and overseas funding of R&D in New Zealand.

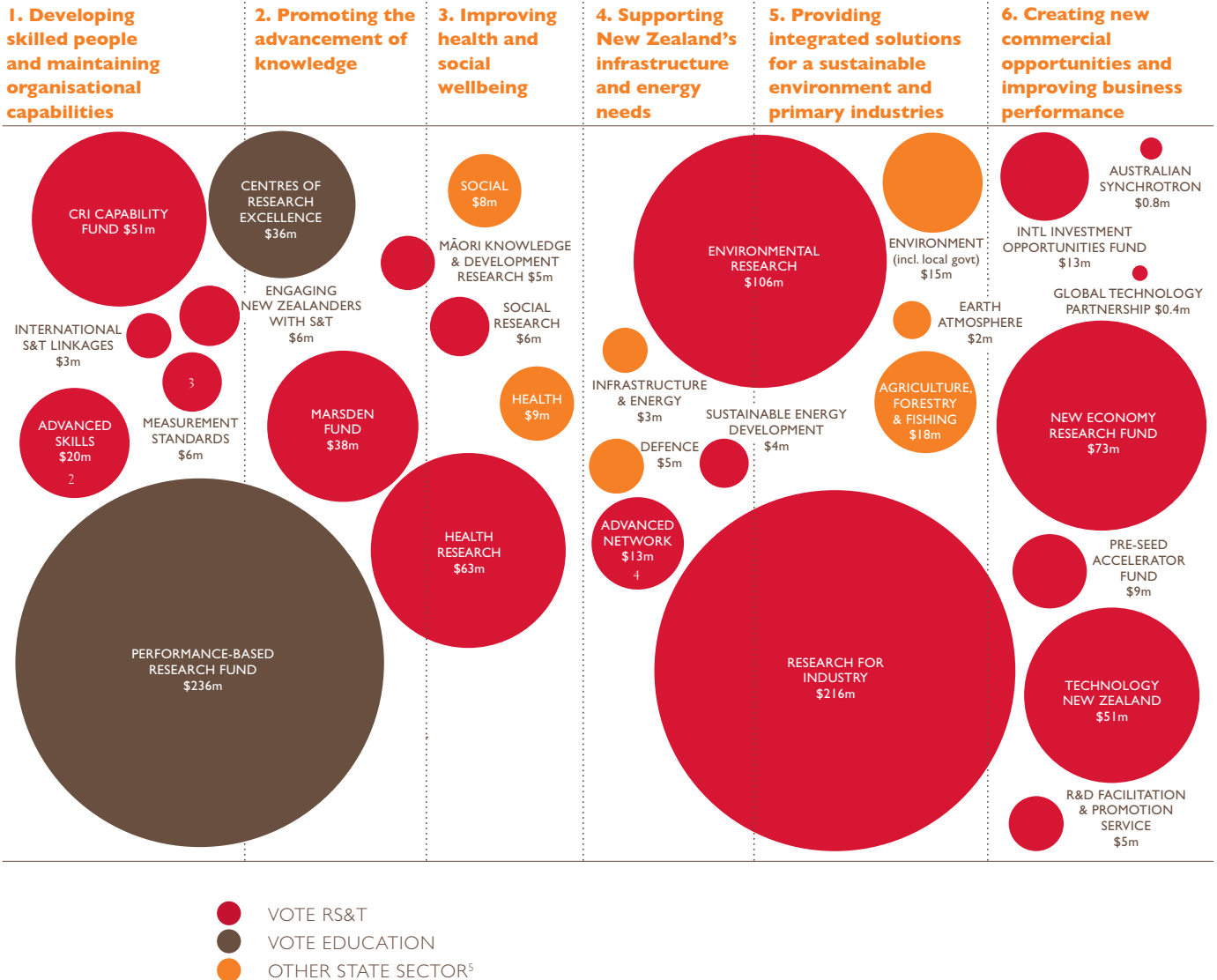
Government's investment in RS&T sits across six investment objectives related to government's knowledge, innovation, environmental, health and social wellbeing priorities. Investment is delivered through a range of schemes from Vote RS&T, Vote Education and funds from other government departments. The diagram opposite lists the six investment objectives (at the top of each column) and illustrates the alignment of key government RS&T investment funds to these objectives. The six investment objectives allow strategic multi-year prioritisation at a higher level than individual schemes and funds.

In 2003 government signalled its long-term target was to increase New Zealand's public R&D investment to match the OECD average; in 2006/07 this was 0.50 percent and 0.66 percent respectively (OECD MSTI 2007/02). Raising private sector R&D also remains critical to the performance of the innovation system. Business R&D investment has been growing faster than the OECD average but remains low compared with other OECD countries.

RESEARCH AND DEVELOPMENT IN NEW ZEALAND 2006, STATISTICS NEW ZEALAND



RS&T Investment Objectives and Major Funds¹



¹Annual value following Budget 2008

²Rutherford Fund, Supporting Promising Individuals

³Convention Du Metre, National Measurement Standards

⁴Advanced Network, Advanced Network Capability Building

⁵Based on data from the Public Sector Financing of Research 2006/07 survey.

Categories represent total investment by socio-economic purpose of R&D, rather than by Vote or department. To avoid double counting, Vote RS&T and Vote Education investments have been excluded.

Challenges

Government's role in guiding the RS&T system requires more than just making funds available. A range of policies and mechanisms is needed to guide investments and encourage collaborations and linkages throughout the science and innovation system.

Four areas for system or policy development are described in the sections that follow. Each is headed with a prime challenge that will help guide investments and activities over the decade or so ahead. The measures that have been or will be put in place to meet these challenges are described. These include recent changes to system settings, such as new research funding approaches, or newly agreed policy commitments. These changes are not a comprehensive list of all the activity underway or planned to support the RS&T system.

The relevant Budget 2008 Vote RS&T investments are noted at the end of the each section.

	CHALLENGE	PAGE
o.1 SUSTAIN OUR SCIENCE BASE	To create an RS&T system that provides attractive career opportunities for talented people and encourages flexible, collaborative research.	25
o.2 FOCUS NEW SCIENCE	To focus and coordinate some RS&T activity toward areas of science strength, New Zealand need and opportunity.	35
o.3 PROPEL BUSINESS R&D	To support New Zealand businesses to be more internationally competitive, investing in and applying RS&T, and drawing on effective partnerships with public RS&T.	47
o.4 CONNECT NEW ZEALANDERS WITH SCIENCE	To connect New Zealanders more closely with science, supporting a strong sense of ownership of RS&T and innovation and improving outcomes from RS&T.	53

“If you have very good people working, not for you but with you, then the chances of finding very important, critical, unexpected things are pretty high.”

Alan MacDiarmid, Nobel Lecture,
2000

o.1

Sustain our Science Base

Challenge: To create an RS&T system that provides attractive career opportunities for talented people and encourages flexible, collaborative research.

Why it matters

- Tertiary education institutes (TEIs), Crown research institutes (CRIs) and other research organisations contribute to the New Zealand and global knowledge base.
- New Zealand's research organisations provide essential knowledge and services to central and local government in areas such as hazard management and delivering strategic industry-good research.
- Research organisations must have appropriate resources if they are to connect globally and deliver nationally-important outcomes.
- Māori and Pacific peoples can make a distinctive contribution to RS&T, but there is a need to grow their numbers in science.
- For New Zealand to occupy a strong position on the world stage, its research organisations need to collaborate rather than compete in areas of strength.
- At the heart of a strong RS&T system lie talented people. New Zealand's system must attract, retain and nurture these people.

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- investment methods suited to building and maintaining capability and infrastructure
 - stronger, enduring and dependable linkages between research organisations and the end-users of research, and
 - more secure and attractive career paths for researchers.

For Vote RS&T investments, there is now less emphasis on contestability. A mix of negotiation, contest and review is used to make investment decisions in areas that contribute to broad government priorities. This allows more flexible research activity, with a stronger focus on outcomes, future research needs, and consideration of whether there is a current research area capable of delivering what is being sought.

The roles of the RS&T investors and research organisations will need to evolve. The Foundation is developing a stronger role both as an investment agent and as a partner in the investment process. Research organisations are to take on stronger roles in leading capabilities, especially with respect to cross-organisational projects. This process is expected to strengthen collaboration and create enduring relationships that give support to significant capabilities.

Stable Funding policies currently apply only to investments made by the Foundation through the Research for Industry, and Environmental Research output expenses and the New Economy Research Fund. The Health Research Council (HRC) will, however, be diversifying its investment approaches to enable a greater focus on applied research for New Zealand needs, as well as continued emphasis on longer-term underpinning research programmes (HRC Strategic Plan, 2008).

Although the changes to the funding system are significant, it will take time for their full impact to be felt throughout the system. This reflects the progressive manner in which they are being implemented. More fundamentally, it reflects the long-run nature of science.

BACKBONE RESEARCH AND SCIENCE

The introduction of the Backbone Research and Science scheme is an example of how government support for the core of the science and technology system has evolved. The upkeep of these assets requires long-term, reliable funding; it is not well suited to short-term, competitive funding. Backbone funding will support databases and nationally-significant collections. It may also be appropriate for maintaining large-scale infrastructure, for example, those identified by the Research Infrastructure Advisory Group (RIAG).

sectors, at both strategic and operational levels. Good networks with research organisations are important and these need to involve researchers as trusted advisers rather than just contractors. As staff tend to be thinly spread and turnover can be high, the challenge here is considerable. For its part, the RS&T sector will need to have regular interaction with departmental staff, including those working on whole-of-government projects. Both parties need to have mechanisms in place that enable responsive advice and fit-for-purpose research activity.

Existing mechanisms that facilitate the use of RS&T in central and local government include, respectively, the Cross Departmental Research Pool (CDRP) and the EnviroLink scheme. Development of further science capability will require commitment from departments, including a willingness to invest resources where appropriate. Such commitment is already in evidence in two new cross-government initiatives: the New Zealand Fast Forward fund (overseen by the Ministry of Agriculture and Forestry) and the longitudinal study 'Growing Up in New Zealand' (led by the Ministry of Social Development)³.

³ www.msdl.govt.nz/work-areas/cross-sectoral-work/longitudinal-study.html. Accessed May 2008.

SIMPLIFYING FUNDING PROCESSES

Feedback on the Agenda stressed there is more to be done to simplify the administrative processes in applying for funding. New stable funding approaches are providing greater certainty for research organisations. However, research providers are looking for those to be matched with more streamlined processes across all the RS&T funding and investment agents. Collective IT arrangements, for example, could mean greater coordination of the application processes. More effort could be applied to ensure coordinated requests for reporting information and more 'joined-up' communications.

Simplifying the system does not mean curbing the diversity of approaches that are needed to fund new areas of research and new research relationships. It does mean actively looking for ways to avoid unnecessary administrative burden. The funding and investment agencies will be looking to collectively identify and tackle the major administrative irritants as seen from the perspective of the research provider.

“A birthplace
of world-changing
people and ideas”

Growth and Innovation

Advisory Board, from *A Vision for
Growing New Zealand*, 2002

o.2

Focus New Science

Challenge: To focus and coordinate some RS&T activity toward areas of science strength, New Zealand need and opportunity.

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Why it matters

- New Zealand is a small country and cannot afford to do everything.
- Some RS&T needs to be focused on areas of science strength, national need and opportunity, across the economic, social and environmental spheres.
- Strong links between research organisations, businesses, government and other RS&T stakeholders are required to achieve fast and effective RS&T impacts.
- New Zealand's wellbeing and prosperity depend on the sustainable management of its land, water and other biological resources.

The growth of research knowledge is both cumulative and intermittent. It takes time and experience to develop new fields of information and to capitalise on opportunities presented. The research effort of our tertiary sector can better contribute to national goals by concentrating resources in areas:

- uniquely relevant to New Zealand's economy, communities and environment
- where we have comparative research strength
- where we have the greatest opportunity to deliver economic and social benefits. **TERTIARY EDUCATION STRATEGY, 2007-2012, P25**

MoRST's 'Roadmaps for Science' (Roadmaps) series of strategies supports the alignment and coordination of existing areas of RS&T activity with New Zealand's current and anticipated future needs. They are developed with sector and research organisation involvement and provide whole-of-government guidance on RS&T directions⁴. Completed Roadmaps are being implemented through, among other things, decisions made by funding and investment agencies such as the Foundation (see table overleaf).

Strategies led by other government departments, sectors, or industry groups can provide more detailed guidance on specific research needs and opportunities from the perspective of a particular sector or industry, eg biosecurity, health or housing. They can provide the basis for partnerships and are likely to play an increasingly important role in guiding Foundation investments through Phase 2 of the Stable Funding initiative.

Focus also means being clear about important new innovation frontiers, where RS&T can make a big difference to what matters to New Zealand, and supporting these in a deliberate, whole-system way. Some of these are identified in this Agenda as transformational RS&T (TRST) opportunities. These recognise the leading role that RS&T can play, but are clear also that transformation is ultimately a much wider social and cultural process.

⁴Further information on the process and criteria for selecting Roadmaps can be found on the MoRST website: www.morst.govt.nz.

Summary of Key Directions from the Completed Roadmaps for Science

COMPLETED ROADMAPS	WHAT ARE THE DIRECTIONS IN THE ROADMAP? (SUMMARY ONLY)	HOW ARE THEY BEING PUT IN PLACE?
<p>ENERGY RESEARCH Published December 2006</p>	<ul style="list-style-type: none"> • Build and maintain a broad suite of critical energy capabilities, such as carbon capture technologies, and whole-system modelling • Identify research capabilities that require a particular focus now, such as those contributing to increased renewable energy resources and reduced energy use and efficiency • Enhance system to ensure energy research contributes effectively to a sustainable energy future for New Zealand 	<p>Roadmap informed the early development of the New Zealand Energy Strategy to 2050 (published October 2007)</p> <p>Guided investments in geothermal research (the Foundation) and marine energy (EECA)</p>
<p>NANOSCIENCE AND NANOTECHNOLOGIES Published February 2007</p>	<ul style="list-style-type: none"> • Focus on basic research from 2006 to 2010 • Increase focus on relevance to existing New Zealand industries from 2010 to 2015 • Increase focus on more transformative applications from 2015 	<p>Roadmap directions are guiding Foundation investments in their New Physical Technologies and Sustaining New Zealand's Economic and Technological Advancement portfolios</p> <p>Supporting coordination of policy across government and linkages with international discussions on regulatory requirements and responses</p>



COMPLETED ROADMAPS	WHAT ARE THE DIRECTIONS IN THE ROADMAP? (SUMMARY ONLY)	HOW ARE THEY BEING PUT IN PLACE?
BIOTECHNOLOGY RESEARCH Published March 2007	<ul style="list-style-type: none"> • Provide long-term support for biotechnology research which underpins and enhances New Zealand's primary industry strengths • Continue to support and develop New Zealand's best biomedical and drug development research • Focus additional investments on meeting sustainable development challenges and opportunities in high growth sectors like innovative foods 	<p>Roadmap directions are guiding Foundation investments in portfolios such as 'Niche Biological Products'</p> <p>Activities in New Zealand Fast Forward will take account of the goals in the Roadmap</p>
ENVIRONMENT RESEARCH Published May 2007	<ul style="list-style-type: none"> • Develop integrated multi-disciplinary research to support improved understanding of environmental systems and inform decision-making on social and economic systems • Improve transfer and uptake of research to better connect science and management • Develop environmental sensing networks and data management capability to improve measurement, monitoring and management of the environment • Improve transfer, uptake and information systems in global environmental change; land, water and coasts; urban design hazards; biosecurity 	<p>Roadmap directions are guiding Foundation investments in climate change, the primary sector and science uptake initiatives such as EnviroLink</p> <p>Activities in New Zealand Fast Forward will take account of the goals in the Roadmap</p> <p>Roadmap directions are guiding collaborative work across science, government and private sectors, establishing and developing sensing networks</p>

Transformational RS&T Opportunities

AREA	OPPORTUNITY	IMPACT	IMPLEMENTATION
High-tech platforms	To develop world-leading technological capabilities in areas such as sensors, intelligent materials and virtual reality. Each platform will be able to support a range of applications and products that can help establish and maintain firms at the forefront of industry sectors such as advanced manufacturing, engineering and services.	Will enable New Zealand businesses to be globally competitive, as well as provide a magnet to scientists, engineers and technologists, encouraging them to stay in or relocate to New Zealand and thus supporting a culture of innovation in our urban centres.	A first-order priority of \$24 million over 4 years from 2008/09.
Future foods	To catalyse a step-change in the delivery to markets of value-added food products and ingredients. This new effort could focus on global health markets, developing high-value foods and ingredients on the back of New Zealand's efficient primary sector and reputation as clean and green.	Will enable New Zealand food and beverage firms with high growth potential to integrate food technology research into their businesses.	A first-order priority, likely to be carried out in conjunction with New Zealand Fast Forward.
Innovation in health delivery	To improve the productivity and cost-effectiveness of New Zealand's health and disability system. This opportunity will be realised by supporting the RS&T capability of the healthcare sector and pulling together local and overseas research knowledge to create innovative solutions to improve healthcare delivery.	Will help to raise the standard of healthcare available to New Zealanders, manage the growing cost of healthcare, and support health technology businesses developing new products and processes to meet the needs of people both in New Zealand and around the world.	A second-order priority; scoping work will progress during 2008/09 led by MoRST and the Ministry of Health.



AREA	OPPORTUNITY	IMPACT	IMPLEMENTATION
Environmental sensing for real-time resource management	To sustainably and competitively manage the environment in real time. These opportunities can range from 'on the farm' to regional and national decision-making in areas such as irrigation and fertiliser application, hazard preparedness, biodiversity and waste management.	Will help New Zealand to manage resources efficiently and sustainably, create new business opportunities and maintain a competitive advantage in increasingly discerning global markets.	A second-order priority, and may be carried out in conjunction with New Zealand Fast Forward.
Making renewable energy work for New Zealand	To facilitate New Zealand's transition to a low-carbon energy system drawing on diverse, dispersed and sustainable energy sources. This will be achieved by accelerating RS&T in the realm of renewable energy technologies and integrating these into the national energy system.	Will help New Zealand harness its plentiful resources of renewable energy — wind, solar, geothermal, biomass and marine — in partnership with industry, and recognising our unique resources, environment, and household and business energy use patterns.	A first-order priority of \$18.5 million over 4 years from 2008/09 in Budget 2008. (In addition to \$12 million for the Low Carbon Energy Technologies Fund approved in 2007/08.)
Transformational cities and towns	To support the development of successful cities and towns, including Auckland, by creating a body of high-quality urban knowledge. This will include knowledge that furthers understanding of the integrated nature of urban development, how urban forms and systems work, and how they contribute to economic growth.	Will contribute to the development of world-class infrastructure, a high quality of life and environmentally sustainable practices, while also creating cities and towns better able to support globally competitive businesses.	A second-order priority; scoping work will progress during 2008/09 led by MoRST.

“Our
technology is
our sword; we
keep it sharp
and bright.”

Sir Angus Tait

o.3

Propel Business R&D

Challenge: To support New Zealand businesses to be more internationally competitive, investing in and applying RS&T, and drawing on effective partnerships with public RS&T.

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Why it matters

- Business R&D is critical to innovation and New Zealand's future.
- Business expenditure on R&D in New Zealand is currently well below the OECD average.
- Effective knowledge transfer between public research organisations and firms depends on research being oriented to the needs of business. It also relies on businesses being aware of the opportunities identified by research.
- New Zealand needs strong international science connections to enable businesses access to leading-edge knowledge and technology.
- With constraints on the supply of labour, maximising the ability of the workforce to innovate will be critical to increasing productivity.

mass to attract globally-competitive talent, R&D and businesses to help drive New Zealand's economic growth.

- **New public-private partnerships, such as New Zealand Fast Forward**

New partnerships between government and industry will be pursued to help propel innovation to more sustainable, higher-value business. Partnerships will involve joint priority-setting, and reflect a government commitment to building R&D capability in industry, including support for basic science skills. The New Zealand Fast Forward initiative, to be established in July 2008, is a recent example. Future initiatives in other areas will be considered where government can add value and there is a readiness to partner.

- **A 'no wrong door' approach to government support for business R&D**

Reductions in the number and complexity of business-support schemes will allow a 'no wrong door' approach for firms wanting to use them. Staff at the Foundation, NZTE and TEC will find it easier to become conversant in all relevant business-support programmes, and will thus be more likely to ask businesses 'What do you need?' than to tell them 'This is what we have'. Businesses should be able to access the information and support they require regardless of which agency they approach. The Foundation's TechNZ programmes will be relaunched in July 2008 supporting a 'no wrong door' approach.

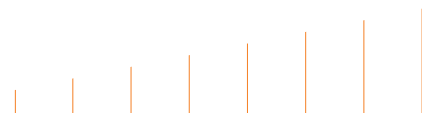
- **Smarter firm connections with international knowledge and technology**

New Zealand firms need to make use of knowledge and technology from around the world. International RS&T linkages can help them do this, while also providing access to overseas markets and global value chains. Finding new ways to access international knowledge, talent, capital, technology and entrepreneurship is a prerequisite to improving the transfer of technology, employing best-practice processes and enjoying the benefit of cutting-edge ideas.

Whole-of-government approaches will identify key potential partners for international linkages and actions for forging them. This will be led by MED and will draw particularly on the roles and activities of NZTE and the Foundation in supporting firms. MoRST's International Linkages Strategy will assist to prioritise and guide science connections.

- **Better links between public research organisations and businesses**

Collaboration between businesses and public research organisations is improving, and there is still room for this to grow further. New Zealand's national and regional innovation systems need continued strengthening. MoRST and other partners will work to reinforce linkages across these systems, for example by engaging with business through the Capitalising on Research and Development Action Group (CRAG). The way research organisations interact with enterprises, investors and industry sectors will be given particular attention. Improved responsiveness and more opportunities for collaborations and interchange of research staff will increase research relevance to businesses.



“Knowledge is
all that grasps and
breaks and strives

...” Robin Hyde,
*from Young Knowledge, in Houses by the
Sea, 1952*

o.4

Connect New Zealanders with Science

Challenge: To connect New Zealanders more closely with science, supporting a strong sense of ownership of RS&T and innovation and improving outcomes from RS&T.

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Why it matters

- New Zealanders have a problem-solving bent that draws them to RS&T. They want to know how RS&T can make a difference to their lives and the lives of others.
- Given the country's small population, all New Zealanders need to be encouraged to play a role, direct or indirect, especially for the burgeoning Māori and Pacific peoples population, to support innovation and the succession of science and its outcomes.
- Science and technology operate within a social context. There will always be applications of science and technology that require value judgements from outside the realm of science.

[...] The central elements of the innovation environment include an innovation culture, “buzzing”, or a number of processes that inspire individuals and organizations and create new innovations, global information channels, a common awareness of innovation and shared interpretative frames of reference. **MAKING FINLAND A LEADING COUNTRY IN INNOVATION**, SITRA, 2005, P16, WWW.SITRA.FI/EN/

The RS&T sector is currently well equipped to lead engagement activities focused on awareness and promotion of RS&T. Engagement that seeks early input to the shaping of research needs and approaches, for example through dialogue techniques, can be more difficult and warrants additional support, particularly to build it in as a more integral and ‘real-time’ part of doing science.

Government has a role to support engagement with New Zealanders, by devising and co-ordinating national-scale activities and putting in place the necessary infrastructure. This contribution is not intended to replace a local approach where that is appropriate, but will ensure benefit accrues from scale and specialisation.

Engagement is a broad term that includes a range of communication styles with different intents. We define these in the context of RS&T as:

- dialogue, typically used to understand the views of others, develop shared views and help guide research, particularly at its early stages
- awareness, typically used to develop an understanding of the state of knowledge in a particular area of research, and
- promotion, typically used to enhance uptake of research knowledge or influence support for research.

“I believe that the coming together of all these different branches of science was one of the factors that made the double helix story so important: quite new vistas arose from new combinations of approaches.”

Maurice Wilkins, from *The Third Man of the Double Helix*, 2003

Implementation and Measuring Progress

MoRST will lead the implementation of the Agenda, coordinating action with other agencies. Collaborative work across government will be essential to success.

Government's commitment to this Agenda will be seen primarily through the level and nature of investments made in RS&T.

Ultimately, though, stronger RS&T for New Zealand will require the commitment of those in the RS&T sector leading and doing the science.

The impact and progress of the Agenda will be guided by an evaluation plan and will be measured through activities such as:

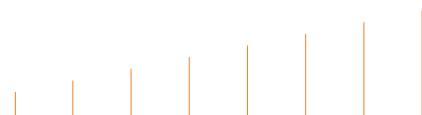
- the biennial R&D Survey
- analysis of alignment of R&D investment with the Agenda
- capability data from Vote RS&T funding and investment agents, and
- evaluation projects; those starting in 2008/09 are: tax credit, international collaborations, Roadmaps, Stable Funding, and TechNZ.

MoRST will report on progress through communications with stakeholders, advice to the Minister of Research, Science and Technology, and its annual report.

Annex I

Strategies, Funds and Policy Initiatives referred to in this document

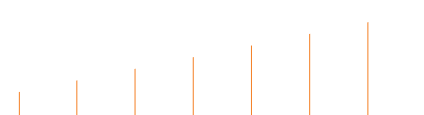
STRATEGIES	AUTHOR	PUBLISHED	FURTHER INFORMATION
Advanced Skills Action Plan	MoRST	Due 2008	www.morst.govt.nz/about/consultations/asap/
Biosecurity Science Strategy	MAF	2007	www.biosecurity.govt.nz/science-strategy
Blueprint for Change	MoRST	1999	www.morst.govt.nz/publications/a-z/b/blueprint-for-change/
Digital Strategy	MED	Due 2008	www.digitalstrategy.govt.nz/
Economic Transformation Agenda	MED	2006–	www.med.govt.nz/templates/StandardSummary_22996.aspx
eResearch Direction/ Strategy	MoRST	2008–	www.morst.govt.nz/current-work/science-infrastructure/eresearch/
Future Focus — Signposts to Success for New Zealand's Primary Industries	MAF	2007	www.maf.govt.nz/mafnet/publications/future-focus/index.htm
I3 Challenge	MoRST	2003	www.morst.govt.nz/publications/a-z/i/i3-challenge/
International Linkages Strategy – Making the Connection	MoRST	2005	www.morst.govt.nz/publications/a-z/i/i3-challenge/



STRATEGIES	AUTHOR	PUBLISHED	FURTHER INFORMATION
New Zealand Curriculum	MinEdu	2007	www.minedu.govt.nz/index.cfm?indexid=1005&layout=index
New Zealand Energy Strategy to 2050 – Powering our Future	MED	2007	www.med.govt.nz/templates/MultipageDocumentTOC_31948.aspx
New Zealand Skills Strategy	DoL/TEC	Due 2008	www.skillsstrategy.govt.nz/
Nga Kaihanga Hou, Māori Future Makers	TPK	2007	www.tpk.govt.nz/en/in-print/our-publications/publications/for-maori-future-makers/?q=future+makers
OECD Review of Innovation Policy: New Zealand	MED/ MoRST	2007	www.morst.govt.nz/publications/a-z/o/oecd-innovation-review/
Roadmaps for Science Series	MoRST	2007–	www.morst.govt.nz/current-work/roadmaps/
Tertiary Education Strategy 2007-2012	MinEdu	2006	www.minedu.govt.nz/index.cfm?layout=document&documentid=11727&data=1
Transport Research Strategy	MoT	2007	www.mot.govt.nz/transport-research-strategy-1/
Vision Mātauranga	MoRST	2007	www.morst.govt.nz/current-work/vision-matauranga/

Strategies, Funds and Policy Initiatives referred to in this document (continued)

FUNDS / POLICY INITIATIVES	LEAD AGENCIES	FURTHER INFORMATION
Building Research Capability in the Social Sciences Network	TEC	www.brcss.net/
Capitalising on Research and Development Action Group	MoRST	www.morst.govt.nz/business/crag/
Centres of Research Excellence	TEC	www.tec.govt.nz/templates/standard.aspx?id=586
Cross Departmental Research Pool	MoRST Foundation	www.morst.govt.nz/funding/cdrp/
Envirolink	Foundation	www.envirolink.govt.nz/
Healthy Eating – Healthy Action	MOH	www.moh.govt.nz/healthyeatinghealthyaction
Medium-Term Investment Objectives for Vote RS&T	MoRST	www.morst.govt.nz/ [to be published June 2008]
New Zealand Fast Forward	MAF	www.maf.govt.nz/mafnet/new-zealand-fast-forward/index.htm
Oxygen Group	MoRST	www.morst.govt.nz/current-work/oxygen-group/
Performance-Based Research Fund	MinEdu TEC	www.tec.govt.nz/templates/standard.aspx?id=588
R&D Tax Credit	IRD	www.ird.govt.nz/rd-tax-credit/
Research Infrastructure Advisory Group	MoRST	www.morst.govt.nz/current-work/science-infrastructure/research-infrastructure/
Science Learning Hub	MoRST	www.sciencelearn.org.nz/
Stable Funding	MoRST Foundation	www.morst.govt.nz/funding/stable-funding/ www.frst.govt.nz/library/corporate-reports/policy-documents/morestablefundingenvironment
Transformational RS&T Opportunities	MoRST	www.morst.govt.nz/current-work/transformational-rst/



Annex 2

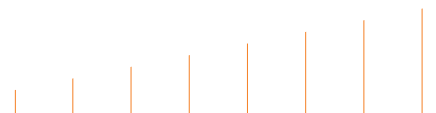
Glossary of Acronyms

ASAP	Advanced Skills Action Plan
CDRP	Cross Departmental Research Pool
CoREs	Centres of Research Excellence
CRAG	Capitalising on Research and Development Action Group
CRI	Crown research institute
DoL	Department of Labour
HRC	Health Research Council of New Zealand
KAREN	Kiwi Advanced Research and Education Network
MAF	Ministry of Agriculture and Forestry
MED	Ministry of Economic Development
MinEdu	Ministry of Education
MoH	Ministry of Health
MoRST	Ministry of Research, Science and Technology
MoT	Ministry of Transport
NERF	New Economy Research Fund
NZTE	New Zealand Trade and Enterprise
OECD	Organisation for Economic Cooperation and Development
PBRF	Performance-Based Research Fund
PSAF	Pre-Seed Accelerator Fund
RAs	Research Associations
R&D	Research and Development
RFI	Research for Industry
RIAG	Research Infrastructure Advisory Group
RS&T	Research, science and technology
TEC	Tertiary Education Commission
TechNZ	Technology New Zealand
TEI	Tertiary education institutions
TPK	Te Puni Kōkiri
TRST	Transformational research, science and technology

Annex 3

RS&T Investment Objectives and Priorities for New Investment

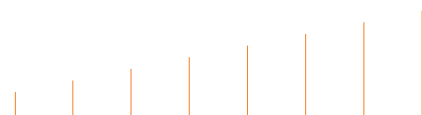
PRIMARY LINKS TO AGENDA CHALLENGES			Investment Objectives	SUPPORTED THROUGH	PRIMARILY DELIVERED THROUGH ¹
SUSTAIN OUR SCIENCE BASE	CONNECT NEW ZEALANDERS WITH SCIENCE		1. Developing skilled people and maintaining organisational capabilities	Investment to enable research organisations to maintain and build long-term capabilities in areas of strategic importance; support skilled and talented people; engage New Zealanders with RS&T; and provide essential support capabilities such as measurement standards.	RS&T: CRI Capability Fund; Measurement Standards Limited; Backbone Research and Science; Supporting Promising Individuals; Development of International Linkages EDUCATION: Tertiary education funding, including PBRF ²
			2. Promoting the advancement of knowledge	Basic or 'blue skies' research across the natural, physical and social sciences, where a contestable approach is used to select the best ideas and enhance New Zealand's research knowledge and skill base.	RS&T: Marsden Fund; Māori Knowledge and Development Research; Advanced Network Capability Fund EDUCATION: Centres of Research Excellence ³ and PBRF
	FOCUS NEW SCIENCE		3. Improving health and social wellbeing	Strategic and applied research where the main objective is to improve the health or social wellbeing of New Zealanders, including support for state sector social and health services delivery.	RS&T: Social Research; Health Research SOCIAL DEVELOPMENT HEALTH



FIRST PRIORITIES FOR NEW INVESTMENT (VOTE RS&T)	SECOND PRIORITIES FOR NEW INVESTMENT (VOTE RS&T)	BUDGET 2008 VOTE RS&T INCREASE (TOTAL 2008/09 – 2011/12)
<p>Support backbone activities, such as databases and collections.</p> <p>Increase investment in existing RS&T engagement activities, such as the Science Learning Hub and Science and Technology Media Centre.</p>	<p>Increase support for career and skill development to capture priorities of the Advanced Skills Action Plan.</p> <p>Provide resources to strengthen the performance of public research organisations.</p> <p>Increase the scope and reach of activities to engage New Zealanders with science and technology.</p>	<p>\$33.3 million</p>
<p>Maintain support through existing Vote Education investments in PBRF and CoREs.</p> <p>Support e-science.</p>	<p>Increase the Marsden Fund.</p> <p>Expand support for unique New Zealand areas of knowledge eg Mātauranga theme of Vision Mātauranga.</p>	<p>\$17.2 million</p>
<p>Target investment at national priority areas and particular New Zealand needs.</p>	<p>Progress 'Innovation in health delivery' TRST.</p> <p>Expand opportunities for investigator-initiated research in health and social sciences.</p>	<p>\$16.0 million</p>

RS&T Investment Objectives and Priorities for New Investment (continued)

PRIMARY LINKS TO AGENDA CHALLENGES			Investment Objectives	SUPPORTED THROUGH	PRIMARILY DELIVERED THROUGH ¹
SUSTAIN OUR SCIENCE BASE	FOCUS NEW SCIENCE	PROPEL BUSINESS R&D	4. Supporting infrastructure and energy needs	RS&T targeted at a range of areas needed to enable long-term sustainability in the economy, such as infrastructure, energy, urban systems, and natural hazards research.	RS&T: Research for Industry; Low Carbon Energy Technologies Fund
			5. Integrated solutions for a sustainable environment and primary industries	RS&T to increase productivity in our primary industries and to ensure a resilient and sustainable environment for future generations, with an increasing focus on RS&T which integrates these economic and environmental outcomes.	RS&T: Research for Industry; Research Consortia; Environmental Research AGRICULTURE & FORESTRY: New Zealand Fast Forward, Sustainable Farming Fund FISHERIES ENVIRONMENT
			6. Creating new commercial opportunities and improving business performance	A range of research and development activities – from basic research aimed at building the next generation of businesses, to initiatives to support innovation and boost productivity within existing firms, and enable international connections and partnerships.	RS&T: Technology New Zealand; Pre-Seed Accelerator Fund; New Economy Research Fund; Research for Industry; Research Consortia; International Investment Opportunities Fund EDUCATION: Partnerships for Excellence; Encouraging and Supporting Innovation



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“New Zealand is my country ... and I think this little country offers some unique opportunities.”

Dr Muriel Bell, 1964