workingpaper

Exploring New Zealand and International Government-funded Science Goals

December 2009

Sustainable Future Institute Working Paper 2009/05

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Prepared by	The Sustainable Future Institute, as part of *Project 2058*
Working paper to support	Report 9: *Government-funded Science Under the Microscope*

Published

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ISBN 978-1-877473-51-7 (PDF)

About the Author

Chris Aitken is originally from Levin. He has completed both a Bachelor of Science and a Master of Environmental Studies at Victoria University of Wellington. He is also co-author of the Sustainable Future Institute's Report 9: *Government-funded Science Under the Microscope* (in press) and Report 9a: *A History of Government-funded Science From 1865 – 2009.*

1. Purpose

The purpose of this working paper is to identify and compare the goals of international government-funded science programmes with those of New Zealand. The paper supports Report 9 of *Project 2058, Government-funded Science Under the Microscope.* The strategic aim of *Project 2058* is to promote integrated long-term thinking, leadership and capacity-building so that New Zealand can effectively seek and create opportunities, and explore and manage risks, over the next 50 years. In order to achieve this aim, the *Project 2058* team will work to:

1. Develop a detailed understanding of the current national planning landscape, and in particular the government's ability to deliver long-term strategic thinking;
2. Develop a good working relationship with all parties that are working for and thinking about the 'long-term view';
3. Recognise the goals of iwi and hapū, and acknowledge te Tiriti o Waitangi;
4. Assess key aspects of New Zealand's society, asset base and economy in order to understand how they may shape the country's long-term future, such as government-funded science, natural and human-generated resources, the state sector and infrastructure;
5. Develop a set of four scenarios to explore and map possible futures;
6. Identify and analyse both New Zealand's future strengths and weaknesses, and potential international opportunities and threats;
7. Develop and describe a desirable sustainable future in detail, and
8. Prepare a *Project 2058* National Sustainable Development Strategy. (SFI, 2009: 3)

This working paper has been written to help progress Report 9 toward the fourth point above, an assessment of aspects of New Zealand's society, asset base and economy in order to understand how they may shape the country's long-term future.

2. Method

During the preparation of Report 9 it became clear that understanding the goals of government-funded science in New Zealand also required the examination of the goals of comparable countries around the globe. To undertake this assessment, this paper presents the goals of government-funded science in New Zealand, as defined by the government, then summarises the international situation so that differences between countries can be easily identified and a range of alternatives considered. These alternatives will be further discussed in Report 9.

The method adopted is discussed below. In particular, this subsection discusses what is meant by a government-funded science goal, the basis on which relevant countries were selected, and how goals, once identified, were classified. This is followed by a brief discussion on the limitations of this research.

Defining a Government-funded Science Goal

A goal, in the sense used in this working paper, is defined as a high-level objective stated by the current government to guide the science programme it funds. For the purposes of this paper we have viewed goals that describe operational processes designed to achieve a higher-level goal as distinct from goals that are clearly outcome-focused, in that they represent the top priorities for government-funded science. For example, some governments see economic growth as a way of achieving a robust science system, whereas others see economic growth as the end-outcome. In the former case, economic growth is considered an operational goal and is therefore excluded from this analysis.

Selection of Countries

Ideally, it would have been desirable to assess comparable countries – those with similar social, economic and environmental characteristics – but clearly that is not always possible. As an alternative, we have selected a range of countries based upon several factors, including population size, proximity, level of innovation and similarity of agricultural base to New Zealand's.

Australia and the United Kingdom were chosen on the grounds of their close ties with New Zealand, both economic and cultural. South Korea was chosen because of its rapidly growing economy as well as its past reliance on agriculture, a factor which also applied to Ireland. A similar population size was a factor in choosing both Ireland and Singapore. The United States was chosen on the basis of its close economic ties with New Zealand, and because of its position as a world leader in government-funded science. Their agriculture-based economies initially led Uruguay and Brazil to be selected, but these were not pursued as we were unable to source relevant reports in English.

Classification of Goals

Once the countries were selected, the challenge was to find the high-level goals. The process included searching for relevant reports on the government websites of each country. Once goals were identified they were listed for each country; they appear in the following text numbered (a) to (r). They were then categorised and grouped by type in Table 1. Goals were grouped based on 'best-fit', which relied heavily on personal interpretation. For this reason, the table is transparent, so that readers can easily review the specific goals in detail. The findings were then summarised in Table 2. This table forms the main output of this working paper and is carried forward into Report 9.

Limitations

There are limitations to this research at each stage; in particular, how higher-level goals are described, how countries were selected, and how goals were chosen and then grouped. Even with these caveats, we believe the resulting analysis provides a useful insight into how New Zealand compares with other countries. We also believe this is an interesting area of study, and that the completion of more research could be of benefit to New Zealand.

3. The Goals

3.1 New Zealand

In 2009, the Ministry of Research, Science and Technology (MoRST) provided several goals for government-funded science in New Zealand. These are summarised by the Ministry as follows:

> The Government is committed to New Zealand science. It recognises the vital role science plays in providing evidence:
>
> (a) for quality decision-making,
>
> (b) creating new knowledge to drive economic growth, and
>
> (c) enriching our society. (MoRST, 2009: 5)

This statement identifies evidence for decision-making, economic growth and a better society as the desired outcomes of government-funded science in New Zealand. While 'economic growth' and 'evidence for decision-making' represent well-defined goals, the same cannot be said of 'enriching our society'. 'Enriching society' can be interpreted in a variety of ways from purely economic considerations to holistic well-being. With such a broad scope of meaning, this goal provides little in the way of clarity, yet it is arguably the most important.

3.2 Australia

Australian government science funding is underpinned by the following goals and principles, which are stated in the National Collaborative Research Infrastructure Strategy (NCRIS):

> (d) Australia's investment in research infrastructure should be planned and developed with the aim of maximising the contributions of the R&D system to economic development, national security, social well-being and environmental sustainability;
>
> (e) Infrastructure resources should be focused in areas where Australia is, or has the potential to be, world-class (in both discovery and application driven research) and provide international leadership;
>
> (f) The Strategy should seek to enable the fuller participation of Australian researchers in the international research system. (DOI, 2008)

Australian government-funded science goals show a desire to achieve more specific outcomes, particularly (d) above, which names economic development, national security, social well-being and environmental sustainability as goals.

3.3 Ireland

The Science Foundation Ireland has identified its priorities from government-funded science as follows:

> (g) Human Capital: Building a critical mass of internationally-competitive research teams in the sciences and engineering underpinning Biotechnology, Information Communication Technology (ICT), and Sustainable Energy and Energy Efficient Technologies (ENERGY), such that the Irish workforce is upskilled to the needs of a high-tech economy. We need to ensure that the absorptive capacity of the country is such that it can identify, acquire and incorporate externally developed technologies, so that Ireland is well-placed to attract and grow high-value enterprises.
>
> (h) Quality Output: Ensuring that SFI-funded research teams continue to produce the highest quality published output, as this is the best external endorsement of the scientific value obtained from research investment.
>
> (i) Global Reputation: Increasing Ireland's global reputation as a location for excellent scientific research and as a source of human and knowledge capital, such that businesses creating next-generation products and services are attracted to and retained in Ireland.
>
> (j) Knowledge Transfer: Providing quality inputs to the technology transfer/ translational industries in Ireland, and growing partnerships that facilitate the expansion of the National Research, Development and Innovation footprint, to ensure that research is optimally exploited for the benefit of Irish society. (Science Foundation Ireland, 2009)

Ireland provides both specific and broad goals. Human capital building and increasing knowledge-to-technology transfer are specific outcomes. Quality output and a good reputation are arguably less specific, in that they have a range of meanings, from commercially valuable to publication in peer-reviewed literature.

3.4 Singapore

The following paragraphs outline the aims for government-funded science in Singapore:

> (k) The Agency for Science, Technology and Research (A*STAR) is Singapore's lead government agency dedicated to fostering world-class scientific research and talent for a vibrant knowledge-based economy.
>
> (l) A*STAR strives to help Singapore develop into a world-class scientific research hub by building up three types of capital: human, intellectual and industrial. (A*STAR, 2009)

Singapore's goals show a drive to become a knowledge-based economy, reflecting a belief that a targeted, government-funded science programme is the best way forward for a small nation like this. In seeking to build such an economy Singapore recognises that there is a strong need to focus on conditions that are favourable for people, not just monetary investment, because financial capital – while significant – is not the most important factor in successful government-funded science.

3.5 South Korea

The South Korean Ministry of Education, Science and Technology has defined the aims of its government-funded science programmes as follows:

> (m) Now, national R&D efforts are geared toward meeting the challenges in a move to a knowledge-based economy with a view to placing the nation among the ranks of the advanced economies by the early 2010s. (MEST, 2008)

South Korea has broad goals for where government-funded science should take the country. They reflect the continuing change and rapid growth of the South Korean economy and the belief that a knowledge-based economy is the most productive path for future development.

3.6 United Kingdom

The United Kingdom aims to develop its government-funded science system so that it reflects the goals set out in the following paragraph:

> (n) BIS[1] is committed to developing a world class UK research base responsive to users and the economy, with sustainable and financially strong universities and public laboratories and a strong supply of scientists, engineers and technologists. (DBIS, 2009b)

The United Kingdom sets very broad goals for government-funded science. Arguably, this allows for easy adaptation to changing circumstances. However, these broad goals also make it difficult to aim for any particular outcome since none are defined firmly or with any priority.

[1] The Department of Business, Innovation and Skills was created in June 2009 from the merger of the Department for Business, Enterprise and Regulatory Reform and the Department for Innovation, Universities and Skills (DBIS, 2009a: 1).

3.7 United States

The government of the United States has defined the benefits of government-funded science within its borders as aiming to achieve:

(o) *Enhanced Competitiveness in the Global Marketplace*: Science has long been a major contributor to the American economy and holds the key to a strong recovery from the current global financial slump.

(p) *Longer, Healthier Lives for all Americans:* American biomedical science is the envy of the world. By giving it our fullest support, including federal funding for human embryonic stem cell research and other promising approaches to treating diseases, we can make medicine better and more efficient.

(q) *Improved American Agricultural Productivity*: Modern agronomic techniques offer solutions to the serious challenges facing farmers in the United States and around the world, including climate change, declining fresh water reserves and the need to reduce the substantial energy inputs and CO2 emissions attributable to agriculture.

(r) *Cultivation of a New Generation of Skilled, Educated, Science-savvy Americans:* By boosting STEM education now, we can rest assured that the next generation of Americans will be among the best prepared in the world to face the challenges of the 21st Century, and will pass to their children a stronger, greener and more sustainable economy. (OSTP, 2009)

This statement shows a focus on both long- and short-term goals, the former in increased agricultural productivity, the latter in the drive for a new generation of scientists. The focus on a specific industry is unusual, in that other countries (excluding New Zealand) tend to leave the specific direction of research to the scientists. It is even more unusual to see a focus on primary production rather than the creation of a knowledge-driven economy. This may reflect concerns over food security.

4. Analysis

Table 1 shows how the goals of each country were categorised, based on the publicly available source text. Note that some countries' goals are grouped in more than one type of general goal. The final categorisation forms the basis for the grouping in Table 2.

Table 1 Goals and Source Texts for each Goal

Sources: A*STAR, 2009; DBIS, 2009b; DoI, 2008; MEST, 2008; MoRST, 2009; OSTP, 2009; SFI, 2009

Country	Specific Country Goal	Goals Grouped by Type
New Zealand	Recognises the vital role science plays … creating new knowledge to drive economic growth (b)	Economic growth
Australia	With the aim of maximising the contributions of the R&D system to economic development (d)	
South Korea	National R&D efforts are geared toward meeting the challenges in a move to a knowledge-based economy with a view to placing the nation among the ranks of the advanced economies (m)	
Australia	Maximising the contributions of the R&D system to … national security (d)	National security
New Zealand	Recognises the vital role science plays in providing evidence for quality decision-making (a)	Evidence for decision-making
Australia	Maximising the contributions of the R&D system to … social well-being (d)	Enhancing well-being
New Zealand	Recognises the vital role science plays … enriching our society (c)	
United States	Longer, healthier lives for all Americans (o)	
Ireland	Ensuring that SFI-funded research teams continue to produce the highest quality published output (h)	High quality government-funded science
Australia	Maximising the contributions of the R&D system to … environmental sustainability (d)	Environmental sustainability

Country	Specific Country Goal	Goals Grouped by Type
Australia	Infrastructure resources should be focused in areas where Australia is, or has the potential to be, world-class (in both discovery and application driven research) and provide international leadership (e)	International leader/competitiveness
United States	Enhanced competitiveness in the global marketplace (n)	
Singapore	A*STAR strives to help Singapore develop into a world-class scientific research hub (l)	
United Kingdom	BIS is committed to developing a world-class UK research base (r)	
Ireland	Increasing Ireland's global reputation as a location for excellent scientific research (i)	
Singapore	The Agency for Science, Technology and Research (A*STAR) is Singapore's lead government agency dedicated to fostering world-class scientific research and talent for a vibrant knowledge-based economy (k)	Knowledge/innovation-based economy
South Korea	National R&D efforts are geared toward meeting the challenges in a move to a knowledge-based economy (m)	
United States	Improved American agricultural productivity (p)	Improved agriculture
United States	Cultivation of a new Generation of skilled, educated, science-savvy Americans (q)	Deep pool of scientific knowledge and expertise

Country	Specific Country Goal	Goals Grouped by Type
Ireland	Building a critical mass of internationally-competitive research teams in the sciences and engineering (g)	
Singapore	Dedicated to fostering world-class scientific research and talent for a vibrant knowledge-based economy (k)	
United Kingdom	BIS is committed to developing a world class UK research base responsive to users and the economy, with sustainable and financially strong universities and public laboratories and a strong supply of scientists, engineers and technologists (r)	
United Kingdom	BIS is committed to developing a world class UK research base responsive to users and the economy (r)	Produces outcomes needed by society
Ireland	Providing quality inputs to the technology transfer/translational industries in Ireland (j)	Translation of research into technology

5. Conclusion

The goals of government-funded science from New Zealand, Australia, Ireland, Singapore, South Korea, the United Kingdom and the United States display many similarities, however there are also significant differences. Table 2 presents a summary of the goals of government-funded science in New Zealand and internationally. This table represents the main output of this working paper and is carried forward into Report 9, *Government-funded Science Under the Microscope.*

Table 2 Comparison of Stated Goals of Government-funded Science from New Zealand and Internationally

Sources: A*STAR, 2009; DBIS, 2009b; DoI, 2008; MEST, 2008; MoRST, 2009; OSTP, 2009; SFI, 2009

	Economic growth	National security	Evidence for decision-making	Enhancing well-being	High quality government-funded science	Environmental sustainability	International leader/competitiveness	Knowledge/innovation-based economy	Improved agriculture	Deep pool of scientific knowledge and expertise	Produces outcomes needed by society	Translation of research into technology
Australia	✓	✓		✓		✓	✓					
Ireland					✓		✓			✓		✓
New Zealand	✓		✓	✓								
Singapore							✓	✓		✓		
South Korea	✓							✓				
United Kingdom							✓			✓	✓	
United States				✓			✓		✓	✓		

Of the countries whose government-funded science goals are examined here, the goals of the United Kingdom most closely resemble those of New Zealand. Of note is the inclusion by the United Kingdom of a goal to build up a strong base of people employed in government-funded science. This goal might be one that New Zealand could consider adopting.

Interestingly, New Zealand has tended to focus on three broad goals, all of which could be argued to focus on economic growth. In contrast, the goals of other countries generally appear to be more diverse, more specific, and generally more focused on an investment in the long term. For example, other countries tend to include goals that focus on the need to develop a knowledge-based economy and to foster a pool of scientific talent and knowledge within the country. Arguably, the adoption of higher-level goals that are diverse, specific and focused on the long term may assist in making New Zealand's government-funded science system more innovative, robust and sustainable. This research raises questions about whether New Zealand's current goals for its government-funded research are optimal, and if not, what higher-level goals are missing. These questions and more are discussed further in Report 9, *Government-funded Science Under the Microscope* (in press).

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