February 2012

Report 9

2058

Science Embraced

Government-funded Science under the Microscope

Executive Summary

MCGUINNESS INSTITUTE

Project 2058: Report 9

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The McGuinness Institute is an independently funded non-partisan think tank. The main work programme of the Institute is *Project 2058.* The strategic aim of this project 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. It is hoped that *Project 2058* will help develop dialogue among government ministers, policy analysts and members of the public about alternative strategies for the future of New Zealand.

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Foreword

If we can embrace its potential, science could be a major game-changer for New Zealand. For too long we have thought of ourselves as a small farming nation making an honest, but simple living; we have believed that our strengths lie in agriculture and tourism and that these areas should be the focus of our economic future. Playing to traditional strengths has merit, but at the same time we must ask ourselves, what is the long-term economic carrying capacity of these sectors? Are these sustainable ways to create long-term wealth for New Zealand?

If we are serious about holding on to our unique culture and way of life, preserving our beautiful country and creating sustainable wealth then we need to raise our eyes above the horizon. I have no doubt that New Zealand has the potential to transform itself into a thriving knowledge economy, taking advantage of the sheer scale of foreign markets to sell high-end technological and creative products, without exhausting the land. That future requires us to aspire. But it is a future that we can create. We are rich in water and energy resources, we have a great education system, world-class science and engineering, a vibrant artistic and creative sector, quality urban environments and a civil society. When we combine all this with our unique landscapes, and our pristine mountains and seas, we have the chance to be 'The place where talent wants to live'.

The gulf between vision and strategy is no small obstacle to navigate. We cannot expect to simply invest more money into scientific endeavour and think that industry will flourish on this alone. What is needed is a national strategy and the resolve to move consciously towards its vision. This is not just a challenge for the science sector; the New Zealand public need to be engaged and inspired, to be involved as stakeholders and investors, and to be willing to take up this challenge alongside the science community. The challenge for the scientists is to articulate and act upon the values that will inspire their fellow citizens.

This report addresses the issue of values and the role of science in contributing to New Zealand as a sustainable nation. It addresses the relationship between science and ethics, the concept of frugal science and the idea of science driving policy. It is not just a review of science; it is an exploration of the conceptual thinking and strategy that drives government investment in science in New Zealand. It addresses the inherent challenge of ensuring top performance by exploring the role of science in New Zealand and questioning how its systems and institutions can be better directed toward a sustainable national strategy. This document provides the basis for a conversation that needs to be happening across New Zealand.

Sir Paul Callaghan GNZM FRS FRSNZ

Executive Summary

[I]f we look to what should be the grand object of all study, the formation, namely, of the mind and the character, it will be found that there is scarcely any mental or moral facility which Science cannot develope and discipline.

Governor Sir George Ferguson Bowen.
First President of the New Zealand Institute
Inaugural Address, 1868

In 1868, in the inaugural address of what was to become the Royal Society of New Zealand, Governor Bowen noted the significance of science to what he termed 'the grand object of all study' – the formation of the mind and character. This report looks not at the specifics of science but at society's investment in science. The proper role of this investment is to foster science that serves the public interest. Government-funded science has a vital role to play in shaping New Zealand's future, but the successful fulfilment of that role depends on the will of its citizens to embrace science, and the will of its scientists to embrace the needs and wants of society.

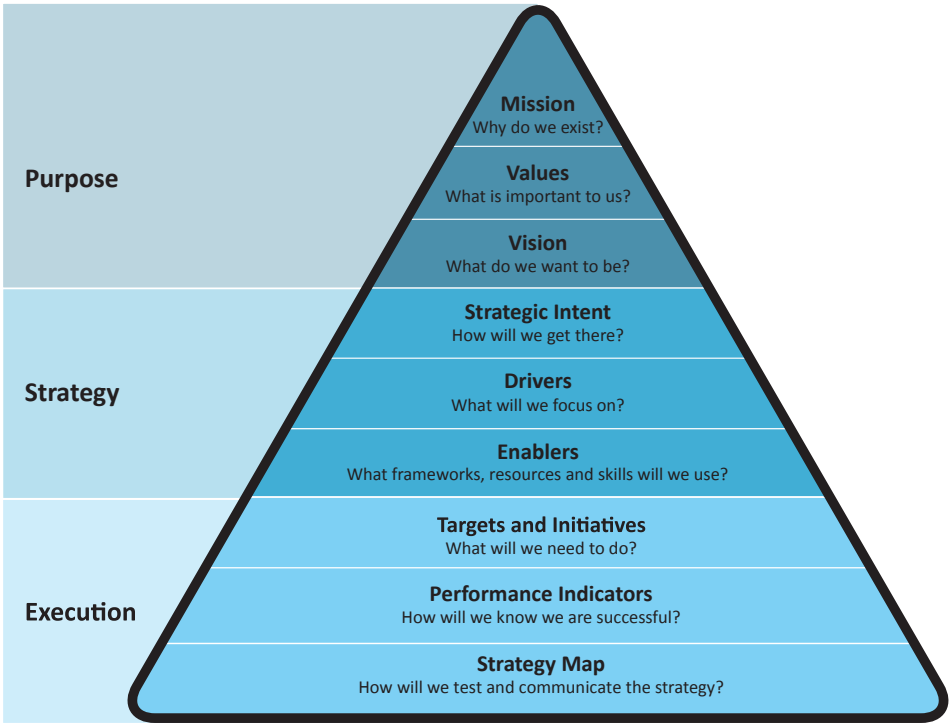
Assessing and strengthening the relationship between this process of investment and the broader context in which it occurs is critical if we wish to pursue science as a powerful tool for leveraging social action and improving well-being. A compelling vision, well-defined strategic intent, and a comprehensive strategy are all necessary to ensure this investment delivers on its potential. Essential to all these things is a broader discussion about what sort of future we want, and how we should work to achieve that future. This report aims to contribute to this important conversation by exploring the system of government-funded science in New Zealand. The report finds that there needs to be greater compatibility between government-funded science and the public interest, and that the responsible minister, policy analysts and science administrators will need to be very disciplined and committed if we are truly going to embrace science in this country.

The Approach

This report aims to contribute to the limited dialogue concerning the government-funded science system, in the hope that New Zealand invests its research dollar well, and delivers sustainable outcomes for current and future generations. The report is divided into four parts:

- **Part one** explains the purpose of the report and provides a brief overview of the methodology (Sections 1 and 2).
- **Part two** consists of three sections, which explore the historical context (where government-funded science in New Zealand has been; Section 3), the global context (the weak signals and wild cards that currently exist; Section 4) and the policy context (how science policy has responded to the global context; Section 5).
- **Part three** analyses the current government-funded science system. This is divided into three sections that address purpose, strategy and execution (Sections 6, 7 and 8). More detail on these sections can be seen in Figure 1.
- **Part four** identifies a number of key themes that become apparent in the earlier sections. Section 9 looks at policy knots – the questions that remain at the forefront of the debate yet are not often confronted. Section 10 suggests ways to optimise society's investment in government-funded science. In particular, it looks at the beliefs that are getting in the way and recommends nine key areas to recalibrate the system. Where possible, our approach has been to separate fact from opinion; allowing readers to make their own judgements about questions that remain outstanding, myths that act as constraints on the current system, and the actions necessary to optimise the government-funded science system.

Figure 1: The Strategy Pyramid



The report is built on an assumption that society needs good science. However, it finds that the government-funded science system has a long way to go before it delivers value to society through the provision of a vibrant and dynamic science community that is committed to working hard to achieve a shared vision for the future. What then is the formula for unlocking the science system so that it fosters significant improvements in the well-being of New Zealanders?

The Nine Pillars of an Optimal Science System

The formula for improving well-being through science consists of nine strategic pillars that together build a space where science and society meet. The pillars build sequentially on one another, creating an integrated and transparent framework in what could loosely be called a social contract. The pillars, in order, are: an agreed mission, a clear set of values, a compelling vision, a clear strategic intent (i.e. a preferred strategic direction), a set of overarching drivers, a set of enablers that meet the strategic intent, a comprehensive set of targets and initiatives, a set of indicators to benchmark progress over time and between countries, and finally a strategy map that communicates on one page how the strategy will deliver improvements to the well-being of New Zealanders.

The first pillar, the mission, is about ensuring there is clarity as to why the government should invest public funds in science and what would happen if this did not happen. Little exploration of this question is apparent in the literature; instead, there seems to be an assumption that this is what developed countries do. Why should this system be regarded as the best way to improve well-being, rather than, for example, purchasing expensive overseas-developed drugs to make New Zealanders well or creating generous research and development tax credits for businesses and allocating funds directly to central government to purchase the policy they require? Understanding why a system exists is an important starting point for designing an optimal system.

The second pillar is a set of shared values. The Ministry of Science and Innovation (MSI) indicates that a set of values is 'work in progress', but this is not good enough. A clear set of values should be driving change, not treated as an add-on after the main event. From our research, six values are paramount:

Value 1: To be honest.
Value 2: To discover.
Value 3: To serve.
Value 4: To sustain.
Value 5: To educate.
Value 6: To be accountable.

When rules and regulations fail, values are all we have. The right values enable those within the system to know right from wrong, know good science from bad, improve communication, collaboration and teamwork, and allow the system to respond consistently to ideas and issues, risks and opportunities, and emerging challenges.

The third pillar demands a compelling vision, one where short-term compromises and hard work are acceptable because of the long-term benefits they will deliver. MSI has put forward the vision of a 'high-performing science and innovation system improving New Zealanders' wealth and wellbeing'. This vision is about performance, and is as much focused on innovation as on science, as much on wealth as on well-being. This sets in place a research and development agenda that tends to focus on how the innovation process might create economic wealth. In contrast, a more compelling platform to attract and commit scientists is likely to be one that focuses on how the science process might best deliver improvements in the well-being of New Zealanders. For example: Science contributes to making New Zealand a sustainable nation.

The fourth pillar is strategic intent. Without transparent processes in regard to the identification and selection of strategic options, an optimal strategic direction will not be developed. New Zealand cannot afford sloppy thinking; it needs to put in place a clear strategy that says as much about what it will not focus on, as what it intends to focus on. The current system lacks a clear strategic intent, one that clearly sets out how well-being will be improved. After a great deal of discussion and deliberation, we suggest the strategic intent for the government-funded science system should be to focus on the following four objectives:

Strategic Intent 1: To inform public policy.
Strategic Intent 2: To improve the physical and mental health of New Zealanders.
Strategic Intent 3: To improve the financial security of New Zealanders.
Strategic Intent 4: To contribute to solving global problems.

Science must inform public policy, but as evidenced in this report, there is little proof that science – whether it is social, environmental, health-related or some other form of science – is shaping public policy. This aligns with the findings of the 2010 *Policy Expenditure Review*, which inquired into the cost, alignment, efficiency and quality of spending under the appropriations for policy advice and found that inconsistencies and gaps exist. It is also reinforced in a recent discussion paper by the Chief Science Advisor to the Prime Minister, who puts forward a case for the need to provide better use of evidence in policy formation.

Health, both physical and mental, is a key contributor to the well-being of New Zealanders, yet in the current system it fails to gain the level of financial support and focus one would have expected. For example, although there is a Health Research Council, it does not report to MSI, nor is there a Crown Research Institute (CRI) that focuses on health, meaning research and development in health is at best on the periphery of the system.

In terms of financial objectives, rather than referring only to wealth creation, the ability to preserve and grow other forms of capital such as intellectual capital, human capital, resource capital and natural capital should also be included.

Lastly, the current system does not focus on global problems, or indeed the opportunity to contribute to solving global problems. There appears to be a growing number of areas where New Zealand could join or lead global research partnerships aimed at resolving global problems. Synergies from such partnerships are likely to include opportunities to build capacity and recognition while at the same time contributing to the well-being of New Zealanders.

All four of the strategic objectives discussed above provide a clear intent, which can be further built upon to strengthen the system and ensure optimal outcomes.

The fifth pillar is clarity over the drivers that support the strategic intent. The current drivers of the science system tend to be broad ranging and nondescript. Drivers denote action and answer the question: if we decided to focus on three or four things to improve the system, what would they be? From our research, potential drivers that would deliver significant outcomes in the long term include a focus on foresight, education, and sustainable energy and food. For example, foresight can be used to test whether the current strategy has external cohesion with what we know or suspect about the future. Education is key as it is not only necessary to create good scientists, but also to create an informed society that is able to embrace science because its citizens know, use and receive the benefits. This means the public need to appreciate the nature of scientific inquiry, understand the processes that exist to test and peer review science, know the benefits of applying science discovery to business enterprise, and value the general knowledge that enables us all to observe and reflect on our current state of progress. Like science, education is a long-term investment, but it should also be assessed frequently to ensure any emerging young Ernest Rutherford or Beatrice Hill Tinsley is identified early and is supported to rise to the top, much in the same way potential sports stars are identified and supported early.

Universities also have an important role in transferring science to the private sector, as in the often-cited example of Stanford University's 700-acre industrial park, which was created in the 1950s specifically for private companies to commercialise the ideas of students. Education is currently undergoing significant change, which in turn provides a huge opportunity to utilise the learnings from scientific research, create science summer schools for budding scientists and integrate science inquiry into the curriculum.

The sixth pillar is a set of enablers to achieve the strategic intent. Our research identified five key enablers that need to be recalibrated: the institutional framework; scientists; research infrastructure; funding, and the regulatory framework. All five enablers need to work together to deliver on the strategic intent. Past experience would indicate that decision-makers tend to focus on changes to the institutional framework, rather than considering the other four enablers. This is unfortunate as institutional changes tend to be expensive and time consuming, therefore benefits take time to eventuate. Contrary to past practice, we consider there are real benefits to be gained from fine-tuning the other four enablers so that internal cohesion exists and synergies are gained.

- Enabler 1: Institutional framework.
- Enabler 2: Scientists.
- Enabler 3: Research Infrastructure.
- Enabler 4: Funding.
- Enabler 5: Regulatory framework.

Enabler 1: Institutional framework

The current system is designed on the basis that more New Zealand research leads to more New Zealand development. We do not believe this is true (see Myth 1 below); we argue that they are two separate activities and require two different forms of management. This means that although we generally find the current institutional framework workable, there are two exceptions. Firstly, we suggest that development funds (those currently administered by the Innovation Board) should be appropriated to a sector better correlated with development, such as the Health Sector or the Economic Development Sector. The Education and Science Sector should retain the Science Board funding, appropriated to MSI, and focus specifically on education and scientific inquiry.

Secondly, the purpose of the eight CRIs does not align with the six priority investment areas. Ideally, they should be merged to form three entities: a biological development arm (a combination of AgResearch, Plant and Food, and Scion); a high-value manufacturing and services sector (HVMSS) development arm (IRL), and an environment research arm including energy and minerals research, hazards and infrastructure research and environmental research (a combination of ESR, Landcare, NIWA and GNS Science). Further, the current Health Research Council would become a CRI, creating a fourth arm focused on health and society. In addition to reporting to the Minister of Science and Innovation and the Minister of Finance, we believe CRIs should be required to report to the minister most closely related to the area in which they operate. For example, the Minister of Agriculture and Forestry for the biological CRI; the Minister of Economic Development for the HVMSS CRI; the Minister for the Environment (or Minister of Conservation) for the environment research arm, and the Minister of Health for the health and society CRI. The role of MSI would then be one of coordination, administration of the funding, and reporting on the input, process, output and outcomes of these four CRIs.

Enabler 2: Scientists

The 2010 *Policy Expenditure Review* recommended that central agencies should investigate a model of appointing Heads of Profession. This led to a Central Agency Policy Steering Group being asked to enter into discussions with the Chief Science Advisor to the Prime Minister with a view to looking at options on how to progress a Head of Science Policy. One of the findings of this report is that those who operate in the science community do not administer themselves as a profession; there is no qualification or organisational body that sets standards as to when and how the term 'scientist' may be used after someone's name. Providing more clarity over how this term is used would promote the science community and enable it to develop a better long-term relationship with society.

We believe the issue of who is a 'scientist' could easily be resolved by adding a professional body within the Royal Society, in much the same way the New Zealand Institute of Chartered Accountants (NZICA) administers use of the term 'Chartered Accountant'. For example, the term 'Professional Scientist' could be used to identify individuals who have a Bachelor of Science degree, have four years' work experience and now spend more than 50% of their working hours on science-related research or development.

Enabler 3: Research Infrastructure

The 2007 report prepared by the Research Infrastructure Advisory Group assessed the research infrastructure needs from 2007–2012, and was to be followed by the preparation of a government strategy for the sector. This project has been put on hold while the recent structural changes are finalised. Research infrastructure provides a strong platform from which the science sector can deliver globally competitive science, and it is timely for a deeper and broader public discussion on the optimal investment strategy. This should include the establishment of a register of current research infrastructure to ensure that assets are well utilised and properly maintained, and allow for an assessment of what should be outsourced or financed through public/private partnerships.

Enabler 4: Funding
Funding for the research agenda is the primary vehicle for change; as such it must be robustly debated, signed off by Cabinet, transparent, and reported against annually. Further, we consider the research agenda should be reassessed annually; this does not necessarily mean work programmes need to change, but they could be modified or fine-tuned to meet new and emerging needs and opportunities. There is a feeling in the literature that once a research investment is approved, it is a sunk cost. In business, it is about squeezing the best outcome out of an investment; hence an annual review of the research investment portfolio should be a matter of good practice, particularly in these challenging and changing times.

It is important to be able to assess whether the establishment of the ten CRIs in 1992 met investment expectations. Have they greatly enhanced the transfer of technology, and are there better ways to meet that goal? The funding of CRIs has long been a vexatious issue in the science system. The 2010 Crown Research Institute Taskforce resulted in a major change to the way in which CRIs are funded, with the introduction of core funding. The changes to date are improvements, but do not necessarily go far enough. We suggest that there needs to be a set of criteria to determine the optimal percentage of non-contestable funding (i.e. core funding) to total funding for CRIs, and that further inquiry should be undertaken to understand the risks, costs and benefits of these percentages. Given the suggested merger proposal above, our thinking would be that primarily commercial CRIs should receive a lower percentage of core funding, e.g. 45%. This is in contrast to CRIs with a less commercial focus, which should receive significantly more, e.g. 75%. The percentage of health and society funding would need to be considered more closely if a CRI were to be created in this area.

Enabler 5: Regulatory framework
The implementation of necessary regulations on public and private activity is critically important, yet it is often subject to criticism from many in the science community, frequently without supporting evidence. Safeguards against financial failure and environmental pollution, as well as regulations that support research and development, encourage investment, and the lodging of patents and intellectual property, inspire the private sector to grow. Scientists should embrace regulation as a means of creating a stable and robust market for development to flourish. This is not to say tweaking is not necessary, particularly as new research informs best practice, but the assumption that regulation negatively impacts on growth appears grossly overemphasised in the science community. Instead we found that risk management practice and ethical standards appear significantly behind public expectations, as indicated in examples relating to genetic modification, the Dairying and Clean Streams Accord and National Water Standards.

The seventh pillar relates to the need for execution of the strategy, in particular the need for clear targets and initiatives. Not only must each target be clear and concise, but the linkages between the target and the initiatives must be logical and achievable. Fundamental to this pillar is the need for the research agenda to be a publicly available document. It must not only list the agenda, but also explain how it was formulated, what evidence it was based on, and who was involved in its development. In other words, the same process of peer review that is common practice in science should also be applied to the research agenda. Ideally, the agenda must set out the high-level problems and mysteries it is trying to solve, and clarify how the research results will create value and how such findings might lead to further research or development. This could be explained using influence diagrams, a useful method for showing how one level of research can feed into another, making it clear that there is an order in which the research should be conducted to best solve the high-level problem.

The eighth pillar relates to the need for a comprehensive set of indicators to benchmark progress over time. One of the key assumptions underlying this paper is that citizens are key stakeholders in government-funded science, a point that is not always apparent in the current system. MSI, as the lead agency, must endeavour to report on the research agenda (input), the administration (process), the output (investment report) and outcomes (improvements in well-being) in a clear and transparent manner. Indicators of interest include the administration costs of the investment dollar for each method of allocating investment funds. For example, if the high-level problem was to reduce phosphate run-off, initiatives could be to research alternative forms of fertiliser, placing a tax on phosphates, looking at how to maximise the value from phosphates (e.g. application methods and timing of application), and reviewing ways to protect freshwater streams. A key indicator would then be a reduction in the imports of phosphates in to New Zealand.

The ninth pillar is testing and communicating the strategy to stakeholders through a strategy map. Strategy mapping is a concept that was developed by Professor Robert S. Kaplan of Harvard Business School and Dr David Norton, founder and director of the Palladium Group. Mapping a one page strategy has proven a very useful instrument for bringing about change. Since MSI's strategy is still a work in progress, this report provides an opportunity to showcase this tool in action (see example in Figure 2).

Together all nine pillars set out a way to develop a culture that embraces science, but this will not be enough. It is clear from reviewing the system that much of the debate on strategy is centred on the pillars in the middle of the strategy pyramid, and in particular on certain aspects of the enablers. The lack of focus on the remaining pillars is a key concern. Clarity over purpose and execution is fundamental to improving well-being; hence refocusing the debate on these pillars is the only way for real progress to be made.

The Way Forward

Put plainly, we need to research the research. Section 9 puts forward 30 policy knots, all of which must be addressed if we wish to develop an optimal government-funded science system in New Zealand (see Table 1). From this work it has become increasingly apparent that a number of dominant beliefs are not supported by evidence and are likely to be untrue. Dominant beliefs that are untrue are myths, and are extremely dangerous in that they can lead to poor decision-making based on false assumptions. If we want an optimal system, we need to ensure that the system design is based on beliefs that are true. Section 10 discusses each of the following four myths, addresses the implications if these myths were busted and, lastly, suggests how each of the nine pillars would be redesigned.

Myth 1: More New Zealand research leads to more New Zealand development.
Myth 2: New Zealand research informs New Zealand public policy.
Myth 3: Science ethics are embedded in science practice.
Myth 4: 'Innovation' is a useful term to drive the government-funded science system.

One of the key findings from this report is the idea that research and development are different activities, requiring two very different management styles. Research should be undertaken to inform policy and inform investment in science, hence it is about the research agenda and infrastructure; who sets the agenda, who implements it and who reviews the results. In contrast development is about new products and services; who creates them, what markets and niches will be targeted, who are the investors and who delivers them to the market. Both research and development intersect with society, but the first is about shaping society through policy, while the latter is about shaping society through products and services, and the wealth they create.

If government wishes to invest in science to preserve and improve our wealth, it must do so by applying the same rules as business. This means government must set the investment criteria including the level of business risk acceptable, the boundaries of the investment (and require approval to go outside these

boundaries), the level of due diligence, and the frequency of independent and comprehensive reviews of individual investments and the overall investment portfolio. In this way value can be assessed, and if it is not performing or the government wishes to change the direction of the public's investment, it can do so by changing the investment criteria, the level of investment, the membership of the boards, and the boundaries so that outcomes can be optimised.

Critical to understanding why such a high-level of governance is needed, is appreciating why it is important. It is not the size of the investment that is crucial (just under 1% of government expenditure) but the fact that it is one of the few areas where government invests solely in our future. Much of government expenditure responds to past problems and current issues, the urgent issues that drive day-to-day activity. The opportunity for the science sector is to focus on the important issues that deliver leaps in progress. In addition, science is a long term investment, it takes many years to undertake research or develop new products and services, and therefore it takes even longer to acquire the benefits. However, although it is a long-term investment, when done correctly the returns can be greatly disproportionate to the level of investment.

Another idea from our research is that over the last twenty years government has wrongly put its effort into creating a dynamic and creative government-funded science system, in particular through the establishment of CRIs. In contrast, we believe the role of government should be two-fold: to create a stable and evidence-based government-funded science system while at the same time working with the private sector to help make it more dynamic and creative.

To conclude, greater compatibility between government-funded science and the public interest requires progress in three areas. Firstly, it requires ministers and policy analysts to be clear about what research they need, to have in place systems that assess and quantify the quality and independence of the research that is provided, and to report back to researchers on what was useful and why.

Secondly, it requires the science community not to distance itself from the public interest, but to seek out better practices that enhance the profession, such as ethical standards, public accountability, comprehensive reporting, and a high level of transparency. In particular, we suggest that science needs to be treated as a profession. Experience indicates this is best created through a membership organisation; one that is supported by individuals rather than entities, so that it creates a society of scientists, not science organisations. This way, scientists can strengthen their collective voice.

Lastly, it requires MSI to be disciplined and committed to providing an example of how science can be embraced to improve well-being. The ministry needs to be an example to the science community – brilliant, agile, forward-engaging, demanding, tactical, flexible, highly focused, ethical and disciplined – but most of all, it needs to create a strategy that compels the minister, scientists, industry and the public to join in a work programme that will deliver New Zealand to new levels of performance.

If New Zealand wishes to pursue science as a powerful tool for leveraging social action and improving well-being it is clear that there is significant work to do. It is our hope that the insights, issues and ideas put forward in this report provoke discussion and provide some light as to the best way forward.

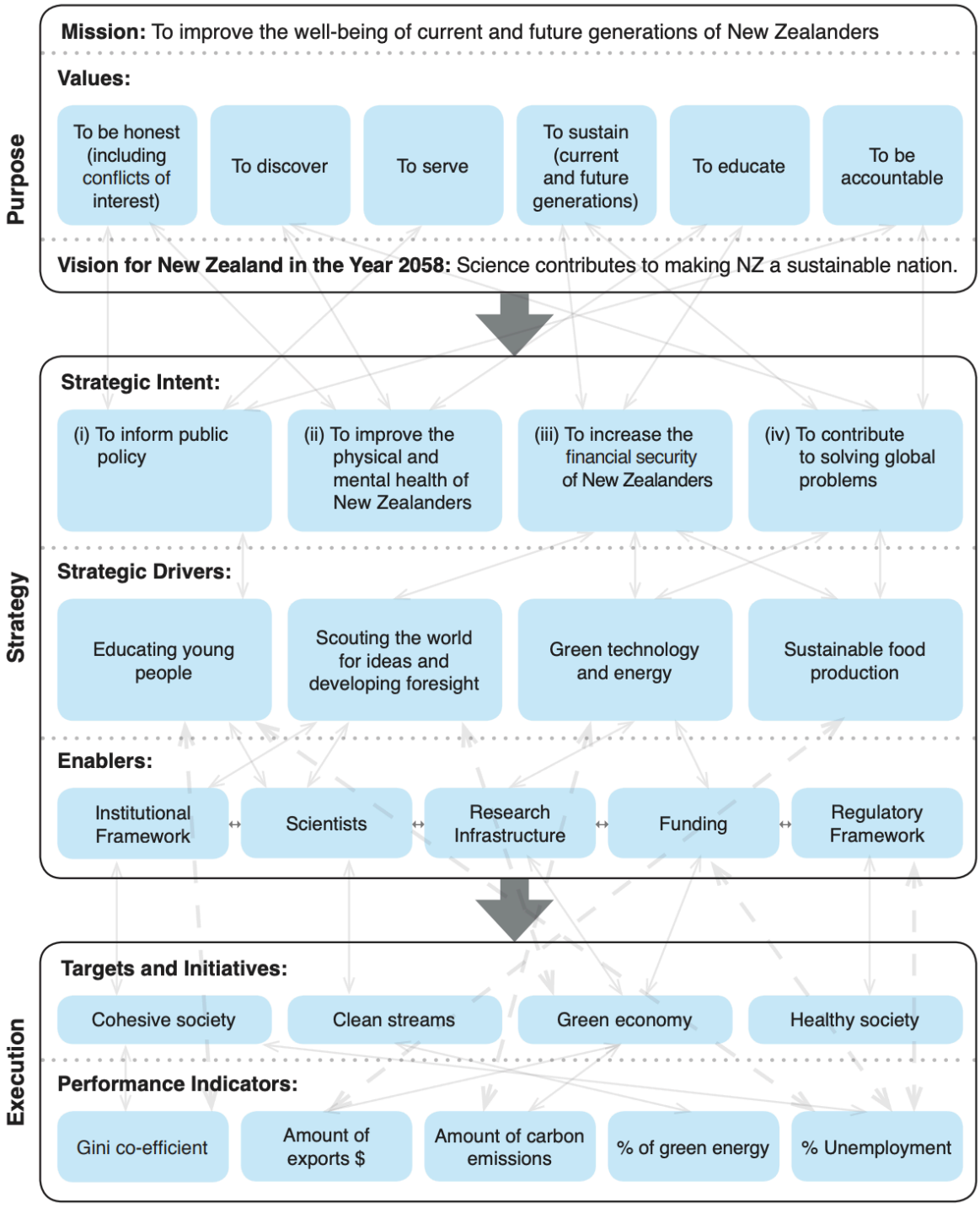
[W]e all learn what are useful ideas or otherwise as we go.

Beatrice Hill Tinsley, 1941 – 1981

We don't have the money so we have to think.

Ernest Rutherford, 1871 – 1937

Figure 2: An Example of a Strategy Map for Government-funded Science



Note: This strategy map aims to show the internal cohesion within the strategy. The horizontal dotted lines show the horizontal integration between ideas, while the vertical lines indicate the linkages between the purpose and the execution. The dashed lines represent the high-level linkages between strategy and performance indicators. This map is provided for discussion and to show what a useful tool a strategy map can be. However it must also be assessed in terms of external cohesion and how it fits within the probable, possible and preferred futures.

Table 1: Policy Knots - Links to the Nine Pillars

Note: The following table from Appendix 6, lists all 30 questions from Section 9 of the report and shows how these questions, what we call policy knots, link to the nine pillars that shape strategy. This method of analysis indicates where, very generally, links exist between policy knots and strategy.

Policy Questions \ Pillars	Pillar 1	Pillar 2	Pillar 3	Pillar 4	Pillar 5	Pillar 6					Pillar 7	Pillar 8	Pillar 9
						Enablers							
	Mission	Values	Vision	Strategic Intent	Drivers	Institutional Framework	Scientists	Research Infrastructure	Funding	Regulatory Framework	Targets and Initiatives	Performance Indicators	Strategy Map
	6.1	6.2	6.3	7.1	7.2	7.3.1	7.3.2	7.3.3	7.3.4	7.3.5	8.1	8.2	8.3
Question 1: Should New Zealand have a greater focus on commercial research or non-commercial research?	✓	✓	✓										
Question 2: Should New Zealand have a greater focus on addressing New Zealand-specific issues or global issues?	✓	✓	✓										
Question 3: Should New Zealand have a greater focus on inventions or innovations?	✓	✓	✓										
Question 4: Should New Zealand have a high-risk appetite or a low-risk appetite?	✓	✓	✓										
Question 5: Should New Zealand have a greater focus on long- or short-term research?	✓	✓	✓										
Question 6: Should New Zealand have a greater focus on 'policy for science' or 'science for policy'?	✓	✓	✓										
Question 7: Should New Zealand have a greater focus on solving problems or mysteries?	✓	✓	✓										
Question 8: Who will review the recent restructure, when will it be done, and against what criteria?				✓	✓	✓							
Question 9: What policies and initiatives will MSI not carry over from MoRST?						✓					✓	✓	

Policy Questions \ Pillars	Pillar 1	Pillar 2	Pillar 3	Pillar 4	Pillar 5	Pillar 6					Pillar 7	Pillar 8	Pillar 9
						Enablers							
	Mission	Values	Vision	Strategic Intent	Drivers	Institutional Framework	Scientists	Research Infrastructure	Funding	Regulatory Framework	Targets and Initiatives	Performance Indicators	Strategy Map
	6.1	6.2	6.3	7.1	7.2	7.3.1	7.3.2	7.3.3	7.3.4	7.3.5	8.1	8.2	8.3
Question 10: How will MSI address the needs and wants of the public?	✓	✓	✓	✓							✓	✓	✓
Question 11: How can MSI drive long-term outcomes for the government-funded science system?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Question 12: What research infrastructure is necessary to meet our long-term needs?				✓	✓			✓			✓		
Question 13: How can Mātauranga Māori be progressed in a modern, funded research context?		✓							✓			✓	
Question 14: How can society have faith that decisions by the two MSI investment boards are independent, based on evidence and in the public interest?		✓									✓	✓	
Question 15: What are MSI's reporting obligations to stakeholders?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Question 16: Has the Crown Research Institute experiment worked?				✓	✓	✓							
Question 17: How can investment decisions by Crown Research Institutes be made more transparent?									✓		✓	✓	✓
Question 18: What level of funding is best for science in New Zealand?	✓	✓	✓						✓				
Question 19: What method of funding is best for science, contestable or core funding?						✓	✓	✓	✓	✓			
Question 20: How can New Zealand's decline in international university rankings be addressed?							✓					✓	

Policy Questions \ Pillars	Pillar 1	Pillar 2	Pillar 3	Pillar 4	Pillar 5	Pillar 6					Pillar 7	Pillar 8	Pillar 9
						Enablers							
	Mission	Values	Vision	Strategic Intent	Drivers	Institutional Framework	Scientists	Research Infrastructure	Funding	Regulatory Framework	Targets and Initiatives	Performance Indicators	Strategy Map
	6.1	6.2	6.3	7.1	7.2	7.3.1	7.3.2	7.3.3	7.3.4	7.3.5	8.1	8.2	8.3
Question 21: How can New Zealand ensure the best university researchers are collaborating effectively?						✓	✓				✓	✓	
Question 22: Do adequate incentives exist to encourage excellence in teaching within universities, polytechnics and wānanga?		✓					✓				✓		
Question 23: Are there adequate incentives for post-doctoral researchers to stay and build their careers in New Zealand?		✓					✓				✓		
Question 24: What impact will a reduction in contestable funding have on independent research organisations?		✓					✓					✓	
Question 25: How can we increase collaboration between research institutions?		✓					✓						✓
Question 26: How can we improve linkages between businesses and research institutions?		✓			✓						✓		
Question 27: How can the public be confident that a Code of Ethics is being applied?		✓					✓					✓	✓
Question 28: What is the optimal composition of the science workforce?				✓			✓					✓	
Question 29: How can we promote science as an appealing career path for students?		✓	✓		✓		✓						✓
Question 30: How can foresight be embedded in central government?		✓			✓					✓			

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Wendy McGuinness
Chief Executive

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