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Paper title: Sustainable Development: responding to the research challenge in the Land of the Long White Cloud, Aotearoa New Zealand.

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Disclaimer: This paper represents the views of the author and is not intended to represent the views of the New Zealand government.

Abstract

Amongst the challenges facing us in New Zealand, three questions relate to the theme of this conference. First, what is the relevance of a Sustainable Development research agenda to an island nation of 4 million people in the grip of a global economic crisis? Second, how may we guide our precious investment in research, science and technology so as to maximise the return to the nation? Third, what are priorities for investment in sustainable development research? The paper explores answers to those questions, finding relevance to the challenge to European research in the way New Zealand science is funded and the opportunities for New Zealand to act as a laboratory for global solutions. Four research themes are discussed under the priority of governance for sustainable development. These include futuring for agile organisations, resilient and adaptive communities, port-regulatory governance, and governance models from indigenous communities.

Introduction

Amongst the challenges facing us in New Zealand, three questions are relevant to the theme of this conference. First, what is the relevance of a Sustainable Development research agenda to an island nation of 4 million people in the grip of a global economic crisis? Second, how may our precious investment in research, science and technology be guided so as to maximise the return to the nation? Third, what are priorities for investment in sustainable development research?

This paper explores some possible answers. These answers are inter-linked and they reflect several realities, for example: that research in New Zealand is a tiny proportion of the global whole, but New Zealand can be a laboratory for the world; that our research resources are limited, so what we do must have impact; that achieving impact in complex systems comes from influencing paradigms and mechanisms of governance[2]; and that different peoples have different world views and approaches to governance.

What is the relevance of a Sustainable Development research agenda to an island nation of 4 million people in the face of a global economic crisis?

In 2003 the New Zealand government issued a Programme of Action for Sustainable Development[3]. This broke new ground in our country by identifying the changes in the way we do things, and specifically in the way government acts, that will be needed to make a success of sustainable development. It described a new way of thinking and working: looking after people; taking the long-term view; taking account of the social, economic, environmental and cultural effects of our decisions; and encouraging participation and partnerships.

In 2007 the then Prime Minister, Helen Clark, announced an intention to make New Zealand truly sustainable. She defined the sustainability challenge as "one of the defining global issues of the twenty-first century", and "a challenge that New Zealand must meet to protect our nation's unique way of life and our future prosperity." She talked of the need to share responsibility in this challenge[4].

In 2009 New Zealand faces a similar challenge to other countries. The result of unsustainable financial practices at home and in the global community leaves us facing an economic hardship that is difficult to predict. We face a harsh reality that unsustainable behaviour is just that: *unsustainable*. The economic turmoil is a taster for the turmoil predicted as a result of unsustainable management of our environmental resources and global climate. Whether the defining issue will be climate or water, soil erosion, or loss of biodiversity, we face an uncertain but almost certainly punishing future.

The economic crisis may support the old adage, *"it is hard to be green when you are in the red"*. Some think we may literally be unable to afford environmental measures in the short-term that are necessary for long-term welfare. Therefore it is encouraging that many national recovery packages appear to include environmental initiatives, for instance in clean technology[5]. But we will miss a significant lesson if we do not recognise that addressing the economic crisis may give us some of the tools we need to address a potentially greater environmental and social crisis looming in the next few decades as a result of climate change and the depletion of natural capital. It may help us to shift paradigms and improve governance systems for lasting benefit to society.

Returning to our initial question: What is the relevance of a sustainable development research agenda in the face of an economic crisis? Scientists might say the crisis is an experiment in how society makes the transition from an unsustainable to a sustainable system. What is the special relevance to an island nation of 4 million people? Scientists might say we have in Aotearoa New Zealand a useful laboratory, with clearly defined boundaries, reasonably well regulated internal conditions, fairly clear external influences, and a national characteristic attitude of "give it a fair go", meaning that we are pragmatic and willing to try new ideas. In this laboratory we may evaluate solutions of relevance to other countries.

How may our investment in science and technology be guided so as to maximise the return to the nation?

One aspect of New Zealand pragmatism is evident in its approach to science funding. We conduct a tiny proportion of the world's science and we cannot afford to be expansive. We must be focused, and we must achieve returns on research investment. We face similar challenges to other countries, demonstrated by a recent EU report on science and policy-making[6]. The report highlighted the need to ensure that EU-funded research results inform policy-making in a meaningful way. EU policy-makers expressed a desire that stronger linkage should enhance the contribution of research to areas of major economic, social and scientific relevance for the EU.

For a decade or more the New Zealand government's principal funding agency, the Foundation for Research, Science and Technology (FRST), has had as a core principle that the public good research it funds must make a demonstrable contribution to outcomes of national value. Therefore research funding is targeted at projects that can show the pathway from research to such outcomes. This requires transparency around two areas in particular: the valuation of the outcomes and the pathway to uptake of research. Research users are usually government agencies and businesses, but also include non-governmental organisations, community groups, and other researchers.

FRST's assessment criteria for research proposals that range from €200,000 to upwards of €10 million are illustrated in Figure 1[7].

Valuation of outcomes takes a pragmatic approach by pointing to established national strategies or those of sector groups (e.g. dairy sector) that have been endorsed by government. Valuation may also include estimates of the economic value of outcomes (e.g. greenhouse gas research reducing economic liability under the Kyoto Protocol). Demonstrating the achievement of value may be problematic when, as is common, benefits are obtained after the project funding has finished. But it is possible to show that research has influenced policy and action in line with the intentions of the research proposal.

The pathway to uptake of research starts at the conception of the research programme. Evidence is expected by the funding agency of engagement between researchers and research users through the gestation of the project proposal, and this engagement may be audited by the agency when assessing the proposal. Engagement during the research project is the subject of contractual agreements with the funding agency. Researchers are bound by contract to deliver workshops, training programmes, publications, secondments, etc, to achieve research uptake. Research users may be bound by the same contract or a derivative, to fulfil their role in the pathway to uptake. Research programmes therefore bring together not only different disciplines, but also different research users, who may co-fund components in parallel, to achieve intermediate and target outcomes of benefit to New Zealand (Figure 2).

Research is a partnership that is best fulfilled when the team includes both researchers and research users, supported by people with a range of additional skills. Figure 3 shows the stages in a conceptual research cycle together with the skills needed to enhance the value of the research at each stage. Beyond the essential skills in science and in research management, skills are needed in *translation* (both ways between the languages of science and users, e.g. policy-makers, and funders); in *decision-making* (when to increase or decrease research funding, or take a different approach); in *planning* for the longer term implementation of research findings and tools beyond the funding lifecycle; in *extension* or *amplification* of research from case studies to the mainstream; and in *listening, evaluation* and *collaborative learning* about the impacts of the research in its social context, from which may spring the new ideas that start the cycle again.

What are priorities for investment in sustainable development research?

The breadth of the subject defies simple analysis. Priorities for New Zealand like other countries extend across a wide spectrum from those deeply socio-economic to those deeply cultural and environmental, with all dimensions represented in most priorities.

Figure 4 depicts a view of how water issues overlap nested economic, social, cultural and environmental dimensions. For example, issues of water consumption and allocation touch on all four dimensions; and Mauri (the Māori term signified by health and life force) connects the environmental and cultural dimensions. This approach helps to break down the silos in our thinking. Economic development, Māori affairs, climate change, and water are prominent in the present New Zealand government's agenda, and all relate to the complex challenge of achieving development that sustains and grows the social, environmental and cultural resources on which it depends.

In a time of great uncertainty about the future *governance for sustainable development* is a particularly relevant theme. Governance, rather like sustainability, is a term with multiple meanings. In the context of this paper the hallmarks of governance are those of effective Boards of Directors: attention to vision and longer-term strategy, risk and opportunity, relationships with stakeholders, goal-setting, and overseeing prudence in management. Governance here relates to both business and government.

Let us explore a research agenda on governance for sustainable development, with four examples providing a New Zealand perspective:

- Futuring for agile organisations
- Resilience and adaptive capacity in communities
- Post-regulatory governance for constrained natural resources
- Governance models from indigenous communities

1. Futuring for agile organisations

Change is speeding up, increasing the pressures on central and local government to provide 'agile' responses to increasingly 'wicked' problems[8]. These are multi-dimensional, with messy solutions, in which uncertainty and risks are typically high, and often there is no "right" answer[9]. Yet agile responses are required when investing strategically in infrastructure, business, and human capital against a global backdrop of significant and uncertain political, economic, social and environmental change.

The initial research question is how to adapt and combine three common futuring approaches of global scenarios (e.g. IPCC), community visioning, and New Zealand scenarios, for a wide user community in New Zealand and so improve the effectiveness of strategic planning for agile responses.

IPCC and other global climate scenarios have been adapted to provide broad-brush information about likely climate changes within New Zealand's major regions[10]. But businesses and government still lack the capacity to identify risks and opportunities to specific organisations or communities. Local government legislation has produced Long-term Council Community Plans[11], but tools are only now in development to give Councils and communities the capacity to model the implications of alternative policies for integrated environmental, social and economic outcomes. One example in New Zealand is the Creating Futures programme[12] which builds on technology sourced in Europe.

An example of national futuring is Four Scenarios for New Zealand[13]. The four scenarios (named *New Frontiers*, *Fruits for the Few*, *Independent Aotearoa*, and *Living on Number 8 Wire*) occupy a matrix with axes of identity (individuality – cohesion), and resources (plentiful – highly constrained) (Figure 5). They give a rich sense of how life could differ in the future: at work, at home, in politics and in business. With whom will we trade? What sports will we play? How will we educate people? And what will all this mean in terms of sustainable development? Since these scenarios and a futures "game" derived from them were developed, 34 organisations in central and local government and the private sector have been enabled to take the long view and explore futures thinking in parallel with strategy exercises.

In spite of those initiatives, contemporary futuring risks being a separate exercise, not mainstreamed in strategic planning or community debate. In a series of workshops and interviews on research directions in 2007-08, a consistent message from research users was the need to address New Zealand's lack of capacity in translating futures into strategy. We identified three opportunities: first, to improve alignment between future scenarios and government policies such as regional development form, transport, infrastructure provision, and natural resource governance; second, to align global economic and social trends with policies for labour and human development; and third, the use of futures by businesses in re-modelling to address environmental and social opportunities, especially as organisations orient themselves into a new world order post-recession.

Two initiatives have the potential to support the capacity for such alignments between futures and strategy. First is to create a shared understanding and resource base of future scenarios relevant to New Zealand. This has the potential to improve the quality of strategic planning, reduce the inevitable duplication of effort between agencies needing such knowledge, and support those with inadequate resources or capacity for doing effective futuring. A deliverable in the pathway to uptake is to put leading international resources on future pressures and opportunities "on every desk" in government (and other sectors), including new methods of engaging citizens in ongoing debate about future

scenarios using Web2.0 and 3.0 technologies, as has been started by the European Commission[14].

The second initiative is to create a Virtual Futures Laboratory in which government, business and other organisations can explore strategic options using relevant science and research tools in a "safe" space. The aim with this initiative is to overcome the barriers to accessing and using research and science that have been encountered by policy-makers and businesses. Barriers include science being narrow and deep, and in silos rather than broad and integrated in a way that reflects the realities of policy-making and business strategy. An effective Virtual Futures Laboratory would make tools and expertise available in a joined-up way, allowing "experiments" that explore alternative futures and innovations, without putting communities, economies and environments at risk.

2. *Resilience and adaptive capacity in communities*

Historically, the long term success of cities and communities has been founded on ability to prevent or withstand shocks, such as resource scarcity and natural disasters, and adapt and capitalize on large-scale change, such as technological advances and significant demographic shifts. Today, New Zealand cities and communities face the challenge of major change, with increasing uncertainty of how forces such as economic recession, climate change, global energy shortages, and an aging, more ethnically diverse population will interact and impact our lives[15]. Compounding this is the modern world's connectedness; a disruption in one part of the world, to financial markets or oil supplies for instance, can rapidly impact cities and communities globally.

Resilience and adaptive capacity refer to the ability to withstand disruptions and/or adapt to large scale change with minimum loss of function. The concept can include structural adjustment or structural change, in the event of substantive system breakdown. Resilience and adaptive capacity is determined by a combination of factors including natural and physical resources, character of infrastructure, human and social capital, collective learning ability, and governance frameworks.

Lack of resilience and adaptive capacity to disruptions and rapid change can include major job losses; deterioration of natural resources; capital losses from obsolescence in buildings, roads, and plant; the breakdown of critical infrastructure systems; social dislocation; and losses in personal and cultural identity. The aim of research is to show how such costs can be replaced with net benefits from, for example, designing adaptable infrastructure and flexible building systems, positioning communities to gain from emerging economic sectors, and strengthening community and business competitiveness with a culture of preparedness and environmental leadership.

In order to build resilience and adaptive capacity, we need to understand what factors and processes make some settlements vulnerable to disruptions and rapid change while others can adapt[16,17]. The desired national outcome is to enable local and central government to build this capacity, moving beyond the current focus on crisis events and disaster management. A framework, indicators and community planning toolkit are needed to enable New Zealand city managers and central government agencies to work with communities and gain their mandate in implementing proactive management responses to uncertain futures.

Local councils will make use of an adaptive communities planning toolkit in preparation of the 2015 Long-term Council Community Plans[14], and in structure and infrastructure plans, which address impacts on future generations. Spill-over benefits are anticipated in communities adopting new economic activities and creating new jobs – with greater diversity being an adaptive response to uncertain futures.

3. Post-regulatory governance of constrained natural resources

Sustainable use of natural resources is the foundation for primary industries that play a major role in New Zealand's national and regional economies. Dairy and meat products alone account for 33% (NZ$10.3 billion) of export income. Hydroelectricity provides over 60% of New Zealand's electricity, while other renewable energy resources are increasingly important. Equally, New Zealand's unique and spectacular environment is a primary draw card for international tourism, which accounts for 18.5% (NZ$7.4 billion) of exports. The success of these and other industries depends in large part on their access to, and use of, high quality natural resources that are becoming increasingly scarce.

Apart from the economic value of natural resources, integrity of natural systems is of increasing concern to New Zealanders. Economic and other resource uses and values are increasingly coming into conflict, creating difficult problems of natural resource governance. Conflicts over water allocation are increasing, as are problems of water pollution. Development of alternative energy resources is often contentious, as are many coastal developments.

In these and many other cases, there are important and contested issues around what is physically, legally, economically, and socially feasible, and then what is desirable, in the management of common resources. Furthermore under resource management and local government legislation, local authorities have a responsibility to recognise the incorporation of Māori perspectives in planning and decision-making, but often struggle with how to implement this effectively.

Successful natural resource governance can only be achieved through integration of social, environmental, economic and cultural dimensions. Present decision-making

typically moves from an imperfect regulatory environment to a combative legal environment in the Courts. Attention is becoming focused on the opportunity for post-regulatory approaches that incorporate stakeholder collaboration, consensus building, and more integrative, inter-disciplinary research[18].

A research agenda we are following is the development of an integrative framework for analysis of natural resource governance problems in terms of efficiency, effectiveness, equity, legitimacy and scale[19]. The research has taken an initial focus on water, but the framework and methods could be applicable to natural resource governance in many sectors and regions of New Zealand. The research draws on a wide range of scientific disciplines, using both quantitative and qualitative methods.

Quantitative models are being developed at both regional and local scales to create better understanding of the role of water in economic production. An 'integrated computable general equilibrium' model has been developed, capable of simulating the broad effects of alternative policies and alternative scenarios for economic development at the regional scale[20]. An 'agent based model' will also be developed to explore specific issues in more detail at the scale of multiple catchments.

Qualitative approaches are being used to develop a better understanding of decision-making processes around sustainable allocation and use of water resources. We are producing an institutional landscape map by examining the legal and institutional frameworks; exploring informal, or 'silent', accounts of experiences of inter-agency decision-making processes, including aspects of authority and institutional barriers to creating new mechanisms of regional planning; examining media representation of water issues; and analysing relevant policies from within and beyond New Zealand's shores.

Collaborative learning techniques build capability in stakeholder engagement and constructive use of scientific knowledge. Where these techniques focus on Māori issues and perspectives, Māori researchers establish and articulate Māori perspectives and knowledge on resource issues and identify appropriate governance models. This often involves finding out how stakeholders understand and interpret the 'Māori voice' with respect to natural resource governance and recommending equitable New Zealand solutions.

4. Governance models from indigenous cultures

The first humans arrived in Aotearoa-New Zealand from Polynesia about 800 years ago, populated the country, and evolved a distinct Māori culture inextricably linked with the natural and spiritual environment. Europeans first settled in New Zealand in the early 1800's, and the Treaty of Waitangi was signed with Māori chiefs in 1840 to provide Māori rights over their lands, resources, and taonga. However, under European

colonisation, an intense period of Māori land alienation and confiscation of strategic resources followed until about 1940 when Māori land represented only 6% of Aotearoa New Zealand. A new era commenced in 1975 in which the Crown (New Zealand Government) recognised the resource alienation as a significant historical grievance, and entered a phase of dialogue, dispute resolution, and settlement.

The resulting compensation to Māori tribes for land and economic losses has provided many with the opportunity to once again govern significant assets and resources (e.g., land, fisheries, property) and to build an economic, social, and cultural base on which to develop a sustainable future for their people. Indigenous Māori make up about 15% of New Zealand's population of 4 million, with about 80% of all Māori now living in urban areas. The Māori commercial asset base in 2005/2006 was estimated to be worth NZ$16.5 billion representing 1.5% of the total economy (an increase of NZ$7.5 billion or 83% since 2001). 52% of Māori commercial assets are concentrated in primary industry such as farming, forestry, fisheries, and agriculture, while 40% is in the tertiary sector, representing growing numbers of Māori who are self-employed and entrepreneurs[21].

A significant question for many Māori organisations and businesses has been how to balance aspirations for cultural enrichment (e.g., retaining strong elements of traditional culture such as values, language and knowledge) with more modern elements of advancement, growth, commerce and economic development (Harmsworth 2006). Our research with a number of Māori businesses[22,23] has shown that effective corporate governance is a necessary precursor to integrating cultural heritage and values into an organisation. It is also essential to have a robust organisational planning and reporting framework, in which to articulate goals and outcomes, and implement, measure and report performance. Our research seeks to support that development of governance.

Durie[24,25] posed the broad question "how is a Māori business distinguished from any other business?" He identified the following six key outcomes that could be used to evaluate a Māori business's contribution to Māori development and advancement: Tūhono (aligns a Māori business to Māori aspirations through comprehensive consultation); Pūrotu (transparency and responsibility to the wider community); Whakaritenga (balanced motives, not just profit-making); Paiheretia (integrated goals, using effective management); Puāwaitanga (best outcomes within wider social, cultural, environmental and economic, perspectives and goals); and Kotahitanga (unity and alliance that encourages cooperation).

These elements distinguish emergent Māori business. They also define a governance framework that has relevance in a world seeking a new social contract between business and society. They look to the long-term sustainable future: "Mō tātou, ā, mō kā uri ā muri ake nei (for us and our children after us)[26], and they express the spirit of sustainable

development: “Manaaki Whenua, Manaaki Tangata, Haere whakamua” (Care for the land, Care for the people, Go forward - We are the guardian of our assets and community[27].

Conclusion

The Land of the Long White Cloud, Aotearoa New Zealand, may not yet have the answers to sustainable development, despite our 100% pure, clean-green image. But we have a pragmatic approach to developing research agendas in *partnership* with research users; our country is a *national laboratory* for solutions of relevance to other countries; a *long view* and *futures* have the potential to inform our policy and strategy across sectors; we can learn from the economic crisis to create *agility*, *resilience and adaptive capacity* in our organisations and communities; and *Māori values and practices* are helping fashion distinctive approaches towards equitable societal goals for sustainable development in this generation and beyond.

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Figure 1. Assessment criteria for proposals used by the New Zealand government's research funding agency, the Foundation for Research Science and Technology in the Public Good Research fund. Target outcomes are set by the Foundation for portfolios of research in which funding is awarded.

Benefit to New Zealand	**Risk Management or success factors**
1. Outcome benefits to New Zealand **Key question:** Assuming this project is successful, what is the potential contribution it will make to the achievement of target outcomes? **What should be included in your answer:** a) Assessment of the opportunity or need and potential impacts from the proposed research (for example, improved returns, avoided costs – economic, social, and environmental). b) The potential contribution to target outcomes, assuming successful adoption and implementation (including potential spill-over benefits). c) The research is beyond "business as usual" and is not likely to be undertaken by others in the near future (industry and private sector, public sector, community/voluntary).	**2. Implementation pathway** **Key question:** What is the likelihood the team will successfully have the research implemented? **What should be included in your answer:** a) Relevant team track record in delivering contributions to outcomes and working with research users (including, but not limited to, past Foundation contracted milestones). b) Barriers to adoption: • freedom to operation including, ethical issues, intellectual property and regulatory hurdles • takes account of existing or new competitors, substitutes and alternative ways of achieving outcomes. c) Pathway to research use: • plan (including mechanisms and milestones) to achieve uptake, capturing benefits for New Zealand • quality engagement with research users, and/or co-investment.

Benefit to New Zealand	Risk Management or success factors
3. Research, science and technology benefits to New Zealand **Key question:** Will the research be of high science quality and build or retain capabilities of potential future benefit for New Zealand? **What should be included in your answer:** a) Advanced knowledge in the research area. The magnitude of the extension of knowledge frontiers and generation of significant new knowledge, potentially contributing to the target outcome. b) Excellence of RS&T fit-for-purpose. Demonstration of soundness of research method (including research questions and/or hypotheses) and the rationale for the approach and methodology, and identification of the strengths/weaknesses of the research approach. c) The potential for this distinctive RS&T capability to contribute to target outcomes in future. Or d) How the maintenance and development of an existing RS&T capability makes, or may make, an important contribution to target outcomes, taking account of the difficulty of replicating it. (RS&T capability includes development of individual and team research abilities and associated support and infrastructure.)	**4. Ability to deliver research, science and technology results (outputs)** **Key question:** What is the likelihood the team will achieve their proposed research outputs? **What should be included in your answer:** a) RS&T track record of teams: • fit-for-purpose science track record • collaborations where necessary to bring together the best team to deliver the proposed research • track record of delivering on research (including, but not limited to, previous Foundation contracts). b) Project management and support: • team leadership, roles and coordination • organisational and infrastructural support • succession planning. c) Project plan: • clearly defined, well-sequenced critical path milestones and objectives • change events and identification of and mitigation of key project delivery risks.

Figure 2. The braided river metaphor for integrating scientific disciplines and research user organisations in a fluid project structure to deliver intermediate and target outcomes of national benefit.

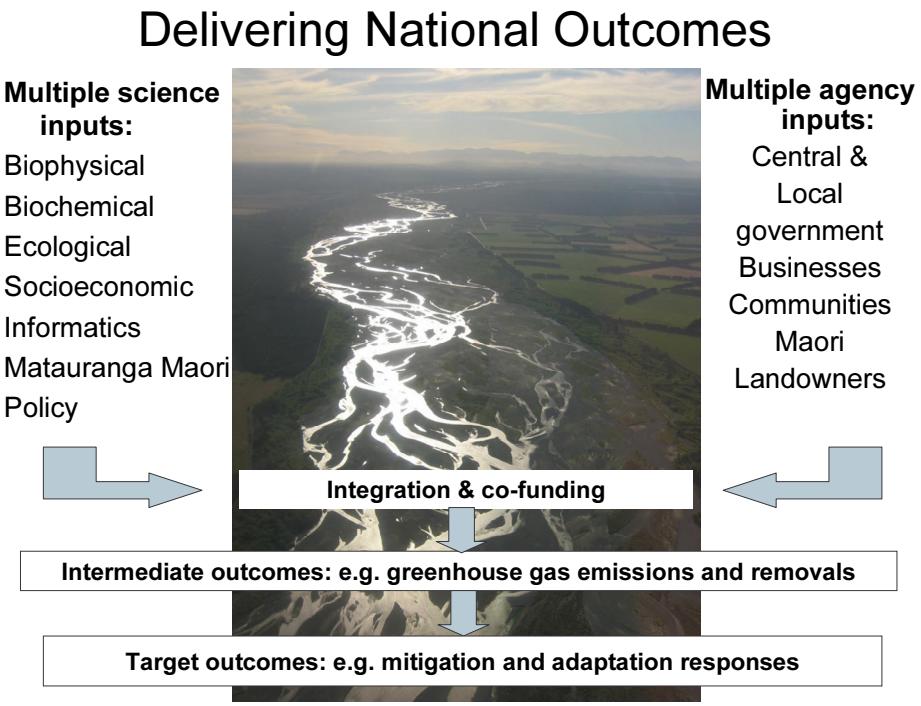

Figure 3. Schematic representation of the science lifecycle showing the phases (black), the specific skills (green) and the newly recognised boundary skills (red) that are needed in addition to the science skills.

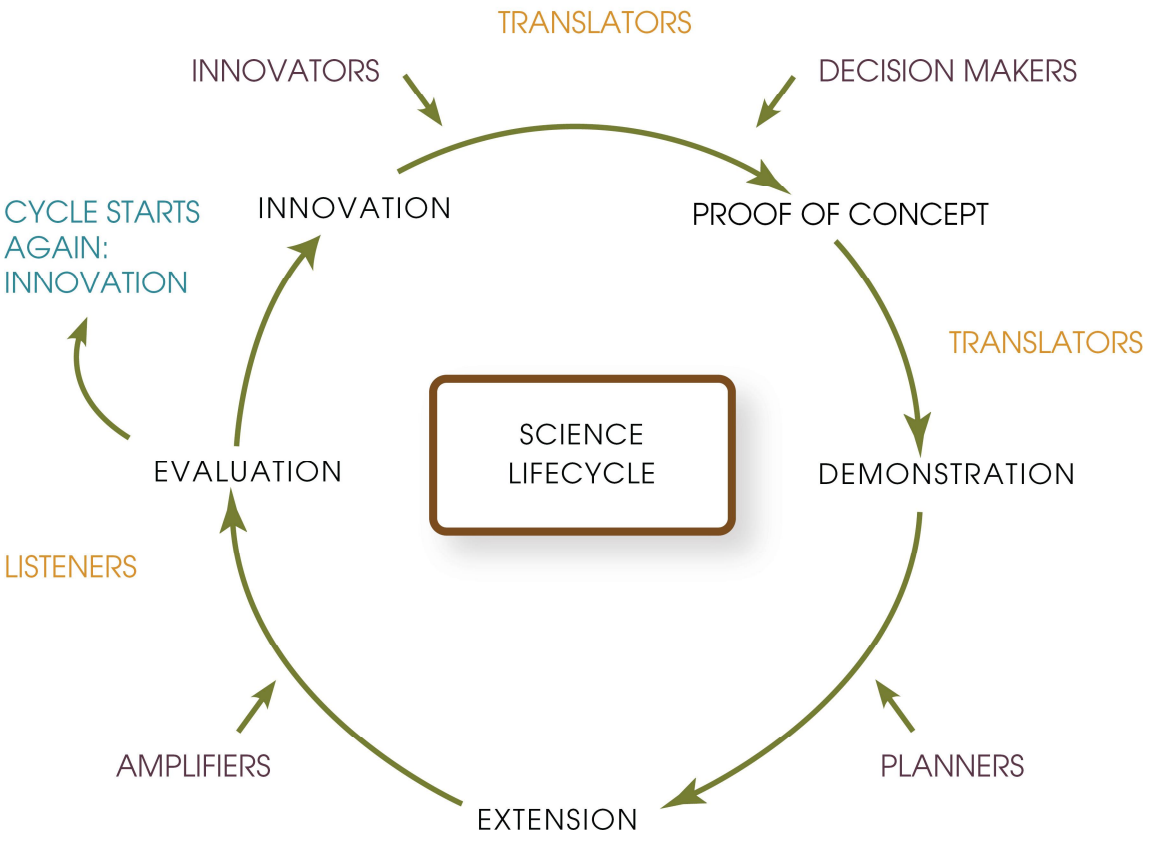

Figure 4. A nested model of the dimensions of sustainable development showing some of the cross-cutting issues associated with water. Note: *mauri* is the Māori term for spirit or life-force.

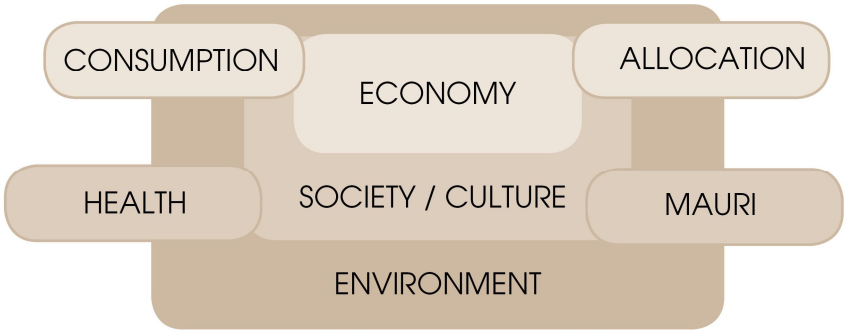

Figure 5. Four Scenarios for New Zealand