Policies for Transforming the Science and Innovation System in New Zealand: 1988–97

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ABSTRACT *In 1989, the New Zealand Government initiated a fundamental reform of its science and technology system, leading to a transformation of science management in New Zealand. The politics that transformed the New Zealand science and innovation system in the last decade have established a system that is unique among OECD countries. Its transformation continues, through increasingly sophisticated attention to definition of outcomes and evaluation of performance at the strategic level. Its commitment to policy innovation will mean that the New Zealand system continues to be worthy of analysis in the next decade.*

Introduction

In 1989, the New Zealand government initiated a fundamental reform of its science and technology system, leading to a transformation of science management in New Zealand.

The restructuring of the science system was part of a thorough-going reform of New Zealand's Government institutions and its heavily regulated and protectionist economic system.[1,2] From 1984 the newly-elected Labour Government deregulated markets, slashed public spending, shrunk the 'borders of the state', and corporatised or privatised most state sector trading activities. Very high levels of public debt and a fiscal crisis in 1984 lent urgency to these reforms. Their speed and comprehensiveness, and the manner in which they flowed through to the science system, reflected a widespread acknowledgment of New Zealand's poor economic and institutional performance, and the ease with which radical change could be carried out in a small country with a unicameral political system.

The New Zealand Science System Pre-1989

Before 1989, most of New Zealand's scientific research was undertaken in Government departments such as the Department of Scientific and Industrial Research (DSIR) and the Ministries of Agriculture and Fisheries (MAF) and Forestry. Researchers in the universities had access to only modest levels of government funding through Vote: Education. A small amount of publicly funded research was also undertaken in Research Associations established by various industry sectors such as the building industry or the coal industry.

Of the Departments, the DSIR was the recipient of the largest share of institutional funding from direct Parliamentary appropriation. It was, at the same time, the largest

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grouping of scientific laboratories and the provider of science policy advice to Government.

Planning of DSIR and other departmental research was subject to relatively limited external and peer review. Funding was provided *en bloc* to institutions rather than to scientific programmes. By the late 1980s there was increasing concern with the high corporate overheads in the departments.

Until the science reforms, there was little attempt to develop science priorities for New Zealand in any systematic way. The arbitrary nature of historical decisions on research expenditure had led to major distortions. In fact, even in 1996 after the corrective action of the science reforms, New Zealand's horticultural research investment is still almost twice that of forestry, and yet forestry earns around twice the export income and is a much faster-growing sector. Likewise, New Zealand's research investment in important emerging sectors as information technology and fisheries and agriculture has been low, largely because of the historical dominance of established scientific interests and disciplines.

However, a more pervasive problem in the pre-1989 science system was its lack of philosophical and strategic coherence. The absence of an independent and coordinated overview of science meant there were significant overlaps and duplications in the work of the Government's research agencies. Science was funded on an input rather than an output basis, and there was no clear policy direction governing the role of science in national life, or the relationship between public research endeavour and that of the private sector (see SMC, 1988). The institutional design of the science system was centralised and linear, driven by a view that R&D undertaken within public research institutes was the dominant source of technological learning in an economy.

As a result of general budgetary constraints, combined with its lack of understanding of and, consequently, commitment to its role as a funder of R&D, the New Zealand Government had reduced public funding of research by over 25% during the 1980s.[3] This was accompanied by low confidence of industry in the relevance, accessibility and cost-effectiveness of departmental research. New Zealand's private sector R&D investment had always been low, and in 1989 was 0.29% of GDP compared with public expenditure of 0.57%. This compares to an OECD average at the time of 1.05% and 0.68% respectively.[3]

The morale of New Zealand's science community in 1989 was therefore at a low ebb, and the climate was right for fundamental reform. However, the science reforms did not occur in isolation, but resulted from the interplay in New Zealand of many economic, philisophical and institutional factors, and therefore have to be understood in the wider context of reform across the whole public sector.

Policy Context: Public Sector Reform in New Zealand

Public sector reforms in New Zealand were based on three major pieces of legislation.[1]

The State Owned Enterprises Act 1988 provided for the corporatisation, and eventually the privatisation of much Government trading activity. This acknowledged that Ministerial accountability for trading activities was ill-suited to the realities of commercial life, and that business decisions needed to be delegated to those with the requisite expertise. This distancing of Ministers from detailed 'hands on' decision making was later translated into the devolution of specific decisions on research funding away from core departmental and Ministerial control.

The State Sector Act 1988 removed centralised control from the public service, devolved authority and accountability to managers, and placed the public and private sectors on a similar footing. This led to the contracting out to the private sector of the

provision of many outputs and services formerly supplied by the public sector. In the context of the science reforms, this came to be reflected in science funding that was formerly appropriated directly to departments being made contestable by the private sector as well as by universities and new Crown Research Institutes (CRIs).

The Public Finance Act 1989 gave financial expression to the philosophies reflected in the State Sector Act. It acknowledged that Ministerial accountability itself was insufficient to fulfil the performance expectations, and it established a more arms-length relationship that allowed Ministers to contract their departments for the delivery of specific outputs and deliverables, without themselves retaining Ministerial accountability for the specific actions and decisions of those departments. A key to public sector reform has been the move away from the funding of inputs (such as salaries and equipment), and monitoring the efficiency of public expenditure, to a focus on outputs. (Outputs are defined as the end results, or deliverables. They may include policy advice, the output of knowledge creation from research, or they may be the number of surgical operations performed by a hospital. The Government therefore contracts providers to deliver the outputs it wishes to purchase. The Government is accountable to the electorate for *outcomes*, that is, for the end effects of the outputs it buys, such as the economic growth resulting from the embodiment of research in new products or processes, or the enhancement of environmental quality resulting from environmental research).

Application of the Reform Framework to the Science System

Against the backdrop of the public-sector restructuring, the philosophical framework for New Zealand's science reforms was grounded in orthodox economic theory, public choice, institutional and transaction cost economics. An important goal of the reforms was to use market disciplines to allocate resources and improve institutional and management performance.

In 1988, a searching review of the science system by the Science and Technology Advisory Committee (STAC) recommended:[4]

- the structural separation of the functions of science policy advice, funding allocation and the undertaking of research;
- contestability for research funding that was formerly monopolised by Government departments; and
- the development of national science priorities based on widespread consultation.

The science reforms were therefore designed to achieve performance gains in the research system through contestable funding, and by opening up of Government science funds to the universities and the private sector. The reforms also sought to resolve duplications and overlaps between research agencies, and to concentrate resources and effort by centralising funding allocation in one agency. The device of contract, whether between the Minister and the purchaser, or between the purchaser and the provider, is a key to the system's operation.[5]

The philosophy was that science should be purpose-driven, done in the interests of the community and not be captured by Government departments, or indeed by the scientists themselves. Underlying the reforms was a focus on delivering outputs and outcomes, on the real and tangible contributions of the science sector to industry and the community, rather than a focus on inputs.

The continuing policy framework arising from the science reforms has been characterised by Simpson and Craig[6] as consolidating a 'shift ... from a somewhat diluted expression of the traditional model of inquiry towards a more holistic approach to

innovation'. The following sections describe the roles played by the policy, purchase and provider parties in implementing an holistic system supporting innovation.

The Implementation of the Science Reforms

The implementation of the science reforms began in 1989 with the structural separation of the policy advisory and funding allocation roles. This was achieved by the establishment of:

- a Ministry of Research, Science and Technology (MoRST) to provide policy advice and to establish priority-setting mechanisms; and
- a Foundation for Research, Science and Technology to fund scientific research on a contestable basis, and to act as an alternative source of science policy advice.

The drive to separate policy from operations was a response to concerns in agency theory and institutional economics about the capture of policy making by either the science providers or the funders. The policy and purchasing functions were also separated from the provider function, mainly fulfilled at that time by the government departments. In 1991, further reform led to the dismantling of the departments and the establishment of new CRIs to undertake 'public good' research.

Structural reform was complemented by process reform.[7] A basis for strategically selective allocation of resources was provided from 1992 onwards by a Statement of Science Priorities promulgated by the Government after broad consultation and debate. The Statement of Science Priorities operates over a 5-year time frame and requires detailed 'Research Strategies' to guide the Foundation's purchasing decisions within these priorities.

The Policy Advisory Function

A key aim was improving the strategic focus and direction of the public research effort, by establishing a policy advisory Ministry and charging it with the development of a science priority setting process.

The Ministry of Research, Science and Technology's main task is the development of national science priorities and the provision of executive services to the Minister of Research, Science and Technology. It acts as an advocate for science in Government channels and as such needs to be a core part of the 'machinery of Government'.

The Foundation has a policy advisory role that complements that of MoRST and means that policy advice to the Minister is contestable in a manner analogous to the contestability of funding for research. The Foundation's policy advisory role is strongly influenced by the views of industry and science user groups.

The Purchasing Function

The Foundation is set up under its own Act as an independent 'purchaser' of science outputs through a contestable process, in contrast to the previous (and elsewhere still common) practice of funding of input through bloc grants to institutions.[8] Its Board is appointed by a Minister and its funding decisions are required to be in accord with broad strategic guidelines issued by the Minister. However, the independence of its specific funding decisions and of its policy advice is safeguarded in its legislation.

From 1990, funding that formerly had been appropriated directly to science departments was progressively transferred to the Foundation to make up the *Public Good Science*

Fund (PGSF). The PGSF is the Foundation's major purchasing instrument and invests about $280 million in research each year. Other funding mechanisms include the $10 million per year *Technology for Business Growth* (TBG) Scheme that fosters cooperative research between research institutes and companies. The Foundation also operates a number of Fellowship schemes.

The Foundation's purchasing system has the scope to be inherently more conservative than some other national funding systems. This is partly because of the distinction the Foundation makes between competition and contestability. While a purely competitive model could see research funding shift among providers each time it becomes available, contestability acknowledges the need of researchers for funding stability as part of a longer term provider/purchaser relationship. That need is amplified in a small system. Contestability means that a new entrant to the market must be significantly better than the established science provider to displace the incumbent from the market, and improves the performance of research organisations as much by the *threat* as the *actuality* of competition: contestability disciplines before it attacks. The contestable rather than purely competitive model is a response to the almost total reliance of science providers, at least in the initial period of establishing the new science system, on Foundation funding, and reflects concern for the protection of core scientific and technological competencies and skill bases, and for the financial and organisational stability of the new science provider organisations.

Much of the Foundation's approach is designed to create a market discipline for research and catalyse productive relationships between science providers and industry and other users, minimising third party intervention where possible. For example, the Foundation's Research Strategies set out strategic directions for particular areas and seek to achieve them by fostering interactive relationships and learning processes between the science providers and users. The Foundation does not itself set detailed strategic objectives, but rather creates an environment in which providers and users can respond flexibly to the uncertainty and the dynamic change that is inherent in strategic R&D.

The Science Provider Function

After the election of the National Government in 1990, it was determined that the departmental structure was inconsistent with the philosophy of contestability and of the science reforms. Departments such as DSIR lacked commercial powers and structures, and were subject to a day-to-day political control that was inappropriate for research agencies that had to contest for funding. Legal, institutional and cultural barriers were also hampering partnerships between public sector scientists and industry.

The DSIR was disestablished and, together with parts of the Ministry of Agriculture and Fisheries, the Ministry of Forestry and the Meteorological Service were restructured as corporate entities called CRIs.[7] The CRIs were established on 1 July 1992 by Act of Parliament as State Owned Enterprises, with the same commercial powers and structures as companies. While the Foundation represents the Crown's interests as *a purchaser* of science outputs that will create wider public benefits, the ownership interest in CRIs is safeguarded by the shareholding Ministers whose concern is their financial viability and competencies, but who play no part in research funding decisions.

The CRIs have considerable autonomy. While the Foundation as the Government's purchasing agent is the major customer, CRIs are expected to develop relationships with industry clients, to build a strong commercial earning base, and to actively participate in technology transfer. They are expected to operate as profitable commercial businesses and to maintain their capital base and infrastructure without requiring on-going capital

injections by Government. The CRIs pay tax and Ministers can require dividends from them although, in practice, profits earned so far have all been channelled back into research programmes and the science infrastructure.

The CRIs are vertically integrated and undertake basic, strategic and applied research in areas of strategic importance for New Zealand. They are aligned with broad industry sectors such as forestry, horticulture and manufacturing, so they are better able to develop links with the users of their research. They have broad science bases but are structured to avoid major overlap with other CRIs. The Boards are appointed by the shareholding Ministers, and include strong industry and science user representation.

The strategic, public-good goals of the CRIs are paramount, a situation that protects them from undue emphasis on short-term commercial pressures that might otherwise occur in profit-oriented companies. The profit objective is a condition of staying in business and maintaining long-term viability, rather than the end-purpose of the CRIs, so that the management focus must be on the contribution of CRIs to their industry or user sector, rather than the commercial returns that can be captured. The responses of CRI management to this mix of public good/private good imperatives has been diverse,[9] with different implications for their ultimate performance and innovativeness.

Where there is conflict between the public good and commercial objectives of CRIs, the shareholding Ministers can resolve them by exercising their ownership interest, or the Foundation as purchaser can negotiate specific objectives in CRI contract. For example, a number of important science assets such as unique taxonomic collections have been covenanted by the Crown as owner of CRIs, or provided with 'ring-fenced' funding by the Foundation.

At present, about 25–30% of the earnings of the nine CRIs are from sources other than the Foundation.

Of the remaining 70–75%, about 90% is from the PGSF, and 10% is allocated directly as Non-Specific Output Funding (NSOF), providing discretionary funding to support promising new lines of research or to maintain core competencies. NSOF is not subject to the Government's Statement of Science Priorities. Over time, CRIs are expected to further diversify their income sources, especially through increased commercial earnings.

Contestable Funding and other Research Providers

Other research providers in New Zealand are not as reliant as CRIs on contestable PGSF funding. Some Research Associations still have access to industry levies, while universities continue to receive funding through Vote: Education, as well as having full access to the PGSF. It is likely over time that universities will undertake a rising share of New Zealand's total 'public good' research. However, because of financial constraints on Vote: Education relative to the foreshadowed increase in Vote: Research, Science & Technology, any significant increase in university research output can come only from the PGSF, and therefore will be driven by science priorities and socio-economic needs.

Costing and Pricing of Research

The Foundation funds research programmes that are fully priced, in order to ensure that providers like the CRIs are viable in the long-term and that the system is in a position to recapitalise itself and provide new infrastructure, equipment, etc.

The full funding of research outputs is designed to meet the long term, sustainable needs of science, while allowing the research agencies themselves to make more detailed decisions about the purchase of inputs. For example, the Foundation does not directly

fund major equipment items, but does so indirectly by funding the depreciation costs of capital items, equipment, buildings, etc. Likewise, the Foundation avoids interfering in the management of CRIs, or in their decisions on infrastructure, staffing or international collaborations. These are seen as inputs that are the responsibility of the science providers rather than the purchaser.

Bids to the Foundation are, in fact, priced rather than costed, since margins may be added by providers for retention and reinvestment in science infrastructure or new research and technological initiatives. A practice is progressively being instituted whereby the extent of the margin is broadly negotiated between individual providers and the Foundation. The full-funding approach applies to the universities as well as the CRIs, to avoid cross-subsidisation by Vote: Education. Full funding is necessary for competitive neutrality among the universities, CRIs and other providers and, above all, to ensure that university research infrastructure can be sustained and centres of research excellence can eventually emerge.

However, the universities are still some way from developing the financial skills to fully manage the new funding environment.

Notwithstanding the development of negotiated agreement between the provider and the purchaser on pricing, there remain problems where the pricing of research applications is opaque and difficult to audit. This has particular relevance where the dominance of a CRI in providing research in particular areas can lead to concerns about monopoly pricing. The challenge remains to develop a pricing policy that ensures the Foundation is maximising the outputs it can purchase, while still sustaining and enhancing capabilities over time.

Buying research outputs implies a complete focus on the delivery of a scientific output or result. In practice, however, the Foundation also assesses the effect of its decisions on some of the system's inputs where, for example, core competencies or the maintenance of key databases, collections and science assets could be placed at risk. The Public Good Science Fund pricing policy is likely to be substantially amended as a result of the move the Foundation is making away from the purchasing of *outputs* at the programme level, to the purchasing of larger portfolios of inter-related research programmes that focus on contributing to *outcomes* (see below).

Intellectual Property

An important consideration in the science reforms was locating decisions at the right level in the system.

The Foundation recognised that intellectual property was best managed by those with intimate knowledge of its content and with incentives to succeed. Therefore, intellectual property created through the PGSF is vested in the research providers, to reinforce the incentive to actively create property rights over research results of commercial potential.

Without rights over the intellectual property, science providers lack incentive to bear the costs of protecting the property and generating returns from it. Moreover, the science providers are closer to industry than centralised agencies such as the Foundation and are in contact with opportunities to commercialise their innovations. Research providers are monitored to determine if intellectual property is being transferred to users and exploited.

In adopting this approach, the Foundation resisted alternatives that would have vested ownership of intellectual property in it. The Foundation considers it has neither

the special competence nor the imperative to manage intellectual property successfully. Nonetheless, this approach inevitably creates tensions with Foundation's obligations to purchase public good outputs. However, some degree of exclusivity is needed to give both science providers and industry the incentive to bear the development, upscaling and other costs needed to turn research results into embodied technology and commercial outcomes. The prospect of broader benefit to New Zealand through utilisation of research results to generate economic, environmental and social returns justifies the approach.

Science Priority Setting

New Zealand is unusual in setting long-term science priorities for the great bulk of its public research funding, rather than using priority-setting techniques only to influence funding on the margin.

The development of science priorities in New Zealand has been based on the principles of widespread consultation, credible technical input, political commitment at the highest levels of Government, and the ability to give effect to the science priorities through the Foundation (e.g., STEP).[10]

Science priority-setting on a truly comprehensive, national basis is feasible because New Zealand is a small country and because the bulk of public science funds are concentrated in one agency. A key benefit making the 'policy-purchaser' split, establishing the Foundation and concentrating public funding in one agency, has therefore been the ability to develop an overview of science and to set priorities for it.

Science Output Classes

The first step in developing a science priorities process was the categorisation of research into 'Output classes'. These Output classes are not disciplinary-based but, rather, are statements of the purpose or end-use of the research. For example, five of the present 17 Output classes are Forestry, Society and Culture, Dairy Production and Processing, Manufacturing, and Land and Freshwater Ecosystems. These outputs classes are vertically integrated, encompassing basic, strategic and applied research, and are typically aligned with identifiable industry groups or user sectors.

Science Priority Statements

Statements of Science Priorities for the PGSF are developed on a 5-yearly basis. The Statements are approved by Government and set funding targets to reach in 5 years (e.g., STEP).[10] The Statements so far have had bi-partisan support from both major political parties, ensuring that the time-frame and planning horizon for science can exceed that of the political system.

The Science Priorities Statement gives effect to shifting priorities between sectors simply by increasing funding for particular Output classes at the expense of others. The Foundation is instructed to implement these funding shifts over a 5-year period.

Science priorities are developed on a consultative basis to allow the users of research to have input into its direction, to encourage the uptake and application of results, and where possible to leverage increased private sector investment in R&D. Priorities Statements have linked public research funding with the willingness of industry sectors to mobilise their own R&D. This particular direction is not primarily concerned with

increasing industry R&D for its own sake, but rather reflects the view that investment and participation by industry in R&D raises skill levels and receptivity to new technology within an industry or an enterprise, and thereby enhances its ability to adopt and commercialise science.

The Science Priorities Statement therefore aims to foster partnerships between science providers and science users. Partnerships will increasingly include Regional Councils responsible for environmental and natural resource management and social policy-related departments, as well as industry groups.

Research Strategies

After priorities are agreed to at the Output class level, the Foundation is then required to develop 5-year Research Strategies for each of the Output classes. Rather than be a passive funding allocator within the framework of the Government's policy and priorities, the Foundation is expected to adopt a more strategic approach to its purchasing decisions. Its criteria therefore reflect not only scientific excellence and merit but the 'strategic fit' between the research, the opportunities in industry and the outcomes desired by Government.

The Research Strategies set out the agreed roles of the various stakeholders aligned with each Output class, including other research funders, and the main science providers. They also include a broad indication of the main research topics, a 5-year funding profile for each topic, and requirements for partnership between the research providers and industry or other user groups.

The Research Strategy in any given Output class therefore creates the link between the Government's longer term strategic directions, the bidding strategies of science providers, and the Foundation's funding allocation process. By setting out areas of research emphasis on a topic-by-topic basis, the Strategy foreshadows the preferred balance in the research portfolio, highlighting opportunities for complementary investments in R&D by user groups, as well as opportunities for research providers to the particular Output class. The 5-year horizon on which the Strategies operate allows the Foundation to take a longer term view of research and to fund programmes for multiple years, increasing stability and reducing the overheads of both the Foundation and the research provider.

However, the Strategies do *not* prescribe specific or detailed requirements at the disciplinary or programme level. Rather, they elucidate the goals, leaving the researchers to choose the disciplines, approaches and scientific paradigms through which they can be fulfilled.

Priority setting and Research Strategy development of this magnitude and comprehensiveness has not been attempted before in New Zealand and apparently not elsewhere in the world on a national scale. Priority setting in other countries has been within single organisations, in particular fields of science, or applied only to a small proportion of the funding available. The translation of the Science Priorities Statement into Research Strategies has involved very wide consultation with stakeholder groups and, in concert with the science reforms more generally, helped raise the profile of science in New Zealand.

Through a planned progression, science priority setting and Research Strategy development in future will be linked to strategies developed by other user groups, such as major industrial, environmental and social stakeholders. Research Strategies will be explicitly linked to the strategies of these stakeholders and will tailor PGSF research in a differentiated way to the appropriate sources and forms of technological learning of

these stakeholders. Science priority-setting and Research Strategy development will in future focus far more on contributing to or delivering end outcomes (such as international competitiveness or protecting environmental quality) rather than be concerned with outputs (such as science publications).

Developing An Overarching Framework For Research, Science And Technology

In 1996, the Government committed itself to an overarching strategy for public investment in science called RS&T: 2010: The Government's Strategy for Research, Science and Technology in New Zealand to the year 2010.[11] This document restated a goal of increasing public research investment from 0.6% to 0.8% of GDP, confirmed public ownership of Crown Research Institutes, and set three main goals for science:

(1) Fostering societal values and attitudes that recognise science and technology as critical to future prosperity.
(2) Ensuring an adequate level of investment in science as a component of national life which has cultural value in its own right.
(3) Maximising the direct contribution of science and technology to diverse social, economic and environmental goals.

RS&T 2010 also helped provide a strategic context for the development of a 'science envelope' mechanism to co-ordinate research funding across the public sector as a whole. The science envelope process effectively allocates funds to research that traverses cross-departmental boundaries; for example, where there are common research interests for both the Ministries of Education and of Labour. It also allows a higher-level appraisal of the overall strategic science needs of New Zealand rather than addressing these needs at the level of individual departments and their Government Budget appropriations.

Technological Learning and Knowledge Application

Notwithstanding its emphasis on strategic choice and linkages between research users and providers, the New Zealand system still is heavily weighted towards funding the production of research outputs by publicly owned providers, with relatively modest resources devoted directly to the transfer uptake and utilisation of those outputs. This in part reflects the difficulty in designing effective programmes to achieve such ends, because of the very heterogeneous needs and behaviours of service users.[12]

Since the sources of science and technology differ enormously among user groups, public investment in research must be differentiated and tailored to the forms of technological learning and knowledge application most likely to lead to outcomes. The Foundation has therefore initiated a major project to develop and apply an economy and society-wide taxonomy of technological learning and knowledge application in New Zealand.

This taxonomy of technological learning will be completed in late 1997 and will help pitch the purchasing system to the form of technological learning most likely to give rise to outcomes. This taxonomy will also form the basis for extending New Zealand's technology policy portfolio to match firms to the appropriate source and form of technological learning and knowledge application. This will also emphasise better access by firms to overseas sources of technology, in recognition of the benefits small, open economies can gain from the international technology base.[13]

Next Steps: Outcome Purchasing and Evaluation

A move from output purchasing to the purchasing of research that contributes to outcomes will involve fundamental changes in the Foundation's purchasing system. The *ex ante* purchasing system will depend on an in-depth understanding of the characteristics, major trends and dynamics of stakeholder groups. At the more detailed purchasing level the Foundation needs to be able to recognise research portfolios and adopt purchasing modes that are consistent with outcome delivery. This may involve *ex ante* economic assessment, detailed appraisal of industry trends aligned with proposed portfolios, and ensuring that research purchased is of a nature and has a delivery mode that aligns to appropriate sources of technological learning for stakeholder groups.

The Foundation is also placing much more emphasis on the contribution research makes outcomes through the creation of human capital, of non-rival technologies, and of technical platforms that form a basis for future innovation. Much of this policy thinking within the Foundation has its roots in new growth theory perspectives on the economics of human capital and of economic growth.[14,15,16,17a,b,18]

A major pilot project in *ex post* outcome evaluation has now been completed[19] and this will be used as a basis for the development of an outcome evaluation system for the entire PGSF. This will measure the wider and more cumulative benefits of R&D, including its contribution to human capital as well as knowledge.

Conclusion

The politics that transformed the New Zealand Science and Innovation system in the last decade have established a system that is unique among OECD countries. Its transformation continues, through increasingly sophisticated attention to definition of outcomes and evaluation of performance at the strategic level. Its commitment to policy innovation will mean that the New Zealand system continues to be worthy of analysis in the next decade.

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