

A more stable funding environment

*A Response to the MoRST 'Sector Engagement Paper'*¹

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Introduction

The Ministry of Research Science and Technology (MoRST) has recently published what they have termed 'a sector engagement paper' called "A More Stable Funding Environment". There are associated background papers including reports from 3 external consultants. These are all available on the MoRST website.

Paraphrasing the current MoRST position it appears that further modifications to the science system are being considered but in the context that "the system is not broken but faces immediate challenges to.....". They have called for comment.

It is tempting to respond encouragingly and enthusiastically, for there is much wrong with the current system. But, it is my view for the reasons set out below, that New Zealand science is caught in a management warp: the philosophies and theories upon which the current science system has been developed create an environment which is the antithesis of that required for an open, healthy, vigorous and productive science sector. The current problems will not be solved by further tinkering with the current system. A new management paradigm is required which is derived from and hence enhances the unique needs and value of science.

A Little History.

The reasons for the science reforms, and hence the establishment of the CRI's are recorded in Hanzard 1992 (CRI Act: 1st, 2nd and 3rd Readings and the Report from the Education and Science Committee) and can be condensed down to the following:

1. Improved efficiency - duplication of research, large bureaucracy, inability to 'retire' old or ineffective staff).
2. Improved accountability - inability to control outcomes using the input lever.
3. Improved flexibility - science was captured by the science providers and the Public Finance Act restricted the mechanisms by which industry could be involved.
4. Improved alignment - better match with government policy and with industry.
5. End of uncertainty and instability in the science sector caused by the 'user-pays' policies of the 1980s.
6. Improved technology transfer - ie better linkage between science and industry.

These reasons are variously expressed in the two government-commissioned working committees (the Beattie Report 1986 and the Arbuckle Report 1988).

It was believed that the best solution to these problems was the establishment of MoRST (the governments policy adviser) and the Foundation of Research Science and Technology (FoRST) (the governments science purchaser),

coupled with the establishment of the CRIs. These reforms saw the application of Public Choice Theory (including Agency and Contract Theory) to the management and delivery of science. These theories brought to science management the concepts of: commerce (including profitability), the purchaser/provider split, contestability and appropriability. (It must be noted however, that the Arbuckle 1988 report suggested that the new CRI's could be either 'for profit' or 'not-for-profit').

There was no objective analysis as to what science was (it was simply assumed that science was just like any other service) and hence what its needs were (in terms of management). Although there was widespread support for the value of science, there was no consideration of the question: what is the optimal organizational model for science, consistent with its needs as a profession, which would, at the same time, overcome the problems that then existed? It was simply assumed that the commercial model was the only solution.

Many parliamentarians expressed reservations about the CRI Act as recorded in Hanzard. The main protagonists were: Hons; Margaret Austin, Steve Maharey, Clive Matthewson, Jim Anderton and Peter Tapsell. These reservations are summarized below:

1. The framework sounds good but will it work - it is not proven!
2. The focus will move from science activity to making money?
3. It will restrict the flow and sharing of information and result in secretive behavior.
4. It will crush innovation and imagination.
5. There will be a conflict between making a profit and public good.
6. It will create competition within and between CRIs.
7. Science is not appropriable and the commercial model is not appropriate.

Some Evidence

These doubts, when viewed in hindsight are prophetic given that there is now considerable evidence showing that the CRI experiment has failed:

- 1 The recent Open Letter via the PSA to the Minister, signed by 600 scientists, outlining their problems and concerns with the reformed science system (<http://www.psa.org.nz/science.asp>)
- 2 The recent surveys of CRI scientists (Sommer and Sommer 1997 and Sommer 2002) showing what the authors concluded as a "stunning level of dissatisfaction" among scientists.
- 3 The recent survey (Koslow 2005) showing that currently 20% of New Zealand best graduates are going overseas and that this is likely to increase to 40%.
- 4 The theoretical and empirical evidence reviewed by Edmeades (2004) showing that the commercial model is inappropriate for science.

¹ This opinion piece was first published in the *New Zealand Science Review*.

Against this weight of evidence, MoRST's current assertion that the system "is not broken" can only be true if the word 'system' means the machinery of the current system and not the people - the scientists - within the machine. This is a woeful conclusion given that by any analysis the true value (non-financial) of any science organization resides in the intelligence, qualifications, training and commitment of the scientific staff.

Some Oddities

Embedded within the MoRST documents are some other interesting assertions. For example, it is claimed that the reforms of the 1990s solved the problems that they were set up to solve. A comparison of the reasons for the reforms, as set out above, encompass all the current problems that MoRST has now identified in the reformed system! In a sense nothing has changed except the scientific workforce is now severely disillusioned.

Reference is also made in the documentation to the effect that the OECD believes that New Zealand science system "appears to be well designed". It is relevant to note that New Zealand is not even mentioned in the very comprehensive OECD report, 'Governance of Public Research' (2003). One would have thought that if the OECD really believed that New Zealand had found the 'holy grail' of science management it would have appeared in this document, focused as it was on the issues surrounding the management of science. The qualification, 'appears', begs the question: from what distance and perspective does it appear?

A Way Forward?

Given the above, there seems little point arguing the detail in the current set of documents from MoRST for two reasons. First, they appear to be predicated on the basis: given the current system what is the least that can be done to solve the current crop of problems. This, in my view, while tempting, will simply lead to the exposure of a further set of problems in the future, as is evidenced by the never-ending tinkering of the current system since its inception. Second, most of the rationalization presented in these documents assumes that science is like all other kinds of human endeavor and therefore Public Choice Theory, with all of its ramifications is, or should be, the primary basis upon which to rationalize science management. This indicates a lack of understanding of science, its values, and its operation.

Science Is Different

Science is different from all other forms of human activity including all other professions, with the possible exception of health and education. However, at one level, health and education are also different from science in that their benefits are more obvious and more tangible in time.

This difference arises because the results (the outputs) of science cannot be predicted in advance and the impacts of science (the outcomes) can only be known in retrospect. In all other professions including law, accounting, engineering,

teaching and health, the task comes to an end or an end point can be defined.

Furthermore, all the other professions owe their ongoing existence to the law of the land. They are required because there are rules and laws requiring their input. (Health is slightly different in this respect, but in any case, the compulsion for health professionals is obvious and motivated by the Hippocratic Oath).

Thus, science is the only profession which is a) truly voluntary at a national level and b) its outputs and outcomes cannot be predicted. There should be little surprise that finding solutions to the management of science, including the allocation and distribution science funds, is fraught with difficulty. This is especially so when it is approached with management theories and solutions developed for other sectors.

As noted earlier, New Zealand's science reforms applied to science, management theories (Public Choice, Contract and Agency theory) that had been developed for commercial activities - activities for which there were definable and measurable inputs and outputs and whose goods and services were tangible (ie products). Such organizations can be accountable in a strictly financial sense (see Edmeades 2004).

Limits of Modern Management Theory

These theories do not apply to normative activities (eg Health, Education and Science) - activities based on values not embedded in money, whose services are largely intangible and hence impossible to account for in the sense that that inputs and outputs can be measured in dollar terms (see Edmeades 2004). New Zealand's failed attempts to commercialize health and education, and current failures of the science sector, are evidence of the truth of this proposition.

In this context it is relevant to note that in the current set of MoRST documents the terms 'public good', 'social return on investment' and 'relational contracts' (ie contracts that recognize public good and the need to maintain the skill base) are all attempts to modify the original theories to accommodate science and still maintain the notion that 'the system is not broken'.

It was also hoped, as part of the science reforms, that the solution to the problem of the allocation of science funds, and with it the problem of 'allocative efficiency' (ie overheads) would be solved by applying 'market forces' - the market alone would select what science was required into the future. From these ideas came the concept of a contestable science fund. However, the theory of contestability does not apply to science for several reasons. First, as discussed above, the outcome of a piece of science cannot be predicted and hence the market cannot assess a priori its commercial risk. Further, scientists cannot move from one discipline to another, an essential requirement for a service provider in an efficient contestable system. Finally, the market does not know what science is capable of - the scientist has more insight, knowledge and information about what science is capable of, than the purchaser.

It is reasonable to argue that all of the above problems have contributed to the trend, since the reforms commenced, from long-term funding to short term funding, and to increasing transaction costs.

Appropriability?

Another concept came to science with the reforms - the notion of appropriability: who should fund a piece of research, the private sector or the government? The answer depends on the timeframe. All science is appropriable given sufficient time (eg consider the pioneering science of the last century by Maxwell (electricity and magnetism), Rutherford (splitting the atom) Einstein (relativity) or more locally (McMeekan in agriculture) to use but a very few examples. Given the obvious truth in this assertion, Public Choice theory would say that no science should be funded by the government! This does not happen of course, because the time-frames of private investors are much too short, and the financial risks far too high.

Thus the question is not: is this piece of science appropriable, but rather, when does it become appropriable. The reasonable answer is that the 'market' will intervene only when it assesses that the commercial risk is reasonable to them. In some cases this is never, because the development of a new science, and hence technology, could undermine the commercial viability of an established industry. This distinction (when is science appropriable) cannot be readily determined by the research funder (in New Zealand's case FoRST). Also, science is iterative and builds on many prior results while rejecting others. It cannot be predicted which pieces will ultimately become useful and which will lead to 'dead ends'. Therefore, it is extremely difficult to pick in advance only those bits of science which will prove useful. This is exactly what FoRST is attempting to do, and because of the difficulties, a likely reason for the high transaction costs in the current science system.

Notwithstanding the above, there is a further problem. Allocative decisions are made on the basis of the likely outcome (indefinable?) and how this aligns with science policy. The longer-term existence and importance of the scientist, or group of scientists offering the proposal, is not considered. This results in instability within the science community, and what MoRST refers to as, 'unintended loss of capability'.

Contestability

Science funding has always been, and will always be, limited. For this reason there has always been competition for R & D dollars. This form of competition is in the nature of science, as distinct from the current contrived system of competition (ie the contestible fund). In the old public service regime this contestability was mainly centered on a contest of ideas - who has got the best ideas for New Zealand that are worthy of funding? Often such decisions were made with the involvement of relevant industries and with an eye on maintaining and developing the skill base (Relationship contracting?). Thus, the issue is not about contestability or otherwise; it should be: at what level should this contest

occur (viz FoRST, Output classes within FoRST, CRI Boards or sublevels within the CRI).

The answer to this question should be: at the level which has the best information to make the decision. This does not mean that the scientists should be left to decide. The optimal outcome in many cases will draw upon many inputs (scientist, science managers government and industry).

These decisions regarding allocation would best be made with the following boundary conditions:

1. There is clear government policy and objective at the problem level. What are the problems that the government sees which it wants science to examine?
2. Allocation decisions should be made consistent with government policy
3. This process should be robust and should not be captured by any one party.
4. The society and industry should properly be involved where appropriate
5. The process should occur at an organizational level which minimizes the transactions costs?
6. It should be collaborative across CRIs where similar skill sets exist to ensure no duplication.
7. Decisions should encompass the need to maintain capability.
8. The planning horizon should be long-term.

A Matter of Trust?

Virtually all discussions and discussion documents on the history and future of New Zealand science in the last 20 years emphasize its importance. The current context national context is the desire to build a knowledge economy. Everyone agrees that science is important. But?

It is implicit in Public Choice Theory, and its various manifestations, that there is no trust between the funder and provider - why else is a contract required? Contracts of this nature are important in commercial activity, accepting that the inputs and outputs can be defined and measured. But these conditions (measurable input and outputs) do not apply to science and hence such contracts are largely offensive and demeaning to science and scientist. They feel untrustworthy. Related to this is the view among modern science bureaucracy that scientists, if left to their own devices, will simply squander resources on their own personal interests and pursuits. For this reason they argue a system must be devised to 'force' scientists to work for the good of the economy. Scientists are intelligent - that is one reason they are scientists - and most, sensing the charade they see, feel undervalued in the current system.

Ironically, the history of science is full of examples of people who devoted their lives to science with little, and often no, financial reward. Most modern scientists know that a career in science is not a path to financial wealth and most are more than happy with that compromise, given the non-tangible, but very deep and personal, satisfaction that comes from the pursuit of truth through knowledge. This is the tradition of science and it is this tradition which is demeaned and dishonored by the current commercial science model and environment. I suggest that this is the

primary reason why 75% of the current CRI scientists would not recommend a science career to the next generation, and why 20% of current science graduates choose to take their skills overseas.

Conclusions

In the scientific tradition, what conclusions are allowable from the evidence?

There is evidence both empirical and theoretical showing that the science system is malfunctioning. It is predictable that the current problems will not be resolved by further tinkering with the current system. A new science management model is required, built on evidence-based and objective analysis of the needs of science and the needs and goals of New Zealand. Some solutions have been suggested (see for example Edmeades 2004) but further development of these ideas waits further evidence-based policy development.

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education news

School of Forestry, University of Canterbury

The year ended has marked another changing year for forestry education in New Zealand. The decision to cease undergraduate forestry education at Lincoln is a significant concern which has reduced the breadth of education available for students within New Zealand. It emphasises the importance of the continuing providers of forestry education for the sector.

The school has undergone a substantial change in leadership. Late in 2006 Professor Roger Sands stood down as Head of School, a position that he has held since arriving in New Zealand in 1994. It also marks 24 years for Roger as a head of a Forestry School. Professor Sands has had a substantial impact upon forestry education and the broader New Zealand in his time here, something the school hopes to mark in mid-2006. Associate Professor Bruce Manley is now Head of the Forestry School. Bruce has been at the school since 1999 and is looking forward to the challenge of being head.

Associate Professor Rob Douglas has resigned and returned to Canada. In the interim the Dean of Engineering and the Forestry Board of Studies chair are looking after the management of the forest engineering programme. The school has been given permission to seek a replacement for Rob and is in the process of advertising for a suitably qualified Forest Engineer. The programme itself is very important as it is a critical area for the industry and is also a strong link for the school with the engineering departments.

Fire has been very much under focus in recent months with the heavy fire season in Australia. The school now belongs to the Bushfire CRC (research centre) based in Australia. This has been achieved through support by a variety of people and entities including Murray Dudfield, NZRFA, and colleagues based at the Ilam office of Ensis. One honours dissertation has been completed to date by Martin Bayley. The dissertation focused on national and

provincial fire severity ratings, provincial fire occurrence, areas burnt, and suppression costs. We are looking to grow our research and teaching involvement in this area.

First year enrolments are trending upwards although new undergraduate enrolments are predominantly being made by older or overseas students. It remains a challenge to attract young people from school into the degree. Associate Professor David Norton has taken over the management of postgraduate students at the school, and numbers are again climbing, although again the interest is primarily from overseas students. The school is working through the process of introducing a one-year professional masters degree. The degree would mirror similar qualifications on offer in North America in that it would be paper based combined with a small research report that would be industry focused. We would be delighted to receive any thoughts on such an offering.

Dr Martin Ritchie (pictured), a modeller from the US Forest Service, is working at the School with Associate Professor Euan Mason for three months, applying



techniques Euan has developed for incorporating radiation and climate-modified radiation use estimates directly into growth and yield equations. This kind of modelling may provide a solution for managers who wish to make growth projections in stands that have experienced climate change, and has already provided better fits to PSP datasets in New Zealand when compared to traditional modelling methods.

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