



New Directions in New Zealand Science

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Introduction

Although this paper deals broadly with New Directions in New Zealand Science, I hope that it will also provide useful background for looking more specifically at the future direction of forest industry research.

One of the fascinating attributes of science and technology and of research is its inherent unpredictability. In the end it is science itself which determines its own directions; both in response to the needs of society, and in response to the process of science discovery and technological innovation.

In which case why is the title of this paper as it is?

The answer lies in the reality that in most respects research and other elements of science and technology activity are like all other forms of human activity. That activity inevitably takes place within a framework which is created by society, and more specifically in modern times by Governments. While these frameworks are essentially unproductive in themselves, they can and do have a huge influence, both positive and negative, on the activity itself.

This paper describes the new framework which has been created for research, science and technology in New Zealand. The key elements of the framework are set out, including some material on the role of the Ministry of Research, Science and Technology. The paper especially outlines the funding regime which will apply in the future.

Finally the paper describes what the new framework will mean for science in New Zealand. In doing so, it deals with some common misconceptions on how the new science regime will operate.

General Aspects of the Science Reforms

The science reforms being implemented by the Government represent the most dramatic structural changes in research, science and technology for many a year. The overall intent is to bring research, science and technology out into the market place – to give science a new

focus on what it can achieve, a new focus on demonstrating the contribution of science and technology to the welfare and prosperity of New Zealand.

The new science regime has the following key elements:

- A focus on **outputs** rather than **inputs**: in other words an emphasis on what science can produce rather than on how much resource it needs.
- A focus on **contestability** in funding: in other words providing a better stimulus for finding and encouraging the best research and the best science and technology, rather than simply funding institutions.
- A focus on **partnership** between the private and public sectors; a better recognition that we will get the best science and technology result if the two sectors work together and if their efforts are complementary.
- An important aspect of this partnership is that the contestable funding for science will be open to researchers from the private sector as well as the public sector.
- The part of the pool that will be open to all comers will be about \$55 million in 1990/91 and that amount will grow in future years.
- Perhaps most important of all, a focus on creating a more **co-ordinated and cohesive** research, science and technology policy; the ability to take a broad view of New Zealand's needs, above the level of the interests of any one science agency.

Changes in Science Structures

a. Functions

At the heart of the new structure is the separation of the Government's involvement in research, science and technology into three functions. Those functions are policy, funding and science operations.

In the past these functions have been mixed together and this has led to confusion of roles.

The separation between policy and funding on the one hand and science operations on the other is particularly important in clarifying roles. New agencies have been created to deal with the policy and funding functions. In the future it will thus much more clearly be the business of the existing science departments (like MAF, MOF and

DSIR) to concentrate on doing science, i.e. on producing research.

b. Participants

The new regime will nevertheless provide opportunities to a variety of organisations, community and professional groups to contribute to research, science and technology in New Zealand.

All of these organisations and groups will have a role to play, and the new structure is designed to make that possible. Those organisations and groups include especially:

- Science users; those who are in the business of turning research results into tangible benefits.
- Science providers; those who are in the business of producing science outputs, i.e. in research and development.
- Scientists and technologists themselves; those people at the science 'work face'.
- The community at large, the ultimate beneficiaries of productive research.

The diversity of groups and organisations involved emphasises that the science and technology sector exists not for its own sake, but for the benefits of its interaction with the rest of society.

C. Organisational framework

There are two important flows of activity in the structure:

- the flow of policy advice to the Government so that policy can be decided;
- the flow of funds to the science providers; the organisations and the people who actually do the work in science, and are for that reason the most important part of the whole structure.

However the aspect that makes the new structure work, and that makes it so different from the previous structure, is the creation of two new organisations.

The first of these is the Ministry of Research, Science and Technology. The primary responsibility of the Ministry is for the policy framework.

The second new organisation is the Foundation for Research, Science and Technology. The primary responsibility of the Foundation is for the detailed work of allocating science funding. The Foundation is an independent agency which will very shortly have its own Act of Parliament.

There has been some confusion about the respective roles of the Ministry and the Foundation in the new regime but it

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is clear that the primary role of the Foundation is to allocate science funding, i.e. to purchase science and technology outputs on behalf of the Government. The primary role of the Ministry, on the other hand, is to develop and advise on policy.

It is nevertheless important to stress that the Ministry and the Foundation have complementary functions. They will therefore have to work closely together for the new regime to work properly.

The Role of the Ministry of Research, Science and Technology

The success of the new regime is very much tied to the success of the new Ministry, because of the Ministry's co-ordinating function.

The particular contribution of the Ministry of Research, Science and Technology is to provide the essential cohesion that research, science and technology has lacked in the past. The Ministry will be uniquely placed to do this for some very simple but important reasons.

They are:

- The Ministry will have a specific mandate for the co-ordination of policy and will be staffed for that exact purpose.
- The Ministry will have no operating responsibilities, i.e. it will be able to focus entirely on the overall picture with no vested interest in any area of operational activity.
- The Minister will similarly be in a position of impartiality, so he or she will be able to take advice and argue around the Cabinet table from a broad perspective.

The Ministry's formal role of providing policy advice includes:

- National priorities for science and technology activities, and the funding levels appropriate to achieve the outcomes wanted by Government.
- The total level of Government investment in research, science and technology; particularly the level of funding for the foundation.
- Development of Government initiatives aimed at encouraging community and industry involvement in research and innovation.

Other important components of the Ministry's role include:

- The audit and review of research, science and technology effort, so that excellence can be identified and encouraged and opportunities for new research opened up.
- The development of a science data base, so that increasingly we can argue science and technology issues on the basis of fact rather than assumption.

DIAGRAMMATIC REPRESENTATION OF FUNDING REGIME

	TOTAL FUNDING	
	COMMERCIAL & PRECOMMERCIAL	PUBLIC GOOD
METHOD OF DISTRIBUTION	investment by science departments	purchase of outputs by Foundation
FUNDING AVAILABLE TO:	science departments only	all contributors to contestable fund including science departments, RAs; also private sector and individuals
DECISIONS MADE BY:	departmental Ministers in consultation with Ad Hoc Committee	Foundation
ROLE OF MORST	monitor performance after funds allocated	advise on priorities and funding levels before funds allocated

- Responsibility for co-ordinating international science at government-to-government level; to complement and assist agency-to-agency science operational arrangements, not replace them.
- And last but far from least, science and technology promotion and science education. In many respects this is the most critical area of all, particularly in the long term.

In the area of science and technology promotion, efforts to date have been fragmented and, to that extent, ineffective. One of the immediate goals of the Ministry is to see that promotional efforts are pulled together so that we can raise the profile of science and technology throughout the community. If we can do this, then we are well on the way to achieving the shift in attitude to research, science and technology which is an important key to an improved level of research investment.

In science education the needs are just as compelling. If, as a nation, we fail to succeed in raising the level of science and technology education in our young

people, then the long-term effects will be severe. Those effects will be evident in research programmes and in the wider development of a science and technology input to the New Zealand economy.

The Ministry has been structured to provide effective implementation of the roles discussed above. This structure includes provision of top-quality scientific advice across all functions, through the position of Chief Scientist. The creation of this position is a statement of commitment by the Ministry to science itself.

Government Funding of Science

An aspect of the new regime which I suspect will be of intense interest to researchers is the application of Government funding to science and technology programmes.

The discussion above has focused on the infrastructure for funding, i.e. the roles and interactions between the organisations involved. Of equal interest is the funding process itself: the key change is from funding institutions to the funding of outputs.

To this end a contestable pool has been created by combining all of the Crown funding that used to go to institutions. This pool will probably contain somewhere between 250 and 300 million dollars in its first year, 1990/91.

The contestable pool will be allocated by the purchase of science outputs. The purchase process will occur within a broad framework set by the Government. That framework will comprise three elements:

- A set of outcomes desired by the Government.
- A set of national priorities determined by extensive consultation, and intended to link outcomes to science outputs.
- A set of broadly defined science outputs to which the Government will each year allocate global funding levels.

The "bids" put forward by so-called science providers including both public and private sector agencies will have to reflect the criteria flowing out of this framework.

In the medium term this new approach to funding will have several important impacts:

- It will ensure that the overall Crown funded research effort has some strategic coherence. Under the old system of compartmentalised institutional funding this was simply not possible. Each agency worked with its own internal priority system.
- It will provide a co-ordinating mechanism for identifying both gaps and excessive overlaps in the overall programme.
- It will encourage research agencies to understand and focus on their own strengths and weaknesses, rather than spreading their efforts over the entire spectrum of research. After some early experiences I believe there will be good recognition of the common-sense of this approach. The old axiom of "sticking with the knitting" is as true in research as it is in any other business. This in turn will encourage collaboration between organisations, so that complementary skills are brought together and thus amplified. This is indeed happening already.

Within this broad framework and as shown in Figure 1 the Government has decided to make a distinction between:

- purchase of outputs for public good research;
- investment in departmental science providers for commercial research by those agencies.

The two types of funding are quite different, and will be managed in a different way.

The investment funding route is specifically intended to support the Government's ownership of departmental

science agencies. It provides a means of generating financial returns on commercially valuable research. In this sense it is no different from the research and development that might be funded by a company for its own benefit.

The output funding route is in contrast now much more clearly targeted to **public good** research. This is, broadly speaking, research of benefit to New Zealand as a whole but which would not be undertaken without funding from the Government. The funding of public good science outputs will be clearly the responsibility of the Foundation for Research, Science and Technology. The opportunity to bid for this output research will be open to all contributors to the contestable pool and to the private sector. Although this is not the case yet, I hope and expect that the universities will eventually become part of this contestable system.

The new regime is dramatically different from the old, and will place short-term pressure on those science agencies which have traditionally obtained the bulk of their funding from the Crown. These pressures will be exacerbated if the overall level of science funding remains tight, which will very likely be the case. This especially applies to the science departments - DSIR, MAF, MOF and the MET service.

It will also pose some interesting problems for the Foundation, particularly in trying to achieve a **level playing field** for all contestants. There is, for example, no commonality between the financial structures of Government departments, research associations, universities and companies. Those differences will have to be recognised in the bidding and selection process.

However, to ensure reasonable **stability** for the science departments in particular during the transition, special arrangements will apply for the first few years.

The essence of these arrangements is that funds will be transferred progressively to the foundations over several years, rather than in one lump. In the first year the Foundation will handle only 20% of the total contestable pool. The remaining up to 80%, depending on how much is taken out as investment funding, will be handled within a special departmental pool, to which only the science departments will have access. Decisions on the allocation of this departmental funding will be made by Cabinet committee.

At this stage no date has been set for the final transfer of funds from the transitional departmental pool to the Foundation.

For 1990/91 in particular, one-off arrangements will apply, reflecting both lack of time in setting up the arrangements for this year, and especially the lack of an adequate information base.

The keynote of the 1990/91 funding round will thus be flexibility in the interests of stability and continuity.

The outcomes adopted for 1990/91 have not been explicitly placed in any priority order, reflecting the lack of any intensive research and consultation on national priorities.

OUTCOMES

- **Growth in G.D.P.**
- **Employment generation**
- **Improved working and living conditions**
- **Maintenance of the environment**
- **Hazard mitigation**
- **National Security**
- **Overseas Aid**
- **Development of the knowledge base**

I should emphasise that the Ministry will be making good this deficiency over the next year. A substantial programme of consultation is planned, backed up by as much research as we can reasonably support. The intention is to have a full set of national priorities in place before the start of the 1991/92 funding round.

The outputs which will apply in 1990/91 are:

OUTPUTS

- 1 **Plants and management practices for pastures**
- 2 **Plants and management practices for horticulture**
- 3 **Farm animals and production systems**
- 4 **Pest and disease management processes**
- 5 **Technologies for commercial forestry**
- 6 **Technologies for fisheries**
- 7 **Engineering, electronics processes and products**
- 8 **Materials and industrial processes and products**
- 9 **Food processes and products**
- 10 **Primary measurement standards and product testing techniques**
- 11 **Technologies for building and construction**
- 12 **Environmental monitoring and technologies**
- 13 **Land and land-based flora and fauna**
- 14 **Geographical structures and solid earth processes**

- 15 Atmosphere
- 16 Marine and fresh waters, their flora and fauna
- 17 Natural environment of Antarctica
- 18 Fundamental information

These outputs are very much a status quo consolidation of the existing output definitions for the departmental science agencies. A thorough review of the framework is again intended to be completed prior to the start of the 1991/92 funding round.

The funding timetable for the present year is very compressed. Even with simplified procedures, which we indeed have, it will be a considerable achievement to meet the deadlines set.

In future years this timetable will be spread out over several months, to allow time for the adequate assessment of research proposals.

The timetable will also conclude somewhat earlier in future years, so that there is ample time for the formal completion of departmental estimates.

Looking beyond the interim arrangements for 1990/91, the new regime will provide both an opportunity and a challenge for Government science departments and for industry research organisations to demonstrate the quality and relevance of their work. To be eligible for Crown funding, however, that work must be increasingly focused on priority areas. Even in large countries it is no longer possible to cover all science and technology fields, but the problem is so much greater in small countries such as New Zealand.

The detailed choices made will depend in part on the level and quality of existing research but also increasingly on the selection of emerging research areas which show promise. It should again be stressed that even at this early stage in the development of the new funding processes and the need for stability notwithstanding, it will be important to provide a framework which allows Government to make marginal changes in funding to existing programmes. There must be the ability to at least signal moves towards long-term changes in the distribution of funds according to Government's priorities for social and economic outcomes.

Conclusions

In conclusion I would again emphasise that the reforms described in this paper are no more than a framework for enabling things to happen. Science is of course not carried out by structures or Governments. It is carried out by scientists and technologists, and by organisations which have the capabilities to recognise and implement science and technology opportunities. The real challenge

for the future is to actually produce effective research results for the benefit of New Zealand.

In concluding, it is appropriate also to look at one or two misconceptions that have developed in relation to the new science regime. Those misconceptions are particularly, and I suppose understandably, held by working scientists and technologists themselves. I want to correct those misconceptions because, if not corrected, they stand to undermine the gains to be had from the new regime.

Those misconceptions can be summed up in three words:

consultation, stability and balance.

In regard to **consultation**, a concern I have heard expressed is that the new regime disfranchises working scientists, that it provides no avenue for them to impact on the content and direction of science itself.

The reality is that the new regime reduces the focus on the science institutions, the major agencies, and puts more emphasis back on science itself. That in turn will place the onus back on scientists themselves to generate and put forward high-quality and relevant programmes of work.

There will in particular be every opportunity for working scientists and technologists to contribute to the generation of national priorities for science. For example, new emphasis is being placed on the development of relationships with the Royal Society which, however imperfectly, does represent scientists rather than research agencies.

The second major misconception is over **stability**. A concern I have again heard expressed is that a focus on funding outputs rather than institutions will destabilise science, that it will in particular prevent the maintenance of long-term science programmes.

The gist of this concern is, again, in my view, misplaced, although a note of caution has to be sounded.

It is certainly the case that the contestable regime will identify and promote science which is relevant and of high quality. Science which does not meet those criteria will suffer by comparison. However this is surely what all of us want; the best science for the benefit of New Zealand and of science itself.

Beyond this slight caveat there is simply no factual basis for arguing that science will be destabilised by the new arrangements. At the level of determining national priorities, the consultation process itself will be a stabilising influence. Priorities will only be comprehensively reviewed at about three-year intervals. The Ministry of Research, Science and Technology will anyway be advising incremental rather than wholesale changes in both priorities and output funding levels. Moreover the

detailed allocation of funding will in future not be handled at political level, that is by Ministers. It will instead be handled by a legally separate and permanent organisation in the form of the Foundation.

In contrast, a very positive and stabilising element in the new regime is the option, provided by the Public Finance Act, of obtaining multi-year appropriations. The prospect of guaranteed funding at programme level for up to five years is one that has never existed before. Moreover it is a facility that both the Ministry and the Foundation are keen to see used. My own view is that it would be an appropriate use of this facility to have well in excess of half of total funding on a multi-year basis, with a spread within this multi-year "block" between two, three, four and five-year commitments.

The third and final misconception is over **balance** in the total research programme. A concern I have heard expressed is that basic research will be disadvantaged relative to applied research under an output-based regime.

Again nothing could be further from the truth. The reality is that basic research will be explicitly recognised under the new regime, both by the incorporation of an output for fundamental information, and through the incorporation of an element of basic research in all of the other outputs.

Moreover both the Minister and I are of one mind in our determination to see that a proper balance is achieved between basic research on the one hand and applied research and development on the other.

The bottom line of the new regime is that in future it will, far more than in the past, be over to science managers and scientists to manage their own affairs. That is the essence of the new direction for science in New Zealand. Success for both individuals and institutions and for New Zealand will depend on how well this challenge is picked up.