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DEVOLUTION:
A THINK PIECE

A REPORT PREPARED FOR THE
MINISTRY OF SCIENCE, RESEARCH & TECHNOLOGY

BY

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INTRODUCTION

A key policy issue for the Ministry of Research, Science and Technology (MoRST) is creating a more stable funding environment -- reducing the instability caused by the contestable system, and implementing a greater level of devolved funding.

In order to complement and support the policy work which MoRST is undertaking, it has commissioned McKinlay Douglas Ltd (MDL) to prepare an independent "think piece". The terms of reference require that the think piece:

- Tests the problem definition and the assumptions made in the Policy Development Context of this ToR. The evidence is mainly anecdotal, although indications of high transaction costs and disaffection are real enough.

- Provides an independent and impartial analysis of the proposed policy objectives. As it is possible we will devolve a significant amount of Vote RS&T, it is important to ensure we are informed by an external view of the NZ system and the players within it.

- Informs MoRST thinking and provides ideas that may not necessarily arise during a policy process.

- Considers: if the proposed devolution solution is the most effective response; or if we should be considering other options.

- Considers: which research organisations we could devolve investment decisions to; criteria for devolving; which of the current funds could be devolved; at what proportion; and what positive and negative impacts could be expected across the system?

Amongst the requirements for the preparation of the think piece are that it:

- Be and remain confidential.

- Not involve interviews or discussion with third parties.

- Be based primarily on MDL's existing knowledge of the New Zealand science system, supplemented by (primarily Internet-based) research on current trends impacting on science funding systems.

Consistent with the requirements of the terms of reference, we developed this think piece drawing on previous work which we had undertaken for MoRST, and material which we were able to access through the Internet.

The remainder of this report is divided into sections which respectively:

- Test the problem definition. This includes responding to the third item of the ToR, providing ideas that may not necessarily arise during a policy process.

- Provide an analysis of the proposed policy objectives. This includes a consideration of how a more trust based, relational approach to contracting with research institutions might operate.

- Considers if devolution is the most effective response or whether other options should be examined.

- Considers which research organisations investment could be devolved to including criteria, funds, proportion and possible impacts.

THE PROBLEM DEFINITION

The background paper provided to MDL by MoRST, " A Stable Funding Environment", expresses the view that, as science providers have evolved, the current contestable system has lost some of its value. The paper states that "this is particularly true in areas of important strategic and environmental research, where a considerable element of uncertainty and high compliance costs may have resulted in confused roles and the loss of skilled scientists."

A View From The Science Community

There is a considerable volume of comment, some of it seemingly quite robust, from the New Zealand science community which supports the overview in the background paper and indeed goes somewhat further. Amongst the problems identified with the current system are:

- The impact of uncertainty on career development
- The very high transaction costs associated with the the bidding into funding rounds, especially given the number and complexity of the different funding arrangements now in place -- a particular concern is the extent to which senior scientists have been distracted from "doing science" by the need to pursue funding.
- The diversion of resources into what many see as a top-heavy set of policy and administration arrangements including two separate stand-alone agencies, MoRST and the Foundation for Research, Science and Technology (FRST).
- A claimed bias towards short-term research undertaken to generate revenue as opposed to longer term knowledge generating research -- to put it another way too great a shift towards the applied end of the scale.
- A culture of competitive behaviour amongst institutions when the national interest would often be better served by collaborative/cooperative behaviour.

The New Zealand science community has been very active in documenting these concerns, as organisations such as the New Zealand Association of Science see them. Most recently, in May 2005 the Association released "There is a Better Way: Eight Recommendations on the Science System in New Zealand."

That discussion paper, whilst recognising the benefits that had resulted from the reforms of the 1980s and 1990s, was nonetheless highly critical of the current funding system (partly because the Association considers that government's total investment in science is inadequate). It identifies a number of features of the current system which it describes as highly dysfunctional and providing

incentives that are inconsistent with a focus on New Zealand's requirements of its science system.

Similar sentiments were expressed in the so-called "open letter" to the Minister of Science, Research and Technology in December 2004.

A more in-depth consideration of the concerns of the scientific community can be found in the special issue of New Zealand Science Review published in 2003 which brought together views from a number of different commentators with experience ranging from MoRST and FRST, to CRIs and other research institutions and the private sector. All recognised that there have been significant gains when the present day is contrasted with the pre-1987 situation. All argue that there is now a clear need for change with a particular emphasis on minimising transaction costs and providing greater stability for New Zealand's science system but without compromising the gains that have resulted from contestability.

These various views are all consistent with the findings of various projects undertaken for MoRST by MDL over the past decade or so. We are in no doubt that the transaction costs associated with the present system are high. They range from the costs associated with maintaining two separate stand-alone agencies, to the direct and indirect costs of contracting/bidding, to the opportunity costs that result from research institutions pursuing short-term gain at the expense of investment in long-term research (identified by scientists as a direct result of a requirement that Crown Research Institutes be financially viable, a requirement interpreted as requiring that they earn their weighted average cost of capital) and of the impact on the present and future science workforce of the uncertainty seen as an inherent in the current system.

Transaction Costs: Are They Too High?

That the transaction costs of the current system are high is not, in itself, evidence that they are too high. The crucial issue is whether the present system, and the costs it imposes, are a necessary condition for achieving the outcomes New Zealand seeks from its science system. Any analysis of the problem definition must recognise that the costs cannot be considered in isolation but only in terms of the extent to which they are essential or not for the outcomes we seek. There is a rough parallel with the well-known comment by Winston Churchill on democracy: "Democracy is the worst form of government except for all those others that have been tried."

The Context For Reform

In considering whether transaction costs are too high, it is useful to set the present system in context; specifically, to look back to the reforms of the 1980s and 1990s and understand why they were seen as necessary.

First, as is well-known, during the late 1980s and early 1990s New Zealand went through a major programme of public sector reform which affected the entire public sector. The overt rationale was a view of the nature of public institutions

derived from public choice theory. This placed a significant emphasis on the importance of understanding the motivation of public officials and designing institutions, and institutional arrangements, to minimise the potential for misalignment of personal and institutional objectives. Specifically, public choice theory assumed that individuals were self-interested and opportunistic and that a major task of institutional design was to minimise the potential for adverse impacts. This included separating out potentially conflicting functions such as the provision of policy advice and the implementation of the resultant decision (including the two separate elements of implementation; purchase and provision).

Amongst other things, science restructuring was driven by a desire to separate out the three functions of policy advice, purchase and provision (see point five at page 47 of "Science and Technology Review: a New Deal" the report of the Science and Technology Advisory Committee - hereafter referred to as the STAC Report). Much of what was regarded at the time as the relatively low productivity of government science was attributed to the fact that these three functions were combined in a single organisation, whether the Department of Scientific and Industrial Research or the other major government science entities such as the Ministry of Agriculture. What amounted to bulk funding of these organisations was seen as creating a situation in which senior managers were able to choose where and how funds were applied almost regardless of the national interest. The obvious solution was to ensure that the objectives for which research activity was undertaken would be determined on the advice of one group of officials, the role of purchasing research in support of those objectives would be managed by another and actual provision would be undertaken by providers separate from the other two functions.

Although many within science clearly thought that they had been singled out for attention, this was not the case. As Anthony Scott, the Executive Director of the Association of Crown Research Institutes, comments in his contribution to the special issue of New Zealand Science Review: " The New Zealand science system was merely another item on a reforming agenda applied to all and sundry, including core State functions (e.g. Justice, Social Welfare)."

It was widely believed, then and now, that the combination of bulk funding and the lack of effective external oversight of government's major science departments resulted in very significant waste. Sean Devine in his contribution to the New Zealand Science Review special issue refers to "the elimination of useless research (about 20% -- 30% of that previously funded)".

If "useless research" on that scale is a natural consequence of bulk funding, and the alternative is the kind of detailed purchase system we now have, it would be hard to argue that the associated transaction costs of the current system were too high -- it is extremely unlikely that they are of the order of 20% -- 30% of total funding.

However, that conclusion would be overly simplistic. First, it is important to recognise that the claimed waste in the previous system was not solely a function of bulk funding. It was also very much a consequence of the public-sector staffing arrangements of the time. Scientists were tenured public servants with strong statutory and other protections against dismissal. An example will make

the point. In the mid-19 80s the writer of this report was a Treasury investigating officer with responsibility, amongst other things, for reviewing certain new policy proposals. He vividly recalls a discussion with a senior science manager in the Ministry of Agriculture. This manager had put forward a proposal for a new policy initiative that would require additional funding -- he argued that there were no funds within the existing vote allocation that could be made available for this initiative. The existing budgetary allocation was in the order of $50 million. The writer queried the proposition that none of this money could be made available. The answer highlighted the impact of staffing rules. The manager concerned pointed out forcefully that a large part of his budget was committed to staff salaries and that he had no discretion to dismiss staff who were surplus to requirements, or whose performance as scientists had fallen beneath reasonable expectations. Previous restraints on funding meant that he had inadequate operational funding to support his current staff (even allowing for an element of non-performance amongst those staff). Accordingly, despite the size of his budget, there was no room for manoeuvre.

The writer has no reason to doubt the general thrust of that argument. Assuming that it is a fair representation of the impact of pre-reform staffing rules, it does cast doubt on identifying bulk funding as the sole cause of underperformance. In turn, this suggests that scientists might not be as disregarding of funders' requirements in a bulk funding situation as typical accounts of pre-1987 practice claim.

Next, the significance of the fact that science was "merely another item on the reforming agenda", to use Anthony Scott's words, should not be overlooked. Generally, public management reform was being driven by a purchaser/provider model. Government departments and other agencies were funded through purchase agreements between ministers and chief executives spelling out the required mix of goods and services which the department or agency would produce, and the payment that would be made for those goods and services. The intention was to impose on government provision, as near as could be done, the same disciplines as applied to firms operating in the private marketplace in the belief that this would encourage departments both to seek out least cost means of production and to focus on the requirements of the purchaser.

In that context, it was virtually inevitable that science reform would take place within the same framework as the reform of other major government activities. In essence, science was caught up in a "one size fits all" approach to the application of the principles of competitive markets within the public sector. There was simply no real prospect of science being treated separately with a "first principles" analysis of how best to apply competitive principles to science.

This was not just a matter of the views of public sector reformers being thrust upon the science sector. The authors of the STAC Report, in a chapter discussing "What Science?" had this to say:

> "Another way of looking at the issue is to see it as representing a shift from government acting as indiscriminate funder, to government acting as a discriminating purchaser…. This necessarily implies a competitive process. The only way in which the government (or an agent acting on its behalf) can identify those projects or programmes which best satisfies its

> objectives from amongst all the projects or programs which might be available, is to rank the latter against each other and make a choice."

What that quotation illustrates is a view that the only way a discriminating purchaser might exercise choice is through the decisions it makes about the specific outputs (project or programs) it decides to purchase. This was entirely consistent with the pattern of public sector reform. However, choice of outputs is not the only way in which a discriminating purchaser might decide to exercise choice as part of imposing competitive disciplines on prospective providers.

This takes us back to the question this section is addressing; is the problem definition -- that the transaction costs of the current system are excessive – correct? At the heart of this is an issue which has bedevilled science policy since the early 1990s; to what extent is it possible for government or an agent acting on its behalf to be an informed purchaser of science outputs?

Purchasing In Conditions Of Uncertainty

In considering this, it is essential to recognise that the purchase of science outputs is significantly different from conventional purchase transactions. At the time that a contract for science outputs is negotiated, the output is not clearly defined and there may be a significant measure of uncertainty over whether the output will eventuate or, if it does, whether it will be appropriate to the purchaser's intentions. This is not simply the conventional problem of information asymmetry, with the provider having an information advantage that the purchaser cannot match. It is often the case of the provider itself being unable to predict what will result -- as is well-known, uncertainty pervades all stages of the process of research, development and finally commercialisation (or in the case of non-commercial outputs, their application).

It can be argued that the successive changes in New Zealand's science funding system, including the proliferation of funding instruments, is a direct consequence of uncertainty -- from the purchaser's perspective, of the inherent unknowability of the outcomes from research -- both directly and through the development and commercialisation stages.

If this is the case -- and there is a very significant amount of published material in science policy internationally which argues that it is -- then we need to consider whether the chosen means of imposing competitive discipline on science was the most appropriate one. Should we simply have assumed that the desire to create a "more market" automatically meant moving to the purchase of science outputs?

A European View

There is an emerging theme, within science policy debates in Europe, which suggests a different approach. That theme starts with a focus on an issue which has not, as far as MDL is aware, received much consideration in New Zealand. The issue is the nature of the search regime within different science disciplines and fields.

The European Commission has established what is known as the PRIME Network of Excellence (PRIME stands for Policies for Research and Innovation in the Move towards the European Research Area). It has been established to address the major transformations that research and innovation policies are currently facing. The PRIME Network held its first annual conference at the University of Manchester in January 2005. Amongst the presentations were two papers from Andrea Bonaccorsi of the University of Pisa. The following quotation is from the introduction to the first of those two papers, Search Regimes and the Industrial Dynamics of Science:

> "Three dimensions capture the essence of relevant distinctions: the *rate of growth*, the *degree of diversity*, the *level of complementarity*. By combining these three dimensions one is able to characterize rather carefully several *search regimes*.
>
> "A search regime is a summary description of the pattern of growth of scientific knowledge and of the actual carrying out of scientific research. A regime is not a scientific field or discipline as such. Rather, it is a *consistent set of dynamic properties of the search process* in a field. Fields and disciplines may be characterized by a particular regime for a long period, but may also be subject to a sudden and rapid regime change. By looking at abstract regimes we leave open the question on what is the typical regime a discipline or field is in (although in our examples we will inevitably talk of concrete disciplines and fields). Also, there is the possibility that established disciplines exhibit different search regimes in different areas.
>
> "Therefore we are not advocating a taxonomy of scientific disciplines (which would be a meaningless task), but propose that, at an appropriate abstract level, there are robust structural and dynamic properties of search that have an empirically recognizable counterpart.
>
> "The characterization of a search regime answers some basic questions about the dynamics of search: How rapid is the production of new scientific knowledge? How many different directions does scientific research take? Which resources are utilized in research? Although there are many other possible questions, we will show that these simple ones are theoretically powerful. The characterization of search regimes is a parsimonious way to take into account differences *internal* to science without falling into phenomenological exercises. The economic, institutional and policy implications are far reaching."

To somewhat simplify the argument in the paper, the case which is being made is that in many of the newly emerging sciences the process of search and discovery is fundamentally different from "normal" science. Furthermore, as the author goes on to argue in a companion paper, "Better Policies versus Better Institutions in European Science", the process of evaluation/project selection becomes quite different:

> "Diversity and divergence require a sharp increase in the exploration and evaluation capabilities for both scientists and policy makers.

"For scientists, this means increasing dramatically the ability to explore in different directions and evaluate the merits of proliferating hypotheses. Institutional systems in which doctoral education and postdoctoral research training are based on competitive principles and better organized perform better in this respect. Doctoral and postdoctoral research are the best institution for exploring in different directions, at a reasonable cost, in a relatively short time frame, under conditions of high growth and divergence. In competitive systems, doctoral students become risk takers and collectively pursue several divergent research directions in parallel. Also, if a grant system allows post-doctoral researchers to create the required complementarities (e.g. creating a laboratory, hiring research assistants), then it is possible to capitalize on exploration, validating the hypotheses and sometimes creating entirely new fields. Clearly postgraduate systems in which students are encouraged to pursue the research directions already envisaged by supervisors and post-docs do not have autonomy in organizing research have far less exploration and evaluation capabilities.

"For policy makers, it is important to note that institutions with a consistent tradition of calling for *independent bodies* for evaluating research (both ex ante and ex post) have some advantages.

"However, even trained evaluators find it difficult to come up with decisive arguments in selecting research projects. Faced with the practical impossibility to decide on intrinsic merits of projects, decision makers refer to the *intrinsic quality of proponents*. They look for signals of quality of proponents, which are better approximated by their past curriculum and the reputational rent of their institutions. Affiliations are a powerful signal of quality. The reason is that affiliation is the final outcome of a long selection process, in which the quality of a scientist has been repeatedly evaluated under conditions of impartiality and competition over his life cycle. Top quality institutions are not important because they are large (as several policy makers believe), but are important because of the underlying competitive selection process. This is an important reason why being in the upper tail of scientific quality is important. When new fields are created, there is no way to know in advance about the relative merits of proliferating and sometimes competing hypotheses, as proposed by new entering scientists. The only way is to be sure that they have survived the best possible selection process. The larger is diversity and the stronger is divergence in the search regime, the higher the importance of selection processes. Therefore in the comparison between Europe and US, it is not the same thing to have the same total amount of publications and to have the same share of highly cited scientists."

To somewhat simplify the argument, what the author is contending is that excellence of institutions may be the best selection criterion for funding under conditions of uncertainty. Much of the analysis in the paper is a bibliometric comparison of institutional rankings within Europe and North America based on the premise that those scientists who are consistently amongst the most cited throughout their careers will be recognised as leaders in their field. In an environment in which the labour market for scientists is competitive -- both in the sense that the market itself is open and that scientists have choice amongst institutions -- the best scientists will tend to work within the best institutions and

in turn the best institutions will have a comparative advantage in attracting the best talent, including the newly emerging scientists.

In essence, this work argues that the appropriate competitive discipline for determining which institutions should be funded is the competition for scientific talent rather than competition for project based funding. It is an approach which carries with it a number of necessary qualifications in a New Zealand context including the relatively small size of our science labour market (although that may be less of an issue than it first appears given that many scientists are effectively operating in an international rather than a New Zealand labour market when considering options for the development of their careers in science). It does draw attention to issues such as mobility amongst institutions, the nature of career development (including the impact of the structure of New Zealand science on education of newly emerging scientists -- the extent to which much scientific research in New Zealand is undertaken outside universities) and in all likelihood the relative absence of the kind of indicators used to rank institutions in the papers just cited. Here it is important to emphasise that the use of bibliometric techniques to establish a ranking is critically dependent not simply on publications as such but on the status of the journals in which publications appear, and on the frequency with which the publications of individual scientists are cited.

Clearly, this is still very much work in progress in a European context. However, it does have an intrinsic appeal because of its emphasis on the consequences that flow from the nature of the of the search regime appropriate to different disciplines and fields and the challenges that result not just for evaluators/funders but for scientists themselves in making a priori judgments about individual projects or programmes. Certainly, the suggestion that effectiveness in competition for scientific talent may be a superior means of applying a competitive discipline to science institutions to competition for project/program based funding has the clear merit of addressing directly a problem which has vexed New Zealand's science funding since the reforms of the 1980s and 1990s.

This approach should also have the added advantage of reducing, significantly, the transaction costs associated with current funding practices. We will return to that issue in the next section of this report.

The Problem Definition: Conclusion

In the meantime we conclude our comments on the problem definition itself. It seems clear from recent history that amongst the problems facing funders have been:

- Determining the relative merits of individual projects.
- "Unbundling" the nature of activity within multi-purpose institutions such as universities.
- Ensuring that commercialisation of research findings is optimised without overly biasing the activity of research institutions towards applied research

and, for that matter, activities that are virtually indistinguishable from conventional consultancy.

- Maintaining research effort in areas that may be of long-term significance to New Zealand but with a low profile from a commercialisation perspective.

Much of the uncertainty claimed by members of the science community to characterise the current funding system is clearly due to problems such as managing for multiple objectives, coupled with the absolute level of government funding (it is always easier to smooth over difficulties in a funding system if the absolute level of funding is relatively generous). We are not aware of any evidence which would support the contention that the adverse characteristics of the present system are the necessary consequences of an otherwise optimal approach to funding science. Instead, it seems more likely to reflect the inherent difficulties of seeking to micromanage in an environment in which not only is the funder at an informational disadvantage as compared with the provider, at least at a project or programme level, but in many instances the information which the funder would require to make an optimal decision is simply not available at the time the funding decision is made.

It can be argued, also, that the underlying assumptions about the nature of public sector management, including the principal/agent problem, have themselves had a negative impact. On this argument, public choice theory is inherently based on distrust and this in turn impacts on the environment its application is intended to manage. This issue is explored in a recent working paper published by the ESRC Centre for Business Research at the University of Cambridge, "Theorising Corporate Governance: New Organisational Alternatives".

This paper is a consideration of the new institutional economics view of organisational structure including a critique drawn from recent literature of what is seen as the negative impact of this view of the nature of human beings in an organisational context. The following quotation sets out the essence of the argument:

> "Some, however, suggest that the refinement of contractual theories of the firm is inadequate, as many of their fundamental assumptions are so inaccurate that they discredit the entire approach. For example Moran & Ghoshal (1996) strongly criticize Williamson's (1975, 1985) pessimistic assumptions about organizations as well as human behaviour and motivation:
>
> "[Economic] theories of today are dominated by a profoundly pessimistic view of organizations, concerned far more about the unintended consequences of organizing than about organizing for their intended purpose, and by an even more skeptical view of individual-organization interactions, grounded in the assumption that the human role in organizations is largely passive and frequently pathological... the all-pervasive concern for shirking, opportunism, and inertia in organizational economics (Moran and Ghoshal 1996: 70).
>
> "Moreover the normative implications of economic theories are perceived to be especially dangerous: Ghoshal and Moran (1996) criticize the fact that

these theories create the conditions which encourage the type of behaviour they assume:

> "Social sciences carry a special responsibility because of the process of the double hermeneutic: its theories affect the agents who are its subject matter. By assuming the worst, this theory can bring out the worst in economic behavior. By assuming opportunism and establishing it as his base case, Williamson is blind to forces that work to confirm or discredit the validity of his assumptions ... In the process, his theory is likely to encourage the very behavior that it takes for granted and seeks so hard to control. (p.39)"

We are not aware of any objective research designed to test the proposition that, within the New Zealand science system, the application of a funding system based on public choice theory principles has had the impact which the quotation above suggests is a possibility. However, in much of the work that we have previously undertaken for MoRST, we have encountered attitudes amongst scientists consistent with a certain alienation from the institutional structure within which they work. It is possible that this may have been no more than the often observed phenomenon that scientists will owe their first loyalty to their science (including their research colleagues) and regard their current employer as simply a necessary means through which they are able to pursue their research objectives.

We conclude that the problem definition is well based and that the search for alternative means of funding capable of minimising the adverse impacts of the current system should be given high priority. This conclusion is subject to one qualifying comment. The problem definition has been developed in the context of the current strategies and objectives for science funding. As we discuss in more detail, when dealing with relational contracting below, it is quite possible that a shift to devolved funding on a relational contracting basis may result in a revisiting of current strategies and objectives.

POLICY OBJECTIVES: A RELATIONAL APPROACH

The MoRST background paper " A Stable Funding Environment" sets out the following five key objectives which should stem from any changes:

- **Stronger and more sustainable connections between providers and users.** Stakeholder feedback indicates that one of the impacts of funding instability is that it is difficult to form long-term useful relationships and connections with other providers and users. The ability for organisations to form direct and substantial long-term relationships with users and be responsive to their needs is important.

- **Improved organisational arrangements within the system.** The aim is not to force, but to avoid creating barriers to changes in organisational arrangements within the system, where there are synergies to be obtained. This could include changes to the scope of cooperation and coordination between providers, as well as the evolution of current organisational entities.

- **Improved alignment of institutional expectations and purchasing.** There is scope to clearly articulate the outcomes the government wishes to achieve within a national RS&T framework to assist in aligning institutions strategies with relevant strategic priorities in the purchasing system. The aim here is to achieve strategic alignment while institutions continue to operate as empowered and independent entities with a significant level of control over their activities.

- **Creative risk taking.** We need to encourage research organisations to take reasonable risks in new areas without being unduly penalised for doing so, or for trying and failing.

- **Less or at least no unnecessary increase in complexity.** Stakeholders have indicated a strong desire to simplify the system. The aim should be for necessary complexity only.

Those five outcomes sit under a proposed action to "devolve a significant amount of public good science funding (up to 60%) to research organisations" (as we understand the term "research organisations" it encompasses any entity which believes that it has the capability to undertake research).

Considering Stability

The five outcomes, as a set, can be seen as the desiderata for an optimal funding system. For the purposes of this report they need to be seen in the context of the current funding system -- would their achievement represent a fundamental change or merely some fine tuning around the edges?

Part of the context for the current funding system is the government's overarching strategy as articulated in initiatives such as the Growth and Innovation Framework. Growing an Innovative New Zealand, the first substantive publication of the GIF initiative, identified three priority areas for research and development; biotechnology, information and communications technology and creative industries. Each of these three are areas we would expect to be characterised by the impact of the forces of dynamism, diversity and complementarity described in the two papers by Andrea Bonaccorsi discussed in the previous section.

This implies a research environment which should be characterised by flexibility and, at least at the micro level, a high degree of instability.

The discussion in "A Stable Funding Environment", in contrast, places considerable weight on stability and appears to be arguing both that the New Zealand system of science funding has matured to a relatively stable state and that it is desirable to maintain this in the future.

Arguably, this is inherent in the five outcomes above. From our perspective, the process of setting the desired outcomes for a science funding system must begin with a clear-eyed understanding of what is expected of a science system, and the dynamics within which it operates.

In a sense, each of the five outcomes is almost a taken for granted in considering any organisational setting. It is hard to argue against outcomes such as achieving long-term relationships with other providers and with users, getting better alignment with the government's desired outcomes, or creating a climate in which research organisations feel able to take reasonable risks in new areas.

One concern we have, which we raise as a question rather than as a statement, is the extent to which the apparent relative stability described in "At Stable Funding Environment" is a function of underachievement. Could it be that one of the costs of the significant emphasis on contestability has been a relative loss both of excellence and of relevance?

Neil Jordan and Paul Atkinson, in their contribution to the New Zealand Science Review special issue (Development of Science Discoveries in the New Zealand Crown Research Institutes) argue that bibliometric analysis of the performance of CRIs in terms of publications in refereed journals indicates a significant relative decline. The following extract sets out the nub of their findings:

> "A compilation of publication data collected from annual reports of the CRIs over 10 years, illustrates the point that international publication rates are relatively static in most CRIs. In analysing these data we do not treat CRIs differently, and we make reference to 'Key Non-financial Performance Indicators Generic to All CRIs' as set out in a policy statement by the Crown Company Monitoring Unit (CCMAU) which refers to "…standard measures of output used internationally…". A variety of things are listed but the most meaningful and comparable as a benchmark relating to science discovery, and actually reported, is international journal publication. With this in mind, we note that AgResearch Ltd over ten years showed an increment in total journal publications, but the numbers of papers in international journals

> indicating competitive science was near static ('flat') despite large revenue increases (56%) over this time. HortResearch Ltd did not report row international publications separately for most of this time but showed a precipitous decline in totals, and at best a static result for international publications in the last three years again, despite reporting significant revenue increment (24%) over the 10 years. The publication output for Industrial Research Limited (IRL) was spiky but near static in totals, again with large revenue increment (54%); likewise for the Institute of Geological and Nuclear Sciences (IGNS) with revenue increment of 52% and also NIWA (127%) with a flat total of international publications in the last four years. It is clear the inflation adjusted revenue in the CRIs significantly increased whilst scientific output of international papers did not significantly increase. This is not a new analysis where publication rates of CRIs have been compared over time as a measure of research productivity, but we have attempted to define those in the international refereed literature and over a longer time span.
>
> "This is not a record of international accomplishment in science which might be expected of apparently healthily growing science institutions, growing as indicated by the reported revenues at the beginning and the end of the publication analysis Period. In explanation, it could be said that the reason for the flat rate of publication in international science journals is that CRI resources have been transferred into profit-making activities and, if this is correct, it is likely to be eroding the science base. It might also be that more commercially sensitive CRIs are withholding publication in lieu of patents and trade secrets. Patenting is not inconsistent with publication and should only throw in an 18 month lag before publication rates resumed at the base rate over these 10 years. If scientific productivity is disappearing into trade secrets, this would only indicate another set of problems in how to gauge New Zealand CRI science performance."

As can be seen from the last paragraph of the quotation, the authors felt it necessary to speculate on underlying causes, rather than feeling that they were able to be definitive. Nonetheless, the findings are concerning, especially when set in the context of the current discussion in Europe on the relative underperformance of European science when contrasted with American science -- with strong evidence of the linkage between publication, citation rates, and the performance of institutions.

Related to this is the concern expressed by number of scientists at the fact that scientific excellence is no longer a criterion for funding within the main funds (although clearly it remains a criterion within the Marsden Fund).

We wonder whether one factor contributing to the relative decline in publication rates and, by inference, in the performance of internationally benchmarked research, is the absence until very recently of any explicit requirement for CRI boards, or universities, to focus on capability. This gap has now been addressed, respectively, by the requirement in the Crown Entities Act that the statement of intent should include how the board proposes to manage the organisational health and capability of the entity, and the introduction of the Performance Based Research Fund within the tertiary sector.

For the purposes of this report, we assume that MoRST takes it for granted that underlying the five desired outcomes is a sixth, excellence in the areas that are significant for New Zealand.

The Nature Of Research Organisations

A further factor to consider, in assessing the relevance of the policy objectives, is both the disparate nature of research organisations and the way that they have changed over time. As participants in the New Zealand science funding system, the three main categories of research organisations come with very different sets of incentives.

For Crown Research Institutes, access to government funding is crucial to their very survival. Accordingly, they have very strong incentives to ensure effective engagement with funders and to invest heavily in ensuring that they capture sufficient funding to support their business plans. Associated with this, they have incentives to restrict access by other players -- for example through their current arguments for increased core funding.

For universities, in contrast, access to government funding through sources other than the Ministry of Education/Tertiary Education Commission is in the nature of icing on the cake -- an additional and at least initially discretionary source of funding outside their core funding (given that they have now had access to this funding for nearly a decade, it is likely that at least in some universities, this is now treated as equivalent to core funding). So far as their incentives go, they are to encourage government to keep funding as open as reasonably possible so as to enhance their ability to compete funds away from other providers. They have a related set of incentives to ensure that the government continues to deny access to PBRF funding for institutions outside the tertiary sector even though these may be quite extensively involved in supporting the education/training of graduate students.

Research Associations are different again. As MDL concluded in the report which it prepared for MoRST in 2003, research associations are not so much a separate category with a number of common characteristics, as a set of unique organisations each with its own defining characteristics. As an example, there is a world of difference between the Cawthron Institute and the New Zealand Fertiliser Manufacturers Research Association. The former has many of the features of a Crown Research Institute with its commitment to undertaking research with a mix of public good and commercial characteristics. The latter is essentially a joint venture between two private sector manufacturers as a means of carrying out research which has generic implications for the businesses but is not so commercially sensitive that the individual firms believe they need to keep the research findings in house.

In many respects, the research associations are stalking horses for commercial firms in the sector which they serve. They have the natural incentive of any private sector entity of shifting as much of their costs, as possible, on to the taxpayer.

Another factor which needs to be considered, and which is somewhat at odds with the apparent assumption of stability underlying the background paper, is the extent to which institutions in the science sector have changed, and continue to change over time. In this respect, it is instructive to go back to "Crown Research Institutes: Research Companies for New Zealand" the report of the ministerial science task group released in June 1991 which preceded the establishment of CRIs. That report had this to say about the nature of CRIs:

> "Each of these 10 Institutes is focused on a productive sector or a grouping of natural resources. Their work will be vertically integrated. They will have a broad focus across a range of science and technology, but avoid overlap with other CRIs."

The reality is that much of the activity of individual CRIs overlaps with that of others. One of the criticisms of the current funding system is the excessive competition that has resulted from this and, as a consequence, the lack of the level of collaboration/cooperation that critics see as essential.

This was partly a consequence of the fact that, in practice, it proved impossible to achieve the kind of pure separation which the report of the ministerial science task group envisaged. However, it also reflects the changing nature of science; the fact that in the new emerging sciences, there are significant complementarities across what might have previously been seen as discrete areas of research.

Relational Contracting

The outcomes outlined in the background paper, and the proposed action to achieve them, reflect a concern to move away from micromanagement through competitive bidding for funding to an approach which places more emphasis on the capability of individual research organisations to identify projects/programs with the potential to contribute to the government's desired outcomes. The background paper postulates that "a greater level of trust could be placed in providers, allowing them to make detailed research investment decisions where they have the greatest information advantage."

This would be complemented by an approach to funding that "should be related to components of an organisation's research strategies or business plans, with the relevant milestones and other details being negotiated between research organisations and the funding and investment agencies. Accountability should be provided for through an appropriate mix of joint planning, negotiation, competition, monitoring and evaluation."

This approach explicitly recognises that it is the research organisations which have the information advantage. Rather than fighting them through a competitive process in which less informed purchasers attempt to corral researchers, the preferred approach is to work with researchers but within a framework which incentivises them to use their information advantage in the common interest.

Relational contracting is an approach which recognises that the purchaser and provider both have a common interest in building an ongoing relationship. The current contract, whatever it may be, is not seen in isolation, but as a step in an ongoing process.

It takes a significantly different approach to the leverage which each party would normally expect to achieve through any information advantage it holds. In a traditional contracting relationship, a party which holds an information advantage will use that as a means of extracting a benefit from the other party. In a relational contracting arrangement, the information advantage is something which is "put on the table" for the contracting parties to share as part of the process of optimising the outcomes for each of them.

In a science funding context, this would have research organisations taking an open book approach with the funder but would also have the funder doing the same with any research organisation with which it deals. Relational contracting is trust based. As such, it is possible only if each party can have confidence that the other party has shared with it all the critical information it holds in respect of the proposed contracting arrangement.

How this is done may differ depending on the nature of the research organisation involved. For Crown Research Institutes, a shift to devolved funding would be a major and positive change in their operating environment. It would result in a very significant component of their total revenue coming to them under different conditions than now apply with a significantly greater degree of freedom at the micromanagement level.

For universities, the situation would be very different. Although public good science funding is obviously attractive to universities, it is a relatively small proportion of their total revenue. It is probably unrealistic to expect that they would change, in any significant way, their approach to managing their business in order to accommodate this. An additional factor in this is their primary accountability to the Tertiary Education Commission as their principal funder. One possible option for addressing this issue is for the contract relationship to be between the funder and a university controlled entity which would have responsibility, within the university, for managing the relationship. Uniservices Ltd, the University of Auckland's research arm is an example.

Research associations would be in much the same situation as Crown Research Institutes. The potential for significant devolved funding would be a major attractor and almost certainly an incentive for them to work closely with the funder in ensuring that their planning, resource allocation, monitoring and evaluation processes met the funder's requirements.

MDL has considerable familiarity with the approach to relational contracting in another sector of activity which has equivalent issues of uncertainty and multi-causality; the funding of economic development agencies. This sector is beginning to adopt an intervention logic approach to contracting. Rather than simply specifying outputs, which has been the traditional approach, the focus is now on the desired outcomes. The process which underpins contracting is one of spelling out the underlying rationale and supporting evidence for the chosen activity, the expected milestones, the endpoint and how that will be recognised,

and the monitoring and reporting arrangements which will support that. This is coupled with the funder itself setting out what it regards as the desired outcomes from economic development activity and the role which it will play in supporting the EDA as provider.

There are useful lessons for science funding from this experience because of the parallel between economic development and research and development. Both activities are undertaken in a context of high uncertainty, multi-causality, and relatively weak strategic planning.

This latter point is especially significant. Inherent in a shift to long-term relational contracting is a need for much more effective strategic planning. In MDL's experience, much of New Zealand strategic planning, especially in the public sector, is either business planning by a different name -- in other words essentially a multi-year extrapolation of current activity relatively uninformed by any understanding of how the organisation's environment might change over time -- or a set of aspirational statements effectively detached from the operational goals and realities needed for their realisation.

Relational contracting will require the funder to have a very clear idea of what the long-term objectives are for science funding. This will include an understanding of the strengths and weaknesses of the New Zealand economy, of key sectors such as education, of the likely future trends that will impact on New Zealand. An obvious example is demographic change, not just within New Zealand as currently extrapolated from our own data but the probable impact of demographic change elsewhere, for example the expectation that between now and 2025 the labour force within the area of the European Union will decline by 21 million and the population aged 65 or over will increase by 40 million.

Objectives

It seems reasonable to assume that objectives will include maintaining/developing capability in disciplines/fields that are expected to be critical for New Zealand's future; enhancing the linkages between science and industry (broadly defined); increasing both the proportion and the absolute amount of investment in research and development provided by the private sector (this may be better expressed as provided by non-government funders). Objectives of that kind remain merely aspirational unless they are translated into specific goals and the goals themselves are consistent in the sense that the goal or goals for one objective do not create perverse incentives impacting on the achievement of the goal or goals for another objective.

Take capability as an example. It would not be sufficient for the funder to state that it required funding recipients to her as on in the in build their research capability. There would need to be some understanding not just of the disciplines/fields involved but also of what was actually meant by capability. Would it be defined in terms of the formal qualifications of research staff with, for example, an increasing proportion of research staff with doctoral qualifications? Would it be in terms of increased investment by the funding recipient in the further development of staff capability -- for example an in-house investment in postdoctoral training? Would it be in terms of publication and citation rates?

For its part, the funding recipient will also be expected to have its own capability objectives and goals and these would be influenced not just by the views of the funder but by requirements such as the statement of intent for a Crown owned entity, or the performance-based research fund. As part of its own strategic planning, the recipient should also have a clear understanding of what it means to be a capable research organisation within the disciplines/fields in which it expects to be active coupled with specific actions intended to achieve/maintain that status.

There is potential for conflict amongst different objective/goals, especially given the obviously limited resources available. If capability is defined in terms of publication and citation rates what does this mean in terms of separate goals for commercialisation and for building strong linkages with end users?

It may simply mean that the funder needs to have confidence that the funding recipient is able to manage these separate and potentially conflicting objectives and goals. In support of this suggestion, there is some evidence that scientists themselves are responsive to financial incentives so that, for example, the way in which royalties from scientific discovery are shared can have a positive impact on both research and commercialisation activity.

In November 2003 the Federal Reserve Bank of San Francisco launched the Centre for the Study of Innovation and Productivity with a conference on Technology, Innovation and Public Policy. Below is an extract from the conference paper "Incentives and Invention in Universities" (the paper is available as National Bureau of Economic Research working paper 9727):

> "This paper makes two main empirical contributions. First, we show that academic research and inventive activity respond to monetary incentives. This finding is important because it means that the design of intellectual property rights, and other forms of incentives, in academic institutions can have real effects on economic growth and productivity. Second, we show that the response to incentives is much larger in private universities than in public ones. Controlling for a variety of other determinants, including university size, quality and R&D funding, universities with higher royalty shares generate higher levels of license income. In private universities, the incentive effect is strong enough to produce a 'Laffer effect', where raising the inventor's royalty share would increase the license revenue actually retained by the university.
>
> "A number of recent studies have found that private universities are more 'efficient', as measured in terms of scientific publications and various outcomes of technology transfer activity. Beyond these differences in the level of efficiency, in this paper we show that scientists at private universities are more responsive to royalty incentives. In this context, we also show that technology licensing offices are more productive in private universities suggesting that private institutions have more effective, commercially-oriented technology transfer activity. These findings imply that private ownership is important in the university sector. Why this is so remains an open question. Case study and survey evidence indicate that organizational structure and objectives in TLO's vary across universities

> (Feldman, Feller and Burton, 2001; Thursby and Thursby, 2001). Understanding how those differences — and others such as internal incentives and institutional culture — are linked to university ownership type and how they affect performance is an important topic for future research, but beyond the scope of this paper."

This is yet another area in which understanding is still relatively limited. There is a simply insufficient research information available internationally to allow a definitive statement that an optimal policy for sharing the returns on intellectual property will have a positive impact both on research and on commercialisation. From work such as the paper just cited what we do have is an emerging hypothesis.

A shift to a devolved funding approach based on relational contracting will encounter a number of such areas where both the funder and the funding recipient will be somewhere near the bottom of a relatively steep learning curve about what actually works in practice. What this emphasises is the importance of continued information sharing, and of a preparedness to take a long view rather than divert from the proposed course at the first sign of any difficulty -- in essence, for both the funder and the funding recipient there will be a need to be comfortable with an understanding that the early years of devolved funding will have about them some of the characteristics of what is sometimes euphemistically described as "learning by doing".

In practical terms, this probably means that the funder will need to have in place the equivalent of a relationship manager for each significant funding recipient and that the relationship manager's task will be one of working closely with the governing body and senior management of the funding recipient. The working relationship will need to have a particular emphasis on the nature and quality of the funding recipient's strategic planning and its relationship to the funder's objectives and goals.

There is another issue that will need careful consideration. In MDL's experience the greater focus on strategic planning, and the goals objectives and activities which result, may have quite a significant impact within any given organisation. It is not uncommon for that much closer focus to raise very real questions about the appropriateness of the current mix and nature of activity. This follows from the fact that articulating a clear linkage from a strategy through goals and objectives to activities may demonstrate that one or more activities should be abandoned or substantially changed.

Accordingly, there is at least the potential that a shift to devolved funding will, at least during the implementation stage, add to instability. Given that the clear expectations within the New Zealand science community regarding the impact of devolved funding, implementation management will need rather more care, and understanding of the impact on research staff, than has sometimes been the case with public sector reform.

Handling this well probably matters more in a change of this kind than in most public sector reforms. The reason is that any change is intended to promote greater stability and a relationship of trust between the funder and funding recipients. If research staff see the change as yet another destabilising and

career threatening factor, then a major barrier will have been raised to the achievement of the intended outcome.

DEVOLUTION VERSUS OTHER OPTIONS

A number of the concerns which have been raised about the current funding system could, on the face of them, be addressed individually. For example, the impact on CRIs of the requirement in the Crown Research Institute Act that "every Crown Research Institute shall, in fulfilling its purpose, operate in a financially responsible manner so that it maintains its financial viability." could be modified. Currently the Act defines financial viability so that "Regardless of whether or not it is required to pay dividends to the Crown, the activities of the Crown Research Institute generate, on the basis of generally accepted accounting principles, an adequate rate of return on shareholders' funds; and The Crown Research Institute is operating as a successful business."

The first leg of this definition, the requirement to earn an adequate rate of return on shareholders' funds, has been interpreted to mean that the CRI should earn at least its weighted average cost of capital. This is a requirement which imposes on CRIs a short-term revenue objective which is inconsistent with operating as a serious investor in long-term research. In practice it must mean either that the CRI sets a primary objective of earning commercial revenue, or that any government sourced project/program funding is set at a level which allows the CRI to earn a profit consistent with the financial viability objective.

The requirement could be rewritten by deleting the reference to an adequate rate of return on shareholders' funds and simply requiring that a CRI operate as a successful going concern, with care being taken to ensure that this meant no more than that, over time, the CRI was able to meet its financial obligations (note that the statement of intent requirements provide an opportunity, CRI by CRI, to set whatever revenue and distribution objectives the Crown, as owner, requires).

It is doubtful that such an approach would address the essence of the concern which lies behind the interest in devolution. The concern is not simply with formalistic issues such as the financial viability test. It is much more about who holds the decision right over the activity that research organisations undertake. Amongst other things, that concern needs to be seen in the context of the "efficient purchaser" orientation that governs public sector spending decisions. There is a clear concern amongst working scientists that the micromanagement which results from this substitutes the judgment of non-scientists for that of scientists.

From this perspective, simply tinkering with the rules will not address the problem. Rather, there is a need to deal directly with issues such as the decision right, and the culture of the decision-making process.

This is not to argue that scientists, within research organisations, should be made autonomous with funding to meet their needs. It is to argue that an effective answer to the problem definition needs to ensure that decisions on

investment in research adequately reflect the knowledge, understanding and objectives of the scientists who will undertake the research. The trick is to balance the government's strategic objectives for research and development with creating a supportive decision environment.

We do not expect a shift to devolution, on a relational contracting basis, to be an instant solution. As signalled in the previous section of this report, there are real risks that will need to be managed. However, given the problem definition we do not consider that there is a superior approach to devolution.

WHICH RESEARCH ORGANISATIONS?

In this section of the report we consider to which research organisations investment could be devolved including funds, criteria, proportion and possible impacts.

For the purposes of discussion we divide research organisations into four separate categories; Crown Research Institutes, universities, research associations (for a description of this category see the MDL report for MoRST "Dynamics of the Structures and Governance of Research Associations) and other -- primarily private sector firms.

The starting point for the selection of research organisations needs to be the objective of the devolution initiative; is it simply to reduce transaction costs? Is it intended to support the achievement of government's overarching objectives for research and development?

If it is the latter, then the first step needs to be determining what those objectives might be in a devolved funding environment. If, as an example, emphasis is placed on building capable research organisations, then priority might be given to organisations selected in terms of both the nature of their core business and of their scale.

In practice, there are bound to be multiple objectives including reinforcing technology transfer, improving our knowledge of New Zealand's natural environment and underpinning the government's objectives for economic growth -- which clearly implies some kind of judgment about choosing amongst different sectors (disciplines/fields in science).

Which Funds?

Another factor to consider is the multiplicity of funds through which government provides support for research and development. A number of these funds are specifically targeted towards the private sector, seeking to encourage greater engagement with research and development -- for example Technology for Business Growth. We would not attach a high priority to changing the way in which those are managed -- and if we did we would probably argue that the context in which to consider change is the government's economic development strategy, rather than its research and development strategy.

We would also leave aside, for the moment at least, those funds which are targeted to high performing individuals and funding intended to encourage original research, specifically the Marsden Fund.

In practice, we would support the judgment in the background paper that priority for change should be given to the Research for Industry and Environmental Research Output Classes. Both are of a sufficient scale to enable the

development of an approach to devolution which could have a meaningful impact on the activities of all four categories of research organisation. Concentrating on those two should provide a more than sufficient opportunity to develop the practice of devolution with the judgment on incorporating other funds to be made later, based on experience with the initial two.

Criteria for Devolving

The criteria for devolution should be tied back to the overarching objectives for research and development. We have already noted the possibility that, as devolution is implemented, those objectives may be refined reflecting the feedback that comes from the process of moving from strategic objectives to goals and activities. For purposes of discussion, we assume that the long-term objectives will be along lines such as:

- Developing the capability of New Zealand's research institutions.
- Improving the linkages between researchers and end users.
- Supporting sectors/industries that offer above-average growth prospects.

The criteria should include demonstrated capability in areas relevant to the long-term objectives including strategic planning/thinking, the ability to "drop-down" to specific goals/activities, research excellence in disciplines/fields relevant for the government 's strategic objectives, competence in, or at the very least a credible commitment to, working with end users and organisational soundness (governance; systems; financial viability).

It may also be desirable to set criteria in terms of the ownership and development of intellectual property developed with the assistance of devolved funding. This might be done purely in terms of the public funder requiring that research supported with public monies be, as far as possible, publicly available. It might be in terms of the research organisation developing an intellectual property strategy designed to incentivise research staff (refer to the argument above from Incentives and Invention in Universities).

Finally, the criteria should include a demonstrated preparedness to work with the funder in a relational contracting mode as that term is used in this report.

Selecting Research Organisations

The nature of relational contracting is such that, at least initially, it will be sensible to restrict devolution to organisations for whom research represents their main or at least a significant part of the total business. Specifically, devolution should be to organisations that are able to integrate this into their strategic planning/thinking and demonstrate that there are reasonable grounds for believing they will achieve the benefits expected from devolution -- including the development of capability.

All CRIs should qualify. Devolution to universities, or to university related research entities, may need more consideration. Clearly, the ability to access funding from the two funds being considered for devolution has become important for the university sector. Withdrawing access is unlikely to be a sensible option. On the other hand, the funder should want to be satisfied that any funds devolved to the university sector were managed in a way that did contribute to achieving the government's overarching objectives. This might make it desirable that any devolution to the university sector be to a separate stand-alone research arm (such as Uniservices Ltd), or at least to a separate business unit with its own management and strategic planning capability.

Research associations present different issues again. As already noted, they are highly diverse ranging from the Cawthron Institute which in many respects is similar to a CRI, to the New Zealand Fertiliser Manufacturers Research Association which is essentially a partnership between two private firms. Eligibility could be decided on a case-by-case basis determined by the extent to which any particular research association could demonstrate that it was committed to the objectives of the devolved funding strategy and had the capability and organisational characteristics required.

A similar approach could be taken with private sector firms. To put it another way, the selection criteria should be focused on the demonstrated potential of the funding recipient to meet the objectives of the devolution programme, rather than on the ownership, and formal structure, of the funding recipient.

Proportion

The first point to make is that there is a significant "legacy" issue. Both of the funds being considered for devolution have a number of long-term funding commitments. Those would need to remain in place although there would be a good case for shifting the contracting and monitoring arrangements for those commitments into a relational contracting mode.

The next point is that proportion -- the funding that each research organisation currently being funded through either or both of these funds receives under the new arrangements -- will be crucial. Associated with this is the virtual certainty that it will be impossible to develop a set of ex ante decision rules for the allocation of funding under a devolved approach, if these were to involve any significant reallocation of funding as between current recipients. The ability to do that will be dependent on experience -- we expect rules for reallocation to evolve as research organisations demonstrate their capability under the new regime.

That said, the funder will need a set of principles to govern the initial devolution. We would suggest that an important criterion for these is to minimise uncertainty and, in particular, make it clear that one objective of the change is to provide greater stability for research scientists (subject to performance, which under the new regime may become primarily a matter for the employer, constrained by its need to demonstrate it is meeting the funder's expectations).

In MDL's view, it will be worth making some financial investment in ensuring the success of the change. Against that background, we would suggest that the

issue of proportion is approached on the following lines (the suggestion is indicative rather than recommendatory):

- The amount of funding available from the two funds be increased by 20%.

- Each research organisation currently being funded through one or both funds be given a commitment to a minimum of 80% of its current funding level for the next (say) three years.

- The remaining funding -- equivalent to 40% of the funds currently available through the two funds -- be allocated to research organisations based on their submissions on how they propose managing devolved funding in order to meet the government's objectives for investment in research and development.

The purpose of this approach is to ensure that, through the implementation phase, every research organisation currently dependent on one or both of the funds to be devolved has a reasonable assurance that it will be a winner from the immediate reallocation. Proper application of relational contracting principles should ensure that those organisations not really capable of adapting to, and providing government with superior returns from, the new environment should ultimately lose funding.

Finally, the suggested approach to initial funding might need to be fine tuned to take into account the nature of existing commitments.

Impacts

Properly managed, a shift to devolution accompanied by relational contracting is described in this report, should enable a much better alignment between the activities/outcomes of research organisations, and the government's objectives for investment in research and development. That will require particular attention to the more difficult aspects of relational contracting which we expect to be the strategic thinking/planning which underpins the choices research organisations make.

On the negative side, our main concern is with the impact on current and future research staff. The work which MDL has done for MoRST over the years has repeatedly brought out the same concerns about morale, career development and organisational health that have led to the devolution proposal itself. It is essential that any implementation be both designed and managed to minimise any further negative impact and, as soon as possible, enable the rebuilding of morale, and the confidence of present and future researchers in the New Zealand science system.

CONCLUDING REMARKS

From time to time, work undertaken for MoRST, including but not restricted to projects for which MDL has been responsible, has had to consider the public policy rationale for government ownership of CRIs. As far as we are aware, whenever this has been done, the answer has been to preserve a critical mass of expertise regarded as important for New Zealand's future development.

To put this another way, the rationale has been the need for capability. There has been a recognition that capability does not arise in isolation but can only be developed and maintained in the international context which characterises the science community.

Despite that, capability has not until very recently been seen as a specific objective. As other commentators have noted, the combination of the financial viability provisions of the Crown Research Institutes Act with CCMAU's role as monitor has placed an emphasis on financial viability rather than on research capability. That is now changing with the new emphasis on capability and on the development of non-financial performance indicators.

This report has drawn on a recent European research which has sought to explain the relatively inferior performance of European scientific research as compared with American scientific research. The hypothesis which ongoing work is clearly testing is that the crucial difference is the capability of institutions -- and that capability is a determining factor in the ability to attract and retain excellent scientists.

We conclude this report with a recommendation that MoRST monitor this line of research and consider its implications for New Zealand -- both in the longer term and in the development of performance indicators for Crown Research Institutes.

Finally we note that the same issue may also apply to universities which themselves have only recently come under a regime requiring them to demonstrate the capabilities of their research performance (the Performance Based Research Fund).