OFFICE OF THE PRIME MINISTER'S SCIENCE ADVISORY COMMITTEE

The role of evidence in policy formation and implementation

A report from the Prime Minister's Chief Science Advisor

September 2013

"[An] important role that public servants play is to help Ministers and the community in general to understand the options and choices they have. It is too easy, perhaps even negligent; to leave Ministers to make decisions with insufficient information, without the best possible evidence, and without learning from what has gone before. And the point here is that there is rarely something where the issues are clear-cut, or where choices don't have to be made."

"The policy advice that informs these decisions must be built on a strong foundation. We have to make sure what looks like a good policy idea is backed up by solid evidence and quality analysis."

Excerpts from a speech by Gabriel Makhlouf, Secretary to the Treasury, April 2013
Part of the Better Public Services Initiative of the State Services Commission

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Letter to the Prime Minister

September 2013

The Prime Minister
Rt Hon John Key
Parliament Buildings
WELLINGTON 6160

Dear Prime Minister

Re: Evidence in the formation and evaluation of policy

You have asked me to advise on how New Zealand's ministries and agencies might improve their use of evidence in both the formation and evaluation of policy. I now present my report *The role of evidence in policy formation and implementation* which contains recommendations on I how I consider this might be achieved.

This report builds on my previous discussion paper from 2011, entitled *Towards better use of evidence in policy formation*, which summarised the complex relationship between evidence and its application to policy. Since that time, and at your request, I have continued to reflect and consult both nationally and internationally on these issues.

To further inform my thinking, and with your agreement and the assistance and support of the Department of Prime Minister and Cabinet, my Office undertook a survey of a number of government ministries, departments and agencies to assess how they perceived the role of research-informed evidence in their work. This survey and its conclusions have confirmed my earlier thinking and have allowed greater focus on identifying solutions.

A summary of the major findings of that survey is appended to my report. These findings demonstrate a wide and rather inconsistent range of practices and attitudes toward evidence across government agencies. Not all are bad. Indeed, there are examples of exemplary practice. Some of the promising initiatives that your Government has made are highlighted. Nevertheless, the variability suggests that a more systematic and whole-of-government approach would be desirable.

Similarly, the quality of assessment and evaluation of policy implementation is quite variable. The required scrutiny can be devalued by agencies that assume their primary mandate is to implement political decisions. As a result, funding for evaluation is frequently trimmed or diverted. For instance, the concept of controlled trials in public policy implementation is well accepted in other jurisdictions but this has not been generally promoted by ministries in New Zealand.

Internationally there is a consensus that research, science (very broadly defined) and technology are playing a much greater role in identifying, mitigating and communicating risks, and maximising opportunities for governments to advance their nation's interests. It is noteworthy that within the global conversation, there is growing recognition of the critical need to be more rigorous both in the employment of evidence for the development of policy, and in the assessment of its implementation. Yet there are also dangers if clear protocols are not in place to manage the processes of incorporating research-informed evidence into the policy process. My report highlights these as well.

All of this occurs within a complex and uncertain environment where human responses and decision-making are influenced by many factors other than well-informed knowledge. Indeed, as I have stated previously, my view is that quality evidence should be seen as base knowledge on which, in a democracy, multiple values and associated perspectives must be overlaid. However, where evidence is conflated with values, its power is diminished. Where evidence is not considered properly, the risk of less than desirable policy outcomes is inevitable.

For instance, it is possible for the research process to be corrupted by inputs that are not objective, or by the failure to recognise personal biases in bringing forward evidence. Researchers can become impassioned advocates for a cause that their expertise could meaningfully inform dispassionately. Similarly, where evidence for policy is generated externally, the science community can fail to understand how the policy (or indeed the political) process works. Scientists can be naïve in assuming that policy follows directly from evidence.

There are standard processes (supported by relevant skill-sets) that must be in place to ensure that such subjectivity and bias are minimised. My analysis suggests that these skills and processes can be overlooked in political and policy domains. Lobbyists can easily misconstrue science and exploit such a situation. The role of appropriately appointed science advisors within departments can ensure appropriate processes and mitigate against these risks.

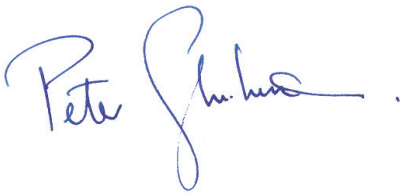
It is also concerning that in New Zealand, there has been insufficient attention paid to proactive investment in research needed to support policy formation. For at least the last 20 years, our public research funding bodies have not prioritised policy-relevant research, resulting in a disconnect between central agency needs and funded research priorities (to the extent that these are set). In turn, this has led to a growing gap between the research community and the policy community in identifying the needs of the policy community that research could address.

My report makes a number of low-cost suggestions for your consideration, some of which were heralded in my earlier paper. In particular, I recommend that protocols be established for how scientific advice is sought and incorporated into the policy process. Secondly, I recommend the appointment of science advisors to major departments to address multiple functions associated with enhancing departmental use of evidence in policy formation and evaluation. In turn, this community of science advisors could play important roles in technology assessment, research need identification, risk identification and assessment across government.

It is important to note that strengthening and assuring the use of research-informed evidence in policy advice in no way weakens the authority of the political process. On the contrary, it must strengthen it. After all, political processes are about making difficult choices based on a range of complex options where there are inevitably trade-offs and spill- over effects – both good and bad.

I thank you for your encouragement to consider this important matter.

Yours sincerely



Sir Peter Gluckman KNZM FRS FRSNZ

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EXECUTIVE SUMMARY

At the request of the Prime Minister, this report has been designed to explore in greater detail the issues that were brought to light in an earlier discussion paper, *Towards better use of evidence in policy formation* (2011). This paper extends that discussion and makes some specific suggestions as to how to improve the use of robust evidence in policy formation and evaluation.

The report is partially informed by a survey that my Office undertook in 2012 to assess the knowledge, attitudes and practices of public servants toward the use of research-informed evidence in policy formation. A number of government agencies were selected to take part in the study, which comprised staff surveys, key informant interviews and document analysis.

Findings of the study pointed to a high degree of variability across the New Zealand public service with respect to the understanding and application of robust evidence for policy formation and the evaluation of policy implementation. While there were examples of promising attitudes and practices, my report suggests approaches that would help to bring the New Zealand policy environment in line with current international practice.

Recommendations are discussed in full in Part 2 of this report (page 19). They include:

1. Develop a standard set of protocols across government regarding obtaining expert scientific advice;
2. Extend the use of Departmental Science Advisors (DSAs) more broadly across government;
3. Use the community of DSAs and the Chief Science Advisor to assist central agencies with longer-term planning, risk assessment and evaluation;
4. Improve and make more explicit the use of government funds for research to assist policy formation;
5. Provide greater transparency regarding the use of research-informed data (or its absence) with respect to complex and controversial areas of decision-making where the public is directly or indirectly consulted.

Key Recommendations

See full description of recommendations in Part 2.

1. Develop a standard set of protocols across government regarding obtaining expert scientific advice;
2. Extend the use of Departmental Science Advisors (DSAs) more broadly across government;
3. Use the community of DSAs and the Chief Science Advisor to assist central agencies with longer-term planning, risk assessment and evaluation;
4. Improve and make more explicit the use of government funds for research to assist policy formation;
5. Provide greater transparency regarding the use of research-informed data (or its absence) with respect to complex and controversial areas of decision-making where the public is directly or indirectly consulted.

INTRODUCTION

Effective decision-making requires good advice, and that depends on informed use of evidence both in developing policy and in evaluating its effect once implemented. In this way the value of government's performance to the benefit of citizens is maximized. However, the relationship between evidence and policy formation is neither linear nor unidirectional. Policy formation is a complex process, in which many factors other than evidence need to be brought to bear.

The complexity of policy formation stems from at least two issues. The first is the need to balance the many inputs into the process (such as rigorous analysis of a problem, analysis of social values, analysis of political context, and analysis of economic impacts). Secondly, the process is further complicated by the variability of uptake capacity and the appetite for such information by policy makers. There is not always the culture and capability within the public service to seek out appropriate evidence and to critically appraise and apply it to a policy question.

This complexity has been at the heart of a major global shift in policy making within democratic societies over the past 15 years. The concept of 'evidence-based policy making' began to gain currency

throughout the 1990s, with the UK Cabinet Office clearly adopting it as a motivating philosophy in its 1999 white paper *Modernising government*.[1]

Since then, scholars have added nuance, reminding us that policy must take into account both robust evidence derived from research, as well as an understanding of social values. Hence, in its more contemporary iteration, evidence-based policy has been more accurately re-cast as 'evidence-informed policy', which is not to diminish the role of research-informed evidence. To the contrary, it has helped to fully establish a particular place for robust evidence among the multiple inputs into policy formation.

The present report is concerned primarily with better ensuring that the highest quality research-derived evidence informs policy development in New Zealand. In doing this, it acknowledges that such evidence is not context-free. Rather, from the methods used to generate it to the way it is applied in practice, the use of evidence for policy formation must be viewed both as a product of, and in relationship to, its cultural milieu.

The challenge, as outlined in this paper, is to build a public service culture that has the attitudes, capabilities and internal processes to support the generation and use of quality evidence derived through the formal processes of research. The interface between science and policy is, after all, an interface; it demands as much capability from knowledge providers as it does from knowledge users. That is, there must be a culture of policy making that, as a matter of course, recognises the need for rigorous evidence to justify policy directions and decisions.

As with any organisational cultural shift, this process requires:

- Skilled leadership of experts embedded within government departments;
- Access to well-developed scientific and research expertise outside of government;
- Expertise in translation ('brokering') between researchers and policy experts;
- Concerted efforts to lift capabilities within public service communities of practice so that there is capacity to evaluate such evidence without bias and with rigour;
- Enabling practices and administrative infrastructures that can accommodate robust processes of data collection and analysis, whether intra- or extramurally.

[1] Cabinet Office (1999) Modernising government, Stationery Office: London, Ch. 2, paragraph 6.

Note On Terminology

In this report, I variously refer to 'science', 'research' and, in their more applied form, 'evidence'. I am aware that these terms can have different interpretations and that knowledge production in science should not and cannot claim to be the production of objective 'truth.' However, the role of science is to provide processes that significantly reduce subjectivity, bias and uncertainty in our understanding of our natural, built, and social environments.

Thus, when I use the terms 'science' or 'research,' I am referring to formal processes that use standardised, systematic and internationally recognised methodologies to collect and analyse data and draw conclusions.

When I refer to science I am including the biological, natural, mathematical, engineering and social sciences; the methodological commentary is equally applicable across all of these domains.

I use 'evidence' to mean robust and verifiable knowledge, derived from the processes described above and used to establish the case for a specific policy response.

These definitions apply throughout the report.

The discussion that follows is divided into three sections:

Part 1 is a general overview of issues involved in applying evidence to the policy process. This section highlights both the practical and philosophical challenges inherent to the process, and relates these to the New Zealand context.

Part 2 makes specific recommendations aimed at improving the quality of, and mechanisms for the use of, evidence in policy formation in New Zealand.

The Appendices offer specific detail on: (1) results of an assessment undertaken by the Office of the Chief Science Advisor regarding attitudes to and use of research-derived evidence in policy formation; and (2) examples of how recommendations similar to those herein have been applied in other jurisdictions.

PART 1 – Evidence and its application within the New Zealand policy environment

1.1. Context

As observed in my earlier discussion paper, *Towards better use of evidence in policy formation*[2], it is generally recognised that the relationship between evidence and policy formation must be interactive. It is rare indeed that any single piece of data is sufficient for a policy shift. Instead, it can be argued that the role of evidence is to 'nudge' the complex and iterative policy formation process in certain directions. As others have argued, this 'nudge' can be further broken down into five key tasks for promoting better use of evidence in policy making: 1) identifying problems; 2) measuring their magnitude and seriousness; 3) reviewing policy options; 4) systematically assessing likely consequences of options; and 5) evaluating results of policy interventions.[3]

Thus, while it is understood that policy decisions in a democracy are inevitably largely based on values domains such as fiscal priorities, affordability, public opinion, political ideology and electoral considerations, effective policy formation must also incorporate the use of evidence as a fundamental underpinning. Without objective evidence, the options and the implications of various policy initiatives cannot be measured. When this happens, judgment can only be on the basis of dogma, belief or opinion. This cannot provide useful estimates of the magnitude of any desired policy effect or of any spill-over benefits and risks. Increasingly it is acknowledged that, in areas where complexity makes policy formation particularly challenging, programmes that are implemented in response to government decisions require *ab initio* and planned evaluation to ensure that the desired effects of the policy are being realised.

Where evidence for policy formation is generated outside of government, there is inevitably the potential for some tension between those engaged in policy making and researchers engaged in knowledge production. There can be cultural divides and quite different understandings of the policy development process. Researchers can overestimate the reliability and the utility of what they know, while policy makers may underestimate what they do not know, as well as the value of objective evidence.[4,5]

As a result, democratic institutions are increasingly seeking ways to improve the use of evidence-based inputs in the processes of policy formation and implementation. The United Kingdom has made the most extensive use of formal processes to increase the use of evidence in policy formation – these have been developed through the office of their Chief Scientific Advisor and assisted by the establishment of the positions of Departmental Science Advisors. In the United States, the Department of Health and Human Services *Translating evidence into practice* (TRIP) Initiative is another example of government effort in this regard. Similarly, the Campbell Collaboration[6] demonstrates the global interest in evidence-based policy making. This international organisation conducts and maintains a database of systematic reviews of the effects of social interventions. It is accessible to researchers and policy makers alike.

What these programmes cannot do, however, is to provide any assurance that they will be used by policy makers. Thus, while the evidence may be available, its application is a matter of preference, personal judgement and organisational culture. For this reason, internal scientific leadership is important within government agencies in order to assist knowledge users to appreciate the value of and optimally use research-informed and robust evidence in the development of policies and programmes.

Situating this report

This report builds on the discussion paper entitled *Towards better use of evidence in policy formation* (2011). It also provides some follow-up (albeit focused explicitly on science advice) to the report of the government-appointed committee chaired by Dr Graham Scott entitled *Improving the quality and value of policy advice* (2010).

[2] Gluckman, P. (2011) Towards better use of evidence in policy formation: a discussion paper. Office of the Prime Minister's Science Advisory Committee.

[3] Prewitt, K. et al. (2012) Using science as evidence in public policy, National Academies Press, p. 4.

[4] Cullen, P. (1990) The turbulent boundary between water science and water management. In Freshwater Biology Vol 24, pp. 201-209.

[5] Haynes, A. et al. (2011) From "our world" to the "real world": Exploring the views and behaviour of policy-influential Australian public health researchers. In Social Science and Medicine, Vol. 72, pp. 1047-1055.

[6] The Campbell Collaboration is an international research network that produces systematic reviews of the effects of social interventions for use by policy makers and programme managers in education, justice, social welfare and international development sectors (*www.campbellcollaboration.org*).

While the Scott report was concerned primarily with government expenditure regarding policy advice, it made useful recommendations regarding "improvements to the leadership and management of the policy advice function,"[7] for which, it noted, "there is significant room for improvement."

The report pointed to the general need for a commitment to evidence-informed policy advice and for more effective systems for accessing evidence and applying this to policy advice challenges.[8] Specifically, to help to "improve the management and dissemination of data and information" for policy formation and monitoring, the Scott report called for:

- A shared approach by agencies for knowledge management and developing capability in research and policy functions (recommendation 28);
- A proactive approach to accessing knowledge and expertise held outside the public sector (recommendation 29);
- The routine (where appropriate) publication of agency data, analysis, research findings and models, particularly on cross-portfolio and/or long term issues and 'big questions' (recommendation 30).

In addition to the issue of access to policy-relevant knowledge, the report also touched on the need to develop processes to ensure that this knowledge is of the highest quality. It suggested that agencies institute a quality management process for policy analysis and advice. It suggested that "advice on significant issues should be developed using accepted standards […] to assemble evidence within a culture of analysis, open debate and peer review".[9]

Since publication of the Scott report in 2010, a number of central programmes have been reformed or strengthened to meet these aims. For instance, Treasury has taken on a central leadership role in overseeing the quality of advice through routine Regulatory Impact Statements (RIS) that are attached to Cabinet Papers. However, this improvement is almost exclusively aimed at the regulatory domain and has less impact on shifting the policy-making culture of the public service toward greater use of research-informed evidence.

[7] Scott, G. (2010). Improving the quality and value of policy advice: Finding of the Committee Appointed by the Government to Review Expenditure on Policy Advice. p. 6.
[8] ibid p. 46.
[9] ibid p. 40.

It is against this backdrop, and with the support of the Prime Minister and of the Chief Executive of the Department of Prime Minister and Cabinet, that my Office undertook a survey in 2012 of how government departments and agencies currently approach the use of evidence in their work. The results of this survey have led me to formulate a number of specific recommendations that follow in Part 2 of this report.

In short, results were very variable; there were examples of good practice but also evidence of some disappointing attitudes and, in some cases, ignorance of the principles by which evidence could and should inform policy formation. The quality of government data and access to it for analysis is variable, despite explicit programmes seeking to improve Open Government. This in turn means that evaluation and assessment cannot always ensure value for programmes that government wishes to see implemented.

It can be argued that these issues are particularly acute in a small country such as New Zealand. Inevitably we have a less complex system of connectivity between elected officials, policy makers, the public and the media. This, combined with the pressures created by a very short electoral cycle, results in greater potential for evidence to be ignored. For these reasons, the issues raised in the present report are particularly cogent.

Re-aligning the Government's policy process toward the more systematic use of robust evidence

A key theme in the survey's findings is that the public service in general requires a better appreciation and understanding of how high-quality and scientifically-derived evidence fits into the processes of formation and evaluation of policy. As a start, policy makers need to consider such evidence as base information upon which to build a policy position. On this foundation can then be overlain the various values dimensions that properly form part of policy formation. These include: fiscal and diplomatic considerations, public opinion, and the political theory and ideology that distinguishes one political party's policy position from that of another. If evidence is treated in the same way as these values-based components and conflated with them, then it loses its critical informative value. This is the very consideration that has led other democratic jurisdictions to develop protocols and processes

that define how objective evidence is to be used as a key foundation to the policy process.

Such a process must be sought for New Zealand. There have been too many examples where appealing to apparently confused science masks what is in fact a policy or ideological debate (for example, exploiting scientific uncertainty to justify inaction on climate change). This has been termed the 'misuse of science as a proxy for a values debate'.[10] Such misalignment can only undermine confidence in both science and policy formation.

At the same time there has been an increasing trend towards seeking public consultation on complex issues, but such consultations are not meaningful if the public is questioned on issues in the absence of an unbiased presentation of the evidence. At times the dominance of ideological rhetoric has inhibited the ability of the public to obtain such information. Put simply, majority public opinion does not create reliable evidence and must not be taken as such. This is not to diminish the key role of public consultation, but simply reiterates that the policy process needs to recognise the inherently different domains of objective evidence and opinion. As will be discussed, this distinction is not always clear and sometimes never can be, which makes the role of intermediaries to assist the policy process all the more important. Further, while the political process is heavily influenced by anecdote, it must be noted that the plural of anecdote is not data.

It is generally understood that governments, within the parameters of their electoral contracts, wish to make effective decisions that do the best for New Zealand and New Zealanders. It is my argument that the better use of quality research-informed evidence is key to more effective policy development irrespective of ideology. Such improvements in the policy process may well imply some small component of additional government expenditure in a time of fiscal restraint, but this is surely the time when good policy advice becomes even more valuable than ever.

1.2. The nature of knowledge and evidence

What is considered 'evidence' has been the subject of scholarly enquiry in the last several decades, creating a considerable literature in the philosophy and epistemology of science.[11] But while the philosophical underpinnings of evidence generation can and should be debated, international scientific standards do provide a framework for a common understanding and acceptability of evidence. Clearly the most robust evidence comes from formal observation and scientific study.

How evidence is generated

When 'data' are systematically collected and analysed, they become 'information'; When 'information' is applied to specific problems or questions, it can be used as 'evidence' to establish a position or course of action. However, the value of data in the first instance depends on the robustness of the approaches used to collect and then analyse and interpret them.

Modern science can be defined by the processes underpinning it.[12] That is, science uses a range of relatively standardized procedures of systematic data collection and analysis. To such data are applied recognisable and replicable methodologies of analysis that are used to produce the increasingly reliable information about the universe, our environment and our society that represents the results of the modern scientific enterprise.

Depending on how research is conducted and how the data are interpreted, the robustness and applicability of the information produced can be affected greatly. This issue of the conduct of research is critical, but it is frequently misunderstood even within the scientific community. In my previous paper entitled *Interpreting science – implications for public understanding, advocacy and policy formation* (2013), I highlighted how misinterpretation can arise from the inappropriate or unsystematic collation and analysis of data. There is also the danger of bias creeping into the collection or the analysis

[10] Pielke, R. (2007) The honest broker: making sense of science in policy and politics. Cambridge University Press.

[11] A considerable body of scholarship including from Michel Foucault, Nancy Cartwright, Ian Hacking and Peter Galison, to name a few, has helped define a field of enquiry concerned with analysing the mechanisms of science and the processes by which it can make claims of evidence. This 'post-positivist' analysis of science has been highly influential in helping to uncover hidden biases and unintended effects of context and positioning within the scientific process. The results have the potential to help make scientists more aware of and accountable for the procedural choices they make and how these may affect the conclusions they can draw, ultimately strengthening the scientific output.

[12] Marks, J. (2009) Why I am not a scientist. University of California Press.

Key Features Of Evidence-Informed Policy Making

1. Quality and accessible data;
2. Robust and accessible data collection and analytical instruments;
3. Critical awareness of analytical assumptions and choices, and of theoretical perspectives that underpin the research methodology;
4. Understanding the limitations of even the most robust evidence;
5. Adjusting expectations of certainty and being able to manage uncertainty.

of data; the latter is more likely where analysts are not formally trained in research methodologies.

Several key features of scientific research can help to make policy making more transparent. These include the importance of (1) quality and accessible data; (2) robust and accessible data collection instruments; and (3) critical awareness of analytical assumptions and choices, and of theoretical perspectives that underpin the research methodology.[13] Incorporating a better understanding of these features within the public service policy toolbox will help to improve the critical appraisal of evidence and thus the quality of policy advice. Evidence must be critically appraised and its limits understood.

In addition to the issue of research quality and integrity, it is important to understand the limitations of even the most robust evidence. Much research output, particularly that most relevant to the policy maker, does not create certainty but rather, it reduces levels of uncertainty within complex systems. Because of this and many other factors related to the inherent variability of social, biological, and environmental systems and to statistical considerations[14], a single scientific finding can be at variance with others. This does not mean that a scientific consensus does not exist or cannot be reached, but expert skills are needed to navigate this knowledge space and critically appraise the material.

Further, researchers in general need to be more explicit about the limits of knowledge – it is as important to define what they know as well as what they do not know. The Popperian view of science may be debatable when applied to grand scientific theories, but it does make the crucial point that it is much easier to disprove something and, ultimately, it is virtually impossible to ever absolutely prove something in science. But this conceptual issue can be misunderstood and misused. This has particular implications when exaggerated in the inappropriate use of the Precautionary Principle – for instance, when it is demanded that something cannot be done unless it is proved to be absolutely safe. Of course such a demand is impossible to satisfy to an absolute degree and thus, when misused in this way, becomes an excuse for policy inaction.

From the policy perspective, such inferential gaps in knowledge are especially challenging because:

- The lack of certainty can be used as an argument by positional advocates to avoid action and this can create extreme positions where the default becomes inaction;[15]
- Most policy decisions have to be made in a fast-paced environment where multiple considerations compete for attention and where there is often little time (and in many cases little capacity) for properly collecting and analysing data, let alone for building a nuanced understanding of uncertainty of evidence.[16]

Understanding and clearly describing these gaps must become an essential part of the policy-making process, both at the outset and through on-going evaluation of policy implementation.

Epistemology: ways of knowing

There are other sources of information, more subjective forms of knowledge, and other pathways to obtaining input that interplay in the policy formation process. These other sources of knowledge need to be made explicit and distinguished from the role that scientifically based research methods should play in policy development.

Indeed, it is important to acknowledge the multiple societal considerations that go into knowledge production for policy work. Certainly, social, cul-

[13] Argyous, G. (2012) Evidence based policy: principles of transparency and accountability. Australian Journal of Public Administration. Vol 71, no. 4, pp 457-468.

[14] Gluckman, P. (2013) Interpreting science – implications for public understanding, advocacy and policy formation. Office of the Prime Minister's Science Advisory Committee.

[15] Oreskes, N. and E. Conway (2010) Merchants of doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming. Bloomsbury Press.

[16] Douglas, H. (2009) Science, policy and the values-free ideal. University of Pittsburgh Press.

tural and indeed spiritual belief systems that give rise to subjective knowledge have a major impact on the political – and subsequently policy – process through the values domains that shape actions. This is especially important in the New Zealand context where Māori culture and ways of knowing can have a positive influence on policy.

Such perspectives, however, must be seen as complementary to knowledge derived from rigorous research methods rather than equated with it. This is not to say that social and cultural perspectives cannot be reflected in the research undertaken – indeed they should (in helping to define the questions asked, the analytical approach and the target population for instance). But the knowledge resulting from formal scientific processes must strive for a high degree of objectivity and should be used as a relatively neutral base on which the policy and political process must weigh all other inputs into the decisions that a democracy requires.

Thus, from the scientific advisor's perspective, advice needs to be proffered in a way that accepts both the presence of gaps in knowledge and the role of other more values-based and socio-cultural elements in the policy decision process. For their part, policy advisors need to recognise that anecdotes do not generate data despite the fact that, in highly political contexts, it is often the most compelling story that carries the most influence.

1.3. Science and values

I am not suggesting that science itself is totally free from values and potential biases. Indeed, researchers make very real value decisions in the course of their work. For instance, such things as choosing baselines against which to measure, and which indicators and metrics to adopt, are choices (with trade-offs) that will affect how research results can be interpreted and applied. But science also provides accepted processes for making these choices transparently, so that the end product passes the replicability test. These issues are discussed in detail in my recent paper *Interpreting science – implications for public understanding, advocacy and policy formation.*[17]

Of course researchers do have spiritual and cultural values too. Science is a human endeavour after all and, naturally, human values can come into play. However, the key to objective and robust science is for researchers to adhere to internationally acceptable practices and to limit the role of any personally held values to areas such as decisions about their research interests and operational principles (for instance a researcher may make a personal choice not to engage in work that requires animal models for instance, or to only accept funds from certain sources and not others).

Where ever personally held values and biases may come into play, it is necessary to ensure that these are clearly identified and do not interfere with the collection and analysis of data as part of a robust and transparent research design. Such transparency ensures that scientific interpretation is based on the greatest possible objectivity and standardised processes. Much of the scientific method (experimental design, peer review, replicability, statistical approaches, publication, etc.) is designed to protect the objective nature of science. Professional researchers are trained to recognise and mitigate any biases that might arise throughout the process.

Despite all the safeguards, however, there will always be individual researchers who choose to advocate for particular positions based on their expertise. To some extent this is inevitable and understood. In doing so, however, these researchers risk losing their objectivity in the course of advocacy. It is therefore advantageous for the policy process to have access to intermediary knowledge brokers (i.e. science advisors) who can mitigate this risk. Building on Pielke (2007)[18], I have argued elsewhere[19,20] that the preferred position for the professional researcher embedded within the policy process is as an 'honest broker' explaining what is known, what is not known, and thus the implications of the options that emerge.

1.4. Social science

This paper is concerned with research-informed evidence for policy making in general, and does not attempt to analyse the specific situation by department or by scientific field of expertise. Indeed, my commentary applies equally across the physical, biological, natural and social sciences. However,

[17] Gluckman, P. (2013). Interpreting science – implications for public understanding, advocacy and policy formation. Office of the Prime Minister's Science Advisory Committee.

[18] Pielke, R. (2007) The honest broker: making sense of science in policy and politics. Cambridge University Press.

[19] Gluckman, P. (2011) Towards better use of evidence in policy formation: a discussion paper. Office of the Prime Minister's Science Advisory Committee.

[20] Gluckman, P. (2013) Scientists, media and society: where are we now? *http://www.pmcsa.org.nz/blog/scientists-the-media-and-society-where-are-we-now/*.

given the large government responsibility for social programme expenditure, it is worth understanding the use of social science for policy making.

Social policy has not historically benefited from the kind of investment in public research capabilities that areas such as conservation and primary production have had over the years. Indeed, the infrastructure and capabilities for policy-relevant science advice is quite established in these areas. The same cannot be said for the social sciences. It is perhaps for this reason that incorporation of robust social science research into policy making remains a challenge (and one that is not unique to New Zealand).

The social sciences have developed systematic and empirical methods to study and draw general conclusions about social phenomena. Yet, in applying social science research to policy, there are still at least three widely-held misconceptions that are worth noting.[21]

First, there can be an assumption that, because the very nature of the social sciences is a focus on society, this allows for values-based interpretations of the research, which can become more prominent in the mind of the policy maker who is not trained to recognise their own hidden biases. In fact, the social sciences can indeed provide robust social data for policy purposes. As with all sciences, however, this requires training and skill on the part of the scientist and the interpreter.

Secondly, empirical techniques used in the social sciences are broad and can range from quantitative to qualitative (for instance, statistical analysis of social metrics, case studies, surveys, or interviews). Quite often, there is still a perception that the more qualitative techniques are more susceptible to bias and personal judgement by the researchers themselves. However, robust social science methods used by trained researchers minimise this risk.

Related to this is a third misconception that undertaking social research for policy does not require particular expertise and can be done by policy practitioners with little or no formal research training. This is both a symptom and a cause of potential devaluation of academic social science for policy purposes. It can also make the research more vulnerable to unintended personal biases, without the benefit of research training to recognise and mitigate such bias.

In fact, rigorous social science practice is necessarily based on a set of methodologies that are subject to the same rules and professional standards as in the natural sciences. Indeed, just as in other forms of science, the same caveats apply: is the underpinning research design and the approach to interpretation adequate? Simply looking at apparent associations in datasets of variable quality does not meet that standard. But when done well, social scientific analysis makes a powerful contribution to policy development.

Evaluating social programmes: applying the science of what works

Given the large fraction of the public purse that is expended in the social policy domains, quality evidence to support appropriate policy development and formal evaluation of desired impacts is critical. Evaluative science and intervention research[22] is particularly important in the implementation of social policy because the reality is that the nature of human systems is such that it is not possible to predict with certainty the direct effect and spill-over consequences of any one intervention.

Too often, social programmes that result from policy initiatives are rolled out based on an idea or a successful pilot that may not, for a variety of reasons, be successful when they are scaled up nationwide or applied in a new geographic location. This points strongly to the need to consider formal evaluation when substantive programmes are initiated. There is also a compelling case for formal evaluative processes to be incorporated into any substantive new programme. The UK Cabinet Office recently released a paper entitled *Test, learn, adapt: developing public policy with randomised controlled trials*[23] which pointed out that controlled trials should be more readily incorporated into the roll-out of social programmes than is currently the case.

[21] Prewitt, K. et al. (2012) Using science as evidence in public policy: report on the use of social science knowledge in public policy. National Research Council of the (US) National Academies of Science.

[22] Intervention research is about examining proven policy or programme interventions to determine what works best, for whom and in what circumstances. This type of research helps policy makers who want to introduce proven policy or programme interventions into new jurisdictions and adapt them to the local context.

[23] Haynes L, et al. (2012) Test, learn, adapt: developing public policy with randomised controlled trials. Cabinet Office Behavioural Insights Team. Available from: *www.gov.uk/government/uploads/system/uploads/attachment_data/file/62529/TLA-1906126.pdf.*

Promising practices in New Zealand

With respect to evaluating the implementation of social policy, New Zealand has started to make moves in a positive direction. Two examples stand out:

- **Prime Minister's Youth Mental Health Project (2012):** These programmes represented a milestone in social science and policy interaction. It was acknowledged from the outset, both by the contributing researchers and policy advisors, that it was not known which of the 22 programmes in the initiative would in fact be effective. This was simply because of the general lack of understanding of many of the factors associated with modern adolescent morbidity. Such acknowledgement by the political process is in itself refreshing, but importantly the launch coincided with the allocation of funding specifically for on-going programme evaluation.
- **Social Policy and Evaluation Research Unit (SuPERU):** The reconfiguration of the Families Commission and the establishment within it of SuPERU and its independent Scientific Advisory Board should now provide an autonomous unit with expertise in social science research and evaluation that could provide support and best practices across multiple ministries. While this unit is in its early days, it will be critical that the Commissioners[24] ensure that the standards and mode of operation of this entity are of the highest quality. It must develop specific skills in programme evaluation such that Ministers will wish to encourage agencies to take advantage of its expertise.

1.5. Typical avenues by which evidence is incorporated into policy formation

The policy formation process is iterative and decisions along the development chain should be continually checked against the best available evidence, which can change over time. This means that, throughout the policy process (development/implementation/evaluation), there is an on-going role for ensuring that the evidence is appropriately applied.

Obtaining quality evidence for policy formation can occur in a number of ways. The list below provides an annotated summary of the most common ways that the results of scientific research can be injected into the policy-making system.

- **Internal knowledge:** Policy analysts are the backbone of policy making. Though a significant number have postgraduate or professional research experience, the bulk of the policy staff cadre in the New Zealand public service is still unlikely to have the research experience and/or competency to critically scan the scholarly literature and fully interpret the science. Depending on the domain, there is the risk that non-expert assessment of complex literature can lead to cherry picking – that is, finding something to bolster an established opinion or relying only on what has been made accessible to the non-scientist via the popular or semi-popular literature. Neither newspapers nor Wikipedia are robust sources of scientific information.
- **Expert advice:** Policy makers may identify a knowledge need and go to a known expert for advice. The quality of that interaction will depend on the nature and framing of the question being asked and the understanding of both the agency and the knowledge broker. Protocols that have been developed elsewhere to clarify these expectations could be of benefit in New Zealand. There is also the problem of identifying an appropriate expert in the first place. Many people may claim 'expertise', but without sufficient knowledge of the scientific literature, policy makers may have difficulty discerning the quality of that expertise and in distinguishing advocacy from unbiased knowledge transmission.
- **Advocacy efforts:** Policy makers and elected officials may be lobbied by scientists either for issues related to science policy or where researchers engage as advocates for a particular cause. As discussed above, there is a risk of a loss of objectivity. The role of Academies, such as the Royal Society of New Zealand, in moderating such dialogue should be important and should be reinforced. However, the ability of the Royal Society to provide robust advice requires resources and an independence that may be limited by its dependency on current arrangements for Crown funding. The more recent evolution into a much broader Academy that includes the humanities (where it is inherent that values dimensions are part of scholarship) will require the development of processes to ensure that, when advice from the Academy is proffered, it is clear on what basis it is being provided, in part so that the Academy

[24] Professor Sir Peter Gluckman, Chief Science Advisor to the Prime Minister and author of the present report, is one of five Commissioners of the Families Commission.

is not perceived as usurping the proper role of the policy maker.

- **Commissioned research:** Policy makers may contract a piece of research externally. However, unless staff members are appropriately skilled in research methods and critical appraisal, then the overall project may be at risk – either by not recognising if the deliverable is of poor quality or by not knowing what to do with high quality but highly technical information. These issues were expanded in my previous paper *Towards better use of evidence in policy formation*.[25]
- **Scientific advisory bodies:** Policy makers may invite experts onto particular advisory committees or panels. As I have argued before[26], this is to be applauded. However, if the required output is scientific advice, then only committees of acknowledged researchers can give such advice, which should then come to the policy maker in an unfettered form. To ensure this, scientific advisory committees require formal governance structures (protocols of membership and operation) to protect their objectivity. The UK has developed very specific criteria in this regard. This does not mean that scientists do not have valuable contributions to make to other forms of advisory committees, but these have to be viewed as something other than scientific advisory committees. Scientific advisory bodies also need full access to the relevant data, as the quality of their advice rests on the quality of data they have at their disposal.
- **Intramural research:** Departments may retain internal research units or staff as the primary sources of broad evidence-informed advice. Staff members may have varying qualifications and training, but most important is that they have proven skills in applying rigorous and replicable methods of data collection and/or analysis. More desirable still is in-house researchers being active in handling the scholarly literature and regularly exchanging informed opinions with research peers, thereby helping to ensure that they are providing state-of-the-art and balanced advice. However, too often, public service budget constraints do not allow access to scientific journals, conference travel, or release time to write and publish papers. Consequently, such staff can become isolated from their scientific peers. A solution encouraged in other jurisdictions is to second academic staff into policy positions for periods of 1 to 3 years, and to allow for policy staff to spend time in academia. This has the mutual benefit of ensuring that more academics understand the policy formation process, and vice versa.
- **Departmental Science Advisors:** Departments may establish Departmental Science Advisors with defined terms of reference. This system is fairly well-developed in the UK and could provide a suitable model for broad adoption here, and as such is discussed at length in Part 2. In New Zealand, the Department of Conservation has an embedded Chief Scientist, and the Ministry of Primary Industries now has an independent Departmental Science Advisor. These different approaches are discussed below. However, these Departments stand out in their recognition of the importance of research-informed evidence in the processes of policy formation, which is far from the norm across government.
- **Parliamentary structures:** In some countries Parliament itself can foster interaction between science and policy development and implementation. The Parliamentary Office for Science and Technology (POST) offers non-partisan advice on scientific matters to both UK Houses of Parliament. Parliamentary Select Committees (particularly where there are bicameral systems) focus on the quality and nature of scientific advice or conduct expert enquiries. However, such a function is very distinct from the role that science advisors play in advising the Executive and engaging in the policy formation process,[27] and the two cannot be linked. Novel approaches are required to enhance parliamentarians' understandings of science and the scientific method. This is important given that relatively few parliamentarians come from backgrounds where such understanding is widespread. One approach is a pairing scheme operated by the Royal Society (London) that pairs scientists and parliamentarians/senior

[25] Gluckman, P. (2011) Towards better use of evidence in policy formation: a discussion paper. Office of the Prime Minister's Science Advisory Committee.

[26] Ibid.

[27] Tyler, C. (2013) Scientific advice in parliament. In Future directions for scientific advice in Whitehall, Doubleday and Wilsdon, eds. Cambridge Centre for Science and Policy.

civil servants for a reciprocal week of exposure to the other's domain.[28]

The above summary reflects the usual methods employed to ensure the supply and quality of science advice for policy, but the extent to which that advice is implemented depends on the internal capabilities within the public service to broker the knowledge and apply it appropriately. The need for leadership in lifting staff capabilities and create a culture of evidence use is addressed in Part 2 of this paper.

1.6. (Un)informed public discourse

There are public debates which have influenced policy decisions in recent years where the New Zealand public would have been better served had an evidence-based process been used within the policy formation process and within the public dialogue that informs it. We have had examples where public consultation has occurred without the benefit of transparent peer-reviewed scientific advice. This has limited the quality of the public and media discourse and may have well led to decisions that in other circumstances might have been very different.

One example is that of folic acid supplementation of bread. A decade ago there may have been no scientific consensus in this area, but there is now a strong consensus that it is safe and effective in reducing the incidence of neural tube defects in newborns. Documents from the Ministry of Primary Industries made that clear, yet consultation went ahead in the absence of these reports being widely available. There may well be valid values-based reasons why a country may decide not to supplement bread with folic acid, for example perceptions of medicalising a common food staple (although we have long supplemented salt, and more recently bread, with iodine), or because a cost-benefit analysis may not seem to justify it. But irrespective, in this case decisions were made with a component of public consultation in the absence of up-to-date scientific data being made freely available.

Another recent debate is that of school class size. Clearly there are very diverse views of the trade-offs, costs and benefits of changing class size. The use of an expert educational scientific advisory panel to review the empirical evidence about enhancing educational outcomes independently of those who generated the data, and prior to any policy decisions, could have contributed to the depth and quality of the public consultation.

Understanding and communicating risk

An on-going challenge for all nations is the adoption of new technologies. Those technologies – such as the internet and social media – that show immediately perceptible benefit or convenience have been incorporated and embedded into societal structures without much critical reflection, yet they are now having profound effects. This contrasts with other technologies that have had more contested introductions to the world; examples include in vitro fertilisation, genetic modification, nanotechnology, synthetic biology and hydrological fracking. Here it has become apparent that explicit rather than tacit social license is needed for such technologies to be accepted.

The difference between this class of technologies and the former is that, at least superficially, they more directly confront individual and social values and beliefs. This sometimes leads to the debate being solely about values without any ability for the public to gain a clear appreciation of the technology itself. Indeed, the level of contention and strongly held values by sectors of the public may completely inhibit the provision of evidence to inform societal opinion.

Better application of research-derived evidence encourages more informed and mature public debate in policy questions. Importantly, it can help to distinguish the risks and benefits of the application of a technology from the fundamentals of the technology itself.

Nuclear technology is a case in point. New Zealanders are proud of being 'nuclear free', but of course we are not – what we have done is limit the application of the technology to medical and biosecurity purposes, while restricting its use in areas such as power generation, transport and defence. By contrast, where we limit the technology itself rather than control its application, there is the danger of embedding rules in the national mind-set that could be difficult to change. Yet technologies change very quickly, and well-communicated quality evidence contributes to the development of appropriate regulatory frameworks that are responsive as technologies change and the risks and benefits become better understood.

[28] The Royal Society. Pairing scheme. *http://royalsociety.org/training/pairing-scheme/*.

Better Risk Analysis For Better Policy Development

- Understanding risk is a matter of both science and human values. Mature public discourse must be informed by both;
- A more informed understanding of risk will become increasingly important in the coming years as the pace of new technologies increases;
- Quality evidence that is conveyed to the public in an accessible way can position society better for decisions on whether to give social license for the introduction of new technologies.

All use of technologies requires a social license. Whether a social license is gained or not depends on when and how the public is engaged with the technology. If the science is presented in a non-partisan manner, rather than becoming embroiled in partisan debate, then a different type of constructive public conversation can emerge. Such a conversation can and should include a full examination of public values about the use of the technology, but values must be distinguished from (and informed by) robust evidence. The recent preliminary report of the Parliamentary Commissioner for the Environment on fracking highlights the value of good evidence-informed public discourse early in the consideration of many technologies.

Given that some of the most intense debates in New Zealand, and indeed across all western societies, in coming years are going to be about the incorporation of new technologies, the science-policy nexus will be even more essential in assisting the public and political leaders to understand the risks, the opportunities, and the trade-offs involved. Indeed, we can expect significant debate on issues such as:

- Next generation internet technologies;
- Genetic modification related technologies where no new genes are introduced (instead there is altered regulation of the native genes);
- Synthetic biology, neural implants and regenerative medicine;
- The use of technologies to manage the balance between environmental protection and the need to enhance social and economic prosperity in a sustainable way.

In such areas, better use of quality evidence will make that debate more productive and less polemic.

Indeed, such issues in the practice of risk assessment and management are themselves complex because there are very different meanings of risk. These may range from the technical calculation of probabilities to the perceptions of likely 'harm' based on personal or societal values. Different kinds of risk are accepted differently. For instance, in the area where technologies and values can be in conflict, the issue of how risks are addressed depends in no small part on whether trust exists or does not exist between the public and the regulator.[29] The assessment of risk is therefore intimately linked both to the provision to the public of high quality information by a trustworthy source and to appropriate and timely engagement of stakeholders.[30]

1.7. A stock-take of evidence-informed policy practices in New Zealand

My survey of 17 government agencies and ministries showed that there are departments where the need for a quality database is acknowledged; conversely, there are others where staff attitudes toward the use and analysis of data to develop a policy case were disappointing.

Some policy practitioners held the view that their primary role was to fulfil ministerial directives, rather than to provide an evidence-informed range of policy options on which Ministers could develop a position. Surprisingly, this view was held in some departments that most need to use objective evidence in their day-to-day operation.

Worryingly, some officials had limited understanding of the scientific process of knowledge production, or were uncertain about it. In addition, they were not clear on how research-based evidence could be used to support policy processes. Rather, it seemed that some preferred to work from their own beliefs or rely on their own experience. At its extreme, I find this deficiency to be unacceptable. In part, I think these deficits reflect the dire need to build some basic competencies in research methodologies and critical appraisal skills across the public service, and to bolster the leadership ranks with people formally trained in the relevant disciplines.

[29] Lofstedt, R. (2005) Risk management in post-trust societies. Earthscan Press.
[30] These matters will be expanded upon in a future discussion paper.

Promising initiatives on the road to improvement

This is not the first time that the quality of policy advice has been scrutinised across government. In the years since the Public Finance Act was enacted (1989), there have been other initiatives aimed at improving the quality of policy advice, including most recently the government appointed committee chaired by Dr Graham Scott (2010) mentioned earlier.

As a result, some concrete steps have already been taken to lift and monitor the quality of policy advice. For instance, under the State Services Commission's recent Better Public Services Initiative, systemic mechanisms are being put in place to provide evidence-informed critical analysis. As mentioned earlier, the Treasury's Regulatory Impact Statements (RISs) are intended to provide due diligence in critically analysing the various options and their consequences – something that requires good data and analytical methodologies. An external consultancy is contracted by Treasury to regularly review the quality of a random sample of RISs. Similarly, the New Zealand Institute for Economic Research (NZIER) is annually contracted by a number of agencies to assess a random sample of policy papers for quality and effectiveness.

This is a laudable level of self-monitoring by agencies and, across government, by Treasury. By all accounts the exercise is already revealing some serious knowledge and capability gaps, which is a good start on the road to improvement. While promising, it is unclear whether these efforts will be useful in helping to build the internal capabilities of staff to generate and/or make better use of research-derived evidence for policy making.

In addition to these efforts, some specific agency examples bear mentioning:

- PHARMAC is perhaps the best known agency with a rigorous approach to evidence evaluation, and it is interesting to note the high public and professional acceptance of the model despite the fact that it must deal with highly contentious issues. PHARMAC's obvious use of science in decision making has fostered its public credibility and, in turn, the acceptance of the difficult decisions it has to make about which medicines are funded by the public health system.
- The Ministry of Primary Industries (MPI) recently took important steps to improve the quality of its policy formation processes. For example, the Fisheries group has developed an extensive protocol for seeking scientific advice on the management of the national fisheries resource, which is a particularly sensitive process. It is significant that this protocol is very similar to the more general guidelines for advice released by the Chief Scientific Advisor to the UK government in 2011. Yet, within MPI there is also recognition of the need to improve matters further. For example, the report on the Psa outbreak suggests that there was over-dependency on a passing comment within a single academic paper without the benefit of experienced scientific review. The on-going issues regarding importation of pig meat can be interpreted in part as a result of conflating scientific and end-user advice in a single process. Overall, however, it is encouraging that the recent Chief Executive of MPI had given priority to improving the use of evidence-informed advice in departmental processes and this culminated in late 2012 in the appointment of a senior and internationally respected scientist as MPI's first independent Departmental Science Advisor.
- The Department of Conservation (DOC) also has such a Chief Scientist position, though without the advisory independence. DOC also benefits from good internal capabilities and processes for knowledge production, analysis and the ability to judiciously commission external scientific input and expertise. However, there are systemic obstacles that can prevent the application of objective evidence in policy and practice. DOC has previously undertaken a review of its science transfer process[31], which tracked the mechanisms and the roadblocks of getting science into policy. Some of these findings are being implemented.

Grounds for concern

While these examples of promising practices are encouraging, our survey also revealed grounds for concern arising in departments relying primarily on internal research of questionable quality and/or commissioning external advice that was not scientifically peer reviewed.

Given that many of the most important decisions that must be taken by any government will relate to matters of resource allocation and risk assess-

[31] Geoff Hicks, DOC Chief Scientist, personal communication.

ment, the current lack of protocols for commissioning or generating evidence-informed advice across government is of concern and runs contrary to best practices internationally.

Another concern common to most departments (with the exception of Treasury and the defence/intelligence sectors), was the minimal horizon scanning, technology forecasting and broader risk assessment capabilities with a view to the longer term. While other jurisdictions put significant resources into these areas, it may well be that our electoral cycle leads to a focus on short-term priorities. However, the country also needs consideration of the longer term.

Policy units that are by definition non-partisan have an obligation to advise Ministers on short-term issues but also must consider the longer-term and multi-generational implications of policy actions. Indeed, internationally, science plays a very important role in such longer-term forecasting – participants in the Small Advanced Nations meeting that New Zealand hosted in Auckland in November 2012 regarded this scientific function as critical.

PART 2 – Suggested steps to enhance the use of evidence in New Zealand's policy framework

In my view there is an overwhelming case to enhance the ability to produce and use quality research and scientifically based evidence within New Zealand's policy development system. Indeed, I have argued for the critical position of evidence derived from rigorous research as the base on which the values perspectives, required in policy development, should then be overlain.[32] This section identifies five areas that stand out for potential action to help to improve the system.

These recommendations are aimed at ensuring that sound evidence gets incorporated into the policy system and that there is the capability internally to critically understand how best to employ it.

Of course, the internal 'culture' of departments and agencies will influence uptake and implementation of science-based inputs and this puts the onus for improvement on Chief Executives and their leadership team. However, as the work of Nutley[33] suggests, among the key factors that determine the use of objective evidence and science in support of policy making are reliable mechanisms such as cross-government work groups and the establishment of expert bodies that specialise in the substance of a policy domain.

Organisational culture shifts occur when enabling mechanisms and leadership are in place. In this regard, my recommendations below should prove useful.

2.1. Setting standards

Key recommendation: Develop a standard set of protocols across government regarding obtaining expert scientific advice.

Both the UK Office of the Government Chief Scientific Adviser and the US Office of Science and Technology Policy have now established protocols for obtaining independent scientific advice, either from individuals or from scientific advisory committees (see Appendix 2). Importantly, principles have been established with the goal of ensuring that such advice is free from bias or filtration. Given the variable state of the use of evidence-informed advice and the limited and uneven appreciation of both its value and its limitations, such protocols need to be developed and applied across the New Zealand policy framework in a whole-of-government manner. This is made difficult because of New Zealand's small corpus of expertise within any given domain, and thus the need for expert oversight becomes more critical.

Key elements in seeking advice either from individual researchers or expert committees were laid out in my previous report *Towards better use of evidence in policy formation* and are reiterated here. Procedures must be in place to ensure that the advice is:

- Politically neutral;
- Focused on the data and its appropriate interpretation;
- Unbiased with respect to its use of data;
- Explicit about what is known and unknown and the quality of the available data;
- Clear in communicating probabilities and magnitude of effect;
- Free from real and perceived conflicts of interest.

I believe there would be value in enshrining these principles within a set of formal guidelines for the New Zealand public service.

[32] Gluckman, P. (2011) Towards better use of evidence in policy formation: a discussion paper. Office of the Prime Minister's Science Advisory Committee.

[33] Nutley, S. and I. Davies (2007). Using evidence: how research can inform public services. Bristol, UK. The Policy Press.

2.2. Science leadership

Key recommendation: Extend the use of Departmental Science Advisors (DSAs) more broadly across government.

The Prime Minister established the Office of the Chief Science Advisor in 2009, modifying and developing the model from that used in other jurisdictions. Internationally, central science advisory roles fall into two categories: those that involve the direction, management and operation of the science and technology system, and those that are independent of the management component, but advise the Executive.

New Zealand, in my view wisely, has distinguished between those types of role and focused on the second, even if this arrangement can potentially create tensions in the provision of advice on policy development regarding science and innovation. Moreover, its independence strengthens the neutrality of the role and gives weight to the broader functions of science communication, advice on evidence in policy formation, science diplomacy and specific policy issues. Together with a role in structuring and enabling risk assessment and foresighting (which is yet to be actioned in New Zealand), these are the key functions that other jurisdictions increasingly perceive as central to the role of a governmental science advisor.

Of these responsibilities, assisting government to ensure the quality and application of research-informed input in the policy development process across government is of paramount importance. As noted above, New Zealand does not have a robust framework across government in this regard (although Treasury has made significant progress toward advancing the quality of evidence for making regulatory – if not policy – decisions).

Clearly departments require access to expertise, yet in some cases they do not recognise that they are lacking it. There is a cultural divide across parts of the New Zealand public service when it comes to the use of scientifically generated evidence for policy formation. As my survey indicated, this is likely the result of differences in modes of thinking, including in some places how to look at data objectively, how to identify appropriate sources of advice, how to recognise scientific bias, and how to identify knowledge gaps. There is also variability in the extent of appreciation of the implications of technological developments. Overall, it is clear that departments or clusters of departments would benefit from more formalised access to scientific advisors.

In my 2011 discussion paper *Towards better use of evidence in policy formation* I pointed out the value of Departmental Science Advisors to the UK policy framework. In the UK, each department is required to have a scientific advisor – the details of the post vary across agencies, depending on their characteristics. Some for example administer departmental research budgets. Recently the UK House of Lords Select Committee reviewed the function and operation of these positions and concluded that they are valuable and critical roles that deserve to be strengthened and made more consistent across government.[34] The Select Committee suggested a framework for appointment and terms of reference for these positions (Appendix 3) which, in modified form, would work well in New Zealand. Australia has also committed to progress in this direction.

There is thus an evidential base for New Zealand to follow in strengthening the positioning of science advisors across agencies. However, we have neither the scale of public service nor the scientific capacity to simply follow the UK system. In our case, scientific advice across ministry groupings becomes logical, and it is also in keeping with the government's desire to encourage a more coordinated public service.

The beginnings of such a system are already emerging in New Zealand. For instance:

- As mentioned above, DOC has a Chief Scientist and MPI has recently created the position of Departmental Science Advisor. The terms of reference for the latter position are largely in line with UK practice. A senior and experienced scientist has been appointed to that role and within a few months has demonstrated within the Ministry the value of the appointment.
- The Ministry of Defence has similarly appointed a Defence Technology Advisor, in a somewhat narrower role that could be expanded.
- MFAT counts on the Prime Minister's Chief Science Advisor in the area of science/diplomacy, and on MPI's Science Advisor to provide counsel on more technical matters.

[34] House of Lords. Select Committee on Science and Technology (2012) The role and functions of Departmental Chief Scientific Advisers. *www.publications.parliament.uk/pa/ld201012/ldselect/ldsctech/264/264.pdf*.

Table 1. Possible sectoral groupings of Departmental Science Advisors

Departments/agencies	State of science advice	Other observations
DPMC	The position of Chief Science Advisor is in place.	
MPI	A Departmental Science Advisor was appointed in 2012.	
MFAT	Arrangements in place.	This might need expansion in due course.
Defence and intelligence agencies	The Defence Technology Advisor was appointed in 2012.	The role might need to be expanded from its current description.
Health	An appointment is needed.	
Education and Tertiary Education	An appointment is needed.	
Social Development and other social ministries	The CE of SuPERU is a partial solution.	A formal appointment within the ministry is desirable given that SuPERU cannot influence the operations of MSD.
MBIE (including Building and Housing, Immigration, Labour), Transport, Internal Affairs	An appointment is needed for this cluster.	Given the different tasks and scope of work this is likely a separate need from the recently appointed Chief Science Advisor for science and innovation.
Environment (including climate change)	An appointment is needed.	
Conservation	An appointment is needed.	It might be combined with Environment.
Treasury	This function is likely largely undertaken by the Chief Economist, but some access to formal external advice may be logical.	
Statistics	This is already the role of the Government Statistician.	
Police, Corrections, Justice	An appointment would seem to be desirable.	

- The establishment of SuPERU, with a degree of autonomy via the Families Commission, could provide a route for that unit to provide some advisory function across the social ministries.

With a relatively small number of additional appointments, I believe that a valuable community of Departmental Science Advisors together with the Prime Minister's Chief Science Advisor could be created. This grouping should work across government to provide leadership in lifting internal capabilities and bringing consistency to all avenues of evidence-informed advice provision.

The Ministry of Health already has a number of advisory committees. However, there remain concerns about the capability of analysts to identify appropriate sources of advice and perform critical appraisal. This is in no way a criticism of the general competencies of the staff, but it does throw into question the criteria used to appoint staff members ultimately responsible for handling scientific information. Thus a key role of a Departmental Science Advisor would be to assist in the up-skilling of the analyst community. For instance, within such a ministry, a Science Advisor could play an essential role in coordinating the development and adoption

of protocols and standards. The role of a Science Advisor would be quite distinct from that of the Chief Medical and Nursing Officers.

Education policy is an area where it is easy for received wisdom to determine policy. Values are often conflated with evidence, again making obvious the need for independent scientific advice.

Thus I would recommend the creation of a number of Departmental Science Advisor positions, each with specific terms of reference appropriate to their ministry or multi-ministry sector (Table 1). Such a group of Advisors has the potential to add greatly to the quality of policy formation, because policy practitioners in those departments would be assured of starting from a sound scientific footing before undertaking more values-based considerations.

It may also be worth considering how a second set of ministries not mentioned above might operate in having their own advisors or by arrangements with the clusters already suggested above. For example, Te Puni Kōkiri may see value in its own Advisor to liaise with the several Advisors suggested above.

Each appointment would call for a broadly experienced scientist with significant national and international mana within the relevant sector. However, it is important to note that, while such roles must be filled by people with a solid professional track record in research, providing evidence-informed advice is not a matter of being expert in every technical field in which advice is sought. Rather it is having the science literacy, knowledge, networks and wisdom to know where to go for information and then interpreting it appropriately (including assessing limitations and possible biases) for use by the policy community. It is also about having sufficient leadership skills and authority to help a department's cadre of analysts to develop their own skills in this regard.

In short, the Departmental Science Advisor must be able to:

- Curate expertise;
- Engage as a peer with other scientists;
- Critically appraise scientific inputs from raw data to selected methodologies to evidential claims;
- Be able to interpret, synthesise and deliver results in a manner that is relevant to policy development and/or its evaluation.

Overall the actual number of appointments needed to create the optimal group of Departmental Science Advisors across government is small – in the order of four to six FTE with minimal support requirements. Yet these appointments would have major impact by:

- Up-skilling staff and lifting departmental capabilities in the use of evidence;[35]
- Ensuring the appropriate incorporation of evidence into policy advice;
- Ensuring the rigour of scientific input into policy advice;
- Ensuring the quality of external and internal commissioned research;
- Ensuring the protocols for external scientific advice and ensuring that appropriate advice is sought;
- Ensuring appropriate standards of policy and programme evaluation are put in place;
- Collectively identifying the government's short- and longer-term needs for research to support policy; and
- Assisting the Executive when called upon to liaise with Select Committees to ensure that evidence submitted is of the highest quality.

2.3. Long term planning, risk assessment and evaluation

Key recommendation: Use the community of DSAs and the Chief Science Advisor to assist central agencies with longer-term planning, risk assessment and evaluation.

There is inevitably a tension between policy making focused on the short term and the planning needed for longer-term readiness. Indeed, policy makers not infrequently need to consider the balance between the two and thereby make temporal trade-offs. However, the political process and the approach of the media make a focus on the shorter term the more likely default position. It is therefore important for policy makers to look over the longer term using advice informed by up-to-date modelling and projection methodologies. This is especially significant for advice relating to new and emerging technologies.

[35] For example: by designing learning and knowledge exchange opportunities between active researchers and end users (e.g. staff rotation, sabbaticals, joint appointments); by liaising with the New Zealand School of Government to help develop the required analytical capabilities in trainees).

For instance, a particular set of issues relates to consideration of the scientific approach to risk, risk assessment and risk management. Here, the formal and objective analysis of the likelihood of certain events occurring and their management implications can often diverge significantly from wider perceptions of risk, which are inextricably linked to public values. It is important that decisions are made with research-informed appreciation of the 'actual risk' as well as taking account of the public's understanding. In some areas such as risk management for natural disasters (for example, building codes or insurance issues), there is a primary role for the formal engagement of the risk research community. Objective consideration of new and emerging technologies requires similar analysis. A skilled Departmental Science Advisor can expertly broker that engagement.

In general, the community of Departmental Science Advisors would become a resource to use in building greater capabilities in longer-term planning, risk assessment and evaluation – a role that is indeed explicit in some jurisdictions elsewhere.

2.4. Government funds towards policy-relevant research

Key recommendation: Improve and make more explicit the use of government funds for research to assist policy formation.

Taxpayer funds are used in three ways to support research for policy formation: (1) agencies undertake research intramurally; (2) agencies contract research extramurally; and (3) some of the contestable research undertaken by the Crown Research Institutes (CRIs), universities and research institutes/associations relates directly to the policy agenda.

The first two of these types of activity do not necessarily meet the standards that research funded through contestable processes is required to meet. A role of the Departmental Science Advisor would be to ensure that such activity is of a sufficient standard to be worthy of the investment made.

MBIE, MoH, MoE and MPI all directly or indirectly operate contestable programmes of funding research (e.g. Marsden Fund, Primary Growth Partnership, Health Research Council, Centres of Research Excellence). The objectives of each of these schemes vary, but internationally it is accepted that governments increasingly want and need academia to engage in research which has policy implications. However, the manner in which the priorities for such research are identified and then provided to the funding agencies is haphazard and uneven. Similarly, there is little formal approach by policy makers to harvesting the results of the research, once it is complete.

Clearly there is a need to coordinate a process of what has been called elsewhere Integrated Knowledge Translation (IKT).[36] A concept borrowed from health research, IKT proposes that knowledge users (in this case policy practitioners) work closely with knowledge producers from the outset to identify the most relevant research priorities and methodologies that could respond to particular policy needs. Again, the group of Departmental Science Advisors would be an effective way of ensuring such links between the policy and research communities.

Another way to improve the use of government funds is to improve the focus and commitment to programme evaluation. Ministers should expect and demand: (1) that more programmes resulting from particular policy decisions are subject to efficacy evaluation; (2) that funds are allocated for this purpose; and (3) that reviews consider not only new programmes, but also existing programmes.

There is no embarrassment in acknowledging that the impact of a new programme is not known at the outset and must be evaluated. On the contrary, a culture of on-going enquiry and evaluation should be fostered in all policy-related activities (following the promising example of the youth mental health programmes). For instance, 'intervention research' and the use of well-constructed pilot programmes are extremely valuable in assessing a programme's success factors before deciding whether and how to take it to scale.

In fact, it is worth considering whether SuPERU should be developed as a government-wide resource to assist in social policy and programme evaluation. SuPERU is still in its establishment phase, but its terms of reference require it to build particular expertise in programme evaluation. SuPERU expects to make its services available across government and it should be encouraged in this role.

[36] Bowen, S. and I. Graham (2013) Chapter 1.2: Integrated knowledge translation. In Knowledge translation in healthcare: moving from evidence to practice, S. Strauss et al (eds). John Wiley and Sons Ltd.

2.5. Transparent and accessible information for public consultation

Key recommendation: Provide greater transparency regarding the use of research-informed data (or its absence) with respect to complex and controversial areas of decision-making where the public is directly or indirectly consulted.

The public, either by sector or more generally, is consulted frequently by ministries on a range of matters. However, there have been examples where no significant research-based information was made widely available prior to such consultation.

This lack of disclosure limits the value of the consultation, and indeed can change the nature of its outcome. Such information should be released in advance, and with this, one further role of the Departmental Science Advisor (and group of advisors collectively) would be to ensure the validity and accessibility of any report released. This would mean providing commentary on knowledge gaps and the limit of what is known. This should be particularly so when such consultation occurs in a climate of strongly vested interest, or when the public is being asked to consider contentious issues. A satisfactory resolution is more likely when the available knowledge is presented in a logical, objective and accessible manner. This work would require some effort and resources toward public outreach and knowledge translation to enable more meaningful public engagement.

CONCLUDING COMMENTS

This report has been restricted to a discussion of the issues related to the development of an evidence base for policy formation, and to providing some options for consideration.

In making my recommendations, I am conscious that they cannot be undertaken in isolation. They link closely with work already underway under the banner of Better Public Services and ideally would be part of a more comprehensive 'knowledge strategy' for the public service, as there are implications for how new policy staff are recruited and trained – even involving the content of academic programmes.

My survey results suggest that there is a uneven understanding of the role of research-informed evidence across the New Zealand public service. Dealing effectively with this challenge is key to providing an evidentially defensible foundation on which to build policy. Once this is in place, values-based considerations can be addressed and integrated – but with the full knowledge of what is at stake from a scientific perspective. To summarise, good science cannot make policy, but bad science or the absence of science will almost certainly lead to poor policy decisions.

Of my recommendations made in this report, two priorities that would make a substantive difference but at low cost would be:

- The establishment of government-wide formal protocols to guide policy makers in sourcing quality research-based advice.
- The appointment of Departmental Science Advisors to major ministries.

Given that governments want to make decisions that meet their agendas but also are effective and have both short-term and long-term benefit for New Zealand, well-informed policy advice is more likely to meet a government's goals, and is certainly more likely to meet its desired goals and be cost-effective.

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Appendix 1

Review of government agencies and ministries about their understanding and use of research-informed evidence in the policy process

Contents

1. Overview

In 2011 the Office of the Prime Minister's Science Advisory Committee published a report on the use of knowledge-based evidence in policy formation. That report posed the challenge of "how to do better in two related domains: the generation and application of knowledge to inform policy making, and the use of scientific approaches to the monitoring and evaluation of policy initiatives."[1] The report argued that sound evidence provides for potential options and solutions which government can subsequently weigh up against other, often competing, factors. That position has been expanded upon by others.[2]

With the support of the Department of Prime Minister and Cabinet, the Office of the Prime Minister's Science Advisory Committee undertook a survey of a range of government agencies during 2012 as to their attitudes and practices relevant to utilising strong research-informed evidence in policy development and evaluation. The present report summarises the results of that survey and some general conclusions that may be drawn.

The key finding of the survey was that attitudes to the use of research-informed evidence in policy formation are highly variable. This variability reflects the absence of whole-of-government procedures on how and when science should be used in policy formation and evaluation. The survey results showed a disappointing approach to integrating science into policy formation in many agencies.

Indeed, there is a general lack of formal protocols or guidelines for seeking expert advice and input, and for ensuring that robust evidence informs policy advice. There are also inconsistencies around methods of seeking such knowledge and commissioning science to support policy development. In addition, there was marked diversity across the agencies surveyed in their understandings of risk, and little focus on foresighting – both in the medium term and, more significantly, in the long term. This results in policy formation that answers immediate needs but does not necessarily provide well for the future.

[1] Gluckman, P. (2011) Towards better use of evidence in policy formation: a discussion paper. Office of the Prime Minister's Science Advisory Committee.

[2] Bromell, D. (2012) Evidence, values and public policy. The Australia and New Zealand School of Government, ANZSOG Occasional Paper, Wellington.

2. Background and purpose of the survey

Citizens have a right to expect that policies will be based on sound reasoning and good judgement. To ensure this, it is essential that all stages of policy formation and evaluation use research-derived knowledge optimally to achieve the best outcomes. It is clear that there are deficits in how government obtains and uses knowledge and evidence, and this necessarily affects the quality of policy formation.

The Chief Science Advisor published his discussion paper on the science-evidence-policy nexus in mid-2011 and, in the course of the rest of that year, had a number of discussions with Chief Executives, management groups and those involved in providing science advice or commissioning research across government agencies. From these initial discussions, the impression was garnered that there were very different practices across government, some of which were very good while others raised concerns.

After discussion with the Prime Minister and the Chief Executive of DPMC, the Chief Science Advisor decided to undertake an assessment of knowledge, attitudes and practices (KAP) related to the science-evidence-policy nexus across government. The purpose was to inform a further report to the Prime Minister, to which this review is now appended.

3. Methods

The research design for this assessment was based on KAP methodology, which is known for its analytical power in psycho-social research that looks at behaviours and behaviour change. Its applicability to the policy-development context is appropriate because appreciation and use of quality evidence by policy makers is, arguably, a matter of socialisation and competencies (i.e.: knowledge, attitudes and practices).

The data collection comprised a structured questionnaire, which was supplemented by key-informant interviews. The aim was to determine how agencies obtain and use evidence for the development and evaluation of policy. For the purposes of this assessment, we define 'evidence' as knowledge in any area obtained by a process of systematic enquiry undertaken in accordance with standard and internationally recognised research methodologies

(whether qualitative or quantitative) and applied to the policy development context.

A number of key public service departments, independent Crown entities and offices of Parliament were chosen for this exercise. The Chief Executive of each agency was requested by the Chief Executive of the Department of Prime Minister and Cabinet to nominate a spokesperson to take part in an extensive structured interview with a staff member from the Office of the Prime Minister's Science Advisory Committee. The questionnaire was sent to the nominated spokesperson prior to the interview taking place, so that they could solicit information from staff and colleagues. Each interview was recorded and transcribed. In addition, some respondents also supplied written answers to the questions, and many supplied additional written material in support of the position of their agency.

The responding agencies are listed in Appendix 1.1, and the questionnaire outline is described in Appendix 1.2. Typically, respondents tended to be principal policy advisors with particular responsibility for their agencies' knowledge acquisition and utilisation. The same interviewer conducted all interviews.

4. General findings

4.1. Knowledge of, and attitudes toward, the science-policy nexus

There was a variable understanding of how research-informed evidence plays into the policy formation process, along with diverse attitudes toward the use of evidence. Some departmental staff interviewed had well-informed and developed concepts of the relationship between evidence and policy formation but others had quite naïve concepts of the interaction between science, evidence and the policy development process and this appeared to be reflected in departmental practice. Most respondents saw scientific knowledge as one of the inputs to policy development, but the growing international consensus about how science fits into policy was not well understood.

For example, some staff members appeared to see their role as primarily about identifying policy needs or responding to the political context, and therefore saw evidence solely in terms of informing those needs, rather than identifying options or solutions. They did not give priority to seeking or commissioning research to inform policy options.

In general, most saw the need for better provision of options to ministers rather than presenting conclusions (that is, brokering rather than advocating[3]) but there were a lot of different viewpoints. These ranged from insistence by agencies that their policy development process is 'pure' to those which acknowledge that policy analysis, development and evaluation involve a values judgement, while stressing that values should not be seen as the only criterion.

There was rather broad ignorance about how science could inform policy, and indeed some scepticism about the concept of the 'honest broker'. Some could not see the role of the scientist as a broker of unbiased information, but rather as an advocate. To quote one respondent:

> *"If you're passionate about science, it [policy development] is possibly not where you should be working because actually, it clouds your judgement to be passionate about any area and then to write policy on it. It can insert itself everywhere, it can insert itself by your choice of the evidence, it can insert itself in the framework you use to select to analyse your evidence, it can insert itself into the models you need to analyse it, then in those options that you might consider you'll consciously weigh some options more than others."*

On the other hand there was a broad acknowledgement that peer review (as it was understood internally by staff members) in policy formation has to be rigorous so that it is used as a mechanism for ensuring that the advice is transparent, unbiased and based on the evidence rather than from a position of advocacy. However, respondents noted a tension, particularly in the social policy area, because people get passionate about what they are working on.

There was a broad recognition, however, that if a Cabinet paper, for example, is highly contentious sometimes "you have just got to, on the balance of judgements, present the department's view and expect it is going to be escalated up." Respondents recognised that the more contentious the issue, the more it is about values judgements:

> *"Policy is a social and political economy equation. The clear thing is that science is a criti-*

[3] Pielke, R. (2007) The honest broker: making sense of science in policy and politics. Cambridge University Press.

cal input to policy but you do not go straight from 'this is the science, therefore this is the policy'. It's taken into account alongside the other pieces of information that are critical in making that decision. There is also a need to recognise that, for Ministers to make informed decisions, they need all of the information however palatable it may be. They make judgements as to the weighting they give to that information, and the role of policy advisors is to test science advice, to separate the knowledge component from any advocacy aspect and instead apply standard policy approaches such as systems thinking, intervention logic and NRS principles to the use of the information."

4.2. Practices employed at the science-policy nexus

Many agencies do not appear to have a formalised protocol for conducting research or obtaining evidence for policy and programme development and evaluation – or at least did not report such a protocol was used. Those that did, however, tended towards a formalised research programme and a formalised evaluation programme as well. Some agencies have formalised processes and criteria for prioritising and delivering research programmes. Evaluation of research programmes is generally *ad hoc*, although some agencies have a more formal system of routinely assessing three to five research projects, areas, or programmes each year (usually involving international experts).

In general there appears to be an *ad hoc* appreciation of the role of science and robust evidence within many departments. When questioned how they went about procuring evidence-informed advice, whether it was via internal departmental advisors, independent science advisory committees, part-time scientific advisors from outside the department (on a contracted or standing basis), or utilising a mixed model (such as technical advisory groups containing both independent scientists and representatives of end-users), it was apparent that there seem to be a variety of models utilised. A number of agencies establish panels which oversee the procurement and delivery of advice. On occasion the methods are combined, e.g. the Ministry for the Environment in developing the National Environmental Standards generally requires both contracted advice and technical advisory groups. Different approaches are appropriate for different situations. One agency uses a preferred provider list which includes Crown Research Institutes, universities and private consultants – but researchers have to be on the list to be considered for a contract. There was no information as to how this list was developed or the quality criteria for selection.

Some of the larger agencies with their own research teams tend to do most of the work in-house, but utilise external expertise for peer review of some of the work. 'Social' agencies that require large-scale population sampling and data collection will generally contract that out. The Ministry of Justice uses technical advisory groups for major evaluation or research projects where there is representation from a range of different agencies. The processes used to identify the appropriate sources (both internal/external) of the research-informed knowledge depends on the issue at hand, and whether the expertise exists in-house or not. Where there are in-house experts in particular fields, they will do the work, particularly with smaller agencies where the experts are issue/area specific.

Agencies dealing with issues in the natural sciences almost exclusively sought advice from relevant public institutions, especially CRIs, whereas those dealing with issues in the social or economic areas tended to favour private research organisations and consultancies. Some respondents commented that the CRI reforms initiated in 2010 have helped with the integration of science into policy development. Overseas providers of evidence are in the minority and their involvement tends to be driven by the specific nature of the research knowledge required. Australia is the largest overseas provider (e.g. in the petroleum and minerals sector, geology, and water quality guidelines).

4.2.1. The practice of identifying and filling knowledge gaps

It is important that research-informed knowledge is gathered in a structured manner, rather than in an *ad hoc* fashion. To that end, therefore, we were interested in whether agencies had a set of formal principles or guidelines governing the procurement of scientific advice or identifying and filling research needs.

The survey revealed that procurement policies and guidelines commonly exist. However, these are limited to setting out a standard purchase process, and to supporting decisions about size/scale, rather than providing guidelines for how to

procure evidence and scientific advice, or on how to identify and fill research needs specifically. The survey identified that there is a lack of simple and whole-of-government guidelines or protocols for obtaining expert scientific advice, which departments can tailor to what is needed in their sector, such as those based on the UK model.

However there are a number of examples of promising practice in individual agencies that should be highlighted. For instance, the former Ministry of Fisheries (now part of the Ministry for Primary Industries) has developed a range of principles and guidelines on the procurement of all services, including scientific advice and research needs. This ministry is also currently developing and implementing specific procurement strategies regarding the purchasing of research services to ensure transparency and to identify key providers for partnering.

Two other agencies also stand out in that they now apply considerable focus to their knowledge needs. The Ministry for Primary Industries has specifically moved from a previous *ad hoc* approach to setting up a more structured process due to influences from the recent appointment of a departmental Science Advisor. For its part, the Ministry of Civil Defence and Emergency Management has a formal process by which guidance to local government is reviewed every 3 to 5 years and this can drive new research needs.

Furthermore, a small number of agencies have a system whereby departmental Chief Executives and/or general managers meet with the research manager on a regular basis (usually monthly) regarding their knowledge needs on the policy front. There is a framework of strategic priorities for the respective organisations and the sector, which leads them to identify the research needs and how to meet the priorities. They have a policy work programme with ministerial endorsement and therefore the policy development process can be supported by whatever research is deemed necessary.

4.2.2. The practice of commissioning intramural and extramural research

We identified a range of internal processes for undertaking and contracting of policy-relevant research, especially in the areas around peer review and quality assurance (QA). There was a range of factors that determine whether research is undertaken within an agency or contracted out. These factors included:

- The topic area;
- Internal expertise and capability (or lack of);
- Funding availability for external contracts;
- Desire to promote internal capability externally (e.g. in a CRI);
- Desire to build capacity internally;
- Deadlines and expected turn-around times;
- Large-scale fieldwork needs (e.g. customer satisfaction monitoring for the labour function has to be out-sourced);
- Requirements for highly specialised facilities such as PC3 labs (e.g. the Ministry for Primary Industries contracts out the majority of their research, but keeping it in-house may be due to the need for specialised facilities).

One agency was quite explicit that all research work is done in-house unless:

- They do not have the specialist technical expertise in-house;
- They do not have the capacity to deliver the work within required time frames;
- There is a particular reason to contract out (e.g. some evaluations need to be done outside the organisation in order for the results to be accepted as impartial and unbiased);
- There is an advantage to the organisation in entering into a strategic partnership with another organisation to deliver a piece of research;
- There are budget constraints.

4.2.3. The practice of peer review

One of the most important aspects of sound scientific knowledge generation is the quality assurance procedures that are in place to assure the validity of research done within, or contracted out by, the agency. In general, respondents stated that material that is published goes through an independent peer review process (often both internal and external, as required by the domestic or international journal). For non-published material, peer review is triggered on a case-by-case basis. For the bigger, more significant or riskier projects, the review shifts from internal to external. In one agency, two external peer reviewers are required for everything published or going to the minister. One agency stated they had no established procedures, while in another the statement of intent is the baseline for establishing QA procedures.

Agencies that undertake all projects in teams may have in-house QA and peer review procedures, with formal QA checks prior to publication. Other agencies ensure formal incorporation of QA requirements in research contracts, and peer review requirements during and on completion of research, or may ensure ISO accreditation of internal laboratories and external science providers. The recent QA standard for fisheries research could be considered a model of good practice.[4] A focus of the recent MPI redesign was to improve procurement processes, with the aim of ensuring quality processes for securing, monitoring and managing contract performance. For research done through, or as an input to, international forums there is usually international independent review.

4.3. Specific knowledge gap areas where a robust evidence base is lacking

Along with the findings regarding knowledge, attitudes and practices toward incorporating quality evidence into the policy process, the survey also considered specific areas within ministries' scope of responsibility that require a more systematic approach to evidence gathering and use. These included risk assessment, foresighting and technology assessment.

4.3.1. Use of evidence for risk assessment

In terms of risk assessment undertaken in the development of policy, many stated that it was a standard part of the policy process. In other words, it was implicit and therefore they had no explicit procedures for identifying and dealing with it. There was an uneven understanding of the importance of risk assessment beyond political and financial risk, and risk related to immediate policy in formation. There is a lack of formal protocols and training in risk assessment. By and large the main aspects of risk were seen to be fiscal, legislative issues and Treaty of Waitangi, all of which tended to be very explicitly identified by respondents. The Ministry for Primary Industries has risk assessment teams because "a fundamental part of a large amount of what this organisation does is as a risk management organisation". The key aspect of this is where science and risk assessment supports risk management decision-making (e.g. biosecurity, food safety, fisheries by-catch). The Ministry for the Environment stands out for best practice in this regard for the development of their Cost Opportunity Benefit Risk Analysis (COBRA) guide, which underlines that evidence, particularly scientific evidence, is a key input to policy advice, and provides guidance on using evidence in policy development.

4.3.2. Use of evidence for foresighting

One of the most significant issues that was uncovered by the survey was the sparse consideration given to foresighting: looking ahead 10 to 30 years to ascertain how the world will change, and what policies should be put in place now, in order to reach that point or to adapt to foreseeable changes.

When questioned about what degree of foresighting and systematic planning was undertaken to address the potential of significant and long-term events before they occur, and how this is informed by research-derived knowledge, the survey uncovered a tendency by many of the agencies to think of foresighting in the lifespan of their Statement of Intent/Minister (i.e. only 3 years). Some may foresee as far as 5 years, but almost none are envisioning the 20-plus year horizon. Many of the agencies surveyed are *ad hoc* in their approach, and see it as simply modelling rather than scientific foresighting that could reveal emerging issues such as potential risks and benefits in the long term of emerging technologies.

4.3.3. Use of scientific expertise and research design for evaluation

The survey revealed major gaps in approaches to programme monitoring and evaluation of policy initiatives. There are two issues here. First, there is evaluation of whether a policy is concordant with currently available information at the time of its development (which should be part of the Regulatory Impact Statements, now required by Treasury). The second issue is evaluation of whether the policy is producing its intended outcomes after its introduction. A number of agencies admitted they do not systematically undertake post-implementation evaluations of effectiveness, with a spectrum of implementation monitoring ranging from informal checking through to reviews and formal evaluations.

The Ministry of Civil Defence and Emergency Management tends to focus on the effect of implementation into the civil defence emergency management framework, rather than the science and policy

[4] Ministry of Fisheries (2011) Research and science information standard for New Zealand fisheries. Ministry of Fisheries, Wellington.

process. In agencies where the research team sits within a wider policy group (e.g. Te Puni Kōkiri) there is greater ability to see the degree of influence and integration of the research into the policy being generated. The Parliamentary Commissioner for the Environment will often issue update reports at a period of time after a report is issued, where they will comment on matters such as what changes were identified, what has been implemented, what has not, and what has changed.

Our survey revealed that evaluation of policy uptake and implementation over an extended time period is not being undertaken in a systematic manner across the public service. The Ministry of Economic Development (now part of MBIE) commented that legislation may have a requirement for a review every 3 to 5 years, which is the primary driver for undertaking the analysis. Within the Ministry for the Environment, on-going monitoring and evaluation of policies is part of the COBRA process and is overseen by the ministry's evaluation function, which is proactive in analysing how their policy is performing and has been built into the latest iteration of COBRA.

4.4. Use of scientific expertise

Perhaps one of the most significant findings of the survey had to do with the variability in capacity and capability across departments to engage with science and critically assess and employ scientific input.

While there was evidence of strong science backgrounds for policy advisors in some agencies, there was more generally a lack of current scientific expertise. In order to address the need for those senior staff charged with providing science advice to keep up to date with developments in their field, the use of professional development plans allows some staff to identify a number of mechanisms including: conferences; workshops; memberships of relevant societies or professional bodies; regular access to and communication with peer networks; participation in science workshops and conferences; on-line activities such as chat rooms and group circulations; guest lecture series. However, such professional development plans are more difficult for staff at the more senior levels. The expectation is that they will invest in their own learning and on-going development.

Another mechanism for supporting technical staff is through secondments/rotations to/from academia, CRIs or industry. The survey showed that while these opportunities were sometimes constrained by resource and capacity availability, some people did move in and out of agencies. In addition, the temporary use of interns and rotation of staff to/from other government agencies was common.

Another issue raised was the relationship between policy managers and the 'senior science advisor' function. Many agencies felt that the Departmental Science Advisor/Chief Science Advisor role was not relevant to their operations, especially those with a high degree of analysis and modelling. The question that was often asked was "Who would the person be reporting to?" It was generally felt that the key person driving much of the research and evaluation output is a team manager, but not a science advisor. This attitude, however, serves to confirm the conclusion that understanding of the role of research-derived evidence in policy formation, along with the potential role of Departmental Science Advisors, is still very much in development.

5. Discussion and conclusions

There appears to be significant unevenness across government regarding departmental use of and respect for research-derived evidence and understanding of how such evidence should fit into the policy process. There is little consistency: government agencies use a range of mechanisms, some more explicit than others, for identifying what research and scientific knowledge is needed in their policy formation. There is variable capacity for using these mechanisms optimally in seeking advice, contracting and evaluating research inputs. In many departments, procedures and protocols for scientific advice were uncertain. On the other hand, there were examples of good practice in some departments which provide a template for more widespread improvement.

Government is clear in wishing to improve the performance of the public service. One component of this might be a general approach across the public service to strengthening the processes that ensure high quality scientific assessment, which is one important input into policy-making, alongside social values-based, economic, cultural and political perspectives. Currently, there are no simple and whole-of-government guidelines or protocols for expert scientific advice. The availability of agreed generic guidelines would allow departments to fine-tune protocols and policies to what is appropriate for their sector. The relative lack of direct sci-

ence expertise and the variable nature of scientific inputs suggest there would be considerable value in following the UK model in the appointment of Departmental Science Advisors, whose principal responsibility would lie in procuring and translating technical advice. Collectively with the Chief Science Advisor, they would create a valuable across-government resource.

There appears to be little systematic liaison across government to define national research needs for the benefit of policy formation and public sector utility. Nevertheless, most of the agencies interviewed identified some degree of liaison with other agencies to identify mutual science/information needs, but some cited the social sector as being particularly able to benefit from progress in this direction. Although some agencies identified their relationship with Statistics New Zealand as being sufficient to meet their information requirements, the demise of the Social Policy Evaluation and Research Committee (SPEAR) drew strong comment from some agencies.

In summary, the primary outcome of the survey was the highly variable manner in which government agencies integrate evidence-informed knowledge into the development of policy. In some aspects of the survey, many agencies showed promising approaches, but none demonstrated a consistently high standard of scientific rigour in policy development.

This variability is concerning, and demonstrates the potential for establishing general guidelines for incorporation into departmental and agency protocols. In addition, the survey results point to the merit in considering expanded use of Departmental Science Advisors to lead agencies in making use of quality evidence for policy formation.

The value of scientific advice in providing options for policy, in assisting risk assessment, technology assessment and long-term planning, and in evaluating policy implementation is increasingly understood in democratic systems. New Zealand policy formation and evaluation would be significantly enhanced if the issues identified were addressed.

Acknowledgements

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Appendix 1.1: Agencies surveyed

The following public service departments, independent Crown entities and offices of Parliament were surveyed for the purposes of this report:

- Department of Building and Housing*
- Department of Conservation
- Ministry of Civil Defence and Emergency Management
- Ministry of Economic Development*
- Ministry of Education
- Ministry for the Environment
- Ministry of Health
- Ministry of Justice
- Department of Labour*
- Ministry of Māori Development (Te Puni Kōkiri)
- Ministry for Primary Industries
- Ministry of Science and Innovation*
- Ministry for Social Development
- Statistics New Zealand
- The Treasury
- Children's Commissioner
- Office of the Parliamentary Commissioner for the Environment.

(NB: * = now part of the Ministry of Business, Innovation and Employment)

Appendix 1.2: Survey questionnaire

EVIDENCE IN POLICY: SURVEY OF GOVERNMENT AGENCIES

INTRODUCTION

This survey is being undertaken to help to understand the role that science-based evidence plays in the development of policy. It is recognised that the response to the science need will vary between government agencies, depending on the circumstances, and therefore not all of the following questions will necessarily apply equally.

1. AUDIT

a) How many scientifically trained Advisors do you have in-house (science = natural, social, engineering and statistics), who are working in a role providing scientific advice?

b) Do you have anyone in the role of a Departmental Science Advisor (DSA) – even if that name is not used explicitly – whose principal responsibility is for procuring and translating technical advice?

c) Does that person consider themselves as 'head of profession' across the Ministry/ Department (M/D) or even whole-of-government?

2. IDENTIFYING RESEARCH NEEDS

a) How, at the agency level, do you identify what research and scientific knowledge is needed in policy formation?

b) What degree of foresighting is undertaken by the M/D? In other words, (a) what systematic planning is undertaken to address the potential of significant and long-term events before they have occurred, and (b) how is this informed by scientific knowledge?

c) What degree of risk assessment is undertaken in the development of policy?

d) Do you have a formalised protocol for research programme development and evaluation?

e) Do you liaise with any other agency to identify mutual science/information needs?

3. PROCESS

a) How do you procure scientific advice?

   i) Internal Departmental Advisors.

   ii) Independent Science Advisory committees.

   iii) Part-time scientific advisors from outside the Department (on a contracted or standing basis).

   iv) A mixed model (such as technical advisory groups containing both independent scientists and representatives of end-users).

b) What processes do you have to identify the appropriate sources (both internal/external) of that knowledge?

c) What arrangements do you have to obtain scientific advice in crisis situations, such as the recent Canterbury earthquakes?

4. RESEARCH PROCUREMENT

This section assumes that new research is needed to inform a particular policy.

a) Do you have standing committee(s) for the management and maintenance of research needs?

b) What individuals (definitions and roles) have scientific responsibility in commissioning research, for example in issuing and reviewing requests for proposals?

c) What determines whether you do research within the Ministry or contract it out?

d) Is there a clearly defined balance between internal and external research providers, and what are the trigger points in making that decision?

e) What scientific quality assurance procedures do you have in place for assuring the quality of research done within or contracted out by the Ministry?

f) If research is undertaken internally:

   i) Who undertakes the research, what is their background, and what level are they in the hierarchy?

   ii) What capacity do they have to undertake the research – do they have a dedicated research role, are funds made available to support the research?

   iii) What degree of experience do they have in undertaking strategic research?

   iv) What degree of independence are they afforded?

g) If you commission external research, what proportion of that is contracted to:

   i) Public research institutions in New Zealand (universities and CRIs);

   ii) Private research organisations or consultancies in New Zealand;

   iii) Overseas public or private research providers?

h) If you commission external research, please comment on:

   i) Who sets research aims and protocols?

   ii) Who monitors that protocols are being followed?

   iii) Who provides research 'stewardship' and is able to make stop/start decisions?

   iv) Whether a formal report is required for all commissioned research?

v) Whether peer review of findings is undertaken to ensure validity, quality and relevance before research findings are incorporated into the policy process? If so, who performs that peer review?

vi) Whether the Department maintains a knowledge register or report archiving system?

5. PRINCIPLES

a) Do you have a set of formal principles or guidelines governing the procurement of scientific advice or research needs? If so, please provide a copy.

b) Please describe how the Department deals with:

i) Conflicts of interest among science advisors and research providers.

ii) Relatedly, the involvement of end-users in providing scientific advice.

iii) The independence of external science advisors, for example confidentiality and their right to publicly challenge policy decisions.

c) How do you ascertain the validity, quality and relevance of the knowledge obtained?

6. DEVELOPMENT OF POLICY ADVICE

a) Describe how scientific knowledge informs potential policy options?

b) What procedures are in place to ensure that science advice is developed and reported "purely" to inform policy options – the concept of the 'honest broker' – versus science advisors acting as 'issues advocates' who conflate advice with values judgements?

c) What is the sequence of events for integration of science with policy development?

7. USE OF DATA

a) Is research data obtained by the Department made available to other users (e.g. other agencies, the public)?

b) What issues around interoperability, data searchability and data warehousing are considered when selecting a research provider?

c) Are there any legal issues around archiving or availability of your Department's data, that will inhibit external researchers and agencies having access to it?

d) Are any such developments in prospect?

8. MAINTAINING SCIENTIFIC CAPABILITY

a) How do senior staff, charged with providing science advice (such as the DSA), keep up to date with developments in their field?

b) What level of support is provided to ensure they are current with available knowledge – either through such activities as attendance at conferences, or access to professional journals?

c) Do any of your technical staff take part in secondments/rotations to/from academia, CRIs or industry?

9. ONGOING MONITORING

a) Is there a process of monitoring post-policy development to ensure that the science advice has been fully and properly integrated into the policy?

b) What evaluation is there in the out-years as to how successfully the science informed the policy?

c) When necessary, is there any follow-up research to explore deviations from the expected results derived from the policies that were implemented?

10. TRENDS

a) What dollars go into research – and how is this broken down in absolute value and as a percentage of the total M/D budget?

b) What is the ratio between internal and external expenditure on the acquisition of scientific knowledge and advice?

c) How many science advisors are employed in this M/D now versus 3 years ago [trying to establish a trend]?

11. KNOWLEDGE OF SCIENCE POLICY INTERFACE

a) Do you have any prior knowledge of work in the science/policy interface, such as that of Roger Pielke?

Appendix 2

Protocols for seeking scientific advice

Both the US and the UK have introduced general guidelines for obtaining independent scientific advice for governments.

Appendix 2(a): United States

In December 2010, Dr John Holdren, the Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy, issued a memo[1] to heads of executive departments and agencies providing them with guidance on implementing the government's policies on scientific integrity. This guidance deals with four key concepts that have been summarised below for consideration in the New Zealand context.

1. Foundations of scientific integrity in Government

Successful application of science in public policy depends on the integrity of the science process both to ensure the validity of the information itself and to engender public trust in Government. Agencies should therefore develop policies that:

- Ensure a culture of scientific integrity by shielding scientific data and analysis from inappropriate political influence;
- Strengthen the actual and perceived credibility of government research by: filling scientific positions based on credentials, experience and integrity; ensuring expert peer review of data as appropriate; setting standards to govern conflicts of interest; adopting whistle-blower protections;
- Establish principles for conveying scientific information to the public;
- Ensure that communication includes the underlying assumptions, the uncertainties and the probabilities associated with both best and worst case scenarios.

2. Public communications

Agencies should develop communication policies that promote and maximise openness and transparency while ensuring compliance around appropriate disclosure of classified information. Policies should ensure that:

- Agencies have articulate and knowledgeable spokespeople who can respond in a clear non-partisan fashion to media requests regarding scientific and technological questions;
- Federal scientists can speak to the media about their official work, with appropriate coordination with supervisors and public affairs offices. Public affairs offices may not ask/direct federal scientists to alter their findings;
- Mechanisms are in place to resolve disputes that may arise from decisions on whether to proceed with interviews and public activities.

3. Use of Federal advisory committees

Agencies should develop policies for convening scientific advisory committees that ensure that:

- There is a transparent recruitment process to technical committees;
- Professional biographical information is made publicly available;
- The selection of committee members is based on expertise, knowledge and relevant scientific contribution in the subject area. Membership should reflect diversity and balanced points of view;
- Conflict of interest waivers are made publicly available except where prohibited by law;
- The products of such committees should be treated as their own findings rather than government's, and thus are not subject to internal revisions.

4. Professional development of Government scientists and engineers

Agencies should establish policies that promote and facilitate the professional development of government scientists and engineers, subject to all applicable laws and policies. These policies should:

- Encourage publication of findings in peer-reviewed journals;
- Encourage presentation of findings at professional meetings;
- Allow government scientists to become editors or editorial board members of professional or scholarly journals;
- Allow full participation in professional or scholarly societies;

[1] *http://www.whitehouse.gov/sites/default/files/microsites/ostp/scientific-integrity-memo-12172010.pdf*.

- Allow government scientists to receive honours and awards for their contributions to the scientific record, where there is no financial gain.

Appendix 2(b): United Kingdom

In June 2010, the UK's Government Office for Science issued the 4th edition of its guidance on the use of scientific evidence within the policy process. The Government Chief Scientific Adviser's Guidelines on the use of scientific and engineering advice in policy making[2] supersedes the 2005 document. A summary of the most pertinent elements of this guidance is provided below for consideration in the New Zealand context.

1. The advisory process

1.1. Triggers for seeking scientific and/or engineering advice

Government departments should, in the first instance, ensure that they have sufficient in-house expertise to deal with the majority of issues requiring scientific input and advice. However, there will be occasions when seeking external advice is necessary. In particular, external science advice must be sought when:

- The issues raise questions that are beyond the expertise of in-house staff;
- Responsibility for a particular issue cuts across government departments;
- A wide range of expert opinion exists and/or there is considerable uncertainty;
- New findings are emerging rapidly;
- There are potentially significant implications for areas of public policy;
- Public confidence in science advice from government could be strengthened.

1.2. Sources of scientific advice

Departments should encourage and enable staff members responsible for individual issues to establish new networks continually in order to capture the full diversity of good evidence-based advice. Sources for research and science advice include:

[2] *http://www.bis.gov.uk/assets/goscience/docs/g/10-669-gc-sa-guidelines-scientific-engineering-advice-policy-making.pdf.*

Key Messages

- Identify early the issues which need scientific and engineering advice and where public engagement is appropriate;
- Draw on a wide range of expert advice, particularly when there is uncertainty;
- Adopt an open and transparent approach to the scientific advisory process and publish the evidence and analysis as soon as possible;
- Explain publicly the reasons for policy decisions, particularly when the decision appears to be inconsistent with scientific advice;
- Work collectively to ensure a joined-up approach throughout government to integrating scientific and engineering evidence and advice into policy making.

- Departments' own experts and analysts and programmes of internally and externally commissioned research;
- Departments' existing expert advisory systems such as science advisory committees;
- Other departments' research programmes;
- Research from non-departmental sources including international bodies;
- National Academies and learned societies;
- The broad science and engineering community; for example universities, private and charity sector research and development funders.

Consideration should be given to understanding the broader international perspectives on issues, through the work undertaken in embassies and consulates.

1.3. Expectations

The roles, responsibilities, expectations and boundaries of external advisors should be clarified at the outset so that there is no misunderstanding in the advisory process. These include:

- Review of existing data;
- Collection and analysis of new scientific data;
- Interpretation of research from different sources;
- Application of expert judgement where data is lacking or inconclusive;

- Identification of policy options based on data and research evidence;
- Providing expert scientific advice on policy options;
- Risk and uncertainties.

When assessing the levels of risk or establishing risk management strategies in relation to a specific policy, all known sources of uncertainty must be taken into account, along with differing perspectives of risk. Early public engagement is often vital to this process.

Varying levels of uncertainty are inevitable and departments must recognise, communicate and manage this. Government officials or staff should not press experts to come to conclusions that cannot be justified by the evidence.

1.4. Quality assurance and peer review

All evidence should be subject to critical evaluation which is proportionate to the nature of the evidence and its use. Scientific advisory committees, learned societies, academics and other experts can assist in this peer review process. The level of quality assurance and peer review to which the evidence was subject should be clearly stated when departments are responding to public concerns over emerging issues.

2. Capacity and capability

Departments and policy makers should work collectively to ensure a whole-of-government approach to integrating scientific and engineering evidence and advice into policy making.

Government departments and agencies need sufficient capacity to recognize the full spectrum of relevant evidence and to know how to access it. They may be assisted in this by those working in a 'knowledge-brokering' capacity.

Benchmarking reviews of how departments use and manage scientific and engineering evidence have been conducted in the UK[3], with on-going departmental scrutiny and self-assessment.

[3] *http://www.bis.gov.uk/go-science/science-in-government/reviewing-science-and-engineering.*

Appendix 3

Suggested framework for the appointment of Departmental Science Advisors and their terms of reference: Extrapolation from the UK model

The framework suggested in the main report draws on a recent UK House of Lords Science Committee report on the topic.[1] The following presents key elements of that report.

Suggested core functions of Departmental Science Advisors (DSAs)

In the UK, all ministerial government departments now include a DSA post, though not all are currently filled. These posts are always given to senior scientists who are in a recognised position to influence departmental decision making. Their primary role is to ensure that a robust and integrated evidence base underpins policy formulation, delivery and evaluation. This role can be further broken down as follows:

- Manage the development, implementation and monitoring of a science and innovation strategy for the department;
- Lead departmental engagement on relevant national and international science and engineering issues;
- Network and share good practices across government.

Accordingly, the DSA functions usually include the following:

- Provide an 'advise and challenge' function directly to the department's most senior officials including the minister;
- Independently challenge the evidence base for departmental policies;
- Oversee departmental systems for ensuring that policy makers consider relevant evidence;
- Oversee any departmental scientific advisory committees;
- Manage the departmental research budget;
- Ensure exemplary departmental science and engineering quality and capability;
- Guide analytical staff in conducting assessments.

[1] House of Lords Select Committee on Science and Technology (2012) Report: The role and functions of Departmental Chief Scientific Advisers. *http://www.publications.parliament.uk/pa/ld201012/ldselect/ldsctech/264/264.pdf*.

Suggested characteristics of New Zealand Departmental Science Advisors

While the UK experience suggests that a 'one-size-fits-all' DSA model may not be desirable or achievable across all government departments, there are nonetheless a number of essential characteristics common to the position. These would apply equally in the New Zealand context. They include:

- **Good standing within the scientific community** as result of his or her scholarly experience or achievements. This first and most important characteristic allows the DSA to access and benefit from the expertise of the national and global community of scientists and also ensures that the DSA can exercise sufficient influence within the department.
- **Good communication and management skills.** These are practical skills that are essential to any senior post. It includes building effective relationships and, in this case, often bridging quite different communities and cultures.
- **Public engagement skills.** While the country's Chief Science Advisor would necessarily take on the high profile work of addressing the public when asked by the Prime Minister, the DSAs nonetheless need similar skills to engage in content-area consultations etc. These skills are important in helping to build and maintain public trust in the science-policy nexus.
- **Understanding the policy environment and risk assessment of policy.** To be effective, a DSA must understand the policy landscape, structures and timeframes. DSAs must have the critical analytical skills to assess risks associated with various policy options. This means drawing on skills to evaluate evidence and weigh up sometimes conflicting evidence from a wide range of relevant disciplines.
- **Project delivery skills.** Experience with project delivery in government is a desirable characteristic in a DSA to help reduce the likelihood of policy programme failures. As the UK Select Committee report suggests, it's important that DSAs have experience in 'delivering the science, rather than the theory of the science.'

The departmental recruitment process for a DSA should be designed to ensure that the chosen can-

didate possesses, at minimum, the above characteristics. This does not preclude consideration of internally recruited staff members for the post; however the ability to engage with the scientific community as a respected peer is a key consideration in recruitment.

Suggested terms of employment of New Zealand Departmental Science Advisors

Based on UK experience, and adapted for the New Zealand context, the following are some considerations in regards to structuring the terms of employment of DSAs.

- **Part-time employment:** it is worth considering a part-time/cross-appointment of a DSA so that the incumbent can maintain links with academia or industry. In exceptional cases where the DSA takes on major management or project delivery functions, full-time employment may be necessary.
- **Length of tenure:** a seconded position of at least 3 years (with the possibility of renewal) merits consideration. This could help to support the DSA's active and on-going engagement with scientific communities outside of government.
- **Access to ministers:** the DSA should have access to their relevant minister(s) to ensure that the evidence they present can influence decisions at the highest level.
- **Guidelines in the event of disagreement:** the UK model recommends the development of clear guidelines to be invoked in the event of disagreement between the DSA and ultimate decision makers regarding the implication of science in policy decisions.
- **Position assessment:** the DSA should be positioned such that they have the authority to work directly with ministers and across the whole department.
- **Relationship with CSA:** the DSA should have a 'dotted-line' relationship to the Prime Minister's CSA so that each can assist the other as appropriate. This will also encourage the development of a cohesive community of DSAs.

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