Post-normal science advising in an era of post-normal policy formation

Opening speech to the First Global Conference on Science Advice to Governments

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I want to welcome you to Auckland. When we planned this meeting we did not expect to be in the middle of an election campaign - an election which has been brought forward because NZ has the chance for the first time to be at G20 and there is broad agreement across the political spectrum to have the new government well established and past the games of coalition politics before that meeting takes place. I mention this only by way of explaining the particular flavor of journalism you may be sampling in our local media while you're here.

This Science Advice to Governments meeting had its origin in an editorial in Nature two years ago by James Wilsdon and Robert Doubleday; This article triggered the International Council of Science to approach me to establish an international expert group to plan this meeting, which was then scheduled to accompany the ICSU congress in Auckland taking place next week. I thank the many people in the audience who contributed to the planning and all of you for making the journey here. Hopefully you will see the best of Auckland this week, as it emerges from winter into spring. .

The objectives of the meeting are described on the website (www.globalscienceadvice.org) and in the draft discussion document that organisers have prepared, and copies of which have been made available to you here today. Many of us are engaged with the business of science advising to governments but there has been surprisingly little discussion as to how this is best done, the principles underpinning it or how we can learn from each other what works and what doesn't. The agenda is set to focus on these issues.

Right from the outset it is important to realize that there are different forms of science advice that operate for different reasons and in different contexts. Firstly it is a helpful heuristic to distinguish the use of science and evidence for policy making from that of developing policy advice for science systems – although, as we know, there is a great deal of interdependence in these two domains of policy, which I'm sure we will hear more about over the course of these two days. But, Secondly we need to realize that with respect to the former, policy-making is affected by both informal and formal inputs and with respect to the latter there are big differences between the nature of formalized general inputs say by an academy to those of advisory panels set up for specific purposes. Both in my comments and throughout this meeting we need to bear these differences in mind.

By way of introduction 5 years ago I was appointed as NZ's first science advisor to its chief executive, the prime minister. I am constitutionally independent being neither a civil servant nor a political staffer – technically I am an advisory committee of one person to the PM, while remaining a salaried academic operating under the principles of academic freedom. My major terms of reference are to promote the public understanding of science, to promote the use of science and evidence in public policy, to promote NZ's interests through science diplomacy, and to provide scientific advice the PM on issues as required. Obviously I am a sounding board for developing or managing policy for science, but I have no direct role in it.. This is primarily the responsibility of the Ministry of Business, Innovation and Employment, which incorporated the Ministry of Science and Innovation

After the second world war the importance of science to national security became very obvious, particularly to the United States, when we saw the beginning of science advice being institutionalized close to the centre of government, first to promote national security and then more broadly with the growth of the industrial complex. Indeed Vannevar Bush who effectively was the first presidential science advisor in the USA and Solly Zuckerman, who was the first CSA appointed in the UK

exactly 50 years ago this year, both came to note because of their involvement in the scientific effort of the second world war.

Gradually a triple mode of advice emerged in such countries – informal and formal advice though the chief executive's science advisor and more formal and deliberate advice though national academies such as the Royal Society and or specific committees set up to address specific issues. Beyond that increasingly sophisticated policy ministries reach out to science either by way of their own technical competence or reaching out to academia, experts or consultants.

But until relatively recently the nature of science advice at the centre of government was relatively compartmentalized – there was advice about the size and shape of government's investment in science and there was technical advice generally on relatively linear issues regarding government's use of science say in managing fish stocks or on adopting new health technologies. In many ways these are technological rather than scientific challenges and with some caveats they are not the cause of the challenges we face as practitioners and academics interested in this interface between science and policy. Rather than this we face a very different set of challenges. Much of this development has been triggered by a number of crises, but also by the changing nature of both science and government.

Firstly the nature of policy formation is now, and probably was always, much more fuzzy than standard textbooks on public policy makers make it out to be. A much more fuzzy policy reality exists and it is critical to appreciate that when understanding how evidence informs policy. It is not an elegant cycle from problem identification to policy formation to decision making to implementation and evaluation, review and so on. Policy makers and decision makers, that is the politicians, are not as distinct in their responsibilities as it is made out to be and the policy analysts who populate much of the cycle are at every stage interacting consciously or otherwise with politicians, experts, lobby groups and the media

Of course we all understand that science does not make policy, the terminology of 'evidence-based policy' is naïve; science informs policy formation. Science can do this at every stage of the process and it can be used to nudge politicians. Notably it neither makes policy nor singularly creates big policy shifts.

Secondly just as with policy formation, the nature of science also has changed dramatically over the years. Science is no longer dominated by relatively linear questions. Computational and statistical developments along with the growth of the research sector in areas such biology and environmental sciences have meant that science now is very much engaged in big systems questions. Of course these big systems questions have some very specific characteristics – they are very complex and non-linear; there is always a large sets of unknowns and conclusions are generally reached in terms of probabilities rather than certainties. As a result there is always an inferential gap between what scientists think they know and what they conclude in such questions.

And here we have a major problem – governments expect and want certainty from science rather than conclusions expressed with Popperian caveats or probabilities and that almost inevitable statement 'more research is needed…'. Unavoidably though, the very big systems questions that science now engages with are precisely the areas where governments need urgent help.

Further, such issues inevitably have high values components – be they of belief and philosophy as in the case of genetically modified foods, or water fluoridation, or economics as in the case of climate change and energy security. In the end the nature of all political processes are such that governments can only move so far from public opinion and their electoral contract. Scientists and advocates for that matter, often ignore issues of effect size, cost-benefit and so on.

Indeed, because belief and ideology can often trump science in real-world political

processes, we have often seen science become a proxy for political and ideological argument even when science, at least at the level of granularity that matters in policy terms,is largely settled. Examples of this include the safety of fluoride in water, the safety of genetically modified food, the reality of climate change, dealing with the obesity epidemic or the ethics of stem cell research. Trust in science is undermined when we allow science, just because it is complex, to be used as a proxy for ideological battles.

And so we have a heady combinations of complex and inevitably incomplete science, issues of high public interest with strong values components and matters of high political urgency and discord.. Such is the world of post-normal science where 'the facts are uncertain, values are in dispute, the stakes are high and decisions urgent'. This is now our domain – the domain of what I term 'post-normal science advice'.

As I have said earlier, it is important from the outset to distinguish between science for policy formation from that of policy for science. While the same individuals are often involved in both they are really largely distinct – if interrelated - issues. Yet in much of the commentary on science advice particularly from science community this important distinction is ignored. All governments operate a science and innovation system and this must have a policy and management framework. Scientists have a vested interest in how this framework operates and most governments have an agency or ministry with scientists engaged in managing these systems. Scientists get nervous when these systems change and governments have a variety of means to seek input into such change. It is inevitable that administrations turn to their science advisors for some input. In some countries such as Ireland the role of managing the science system and providing input on evidence for policy are combined, but in most countries some degree of separation is maintained.

But lines are necessarily blurring. Our job is to help maintain some conceptual and operational clarity. First, advisor engagement in policy advice for the science system

carries with it the risk of being seen more as a lobbyist for science with a consequent erosion of advisory effectiveness in dealing with broader issues. Secondly, right now the science system as a whole is undergoing its most disruptive changes that have seen for over two generations and the science community may not recognize how fundamental these changes are and what their impacts will be. Here the science advisory system must have a major role.

There are many factors contributing to this disruptive change – just to list the most obvious:

- The democratization of science as it shifts from a patronizing relationship with society to a true compact. As a result there is a growing view of the science system being utilitarian across the globe. This is manifest in more overt impact agendas. However, while this is understandable that it has tended to focus on the potential direct economic benefits of research when in fact, the impact of research is of course much broader taking in national reputation and identity, public policy, environmental management, societal and personal health, protection of national interests and human capital development. Of course all of the also indirectly impact on the economy.

- Aligned with this is the growing recognition that many of the major societal issues that we confront will have science and technology at their heart. At thr same time though people are understandably concerned by many new technologies, the pace of change and the potential for unintended consequences. Concepts of risk identification and management and precaution vary greatly between scientists and the public.

- The changed nature of science communication and thus assessment of science performance arising from open access publication, and the development of alternate means of science communication

- The peer review system is close to collapsing internationally under pressure from the expansion of tertiary education-associated science. Peer review has been the mainstay of quality assurance in science but it is a large but hidden cost on the science system. It is inherently flawed but, like democracy, no better system has been developed. However, the way peer review is conducted must change and the focus must be on finding and using systems that are transparent and ensure quality and integrity.

- Much research is increasingly done by large multidisciplinary teams and this creates challenges of assessment and organizational structure.

- Both the move to open access data and the growing capacities in big data are fundamentally changing the opportunities for and the types of research undertaken,

- The greater transparency in science is exposing incidents of a lack of professionalism in science, and in particular issues of research integrity. A particular issue has been the poor reproducibility of much science driven by the rush to publish, the academic impact agenda and the personal stakes now associated with 'breakthrough science'

- The growing commitment to promoting public private sector partnerships in science creates new tensions within the academic

community and beyond raising issues of management of perceived conflicts of interest .

A final point in this context:

- Increasingly we live in a post-trust society and trust in experts is increasingly hard to sustain. Scientists face this when science is used as a proxy in issues debates and ideologues have found that one approach to driving their agendas is to undermine trust in the science or the scientists. On the other hand we have seen the rise of the public scientist – this is to be encouraged – we need this for the social compact to become a reality. But regrettably there are scientists who use their perceived position of trust to advocate for a cause often related to their science but going well beyond the data and, in its extreme form, this undermines trust in the whole of science. This is being exacerbated by the changed ways information and opinion is disseminated through cyberspace.

In the remainder of this talk I want to focus on the primary issue for this meeting; namely how science and evidence can be inserted into the highest levels of government decision making.

As Sheila Jasanoff has pointed out, different countries have different traditions treating to how public reason is formed and this in turn is reflected in how systems of science advice have evolved. We have countries with individual science advisors to their chief executives, countries that rely on panels, and countries that rely on academies. There of course are also combinations of of these modes. I would argue that we need to get beyond a narrow focus on structure and recognize that we inevitably require the mix of approaches. In particular we need to consider the role of informal versus formal advice in the fuzzy world of policy process that I described earlier.

For this audience I do not have to expand on why governments need evidence to inform policy across every domain of government. The scientific process – including social science – remains the only means by which to develop relatively reliable information about of world and ourselves. The only alternatives to this are belief, tradition, dogma and anecdote. Although the latter is the biggest influence on many politicians and voters, it is now accepted by many governments that it is evidence that must inform what I might call 'the post-normal policy process". The question is how to do this.

Some scientists still think that science is about facts and that it is facts which make policy. But, (philosophical issues regarding the nature of 'facts' aside) the science that is generally needed is nearly always incomplete for the reasons I discussed earlier and there is therefore almost inevitably an inferential gap between what is known and what is concluded. I know Heather Douglas is in the audience and I am greatly indebted for her work pointing out that the significance of that inferential gap may be the most value-laden issue a science advisory system needs to deal with. We as scientists must acknowledge the limits of what we know and yet still help the policy maker. In doing so I would argue that it is critical that science advisory processes act as honest brokers rather than as advocates – to steal a term from another of our speakers Roger Pielke.

Others may act as advocates, but the process of institutionalized informal and formal science advice needs to be based on honest brokerage of knowledge. And by knowledge I do not mean simply brokering facts, knowledge is information and its context (what is known, what is not known, and what is the power and limitation of the methodologies used). Honesty also means indicating where values have entered into the science process. The values based domains are properly those for other components of the policy and political process.

So let me turn to the practical realities of science advising because this brings us to a generally ignored consideration – namely the nature of institutionalized informal and formal science advice.

When the issues very structured – generally for long-term matters or where there is little political contention or the matters are rather technical – governments will establish panels or turn to academies for authoritative advice. The USA's use of its national academies is a splendid example. In turn, whether a government does so or not may depend on the standing and confidence in the ability of the national academy to act as a broker as opposed to being an issues advocate. Where such confidence is lacking or where the academy is not best structured to address an issue, governments may establish expert panels directly or through other intermediaries. The more the issues relate to matters with greater values components there more likely they are to turn to invited panels. This may or may not be appropriate, depending on what protocols sit around the use of such expert committees. The UK and USA have both established protocols for such activities and is part of my own work programme is to jointly develop and work with a network of departmental science advisors.;. Clearly issues of independence, quality assurance, lack of bias and trust all come into play. The UK and USA protocols try and address these issues and my own reports to government emphasize the need to enshrine these principles locally.

But whatever kind of panel is established or if the government turns to an academy there are obvious limitations. The report of the panel can almost inevitably only insert itself at a single point into the policy process. Questions set the agenda and a question has already been framed by the time the government turns to a panel. Such panels have no ability to play a role in the fuzzy post-normal policy processes described earlier.

As I have just mentioned, some countries like the UK, NZ, Malaysia and Australia

have established chief science advisor positions and these roles are in turn being supported by networks of departmental science advisors. Such advisors have one unique and critical function – namely that of informal input into the policy process – obviously they may also have some formal input or manage formal input form others. They have the capacity to be there at the beginning, wherever in that cycle the beginning is, they have the capacity to have an iterative engagement at every stage in policy development including the design of final policies. This is a critical role and should not be seen alongside usual political appointments that may ideologically aligned. It allows for an honesty and frankness in dialogue not possible via committee in the early stages of policy thinking. It allows a minister or prime minister to explore ideas at the crucial early and most formative stage of policy development. It allows input later in the process and permits early thinking and debate to be carried out in a 'safe policy space' , minimizing confusion and mixed public messages. I could go on but in my view such necessary contribution is the reality of post-normal policy making and post-normal science advising. Most acute in all this is a trusted point of contact in the face of an emergency.

But irrespective of whether advice is formal or informal two characteristics are needed which in the end cannot be institutionally controlled. These depend on the public integrity of the individuals involved and the system in which they are embedded that protects the independence of their advice.. Formal advice is easier to quality assure as that advice is generally tangible and the process is often public. But in the end the issue of trust is more difficult because the more values-laden the issue, the greater the risk of accusation of bias be it fair or unfair.

Informal advice is more complex hence the importance of individual integrity and quality and an assurance that this individual is structurally independent. One key protection is to ensure that the role is apolitical and independent – a feature which is not necessarily universal.

Thus trust is key. The advisor or advisory system must have the trust of the policy maker and politician to be effective and listened to especially when there is big gap between the science and prevailing ideology. But equally the science advisor needs the trust of the public and the media to the extent that is possible. This creates some complex tensions. The tensions get even greater when one considers the expectations of the science community that can be naïve in relation to understanding the science-policy nexus. One of the ways I have tried to engender that trust is to write and talk openly about these issues and how science fits into the policy process. That is why I described the principles I operate under in a article in Nature earlier this year.

Another challenge is to choose when to enter battles publically. For it is human nature for politicians to be more open and thus more engaged if they can assume it will not be a political lightening rod.. No matter how independent a science advisor may be constitutionally it is catastrophic to battle governments in public – they become adverse to any enagagement. Academies have more freedom in that regard but need also to have regard to this issue.

In this introduction I have tried to open up a number of issues that I think we will spend the next two days discussing – we have designed this meeting so as to have a high level of engagement by practitioners of science advice of different types along with input from academics who study such issues. Hopefully we will learn a lot from each other and find that there is much more we could have discussed. In the last session we will reflect on the meeting and sense whether the network that we have formed here will have ongoing value.

I thank the International Council of Science for triggering the discussion that led to this meeting, the members of the organizing committee for their engagement and all of you for being here for what I hope will be a most valuable two days.

Thank you.