OFFICE OF THE PRIME MINISTER'S CHIEF SCIENCE ADVISOR

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Address given by Sir Peter Gluckman, at the invitation of the Joint Research Centre of the European Commission

October 15, 2014
Brussels, Belgium

"The art and science of policy advice: Can we embed science into the processes of government?"

Many are engaged with the business of science advising to governments but there has been surprisingly little discussion from the practitioner's perspective as to how this is best done and the principles that should underpin it. This led to the establishment of a steering group, that I chaired under the aegis of ICSU, to convene the first international meeting on the topic in Auckland about 6 weeks ago. The meeting was attended by over 45 countries, and some 230 delegates, and led to the agreement to further develop the network. I have only time today to touch on a few key points.

It is important to realise that there are different forms of science advice that operate for different reasons and in different contexts. In this, there are two important points to make that are often ignored.

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, there is a great deal of interdependence in these two domains of policy and the same players are often involved. Yet in much of the commentary, this distinction is ignored.

All governments operate a science and innovation system and this must have a policy and management framework. In some countries 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 because of the risk that the advisor may be perceived as simply a lobbyist for the science community (though an advocate for the *use of science* in policy in general is quite different).

But the science system as a whole is undergoing the most disruptive changes that have been seen for over two generations, and there is a need for evidence based policy to inform the future of the science system so the advisory system needs to have a role in framing the discussion. Some of the factors contributing to this disruptive change include: The democratization of science as it shifts from a rather patronising relationship with society toward an effective compact with society. As a

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result there is a growing utilitarian view of the science system, which is manifest in more overt impact agendas. 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. Then there are the more practical issues: the changed nature of science communication and assessment of science performance, problems with peer review, the moves to open access data etc. Furthermore, the greater transparency in science has exposed incidents suggesting a lack of professionalism, 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'.

Increasingly we live in what has been called a post-trust society where trust in experts is increasingly hard to sustain. Scientists face this when science is used as a proxy in values-based debates: ideologues have found that one approach to driving their agendas is to undermine trust in the science and scientists. Yet at the same time, we have seen the rise of the public scientist, which is to be encouraged. But over-zealous claims can undermine trust in the whole of science.

The second big issue is that we need to understand that science informed policy-making needs both informal and formal inputs; these operate very differently and for very different reasons and a complete advisory system needs both approaches. Until relatively recently, the nature of science advice to government was limited to relatively technical advice 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 at the interface between science and policy. Rather, now we face a very different set of challenges, particularly the so-called 'grand societal challenges' which span borders, disciplines, and comprise a constellation of related and compounding questions.

We all understand that science does not make policy, the terminology of 'evidence-based policy' is naïve; science can inform policy formation at every stage of the process and it can be used to nudge politicians. And the nature of policy formation is now, and probably was always, much more fuzzy than standard textbooks make it out to be. 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 politicians are not as distinct in their responsibilities as it is made out to be. If evidence is to inform policy properly, it has to be able to interact at every part of this iterative process. Formal approaches alone do not achieve that.

And the nature of science also has changed. Science is no longer dominated by relatively linear questions. Science now is very much engaged in big systems questions and these questions have some very specific characteristics; there is always a large set 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.

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

Add to this that such issues inevitably have high values components – be they of belief and philosophy as in the case of genetically modified foods, or of economics as in the case of 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. 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 in cases where the scientific consensus is fairly clear. Trust in science is undermined when scientific complexity is exploited such that science is used as a proxy for ideological battles.

And so we have a heady combination of complex and inevitably incomplete science, coupled with 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.

So how can science and evidence be inserted into the highest levels of government decision-making? Different countries have different traditions that reflect how public reason is negotiated and maintained. 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 and in general there are combinations of these models.

Some still think that science is about facts and that it is facts that make policy. But the science that is generally needed is nearly always incomplete and there is therefore almost inevitably an inferential gap between what is known and what is concluded. That inferential gap, including the context in which it is set, 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 must generally act as honest brokers of knowledge about the implications of potential actions, rather than as advocates of one course of action over another.

Other scientists outside the advisory processes may act as advocates based on their interests and expertise, but the process of institutionalised 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 (that is what is known, what is not known, and what is the power and limitation of the methodologies used). Honesty also means being alert to and indicating where values have entered into the science process as they always do. But the dominant values based domains are properly those for other components of the policy and political process.

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When the policy questions are very structured (generally for long-term matters, where there is little political contention) or when the matters are primarily technical, governments will often establish panels or turn to academies for authoritative advice. 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. The more the issues relate to matters with greater values components, the more likely they are to turn to invited panels. This may or may not be appropriate, depending on what protocols exist for the use of such expert panels. Clearly, issues of independence, quality assurance, bias and trust all come into play. The UK and USA protocols for scientific committees try and address these issues.

But whatever formal process is used, there are limitations. Almost always, the report of the panel can only insert itself at a single point into the policy process and it cannot be done quickly. The policy 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.

Because of this, an increasing number of countries have established science advisory positions (often to their chief executives) and these roles are in turn being supported by growing networks of departmental science advisors. Such advisors have one unique and critical function – namely that of informal input into the policy process and they may also manage/convene the formal input from others. They have the capacity to be there at the beginning, wherever in that cycle the beginning is. And 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 be ideologically aligned. It allows for an honesty and frankness in dialogue which is not possible via a 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 thinking. It allows input later in the process and permits early thinking and debate to be carried out in a 'safe policy space', minimising confusion and mixed public messages.

In addition, the role of the individual science advisor becomes critical in emergencies/crises when the distinctions from honest brokerage and crisis decision-making blur. This was highlighted at the Auckland conference.

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 that the system in which they are embedded protects the independence of their advice. Formal advice is easier to quality assure as that advice is generally explicit and the process is often public. But informal advice can also be generally assured via the network that supports the CSA – for instance, I have a network of departmental science advisors and others.

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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 a big gap between the evidence and the prevailing political ideology. But equally, the science advisory system needs the trust of the public and the media. This creates some complex tensions. The tensions get even greater when one considers the cultural gap between the world of science and the worlds of policy and politics. Indeed, the expectations of the science community can be naïve in relation to understanding the operational realities of the science-policy nexus.

Before finishing I should say something about science advising at the trans-national level, although my remarks focus on the UN system, not on the EU. The nature of trans-jurisdictional processes is such that while formal processes can be established to provide base knowledge such as the IPCC, policy formation is very much a negotiation between nation states, often based on very different priorities. Officials in the international agencies have, in general a limited ability to influence that process and, with a few exceptions generally in very technical areas, evidence informed policy really depends on domestic inputs to the nation's representatives. Understanding this raises some interesting possibilities about how science advice in the international arena should operate. We need discussion on this as the global community heads towards the post-2015 agenda.

Thank you.

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