

**‘ACADEMY, RESEARCH INSTITUTION AND NATIONAL INNOVATION SYSTEM’
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Role of the Australian Academy of Science in development of a national innovation policy

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I have been asked to talk about how national academies can contribute to the development of national innovation systems. Now, the answer obviously depends on what an academy is and this varies considerably from country to country. I have remarked to Professor Lu on an earlier occasion that if I put together (i) my academy, (ii) the Institute of Advanced Studies of the Australian National University and (iii) CSIRO (Australia’s Commonwealth Scientific and Industrial Research Organisation) and scale it upwards by perhaps a factor of ten, only then do I get something that resembles the Chinese Academy of Sciences. Hence, the role that academies can play in developing and implementing a national innovation system will vary according to in-country conditions and there is surely no single preferred way of doing it. Thus I do not think that I can, or should, tell you what your roles should be. Instead I will explore some of the issues that the Australian Academy of Science (AAS) has encountered in the promotion of science for the purpose of improving the human condition. I can then leave it to you to decide whether some of this experience may be useful to your circumstances. In return, I will be listening to your presentations to see on how we may improve upon our ability to contribute to a country’s knowledge-based development.

The AAS (www.science.org.au) is an independent body of the nation’s leading research scientists, created very much in the image of the Royal Society of London. It does not have its own research institutes nor does it have any statutory obligations to government. We do receive a small grant-in-aid for partial support for our administrative staff and infrastructure costs but the bulk of our operating and capital costs come from contracts and private sources.

The AAS was created only in 1954 at a time when there was no high-level national science advisory body in the country, a time of post World War II reconstruction with a burgeoning of

science globally, and when successful wartime partnerships between science and technology were still remembered¹. The leading scientists of the day recognised that it was an appropriate time to form an independent national academy and this proceeded with the full support of the Commonwealth Government, in the realisation that such a body was indeed the best way to advance science and technology in Australia.

From the beginning an important objective of the AAS was: 'To promote, declare and disseminate scientific knowledge, to maintain standards of scientific endeavour and achievements in the natural sciences in Australia; and to recognise outstanding contributions to the advancement of science.' In large part, because of the policy-formulation gap that existed at that time, this objective was from the very beginning interpreted as including contributing to the discussion of the national science policies and agendas. This included, for example, initiating discussions on why government should establish a national advisory council for scientific policy advice. This finally came about in 1977 with the establishment of the Australian Science and Technology Council (ASTECC) as a statutory body, with a strong representation, including its chair and deputy chair, from the AAS. The role of the AAS in creating this was specifically acknowledged by the prime minister of the day that, '...over many years...the Academy...led the fight to have a sensible and properly based science advisory council established in Australia.' I mention this because when academies seek to influence governments they have to be prepared to work on long time-scales and to work consistently with successive governments.

ASTECC subsequently evolved into the Prime Minister's Science, Engineering and Innovation Council that, because of parallel growth of other executive bodies, is free of executive responsibilities, and has as its primary role of bringing science and technology issues directly to the attention of the prime minister and to government ministers and to respond to issues raised by ministers. Over a period of years this has resulted in a greater high-level awareness of how science underpins much of what modern governments do and they have been able to raise emerging issues earlier than may otherwise have occurred. But being political creations, their continued existence can never be taken for granted and at present the government is considering restructuring it to a 'Prime Minister's Innovation Council'. This has an inherent risk of the innovation debate becoming increasingly dominated by economic arguments and models and less so by the need to build national innovation on the strong and long-term science and technology foundation. The challenge for our academy is to ensure that this is not allowed to happen.

If we look back at its early days, the AAS also played a critical role in the creation of a body to fund research in the natural sciences in Australian universities, the precursor to the Australian

Research Council, at the same time as science and technology became increasingly important in other government portfolios. Also, because the AAS through its elitist election policy had effectively distanced itself from the applied sciences community, an independent Australian Academy of Technological Sciences and Engineering was created in 1976. For the same reason, it had distanced itself from the science-based professional societies and, to maintain these links, it actively encouraged the formation in 1985 of the Federation of Australian Scientific and Technological Societies to act as a lobby group for Australian science and technology.

Thus the original science policy vacuum has become increasingly filled from within the government's own agencies and by other independent bodies. This has meant that the role of the AAS in contributing to science policy formulation and debate has also been under constant review and we have to be realistic about what can be done in today's environment. Not being a funding agency, the AAS has to be content with providing advice as one body amongst others. And we have to accept that the only recall when that advice is not recognised, let alone not acted upon, is to ensure that the case is better prepared next time.

The AAS has responded to these shifting sands by creating its own Committee for Science Policy with the express purpose of anticipating emerging science policy issues, alerting government to these issues, and responding to policy issues emanating from government.² The Secretariat works through the Council of AAS, using the membership as a whole and outside advice where appropriate, to identify emerging issues, to prepare position papers on significant issues, to respond to the calls for inputs into government inquiries, and to respond to the public statements made by government on matters within the AAS's competence.³

There is a balancing act in all of this: our independence means that we can offer free and fearless advice to government but this has to be balanced with reality. Free advice that is constantly ignored by government is not of great value and neither is advice that simply rubberstamps government's wishes. In particular we have to strike a balance between the advisory role and a less cautionary lobbying role that many of our members would prefer us to take.

So how do we go about this? How does an academy develop and maintain an effective element in the larger sphere of developing a national innovation system? That this very question is asked at this symposium is significant because it starts with the premise that an academy should be a driver in knowledge-based development and not be merely a collection of distinguished scientists basking in the glories of past scientific achievements. The AAS agrees

with the proactive role, and its objectives, then and now, are to promote science in Australia at all levels including the alignment of science and technology with national aspirations and to use science to improve the human condition. We believe that there are very legitimate and achievable roles for an independent academy to play: to take on the responsibility of pursuing excellence in the science and technology that underpin the national effort to be an innovative country and to make sure that in national innovation debates the all-important role and functioning of science and technology is not overlooked in the commercial and economic arguments. In other words, to contribute to the development of a vital environment in which it is recognised that it is wise and long-term investment in innovative human and material resources that provides the springboard for long-term growth in wealth, health, sustainable employment and environmental benefits.

In the modern parlance of managerialism, our vision is that, 'the Academy is the prime representative of Australia in natural and applied science, a champion for scientific excellence in Australia and an independent adviser on Australian scientific research, teaching and technological innovation.'⁴

We develop this vision through four major programs:

- Excellence: recognising and rewarding excellence in scientific research.
- Education: development of education and public awareness programs in science.
- Policy: developing the ability to provide science policy advice directed at national needs.
- International: linking Australian science into global science through the fostering of international and bilateral programs.

Because AAS is an independent advisory body there is no government ownership. There is no government obligation to seek advice, let alone to pay heed to any advice given. Thus whether advice is sought and listened to depends on building up trust with government at both ministerial and bureaucracy levels. This can take time and the time-scale of building this can be longer than the time-scale of politics and politicians. It has to be able to survive reshuffles within a government and changes of government. Thus the path to building up long-term confidence in the AAS's claim to be a legitimate part of the national innovation debate is best assured if there is a record of high quality, considered and reliable advice, independent of the government of the day, confidential when appropriate, and timely in its response and in anticipating future issues.

Essential in this is the need to maintain, recognise and reward excellence in science. Members of an academy should be the elite of the country's practicing scientists who have been elected

for their own contributions to science.⁵ This can mean that election may come rather late in a scientist's career and in disciplines that are already mature. Unless addressed in a pro-active way this can of course lead to a 'dormant' institution and the challenge that all academies are faced with is how do we create an elite body that is at the same time able to respond authoritatively to issues raised by the most recent advances in science and technology at the interfaces of traditional disciplines? Our approach is not to fix the total membership but to place a limit on the numbers that can be elected in any one year, coupled with a pro-active effort to identify potential candidates from across the entire science community who have already made their mark and who show great promise of doing even more: all without reducing the criterion of excellence. There are obvious risks, but I believe that the risk of ossification is greater.

Innovation rests on knowledge and all knowledge starts with education. Thus for the AAS the education programs to improve science education across the country are particularly important. This lays down the base not only for future generations of scientists and also for the broader community to understand how science and technology impacts on our world so that informed decisions can be reached. It is the broader community that elects our politicians and if it does not understand the benefits of science and technology then there is little incentive for politicians to raise the issues above their horizons.

Our concern with science education is particularly focused at the primary school level because this is where bad habits often start: with children, innately enthusiastic and curious, not being encouraged to develop a questioning mind, not encouraged to develop a desire to understand and explain the world around them. This is not the time to explore why the AAS has been compelled to develop its own primary school teaching program, nor to develop how we have gone about this by working within the existing school systems. But the main outcome is interesting if only as an example of what an academy can achieve. The resulting program *Primary Connections* started in 2004 with a pilot program funded by the AAS, trialled in 56 representative schools, and independently assessed.⁶ The initial success led to government support for a phase-1 trial across all states and school systems, that today has reached approximately 30 per cent of schools across Australia. Further assessment of the program outcomes then led the government to fund a further rollout with the aim to reach all primary schools by 2010. As I have already said, this is not the place to go into details of the program, but I will note two reasons for the success: (i) that it is the AAS backing of the program, with the guarantee of quality of the contents and of its independence, that has made the program acceptable to federal and state governments as well as to the different school systems; and (ii) that the AAS is seen to be concerned enough to do something about science teaching provides an immeasurable incentive to teachers. Also worth noting is that as a highly successful and high

visibility program, it indirectly lends confidence to the AAS's ability to contribute to other areas of public concern and debate, and this includes science policy development.

So back to the science policy area. There are some particular challenges that may be common to other academies. Foremost is: how to provide advice to government across the entire spectrum of science and technologies, on time scales that are not always consistent with careful consideration? Australia spreads far and wide with its population unevenly distributed. The membership of the AAS is limited to only a very small fraction of Australia's active scientists, certainly less than 0.3 per cent, and there is always the risk of the body not being representative of Australian science, particularly at times of rapid evolution in newly emerging areas or in times of rapid political development. Plus we have a federal system of government in which many issues of education, infrastructure development and public health come under state government jurisdiction and we should be providing advice to both levels of government. This creates special problems for the AAS: how can we be representative across the country and across disciplines and maintain an active membership that is prepared to contribute to the AAS goals, and yet retain the highest standards for election?

That is our constant challenge. I believe that it is at least as important to be an effective academy as it is to represent the highest levels of excellence in science. Thus there is somewhere an optimum limit to the size of an academy that will be a function of a nation's population and level of education. I do not believe that there is a linear relationship between the size of an 'effective' academy and the population of a country and I suspect that a better mathematical model is more like a parabolic function in which countries with a small population base need a proportionally larger percentage of its scientists involved, than do countries with large populations. And if one looks at academies that are seen to be effective in promoting science and technology in their countries one can in effect begin to see such a relationship.

But there may be other ways in which academies can be more effective in providing timely and quality advice. One is to make use of Australia's diaspora as a natural bridge to overseas scientific developments and source of advice. This could be done through greatly expanding election in our Corresponding Member category or by removing the requirement that members have to be residents in Australia at the time of election. This is something that we do not yet do well and we do not draw effectively on the talents of leading Australian scientists based in overseas universities and research laboratories.

Another way is to engage with the broader scientific community in the country and this we do better, making use of our discipline-based national committees that are made up of both AAS

and non-AAS members.⁷ These committees serve as a link with other Australian scientists and include representation from scientific professional bodies. They also serve as gateways to international linkages. Their activities include discipline reviews and the development of discipline decadal plans, alerting the AAS to particular issues brewing in the background, organisation of workshops and conferences, and contributing to policy development. The benefit of these committees is that we can access a younger and a more 'at-the-coalface' part of the community for our advice.

A third way is to for the AAS to engage with young scientists and to draw them into our activities at an early stage. We attempt this in a variety of ways: to including them in the national committee work, through mentoring and early-career programs⁸, through our High Flyers Think Tank and Frontiers in Science programs⁹, and through their preferential treatment in our international exchange programs¹⁰.

A fourth way is for linking with the other learned academies in Australia. This particularly includes the Australian Academy of Technological Sciences and Engineering on matters of science and technology through joint responses to government initiatives or through joint workshops and symposia on, for example, technology issues related to climate, water, energy and resources. But on issues with a broader social implication we also join forces with the Academy of the Social Sciences in Australia and the Australian Academy of the Humanities under the National Academies Forum¹¹ umbrella. This has led, for example, to a joint response to Australia's recent Innovation System Review¹², and to studies on sustainability, on environmental, social, legal and ethical aspects of the development of nanotechnologies, and on the public acceptability of nuclear power, as well as on historical issues where science has played a role in early Australian discovery and adventure.

There are other issues that warrant exploration. If one can develop good advice, how do we get governments to act on it? How to get the AAS's advice to be seen by the broader community as an important input into debate on national issues? What is the role of academies in developing the international science and technology links? But there is no time here to explore these and similar issues further. But in case it all seems that there are too many hurdles, I would like to finish up with one recent, if small, success story. A matter of concern for the AAS has been growing evidence that we are losing a lot of research talent during the transition from the post-doctoral stage to the senior researcher stage due to a lack of mid-career opportunities. We made this a central issue in our biennial science policy statement¹³ and have returned to the same messages at numerous opportunities, with the outcome that the government has created

1000 new mid-career research positions to be introduced over a four-year period. It shows that small oak trees can grow from small acorns.

¹ *The First Fifty Years* edited by Frank Fenner, published by the Australian Academy of Science, 2005.

² www.science.org.au/academy/academy.htm

³ See, for example, the reports in <http://www.science.org.au/reports/index.htm> and the annual report for 2008 www.science.org.au/reports/2008anrep.htm

⁴ www.science.org.au/policy/strategic.htm

⁵ www.science.org.au/academy/fellows/fellow.htm

⁶ www.science.org.au/primaryconnections/index.htm

⁷ www.science.org.au/natcoms/index.htm

⁸ www.science.org.au/events/ecr.htm

⁹ www.science.org.au/events/thinktanks.htm and www.science.org.au/events/frontiers.htm

¹⁰ www.science.org.au/internat/index.htm

¹¹ www.naf.org.au/

¹² www.naf.org.au/11september08.htm

¹³ *Research and innovation in Australia: A policy statement*, www.science.org.au/reports/2007.htm