

**CRCA 2012**  
Collaborate Innovate

What Australia Wants  
Professor Ian Chubb (15-20 mins)

Discusses:

- need to set research priorities
- an education system that supports supply of required expertise
- need for more collaboration
- need for research in industry

Good morning and thank you for the invitation to be here today.

It's a pleasure to be on a panel with Professor Hoj and Miss Carnell, no doubt one the most intelligent line-ups of the conference.

The short answer to What Australia Wants is that we want a healthy and safe, socially, culturally and economically prosperous nation. And I doubt too many in this room would argue with the proposition that scientific research will be key to that prosperity.

The long answer involves finding out what we need to forge a path to get there.

Considering what Australia wants and discussing it here with you today is actually very timely. This time next week I will be addressing the National Press Club to launch my Office's Health of Australian Science report, which examines in detail our successes and vulnerabilities in order to determine where our priorities should lie.

It is timely for today because in order to determine where the path should go, and which turns to take, we first need to be able to understand our current system and where we our present trajectory is heading us.

The Health of Australian Science report does just that: from our high schools, to our universities, to industry, to international comparisons, it offers a comprehensive overview of where we stand.

Of course, my media folk will kill me if I reveal too much too soon, but what I can say is that Australia's science system overall, is a healthy one.

We have many strengths: we are well represented in the international scientific arena, our researchers are some of the most productive in the world and our education

systems produce graduates in many of the areas we need.

But there are areas for concern - some in regards to overall funding structures, and some that are discipline-specific. And while I won't go into too much detail I will touch on the relevant findings that have led me to some of Australia's wants and needs.

Included in those is an efficient, productive and innovative workforce. And to get that we need education and innovation to be fundamental underpinnings to our systems.

There are a couple of approaches possible: make strategic choices wisely, or hope that activities will coalesce around important issues when they become important or when they appear to be. The former has to do with investment choices among other things; the latter will depend on a capability being available when we need it but with no or limited planning to ensure it.

Being strategic, and being as prepared as possible is significantly more desirable. To lead us there, Australia needs the ability to be able to set research priorities.

At the moment, 60% of government R&D goes to our universities<sup>1</sup>. The majority of that funding is heavily influenced by what the students choose to study, particularly the choices of undergraduates.

This means that as a whole, more, probably much more, than 50% of all government spending on research is seriously influenced by the choices of our 17 and 18 year olds, usually under the advice of 'choose something you find interesting'.

Students exercise choices when they identify what they want to study. And it is peoper that they do. Doubtless there are multiple inputs: their own interests, parental and teacher advice, friends. When those choices turn into enrolments, the universities are funded according to where the students enrol and what they do Base funding follows students, funding is used to employ staff; staff are expected, in many universities all staff, are expected to conduct research; staff apply for research grants.....

This basically logical approach to funding may well put some important disciplines at risk because they are not

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<sup>1</sup> Pettigrew, A. G. (2012) Australia's Position in the World of Science, Technology and Innovation, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra.

popular at a given period. Fewer students, fewer staff, fewer applicants for research support in a field, fewer PhD candidates...

So is a popularity contest the best way to ensure Australia is conducting research, and preparing a skill base that will prepare us for the challenges of the future? Or in other words, is it a strategic approach to developing a research profile and a skill profile?

I am inclined to say no, particularly when we look at trends in undergraduate enrolments over the last decade.

We have seen a steep decline in the number of students taking agriculture and engineering, as well as a disturbing trend in those taking the enabling sciences of maths, chemistry and physics. In agriculture in 2010 for example, we had only 743 graduates. That same year, approximately 4500 agricultural science jobs were advertised<sup>2</sup>. In engineering the story is similar: we produce less than half our annual engineering workforce needs, with around 6000 graduates annually.

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<sup>2</sup> Chief Scientist, Senate Enquiry into Agriculture. <http://www.chiefscientist.gov.au/2012/02/senate-enquiry-submission-agriculture/>

To ensure our research funding is delivered most strategically, three months ago the government established the Australian Research Committee, which I chair.

The terms of reference of the committee are to provide advice on emerging problems and opportunities for research investment. The primary focus for this year is the development of a National Research Investment Plan.

This plan will provide a strategic framework to help government make decisions about how much funding should be given in certain areas, how to balance research investment, between basic and applied research, and between universities, industry and government agencies.

The fact is, our investments at the moment are not underpinned by any sort of sustainable strategy because largely, it does not acknowledge that some areas of research simply ARE more important than others right now.

We need to ensure Australia is prepared for a future where entirely new industries will be born. A future where we will not always be able to rely on our natural resources

for our prosperity. A future where the climate will affect us in ways we still find hard to predict, and a future where we will need local expertise in a range of research areas that may be different from those needed now.

So part of the national plan is to look at the key policy challenges over the next decade, and in that light, determine the priority areas for research investment.

This is something we need because we cannot do everything. We need to have the discussion: how do we become strategic and seek to ensure that there are no (or very few ) gaps in our capability while avoiding the pitfall of 'picking winners' or being consumed by present exigencies or even being tightly constrained by what we know now?

It is odd in life how different things suddenly leap back into your mind from times long past. I remember when competency-based assessment was the hot topic. To some it meant assessing competence ahead of assessing knowledge and had strong protagonists and antagonists. One of the lines against it was the possible stifling of creativity when the practitioners of today set the standards for assessment of those of tomorrow. It characterises the

discussion we now have to have: using the knowledge and wisdom of today's practitioners to identify what we need to prepare for the unpredictabilities of the future without fixating on tomorrow.

This means we need to think through change. We need to have the levers in place to be able to respond to new challenges as they appear and give funding to the places it is most needed, not where bachelor degrees are most popular.

But even if we can change the funding structure so that the money no longer follows the students so tightly, it does not address the additional challenge that will affect our workforce if/when we do not have enough experts in the areas we need.

There are disciplines where we are already facing workplace and research shortages, and those where the shortages are expected to get worse – areas like engineering, mathematics, physics, chemistry, agriculture and statistics.



We can't force students to take degrees in the national interest – ahead of their own. We need to make them so interesting (or show how extraordinarily interesting they are) that students want to study these topics.

No matter how much funding we pump into strategic research areas, it will be useless if we do not have the human capital to perform the research, to think innovatively and to develop creative solutions.

And the pipeline starts early.

The number of high school students taking high level maths and science has been declining for years. Between 1992 and 2009, the proportion of Year 12 students taking physics, chemistry and biology fell by 32%, 25% and 32% respectively. We need to find ways to entice students to study these subjects.

Part of the problem, I believe, is that students are disengaged from the ubiquity of science. In a study of Australian high school students, of the students **not**

studying science, only 1% thought it relevant to their future 'almost always'. That is a frightening statistic.<sup>3</sup>

How can we expect students to take up science subjects and degrees when they cannot see the relevance to their lives? I have already assembled a brains trust to tackle this very issue in my office and you can expect to hear more about it later in the year.

While part of what Australia wants is more science graduates, the other part is that Australia needs more quality research. My office has recently released a report, and this one is public so my knuckles won't be rapped for talking about it. This one looks at the OECD scorecard on science and how Australia's funding and research outcomes compare internationally.

In the number of publications per 1000 population, Australia produces 2.4, lower than Scandinavian countries, but higher than the UK, Canada, USA and much of Europe. Of those publications, almost two thirds are published in the top 25% of journals<sup>4</sup>.

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<sup>3</sup> Australian Academy of Science, 2011. *The Status and Quality of Year 11 and 12 Science in Australian Schools*

<sup>4</sup> OECD Scorecard, 2011, Page 94.

While our performance here is strong, one interesting trend from the analysis was that, in most cases, the higher the level of collaboration in a country, the higher the relative impact of publications.

Denmark for example has international collaboration on more than 50% of its publications, and their publications are cited 68% more than the world average<sup>5</sup>.

For Australia to maintain its contribution to the global body of high quality science, we also need to maintain and improve on, our international collaborations.

This is for more than our own nation's prosperity - I believe we also hold a responsibility as a rich, developed nation.

As the world continues to face global problems such as climate change, disease and food security, we must accept that no one country will be the solution to these problems and that these challenges require collaboration. With the resources to do so, we need to continue to contribute in a meaningful way, to the solution to the world's problems.

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<sup>5</sup> Ibid, Page 47.

The final thing I believe Australia needs is more research being conducted in industry, which I'm sure Kate will speak on.

The OECD scorecard shows that we have one of the lowest number of researchers in industry out of developed countries, with only 2.2 researchers employed in business enterprises per 1000 workers.<sup>6</sup>

This is half the amount of Canada, and almost a fifth of Finland. This shows a critical lack of investment in, and a significant disadvantage for, innovation in Australia's industry sectors.

The relatively low level of R&D activity in business in Australia is consistent with Australia's economy being heavily based on the export of natural resources, especially coal and iron ore.

To sum up, I see Australia's needs as four-fold: a need for strategic funding mechanisms, more graduates in specific disciplines, greater international collaboration, and greater integration between research and industry.

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<sup>6</sup> Pettigrew, A. G. (2012) Australia's Position in the World of Science, Technology and Innovation, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra.

Governing all of these, is the need for Australia to make strategic decisions about our future - to make choices and invest in them appropriately, not to enter a challenging future with limited preparation and planning. The risk is just too high to hope that things will turn out in our favour.

Thank you