Australian Government

Chief Scientist

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Global Research Infrastructure Forum

20 minute keynote address

Global challenges, global science, global equipment

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Charles Perkins Centre
UNIVERSITY OF SYDNEY

Every occasion has both primary and secondary significance. For me, the secondary significance today is that this is the first address I will deliver as Australia's Chief Scientist.

And what better occasion could there be?

Everybody here accepts that the world needs great science, and that great science needs great equipment.

Great innovation comes from the two combined.

Science and innovation: these are the centrepiece of the Australian Government's growth agenda. My great mandate as Australia's eighth Chief Scientist. And our core business today.

Some people take the view that 'innovation' is just a buzzword – destined to die with kale and quinoa.

We forget that people once thought that way about the word 'infrastructure', too. Well, they certainly did in Australia. The word "infrastructure" wasn't used by politicians in our Parliament until the 1960s. And even then it was dismissed as 'modern jargon'. Would never catch on. Ridiculous word.

It turns out that the people who thought that were wrong. And they were wrong not just about the word but about the enduring power of the concept it represents.

Some things have an importance that extends beyond themselves. Some things impose obligations on their hosts as custodians for the nation – and the world. Some things are vital to plan – not just because they are expensive, but because they are imperative.

So what are those things? Sixty years ago, they included power stations and roads. But infrastructure planning logic wasn't extended to telescopes and laboratories.

Australia did have them back then, including the radio telescope at Parkes. But the phrase 'research infrastructure' doesn't appear in our Parliamentary records until 1985.

In other words, if you were a kindergarten child when Neil Armstrong walked on the moon and the radio telescope at Parkes relayed the images – you were in the workforce by the time 'research infrastructure' was mentioned by that term in the Australian Parliament. It is my experience that you still get the odd blank look when you use the term 'research infrastructure' today.

But the thinking is shifting, and so is the place of science in the national and global conversation.

We meet today with the mandate of our national leaders – who are telling our parliaments that this work is critical.

- That research facilities today are the places where knowledge is gathered and ideas spark.

- That these facilities give the world's smartest people a reason to come, and our own smart people a reason to stay.

- That they allow us to make all the *other* bits of infrastructure more productive and sustainable over time.

Crucially, we know that if you build a particle collider, you've got a phenomenal *people* collider as well. We know that if you build

great equipment, you'll give yourself the tools to build a better country.

And you in this room are privileged to be charged with bringing that infrastructure about.

An engineer and researcher's approach

I say this from an engineer and researcher's perspective. Creating frameworks that work reliably is what we do – even when the aims are bold and the resources constrained.

I have been specifically interested in scientific equipment throughout my career:

- While gaining my PhD in electrical engineering.
- Starting a company named Axon Instruments in San Francisco in 1983, as a medical devices company making precision amplifiers to measure the electrical activity in brain cells.
- Expanding the business over time into imaging technology, and hardware and software for data capture and analysis.
- Coming back to Australia as an advocate, philanthropist, and policy thinker.
- As Chancellor of Monash University.

- And of particular relevance, as a member of the panel commissioned last year by the Australian government to review our national research infrastructure.

So if I have only been Australia's Chief Scientist for ten days (including a weekend and a public holiday) I have been thinking about these topics for a very long time.

Of further relevance, I am very pleased that I have been tasked by the Prime Minister to chair the expert planning group which will map Australia's long-term needs in infrastructure for science and research.

I am very conscious that I take up that task at a moment of rare national opportunity.

Last year, through its National Innovation and Science Agenda, the Australian Government committed to investing $2.3 billion over the next 10 years in research infrastructure.

That includes $1.5 billion in operational funding for our existing national collaborative research infrastructure; $520 million in operational and related funding for the Australian Synchrotron; and $294 million for the Square Kilometre Array.

This is long-term, committed funding – committed not just on paper but in the very clear statements of the Australian Government and the Australian Opposition.

There is bipartisan recognition that this is important – and bipartisan commitment to get it right.

If the recommendations of the expert planning group are accepted, whatever they might be, then the financial

commitment announced last year will only be a part of a much bigger commitment to research infrastructure over the next ten years.

I start my planning task with the presumption that our commitment at home can also contribute to the community of like-minded nations.

Learning the lessons of NCRIS

Our ambition is justified by Australia's experience. It is justified by the success we realised when we put in place a long-term agenda.

But it is also balanced by the lessons we learned when we almost allowed that agenda to stagnate.

Ours is an example worth sharing, as a case study in both failure avoided, and success.

In 2004 in Australia the government made a much appreciated, bold commitment to our national research infrastructure – and our place in the world – with a framework we called the National Collaborative Research Infrastructure Strategy, fondly known as NCRIS.

It was funded by a $2.7 billion investment by the Australian Government, matched by $1 billion from our universities.

It was an agenda that understood the human skills to be just as critical as the physical tools. It planned for both, by including seven years of operational funding. And the plan worked.

Today the NCRIS network supports over 35,000 researchers, both here and abroad, through 27 active projects delivered through more than 200 institutions.

NCRIS has helped Australian researchers collaborate with colleagues in over 30 countries. It has paved the way to our involvement in other great projects, like the Square Kilometre Array. And it has brought remarkable people who I am proud to know into the circle of Australian science.

As Chancellor of Monash University, I was very aware that NCRIS made it easier to attract top international researchers, as our Vice-Provost would often remind me.

How many more talented people have come to Australia, and not just to Monash University, because they couldn't do their research back in their home country? It's hard to quantify, but anecdotally it's a lot.

And beyond that great injection of talent – how many phenomenal discoveries, products and processes, of global significance, emerged from NCRIS-funded facilities? We don't have a count, but here are some examples:

The nanopatch provides a solution to many of the problems with vaccines delivered the traditional way.

It is an array of very small silicon needles, about the length of two skin cells, pre-coated with the vaccine. When pressed onto the skin it delivers its payload to the patient with no pain, no fuss.

It needs no refrigeration, making it cheaper and safer to transport. It could ultimately be self-administered in

communities where nurses and clinical facilities are extremely scarce.

It was developed using the silicon foundry equipment at the Australian National Fabrication Facility.

The Castrip Process is a way of producing flat-rolled steel that, quite remarkably, needs less than 10 per cent of the floor space of conventional steel mills. It was developed by researchers using the Australian Microscopy and Microanalysis Research Facility.

The Hendra Vaccine was developed as a critical response to a bat-borne virus that killed 4 people and 90 horses in Australia in the course of some 50 outbreaks over 20 years.

Although infections from the Hendra virus are rare, the fatality rate is extremely high, reaching 60% in humans and 75% in horses.

Thanks to work undertaken at the Australian Animal Health Laboratory, we now have a vaccine available on a commercial scale.

And finally, let me mention the **Integrated Marine Observing System** that is putting major pieces of the global climate change puzzle into place.

Working with related observing systems around the world, our marine observing system has recently helped to answer the puzzle as to where the heat from global warming is being stored.

The answer, of course, is that the ocean is a much larger sink of the heat energy from global warming than is the atmosphere.

These are a small sample of a phenomenal contribution to scientific as well as human progress.

Of course, from a planner's perspective that progress is a two-edged sword. Great equipment helps to make itself redundant.

When science moves on, because research facilities drive it, they must be re-equipped to keep up the global pace.

We know something about that process in Australia, too. That's the second half of this case study.

The capital and operating funds committed to NCRIS ran out in 2012. The last major new injection of capital funding for NCRIS took place in 2009.

Those funds terminated in 2013. Since that time our facilities have functioned on annual funding, sometimes not announced or released until the last minute.

As a result, facilities have not been able to offer certainty to their staff. And as a nation we have not been planning the next generation of national-scale equipment.

We slipped on both fronts and we paid the price of lost momentum.

But we don't have to incur that price again, with the long-term operational funds committed, and the national planning process in place.

We know we can't expect to plan and build great facilities just once.

We are setting out with the intention of re-investing the knowledge dividend - making the facilities advance with science over time – and keeping the human skills at the core of the strategic plans.

In that process, forums like these are critical for Australia – and for Australia's contribution to the world.

I am excited that we plan to build the best national systems we can with the benefit of our shared experience. I am even *more* excited that, collectively, we are looking to the possibilities of building the best global systems we can.

These are complementary aims: the national and the global.

We need to build national systems that are supportive of the global framework. We need to build a global framework that draws on our experience with building national systems.

As I said at the outset: the world needs great science, and great science needs great equipment.

In that context, let me conclude by framing some of the key questions for us today.

1) How do we include the human skills in our planning for the physical equipment?

2) How do we balance the need for certainty with the need for agility in the way we set out our plans?

3) How do we deal with the reality of limited resources, and show we can use them productively?

4) What can the Asia Pacific region in particular offer to the emerging global process?

5) And in the big picture – how can we build the best possible global architecture for science, embracing more and more nations and facilities every year?

As Australia's Chief Scientist, I'll be playing my part. I look forward to working with you on the mission ahead.

Thank you.