



Australian Government

Chief Scientist

PROFESSOR IAN CHUBB AC

LES POWER MEMORIAL LECTURE

4:30 to 5:30pm

9 November 2015

The Innovation Imperative

**James Cook University
TOWNSVILLE**

Innovation: a brief history

It is a great pleasure to join the roll-call of speakers who have come to James Cook University and delivered the Les Power Memorial Lecture in its long and distinguished history.

The program in previous years has listed speakers with an asterisk to mark all the ones who'd won Nobel Prizes.

When you need a marker of that nature you know you are dealing with an illustrious field.

The calibre of the speakers and the variety of the topics they have chosen is a testament to the man we honour.

He was a first-rate scientist with a vision for what science could offer to this nation as well as this region. So he was, like so many scientists, ahead of his time.

These days we hear a great deal about science – and even more about innovation, occasionally with the sense that the two might be related.

It wasn't always so.

In the early days of our nation, 'innovation' simply meant 'something new' – and being new, there was a good chance it was going to be something bad.

You can see the traces of that way of thought in the Hansard records of the early years after Federation.

For decades after 1901, federal politicians would thunder about:

- This 'pernicious innovation' (Senator Edward Millen, 2 July 1919)

- This ‘insidious innovation’ (Senator Thomas Bakhap, 9 September 1915)
- This ‘glaring innovation’ (Senator Albert Gardiner, 13 November 1918)
- This ‘monstrous innovation’ (The Hon William Archibald, 21 August 1913)
- This ‘novel, extreme, far-reaching, and unparalleled innovation’ (Senator Albert Gardiner, 13 November 1918)

For men – and they *were* men – who had just embarked on the great experiment of a new nation, they could be deeply suspicious of change.

They spoke of agility when they were referring to acrobats – or the acrobatics of lawyers.

They spoke of disruption – as a recurring grievance they had with the postal service.

They made a word from the syllables ‘start’ and ‘up’ – but it was ‘upstart’, and it wasn’t a term of praise.

So they would be wrong-footed by the topic of my speech, as well as the lexicon of the present day – as crowded as it is with unicorns bounding nimbly across the valleys of death.

One people, one destiny, one innovation agenda

But our ancestors were also capable of vision and imagination – just as we are today.

No-one did it better than Henry Parkes.

In his famous Convention speech in 1891, he laid down an Australian ideal that resonated then, and still speaks to us in our better moments.¹

“[O]ne people may make common cause and inherit one destiny... It means that great Australian people, increasing day by day, year by year, increasing not only in number but in all the power that number and civilisation know, in the power which is conferred by bringing science as a harnessed steed into our service, and by bringing to bear upon our fortunes all the abundance of an advanced civilisation.

“We seek in the best way that is possible, by federated power, to master our own destinies and to win our own position in the world, and in entertaining this lofty and enlightened ambition we are not prepared to take any second place amidst the civilised peoples of the world.

“One people. One destiny.”

And, we might say, one innovation agenda.

Of course times have changed – maybe not always in the direction of greater enlightenment, but relentlessly in the direction of innovation.

In the past three months, the word ‘innovation’ has been recorded more times in the Federal Hansard than it was in the first twenty years after Federation.

Nobody in those three months thought to connect it with ‘pernicious’. Nobody thought to use the word ‘monstrous’ about anything at all.

¹ The Hon Sir Henry Parkes, Address to the Constitutional Convention, Sydney, March 1891. Online: <http://parkesfoundation.org.au/resources/sir-henry-parkes-2/in-his-own-words/>.

The challenge we face now is to grasp the *concept* of innovation as well as the word – and to unite it with that enduring ideal of one people.

Innovation for every Australian – not just the rich, not just the talented, not just the cities and not just the Australians who happen to be alive today, at the expense of those who will need to live in this country tomorrow.

What does that mean in practice?

- It means we harness new knowledge to build new businesses, industries and jobs.
- It means we prepare our students – all our students – to be curious and creative, as well as capable.
- It means we come to new technologies with insight and understanding, as a society, not just a lot of shouting people.
- It means we seek knowledge – both to apply it to our immediate needs and to work towards our far-distant ambitions.
- It means we recognise our universities as a national and global resource, and one of far greater importance than anything we could dig out of the ground.
- It means we are confident in our nation and its capacity to be a contributor to the world – not just a bystander to the destiny we will inevitably share.

So I don't mean innovation as the hobby farm in the Australian economy – a sideline that some of us pursue when we have the time or the inclination.

I mean innovation as the core business of the entire country – pursued strategically and creatively through every part of public policy.

We have to approach it in that way because it is the shared destiny of which Henry Parkes spoke.

There is no mainstream economy running parallel to the innovation economy.

There is one economy, in which some companies and people do better than others, and those with the benefit of knowledge and skills are likely to do best of all.

That doesn't mean that those of us without those advantages can opt out of it – any more than those of us who *do* have those advantages can succeed on our own.

Modelling carried out this year for the Committee for the Economic Development of Australia suggested that some 40 per cent of the jobs we do today are very likely to be automated – done by robots or algorithms – over the next 10 to 15 years.²

Over 50 per cent of jobs in five years' time are likely to require the skills not just to use technology, but to configure technology systems.³

We can quibble the precise numbers, but not the underpinning logic: change is going to be the mainstream experience, so it cannot be a marginal concern.

The dangers of thinking small and achieving less

Today we are very good at hobby farming – less so at scaling up the production.

² Committee for Economic Development of Australia, *Australia's Future Workforce?* June 2015. <http://www.ceda.com.au/research-and-policy/policy-priorities/workforce>.

³ Foundation for Young Australians (August 2015). *The New Work Order*. Available: <http://www.fya.org.au/wp-content/uploads/2015/08/fya-future-of-work-report-final-lr.pdf>

We hobby farm the teaching of science and mathematics in schools – to the point where close to one in two HSC students in New South Wales takes no science subject at all.⁴

The proportion of students studying no mathematics has almost trebled since 2001. A recent survey suggests that just one in three Australian students has the opportunity to learn coding as a core subject at school.⁵

Is this the foundation for our great economic transformation?

But we allow it to proceed. In fact, we tell students it doesn't matter. Twelve Australian universities do not require a student to study mathematics at even the most basic level to enrol in a science degree.⁶

Can we blame them if they take us at our word?

And so we come to higher education – with a dwindling cohort of people with both the will and the capacity to develop all the science skills our economy requires.

On the latest OECD statistics, about 18 per cent of our graduations are in science and engineering fields.⁷

It places us 33rd of the 40 nations in the dataset – not just below Germany, Finland and Korea; but below New Zealand, Canada and Estonia.

So the pipeline of STEM-skilled people is leaking – and it doesn't flow into the candidate pool for Education degrees. In

⁴ J Mack and R Wilson, "Trends in mathematics and science subject combinations in the NSW HSC 2001 – 2014 by gender". University of Sydney, August 2015. Available: <http://www.maths.usyd.edu.au/u/SMS/MMW2015.pdf>.

⁵ Microsoft Asia Pacific, "We Speak Code", March 2015. <https://news.microsoft.com/apac/2015/03/23/three-out-of-four-students-in-asia-pacific-want-coding-as-a-core-subject-in-school-reveals-microsoft-study/>.

⁶ Data provided by Australian Mathematical Sciences Institute.

⁷ OECD Science, Technology and Industry Scoreboard 2015, *Innovation for growth and society* (October 2015). Available: http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard_20725345.

2015 more candidates came to study Education with an ATAR under 50, than over 90.⁸

Nor does the pipeline flow particularly well into industry.

About three in 100 science students complete an industry placement of at least three months as part of their degrees.⁹ Only one in seven participates in any sort of placement or project at all.

Far fewer have access to a university-based spin-out company – because we produce very few of them – or an entrepreneurship program – because we don't encourage science students to take them.¹⁰

Less than 6 per cent of our doctorate holders are employed in agriculture, mining or manufacturing – compared to 13.3 per cent in Germany, and 14.1 per cent in Switzerland.¹¹

We are not incapable of innovation – but too often we are incapacitated by our own choices, including the choice to do nothing with the evidence that we need to do more.

Other nations have found the resolve to *be* nations, and approach the future as a truly shared concern.

Consider South Korea.¹²

After the Korean War, per capita income was about the same as Ghana's. People lived on foreign food donations and

⁸ Department of Education and Training, Undergraduate Applications and Offers, February 2015, p 15.

⁹ Office of the Chief Scientist (August 2015). *STEM-trained and Job-ready*. Occasional Paper Series, Issue 12. Available: <http://www.chiefscientist.gov.au/2015/08/occasional-paper-stem-trained-and-job-ready/>.

¹⁰ "Boosting High-Impact Entrepreneurship in Australia—A role for universities", Spike Innovation, October 2015.

¹¹ OECD Science, Technology and Industry Scoreboard 2015, *Innovation for growth and society* (October 2015). Available: http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard_20725345.

¹² See Kongdan Oh, "Korea's Path from Poverty to Philanthropy", Brookings Institute, June 14 2010. <http://www.brookings.edu/research/articles/2010/06/14-korea-philanthropy-oh>

foraged plants. Schools had no desks or chairs, let alone textbooks or science labs.

No competition for Australia, at the time.

Today Korea is the world's 12th largest economy and top-ranked innovator, according to Bloomberg.¹³

Last month the OECD published an analysis of its patent data identifying Korea as one of the three nations best placed to lead in the new generation of advanced materials, health technologies and ICT.¹⁴

The OECD classified these fields as the 'frontier technologies' expected to play the most significant role in economic growth in the decades ahead.

The US, Japan and Korea now account for over 65 per cent of patent families in these areas – with Korea showing the strongest relative rise since 2005.

Its public R&D spending has quadrupled in real terms since 2000 – but it is spending by way of investment, and it is yielding rewards.

Perhaps our position in the future depends less on our starting advantages than our capacity to see *past* those advantages to the things that are hard to do.

The advantages you make yourself. The lasting advantages – not just the starting ones.

So let us pursue innovation in its richest sense – imagine the future in its brightest sense – and be a nation in the best sense.

¹³Bloomberg Innovation Index 2015. <http://www.bloomberg.com/graphics/2015-innovative-countries/>

¹⁴ OECD, "Governments must step up investments in frontier technology", 19 October 2015. Available: <http://www.oecd.org/newsroom/governments-must-step-up-rd-in-frontier-technology.htm>.