20th Manning Clark Lecture

delivered by David Thodey AO, Chair, CSIRO

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Why science, research and technology are driving Australia's future

Check against delivery

Well good evening, and thank you, Gareth and Sebastian, again for those very kind words of welcome.

It really is great to be here, and thank you for the opportunity to come and share with you the Manning Clark Lecture.

I, too, would like to recognise the traditional owners of the land on which we're meeting, more than 25,000 years of history, and we are such a small part of that, and I would like to pay my respects to their Elders past and present.

So what a wonderful facility, firstly. Our congratulations, Gareth, and to the whole University on this new facility.

It has a wonderful feel to it, and the whole complex is just tremendous, and great to see ANU doing so well.

And I should quickly say, I think I'm a very poor substitute to Dr Ken Henry, and such an illustrious group of people who have spoken over the years.

I hope I can just do a little bit of justice tonight.

But Ken was very sad not to be here.

He just felt it was better that at this time that he didn't participate in this wonderful event, and I know he was very disappointed not to be here.

So the title of my speech, ***Why Science, Research, Technology are Redefining the Future of Australia***.

This relates to many of the things that I'm doing at the moment, and I will try to make it as interesting as I possibly can, and not bore you with technology, but it is a world of technology and science and research, and it is having a significant impact on the future of our great nation.

Manning Clark, like many historians, wrote about history, I daresay in many ways to help understand the world he saw at that time - that's what historians do.

I think history is a great guide to the future, and I, like you, hear many statements like, well we're entering this incredible period of change, a unique period of technology innovation, and of disruption.

And while it is true, it is not the only period of enormous change we've been through, and we seemed to have survived pretty well in the past, so I think we will survive going forward.

But I do want to just share a couple of things before I get into the foundation of the speech.

Interestingly I do think we are entering into an enormous period of change, that is, a period of greater volatility, and technology is a critical part of that because of the way information flows around the world.

It is making it more difficult to predict the future.

In fact, it's always been difficult to predict the future, but even more so now.

But I do think that we, and I say the collective we, have a responsibility, if not an opportunity, to be more prepared to the changes that are coming towards us, and I think that that is the critical thing, because there could be negative social, environmental and economic impacts of many of the changes that are coming towards us.

So what I thought I'd do tonight is actually draw on a number of things that I'm involved in, and try to weave a story, that I hope keeps you all attentive.

It's a story about science and research, and also about the future of Australia.

I'll include the Public Service review that I am chairing, and because I am Chair of CSIRO, a wonderful organisation, I'll talk about that.

And I will talk a little bit about technology innovation because I've lived that since I joined IBM back in 1979, and I've just been a part of the technology evolution, and it's been incredible in terms of my career.

One of the other things that I want to weave in here is that CSIRO regularly compiles an Australian National Outlook, and it looks at the future of Australia to try to guide the science that we do.

While it's not a published report I want to share a little bit of some of the themes that are coming out there.

Then I'll talk about the Public Service, and I'll try and wrap it together at the end, if you're still with me.

So if nothing else, I hope it's interesting and provocative, and we can get to Q&A, which is always more fun.

So let me talk about CSIRO. What a wonderful Australian institution it is and known the world over.

It is our national science agency, and brilliant because of one thing – our outstanding scientists that we have in Australia.

That is what has made CSIRO so successful.

It's nearly a hundred years since Billy Hughes announced the forebears of CSIRO, and he said that science can develop mineral wealth, solve the insolvable, and provide a saner and wider outlook on life – a wonderful optimism about how science could really play a critical role going forward.

And the way that CSIRO was set up was to do three things.

One was to look at science for the national good, to consider what is in the long term best interests of Australia.

It was there to facilitate engagement with industry.

And to act as a collaborator across all the wonderful science agencies, universities, that existed in Australia.

I think in general it's done quite well.

It is a national institute, it works across many different areas, and it has always been focused on partnering with industry to make a difference.

Now I will say that it's not all commercial interest.

It could be environmental, it could be a social outcome that we work on.

It has now about 5,700 staff, it has a budget of just on $1.4 billion, $800 million of that comes from the government and appropriations, the other money actually

comes from partnerships or royalties and other external sources that allow us to do the work we need to do.

So it is a wonderful institution.

Now what you probably don't know is the way that it's structured is around the National Science Agenda.

Let me briefly talk about this, because this is the breadth of what this organisation does.

It does agriculture, food and nutrition – and remember that is the biggest part of CSIRO and it has made an enormous difference over the years.

It also covers land and water, so it gets involved in all hydrology, land management, and related environmental issues.

Astronomy and space, and I'll talk a little about that in a moment.

It does what you would call deep data analytics, and artificial intelligence, and a group that was called NICTA, the National ICT Agency, now merged with CSIRO's data experts to form Data61.

And in case you're wondering why it's called Data61, it took me about two days to work it out, it's just because that's the country code for Australia.

I suppose a telecommunications person like me should know that!

It does energy; advanced manufacturing; minerals; ocean and atmosphere, so that includes the Climate Science Centre down in Hobart; health and biotech; and then manages a lot of our national research infrastructure.

So it is very large, and is an incredible part of Australia.

But, like most organisations, and in fact Australia as a whole struggles with this, CSIRO is really trying to work together to create a more collaborative science and research world, because one of the things that we score very poorly on as a nation, on global settings, is collaboration between academic, private and government.

We do not score well at all.

And the other thing is while we score very highly in terms of our science and research, when it comes to our impact science, that is, taking science and

delivering something with it, we are not as good as many other countries around the world.

But CSIRO has done many great things, and I'm sure you remember some of them.

It was the inventor of Wi-Fi.

Aerogard, that wonderful anti-fly spray.

The polymer banknote came out of CSIRO, wonderful innovation there.

And the Australian Animal Health Labs generated the Hendra Virus, which was a critical development. If you ever go to Geelong, you can see our wonderful facility there.

But CSIRO can't stand still.

So we're starting to move towards new platforms of science, called Future Science Platforms, from areas like synthetic biology to environomics.

One of the ones that I love very much, maybe it's my background, we've a Future Science Platform on deep earth imaging, where we're trying to map the three kilometre crust of the earth in Australia, taking all the seismic data and be able to actually visualise that data so we can have a better sense of where gold, iron ore, lithium strains could be.

Amazing project.

We're also looking at precision health, and the use of hydrogen in this very complex energy market.

So these are some of the things that we do.

In terms of the research facilities, I mentioned the Australian Animal Health Lab down in Geelong, which is a very important part of what we do, but you would also be aware of the Square Kilometre Array.

We have a property in Western Australia where we partnered with South Africa and others to build the SKA, and we have this enormous capability of looking at the pulsations of the universe.

It's very, very important work trying to discover, perhaps not the origins of the universe, but at least some of the impacts of it.

And so we span an enormous amount of things.

We also partner with the US and China developing relationships to work globally, because science and research is no longer a domestic event, it is an international event.

But the point is that whilst CSIRO has this wonderful history, it can't stand still, and the reason is that we need to look at the impact that technology will have on the way we do our work.

So we've just finished a 20-year view in terms of where we think CSIRO will be out to around about 2035, 2040, and we've been looking at the impact of technology on the way we do science and research.

For example, the way we work in the labs, the way we work on the Great Barrier Reef, the way we look at science and climate science change.

There's some technologies that you will be familiar with, that I'll quickly take you through, because even though I'm a technologist, I've never seen the confluence of so much breakthrough technology coming together in the way that it is now changing our lives.

Just look at your smart phone, I daresay that all of you will know when you lose your smart phone before you lose your wallet.

It's become a part of our life.

There may be some of you who have resisted the inclination to have one, which I applaud you for, but most people now can't live without it.

So there’s some big changes – consider your computer.

As you know, last year's Australian of the Year, Professor Michelle Simmons works in quantum computing, and I know there’s work here as well at ANU.

The connectivity speeds and looking at 5G will change the way we communicate.

There'll be 80 billion connections around the world within the next 15 years – 80 billion, nearly ten times the population of the world.

Think about software, there’s a saying within our industry that software eats everything.

It's no longer hardware, it's the software.

You've seen that in the case of artificial intelligence, and data analytics are becoming critically important – they are changing the way we run our businesses, the way we govern, the way we run a university, the way we run small business, the way we do everything in our lives.

And then you add to that robotics and automation.

CSIRO just opened a new robotics centre up in Brisbane, and I tell you, the robotics may not be wonderful works of art yet, but they're going up buildings looking for cracks and they're totally self-managed.

Robots are now looking at dams, and going underwater to look for cracks – tasks that we humans would never have been able to do.

So it's changing the way we manage infrastructure.

Then we've got this whole area of personal assistance.

I'm sure you all use Siri, or Alexa, or Cortana.

These are things that have got intelligence that are coming into our lives, and if not your life, then your children or your grandchildren's lives.

And then lastly, virtual reality and augmented reality are changing things.

You probably haven't heard of something called digital twins – do you know what digital twins are?

It's the ability to create a digital ecosystem that is a direct replica of a real ecosystem, and so digital twins are becoming very, very popular in terms of doing modelling of what might happen.

So the reason I talk about this is not so much to give you an education lesson, but to share an insight into how this is changing the way CSIRO does its job.

We think that AI and data analytics will change what a scientist does.

Robotics will change the way we do research in the field.

Drones we put down mines to do 3D-scanning already, but drones have also changed the way we do agriculture in terms of how we manage livestock, but also in terms of wheat and other grains.

The power of quantum computing.

And then there's this enormous one around gene sequencing, which has enormous ethical issues around it, but the power of gene sequencing is very, very powerful and something that we need to stare into.

So technology is changing the world, and it will change the future of Australia, it will change the way we do research.

Even as I look at some of the papers that are published from CSIRO, we use AI to determine the authenticity of research today, because there is so much potential misuse or claiming of new ideas, that we need far more intelligent ways to look at what we're doing.

So that's CSIRO technology.

Now let me try and apply that to Australia.

One of the things we do is to look at where the future is going, because we're trying to determine what science we should be doing that will be in the best interests of this great nation.

So we publish every few years the Australian National Outlook, and the big question we're trying to answer is this: how do we ensure that Australians enjoy the world's best quality of life, and that future generations of Australians have access to even better opportunities?

So that's the question we're trying to answer.

And the way we do it is that we have this modelling tool that brings together social, environmental, economic data together, and allows us to do some modelling on that, and we move it around with different variables.

It's one of only a few projects we know of that's trying to be predictive.

It allows you to make trade-offs between factors, so if there was a two-degree increase in temperature, what would be the impact on our towns, on our agriculture sector?

So it's a very powerful tool.

We're looking out to 2060, and 2060 is a long time away, but we need to look that far out to determine what we're doing.

It's as close to the intergenerational report that I've seen.

You've got to start somewhere, so we start with what we have today and I think most would say, if you asked about Australia, we've had a pretty good run, you know we've done pretty well.

We look at things like there's been 25 years of uninterrupted growth.

But when you get underneath that, this growth has been largely built off our resources base, and one of the things that's become very clear is we really lack economic complexity.

Now lacking economic complexity is not a good thing, because it leaves you exposed to big shifts in the world's economy.

There was some research done at Harvard Centre for International Development that ranks Australia 87th in the world for economic complexity – 87th.

Do you know the two countries we're on a par with? Kazakhstan and Cuba.

Interesting, isn't it?

I mean it's this very, very beneficial, profitable, prosperous resources sector can also be an impediment for the future.

When you look at technology adoption rates, we're about 50 per cent lower than other countries.

And in fact if you look at the percentage of GDP we invest almost 40 times less in venture capital than the US or Israel – 40 times less.

I should quickly say that we've invested a lot in research in the minerals sector, but in terms of general entrepreneurship we have not invested a lot.

When you look at liveable cities, we have some of the most liveable cities in the world, but as our population grows our cities are becoming increasingly stratified.

Highly paid service jobs are becoming very concentrated in the inner cities, and they've led to pushing up house prices, and more people having to move out to the periphery, and if you don’t have good transportation systems that becomes a big issue.

We may have world class education and health, but our education standards have been declining, and with the ageing population, the health bill is enormous for Government.

So there are lots of good things, but there's a bit of a sting in the tail of many of these wonderful trends.

There's a lot at stake.

What we've modelled is a 'do nothing' case, which doesn't look that attractive, interestingly.

Our economic growth slows, inequality rises, our cities sprawl and become more congested, and we fail to create an environment that is healthy and conducive to a good lifestyle.

We've also modelled a more visionary outlook which has a far more positive outlook, that has good economic growth, good social outcomes.

We're trying to answer five questions:

- What do we do to create a more diverse economy? How do we stimulate the private sector to do more, using technology, innovation, education?
- How do we build more connected cities which have access to more affordable housing, jobs, services, and better recreation and transport? And we're looking at things like different housing options in terms of affordability and density, we're looking at heterogeneous land use mix, and we're also looking at how we make better use of regional Australia. And I'll come back to that later on.
- Obviously a low emissions economy is important. It is very difficult to get there, because there's many economic factors, so you need economic energy policy, you need good energy productivity, and of course you need to do more to sequester carbon.
- The fourth area is around productivity and water management in the agriculture sector.
- And the last area is around culture, how do we create better engagement, curiosity and collaboration, and create a more inclusive civic and political process? We think that's very important.

These are some of the questions we're attempting to answer, and we think it's important that we have a debate about them, and try to make some trade-off in the modelling in what we're doing.

Let me ask you a few questions as I finish up this section.

Let's say Australia's coal exports decline by 75 per cent, and we look out to 2060, what will take the place of coal export?

If we're looking at more liveable cities, I'll start with Sydney.

By 2050 it will be a city with a population of about eight million, about the same size as London.

What are we going to do to better plan for it?

This is not all about the North Shore and the inner city, this is about Western Sydney.

Let me come to Canberra, I understand there are some projections for Canberra to double in size by 2060 to just under a million, maybe 800,000 people.

What are we doing to create an environment and attract people here, to make it attractive with a good lifestyle?

We're going to publish this National Outlook later in the year, and we hope that it will cement at least some thought and debate.

This is just a little insight into some of the things we're trying to work through.

The other project I'm involved in is looking at the future of the Australian Public Service.

I've been asked to look at what would a fit-for-purpose Australian Public Service look like over the next two decades?

It's not trying to address necessarily the issues of today, but trying to look out over the next couple of decades.

As I said, looking to the future is difficult.

It's a lot more variability and volatility.

But I should say this is not about trying to fix the Public Service.

I don't think it's fundamentally broken.

Can it be better? Yes.

It's about trying to get ahead of the game, about trying to look at what should it look like in the future, especially in light of some of the technology changes we see in big data and artificial intelligence.

We have a review underway and I'm joined by a wonderful panel.

- Maile Carnegie, who is an ex-CEO of Google, and now working at the ANZ Bank.
- Glyn Davis, you would all know Glyn, a great public administrator and a great leader.
- Gordon de Brouwer, who was the Secretary of Environment, a long illustrious career within the Public Service.
- Belinda Hutchinson, Belinda is ex-Macquarie Bank, and is now on the QANTAS Board, and Thales as well.
- And Alison Watkins, who is the CEO of Coca-Cola Amatil.

We also have an international group with people from the UK, Singapore, Canada, New Zealand, and a number of ex-politicians as well, involved in the review process, to keep us on the straight and narrow.

It is a very difficult job because there's so many variables involved.

But let me just say a few words on it.

Under legislation the Australian Public Service, or APS, exists to serve the Government, the Parliament, and the people of Australia.

Now let me begin by noting that's what the legislation says – and there is no prioritisation in that list, it is the Government, the Parliament, and the people of Australia.

So the APS has a 117-year tradition, and plays a critical role in our society.

It has about 150,000 employees.

It has 18 departments, and now 100 agencies, it has presence right across Australia, and roughly 40 per cent of the APS work in Canberra.

It has responsibilities for a wide range of work, including strong, independent policy advice.

It delivers $170 billion in payments each year, touches about 4.4 million businesses, and has 700 million interactions.

So it's a pretty complex, wide-ranging organisation.

The scope of work we've been asked to look at, as I said, is fit-for-purpose, and we've been asked to identify an ambitious program of transformational reforms that will result in an APS that is fit for purpose.

Transformational reforms and ambitious programs – so this process of looking to the future is very important.

We've tried to do it differently this time, because we wanted to engage as many people as we possibly could across citizens, across the APS itself, and across academic institutions.

We've run a very open and transparent process that hopefully will allow debating and setting a vision for the APS that will be transformational for the good of all Australians, and of course creating a vibrant and enabled APS.

We've also looked to Canada, the UK, Singapore and New Zealand, where they've put in place some quite innovative policies around open government transparency, and others.

But there are many challenges.

How do you sustain and build on the performance of the APS in this changing world?

How do you really grasp technology, or be aware of geopolitical shifts, or domestic political volatility, or rising expectations from citizens, and of course declining trust?

And as well, as I demonstrated at CSIRO, a fundamental changing of the way we work is very important to consider.

The Westminster System has served us well, and it has protected all arms of government, but we must make sure the Westminster System evolves to the needs of the world as we find it today, without actually going against any of the core principles.

They are the principles of an apolitical APS, of frank and fearless advice, and serving the government of the day; they must be reserved for all time.

When I talk to many people who have been around the APS for a long time, they talk about us being in a period of managerialism and devolution over the last two decades.

We're moving to a world that is far less predictable, where you need stronger governance and professionalism, and an ability to work in ways we have not had to work before across government, across departments, to solve the complex issues that we find the world in today, and that's across policy, regulation, and in delivery.

As we have gone out to talk to people about the APS, we've heard things like:

- The APS can appear too timid and lacking in confidence
- There's a misalignment in priorities between different groups
- We have the sense that the APS is not achieving its full potential
- There's fragility in relationships, internally and externally
- There's a retention of people and a lack of diversity in the APS, especially when you look at the Australian population. Do we have a Public Service that is truly reflective of the population that is truly multicultural?
- There's a sense of inflexibility, and a sense in which we're not as responsive in some areas as we would like to be
- And then lastly, there has unquestionably been the influence of political processes in the workings of the APS.

So it's very early days in terms of where we're at.

We've been at this six months.

We do report later in the year.

I will be giving a presentation next week where I'll be talking in more detail about some of the specific findings.

But let me just give you some broad things that I've talked about before, but I think are important.

There is a lot of importance in the sense of the legislative structure in which the APS works, the role of Prime Minister and Cabinet, the role of the APS Commission, and the role of the Secretaries Board, because they are the mechanism by which the APS works.

There is an importance in terms of purpose, culture and the behaviours of the APS in engaging with all stakeholders.

There is a need for a more flexible operating model.

I will not use the word agile, but in today's world things need to change more quickly, and the days of Machinery of Government changes, if any of you have been involved in them, are taking too long, and are rendering the APS not as responsive as we think they should be.

We think there should be greater professionalisation within the APS itself.

We think that there needs to be investment and leadership, and functional capability.

We need to understand clearly what core capabilities need to be within the APS, and what can be given to others.

I think we need to be more focused on outcomes and cross-government collaboration.

We need to have innovative approaches to policy and to regulation delivery, and enabling our public servants to do that.

We need to be more citizen centric, and that is difficult in terms of a modern APS.

And we need to look at management models and process as we go forward.

Now let me be clear, the APS is not a private sector organisation.

It is anything but.

It is a far more complex and nuanced organisation that exists in a political context.

But we need a strong APS for the good of Australia.

So you can imagine that we'll be touching on all these areas of capability, governance, operating models, trust, technology, culture, policy delivery, regulation, and others, and we hope that it will create a great conversation as we put out our Discussion Paper, and then we will report later in the year.

So that's part of my day job, and it is challenging, but I think really important for us all.

Let me finish on a little bit of the future work, and then we'll stop and have some Q&A.

I do want to just focus on this – there's been a lot written around the future work.

I'm Chair of a group in the New South Wales Government called Jobs for New South Wales, and a document we published about the future of work going back two or three years ago.

The then Premier set a target to create a million new jobs in New South Wales by 2035.

A great aspiration, especially when you start to think around the changing nature of the labour market, impact of automation, and the economy going up and down.

CSIRO's Data61 did quite a bit of work on this, and McKinsey did a very good report called No Ordinary Disruption that looked at this on a global stage.

Their report talked around the impact of the ageing population, the movement of the economic centre of the world into Asia, the significant impact that will have, the impact of automation, and the change in the labour market.

I've always liked the statistic that if you go back to 1915 and ask the question, how many people of the world's population, or working population are working in agriculture, what do you think the number is?

It was about 70 per cent were working in agriculture.

And today it would be less than 10 per cent.

We have this incredible ability to adapt in our society.

So what we've been doing is looking at where job creation will be.

It's interesting, because today unemployment nationally is, what, 5 per cent?

In New South Wales it's just a tad under 4 per cent, and youth unemployment is the more challenging one, is sort of in double digits.

However, that doesn't really indicate the challenges as we move forward, as you start to get this movement in the labour market.

We looked back over the last four years and there were 600,000 jobs created in New South Wales.

Interestingly 1.1 million jobs were created in small and medium business, and half a million jobs lost in corporate Australia in New South Wales – 1.1 million new jobs in small and medium business, half a million lost within corporate Australia.

If you look at the small and medium business, the 1.1. million jobs, 50 per cent of the new jobs came from what has been called gazelles, you know this word, or scale-ups, you know this term, so these are digitally enabled.

A good example would be Atlassian, a digital company.

Atlassian now employs around the world about three thousand people, but started from nothing – it's a project management tool.

So a lot of these new jobs came from these areas that scaled-up.

The other interesting thing is that when you look at workforce participation rates, women participation rates in Australia are in the mid 60s, in Scandinavia is in the mid 70s.

Then you look at the impact of the ageing population and the number of people who will be in work and out of work over the next 20 years, and how many of us are paying tax, or how much our grandchildren need to be paying in tax to keep us alive, it's a big issue.

And then of course the changing nature of work.

So the reason I finish there is because when you look at the impact of science and research, you look at the impact of technology, the future of Australia, this comes back to work, it comes back to where value is created, and we have a responsibility to work on that.

I think we need to be in control of our destiny, we can't be a victim.

So what I've tried to cover is that research and development is very important in terms of public and private sector as we transition the economy.

We need a stronger services base.

The importance of education in STEM will be absolutely critical to our future prosperity, building off that very strong base of minerals, agriculture, but we need the services industry to replace much of that revenues that will go away.

Technology will change the way we live, the way we operate, the way we learn, the way we're entertained, and will continue to be the case.

We must continue to have a greater vision for Australia, and especially within the Asian Century that Ken Henry so ably described seven or eight years ago.

We need a strong, independent public service to help guide us through this, and we need to invest in the public service to serve the Government, Parliament, and all Australians.

And we must continue to plan for a very different workforce.

So with that I'll close my speech tonight, and I'm delighted to take any questions.

Thank you.

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