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INNOVATIONAUS CAPABILITY PAPERS LAUNCH

A time to commit: Making the most of Australia's strengths in the new economy

Thursday 19 October 2023

Canberra, ACT

I'd like to acknowledge the Ngunnawal people on whose lands we meet. I acknowledge the deep and unbroken connection of Australia's Indigenous peoples, and their valuable contribution to our knowledge about this land.

This is my second visit to the Parliamentary Triangle this week. On Monday, I was up at the big house for the announcement of the Prime Minister's Prizes for Science, for which I chair the judging panel.

The winner, as you know, was Professor Michelle Simmons, and what a great outcome. Michelle captures everything it means to be innovative in science – she's a top-rung researcher, and she's taken the leap into commercialisation – attracting investors and building a big, multidisciplinary team to advance silicon quantum computing.

This obviously takes enormous courage. It also takes the ability to imagine a future, and a deep belief in the science, even when so many technical and engineering problems remain ahead.

I can't be sure whether a silicon-based quantum computer will beat other technologies to the finish line – or, for that matter, will ever be fully realised. But that's almost not the point. Because just by pursuing this big aim, Michelle and her team have already unlocked a suite of new applications and possibilities.

They made the world's first single-atom transistor, and then the world's first integrated circuit at the atomic scale. They're the only company in the world that can manufacture electronic devices at the atomic level.

Atomic-scale microprocessors have any number of applications – for example, allowing the manufacture of low-energy electronics, which will be massively useful as demand for energy increases.

To read Michelle's essay in the Capability Papers is a real insight into the complexity and the painstaking long work that goes into such advances.

This is the way innovation works. The end goal is audacious. The investment and the risk are very real. And along the way the discoveries can be astonishing and often unexpected.

We're in prize season!

As well as the Prime Minister's Prizes for Science, the Nobel Prizes have been announced – and quantum featured there too.

The Nobel Prize for chemistry was awarded to three scientists who turned theory into reality with the invention of quantum dots. Quantum dots are nanoscale phenomena, where atoms are squeezed so tight that they start to behave like waves instead of particles. And that opens a world of new possibilities.

That discovery – over decades of patient science – is now being used in new forms of quantum chemistry. This means self-healing smart materials, drug delivery, energy materials, and sensors.

Quantum science is in a moment.

It's a moment that can apply to Australian science and innovation more broadly – so we can accelerate discovery and bring it through to real impact in clean energy, high-tech manufacturing, the digital economy, biotech, and other huge opportunities for us in Australia.

We're in a dance – those of us in this room. I don't say this just because my husband's here! I meet with some of you in the audience often. We come together, in different combinations and different venues.

We have some really valuable and enjoyable conversations. We talk about the challenges, and the roadblocks, we identify the things that need to be done to move the agenda forward. To turn ambition into reality.

And then we come together again.

And we talk again on topics that are not dissimilar to last time we met.

Now, I'm not sure whether square dancing was a formative experience for you at school, like it was for me. Square dancing was certainly part of my early years. You line up, facing your partner. You step forward and you step back. Then you do the do-si-do, and you switch to the right, and off you go again with your new partner.

It goes like that around the circle of dance partners, until you're back at the start, once again facing the person you began with.

Loads of fun. Highly worthwhile. Not a lot of progress.

I don't want to suggest anything but the greatest of respect for events such as this one, where members of our ecosystem – whether in research, industry or government – meet to thrash out the issues. Doing the kind of hard thinking that's needed to find solutions, getting together to share insights and ideas, making the case and doing the advocacy – these are all incredibly important parts of the process. But there comes a point where we have to commit.

Just to be clear, I'm no longer talking about your dance partner! What I'm suggesting is that there comes a point where every person with the power to make a call must do so. And this is what I want to talk to you about today.

The Capability Papers provide some really direct summaries of the challenges. They pull no punches, and offer good ideas about what needs to be done to link up and deliver.

Through the papers and the discussions this morning, there are commonalties. We agree on the enormous opportunities and on the excellence of Australia's offering.

We agree on the need for scale. The need for an ecosystem approach. The need to specialise, to choose Australia's niche and knuckle down, as so well laid out by my predecessor Alan Finkel.

And now, it gets hard.

Michelle describes herself as risk-averse. But there's no question it took big decisions to advance silicon quantum computing to where it's at today. I asked her about the moments in her career when she had to take her courage in her hands.

She mentioned the decision to come to Australia. And the courage to be the lone woman so often during her career. She also referred to the enormous risk she took when she decided to combine scanning tunnelling microscopy with molecular beam epitaxy – two disparate techniques that hadn't been used together before. This was a big bet on a new approach.

She refers to the huge risk in time and effort it took to start a company, and to approach business and corporates for backing. And her decision to become a full-stack manufacturer rather than a niche operator. Her career contains a list of brave decisions.

And we need more of them.

As a nation, we need brave decisions about scale. I want to see a big, ambitious, deep-tech manufacturing capability in Australia. But we cannot hope to achieve this without scale.

If we are to enter supply chains for semiconductor components, we need scale. If we are to take full advantage of the energy transition, we need scale. If we want to reignite manufacturing, or ride the wave of RNA innovation, or lead the development of quantum sensing or computing in Australia, we need scale. We also need brave decisions about where to place our attention.

I want to be clear: the fundamental research is the starting point. None of what we're aiming to achieve today, whether in clean energy, healthier communities, or getting a rover to Mars, would be possible without that strong, curiosity-driven research.

The real-world uses for quantum dot technologies have come off the back of decades of work. The work of the Nobel Prize winners began in the 1970s.

This is the pattern for every endeavour in science, discovery, and innovation. Whether it's solar panels, batteries, the catalysis of hydrogen, advances in minerals exploration – all of these capabilities are built on decades of patient research in our universities and publicly-funded institutions – curious minds following where the questions lead.

But there also comes a time, as I said, when we have to commit. That means naming the thing we want to build.

I know we sometimes shy away when the stakes are big. And so we fall into inaction. But the technologies that will drive our economic and social future are not bench-top projects for the lab or the garage. They're incredibly complex. They require specialisation.

We have a tendency in Australia to spread ourselves too thin. In quantum technologies, for example, Australia ranks 60% above the global average for excellence but 30% below when it comes to specialisation. We sometimes seem to follow the Vegemite theory of economics – a little goes a long way. Goodness

knows, it works for Vegemite! But it's not serving us well in the new economy, where specialisation is key.

The new technologies also demand speed and scale. Complex infrastructure and big, cross-disciplinary teams. And a new way of working.

We need a systems approach across government, industry and research, working from discovery all the way to delivery.

This isn't the place for all the detail, but I suggest, as a starting point:

- new arrangements for how data is collected and shared
- a focus on building demand in the domestic market
- staying agile with changes to regulatory requirements
- making the most of opportunities for public-private partnerships
- loosening the grip on IP, to unlock what Adrian Beer refers to as the vaults of amazing innovation and stranded research outcomes sitting on the shelf
- and new ways of educating our kids.

There's a third thing I want to talk about today.

I've spoken about specialisation and being prepared to focus efforts on specific technologies. I've spoken about scale, and developing new integrated ways of working in big cross-disciplinary teams.

The third thing is the need to play to our strengths, and leverage synergies. We have strengths, of course, in mining. This is the reason Alan refers in his paper to the production of green iron as an avenue of great potential for Australia.

We have strengths in minerals exploration and in automation, which is why I expect we will continue to lead the world in remote sensing technologies, and navigation in areas where GPS can't reach – in underground mines, as well as at sea and in space. And why we have opportunities in robotics.

We have strengths in biotechnology – RNA and synthetic biology, especially, are valuable opportunities. We have strengths in photonics, plasmas and quantum – Simon Poole rightly refers to photonics as our "hidden economic engine". There are great synergies between photonics, quantum, and semiconductors. They're the trifecta that can accelerate advanced manufacturing.

But we can't simply waltz in the door and expect success in any of these areas. They are strengths, but we only retain our advantage if we identify the niche, work at scale, invest strongly, and work together.

Absolutely, things will go wrong. Not every project will lead to success, just as not every experiment in science will have a positive outcome. But, as with the ultimate quantum goal of a full-stack quantum computer, regardless of the outcome, there will be important wins, and unexpected advances, along the way.

As scientists, we're accustomed to living with uncertainty and null results. This is ingrained in the scientific process. I'd like to see it more widespread in the process of

innovation in Australia. So that we're prepared to back something risky, and with uncertain outcomes, and not fear failure.

I want to see new ways of operating that are more in step with the complexity of the new technologies. So we don't end up doing the same dance we did at primary school when the music has changed.

I know many of you share my views on this.

In their contribution to the Capability Papers, Emily Hilder and Tanya Monro refer to "courage to do things differently – with urgency, pace and acceleration". This is a message we can all take away today.

A licence to do things differently.

A licence for courage.

An explicit tolerance of failure.

And an urgency and pace to our actions.

I don't know how to express it better.