



Australian Government

Chief Scientist

DR ALAN FINKEL AO

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Keynote address

If you don't look, you don't see

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**Sofitel Wentworth
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In the early days of GPS, a German man was driving his Mercedes Benz on a highway near Hamburg. And he was following the instructions on the screen to the letter.

He drove past warning signs.

He drove through barricades.

He drove into a construction site... and he ploughed into a giant heap of sand.

Now we might laugh at that gentleman's blind obedience to a fallible system.

A system, for the record, that comes with a very clear disclaimer: *drive responsibly and disregard any hazardous or illegal suggestions.*

Prudent advice. But I want to put it to you that we might *all* be guilty of ignoring it.

Not in navigation – but in innovation: the way we map it, the way we measure it and the way we discuss it.

I want to point out the genuine strengths of our economy, those that fall outside the range of the global innovation radar.

And I want to persuade you that we have far more at stake than bragging rights in an academic debate.

Our map of innovation is how we optimise the levers to steer our economy.

Are we on the high road to progress... or are we in the sand-heap of history?

Either way, we ought to know.

Let me take you through the warning signs that prompted me to reconsider the map.

When I became Chief Scientist it quickly became apparent to me that I was expected to do two things.

One, talk at conferences on the dearth of start-ups and industry research engagement.

And two, visit start-ups and launch industry research engagements.

I seemed to be working for two different countries: the one that couldn't innovate, and the one that could.

Of course, I was only collecting one pay-cheque. But still, it seemed a little disingenuous.

Then I travelled overseas. Everywhere I went, people were asking me about the "Australian Way".

Look, they'd say, you've recorded an economic growth streak that has never been equalled by any other nation in the developed world!

You're home to the most liveable city in the world, according to The Economist magazine, and three of your cities make the Top 10!

Your universities are magnets for our students!

Your healthcare system is one of the best in the world!

Sure, your electricity isn't great... but let's move on...

They'd ask me: What's Australia's secret?

Then I'd come home, and no-one had ever heard of the "Australian Way".

Look at the numbers, they'd say: we are bad at innovation, bad at invention.

The implication back home was that Australia was the basket case of the OECD.

I didn't believe it.

So I dug a bit deeper. I started asking people about the data.

I asked people in business, people in universities, and people in government.

I discovered a strange phenomenon.

Many people felt that the innovation metrics failed to account for their particular institution or industry. Or that the data were wrong for them but probably applicable to everyone else.

I'd visit a Vice-Chancellor, and *their* university was engaging with industry, at comparable rates to their partner institutions in the United States or Europe: ergo, the problem was everyone else.

I'd visit the CSIRO, and the message was the same: they were engaging with industry, the problem was everyone else.

I'd visit ANSTO, and they were engaging with industry.

Everyone was better than average. But, somehow, we were collectively subpar – like a class of geniuses that was incapable of passing basic maths.

A conundrum!

Then I started working with Bill Ferris and the board of Innovation and Science Australia, on indicators for the Scorecard that we included in the Performance Review.

We quickly realised that the attention-grabbing numbers, like our rank in the Global Innovation Index, were insufficient for the sort of monitoring and diagnosis we had in mind.

Guiding policy by that high-level ranking alone would be like navigating the streets in downtown Sydney using a low-resolution tourist map of Australia.

What we needed was a suite of indicators that would be meaningful in the Australian context, but credible and perhaps transferrable to our partners overseas.

Given the time constraints, we built the best Scorecard we could, from the options available.

It turns out that it is not easy to come up with indicators that are globally aligned, frequently reported and measuring causation rather than correlation.

And many organisations were searching.

The Australian Academy of Technology and Engineering, better known as ATSE, ran a pilot study for a new measure of impact and engagement, which the Australian Research Council is now pursuing.

Simultaneously, IP Australia was mining its databases to pinpoint the generators of patents.

They found that, judging by the number of patents co-held by a university and an industry partner, our performance is similar to South Korea and Israel, and comfortably in the upper middle bracket of the OECD.

The National Survey of Research Commercialisation (NSRC) observed that Australian universities reported over 10,000 research contracts, consultancies and collaborations in 2013.

That figure is more than ten times higher than the number of innovation-active Australian firms collaborating with research organisations that we reported to the OECD in the same year.

And the NSRC figures did not even include the industry engagement by CSIRO and other publicly funded non-university research institutions.

Independent analysis by BHERT, the Business Higher Education Round Table, also questioned the OECD statistics on industry engagement.

There are other metrics which ought to raise an eyebrow.

For example, we are rated 27th out of 27 OECD countries on the percentage of high-growth enterprises. That's terrible. But is it accurate?

Does it make sense that a country that has sustained the longest economic growth streak in history has the lowest percentage of high-growth enterprises in the OECD?

Something is not right with the metrics.

I freely acknowledge that there are innovation metrics that *do* pass the credibility test and indicate that there are regrettable gaps in our performance.

That's a genuine concern.

But we can't know where to intervene if we don't have a reliable and comprehensive picture.

If you don't look – you don't see. If you don't see – you're driving blind.

So I thought to myself, what if I could use my position, as a leader who speaks to leaders, to collect instances of innovation not reflected in the metrics?

And feed into a national effort to produce a better map?

I've started by sorting my examples into four main categories: all of them important to our economy, but globally applicable.

FIRST: Embodied innovation.

To start, think of two different successful companies.

One operates a factory that makes silicon chips.

The other operates a mine that extracts iron ore.

Now be aware that one of the “knowledge diffusion” metrics in the Global Innovation Index is high tech exports. This is a ratio derived from high-tech exports on the top line, divided by total exports on the bottom line, where high-tech exports are things like semiconductors, software, pharmaceuticals and medical devices.

The silicon-chip production advances a country up the Global Innovation Index because it contributes to the high-tech exports above the line. Of course, it also increases the total exports on the bottom line by the same amount, but the net effect is that the ratio improves.

The iron ore production, on the other hand, pushes a country down, because iron ore exports only plug into the total exports figure below the line.

That is, the more iron ore that is exported, the bigger the bottom line, while the top line stays constant, so the worse the country looks.

Let me repeat that: the better we do at producing and selling iron ore, the worse we look.

And yet an Australian iron ore mine is arguably every bit as innovative as an overseas silicon chip factory.

I think of Rio Tinto's Mine of the Future in Western Australia.

I got a good taste of the extraordinary high-tech used by Rio Tinto when my wife and I visited their Perth control room last year.

From there they supervise their mine in the Pilbara 1,500 kilometres to the north.

That mine includes the world's longest private railroad, much of it automated.

The world's largest fleet of autonomous trucks.

More than 400 operators in the Perth control room tracking 3D visualizations of every piece of capital equipment.

I struggle to imagine that even a silicon-chip factory could be working closer than that mine to the frontiers of artificial intelligence, big data, automation, materials engineering and industrial chemistry.

The mines operated by BHP and Fortescue are no slouches, either.

If our mining industry didn't invest in mining innovation, Australia would not be the iron ore export powerhouse that it is today.

Now, if you know where to look, you can see the minerals sector in the existing innovation statistics. It is a major contributor to patent filings, research collaborations, technology investment and high-skill employment.

But these are insufficient to describe the magnitude of the achievement and they don't scale with the production volume.

Too often, we see the rocks – and not the robots. The products – and not the processes.

And so we discount the phenomenal effort and ingenuity required to maintain our competitive edge in primary industry.

This suggests to me that there is something we should be counting, but instead we are ignoring.

I couldn't even find a *name* for it, so I came up with one: "embodied innovation".

So first, let's measure embodied innovation: it's important.

SECOND: Hidden innovation.

I owe the unofficial name of this category to Bronte Adams, a colleague on the Innovation and Science Australia board. Bronte calls it the Smashed Avocado Economy.

Is it difficult to reduce an avocado to a green smear on a piece of bread?

Not particularly.

They *do* say that smashing it, as opposed to simply *mashing* it, takes genuine expertise. It's in the wrist action and adds about \$10 to the price.

But even so, where's the innovation?

Well, it's in the way we approach the avocado.

A decade ago, avocados were good for two things: salad and guacamole.

They were seasonal, the quality was variable, and for many people the price was exorbitant.

So the industry set out to redefine the avocado: as the all-round everything food.

They reengineered the production chain to raise the quality, ensure supply and lower the price.

At the same time, they transformed our awareness of what an avocado could be.

Now it's smashed avocado for breakfast, avocado smoothie for morning tea, avocado in sushi for lunch, avocado in tacos for dinner and... wait for it... avocado brownies for dessert.

Avocado may well be the first solid food an Australian baby will eat.

And the retail value of the Australian avocado industry has almost trebled in the past decade: from \$340 million, to \$920 million.

That doesn't include the value added by countless cafés, and the way they've built the Aussie brunch into a global brand.

The Global Innovation Index counts creativity in terms of ICT exports, page edits to Wikipedia, YouTube uploads, number of feature films, and so on.

It tries to lead you down the path to Silicon Valley. But Silicon Valley is just one of many places to visit.

We shouldn't undervalue the innovation that smashed the avocado, simply because it is creativity in a different form.

So first, we need to measure embodied innovation. And second, we need to measure hidden innovation.

Now THIRD: Social innovation.

Let me illustrate this category by a story.

A few years ago, Toyota was asked to assist a soup kitchen in New York.

The company sent a team of engineers down to Harlem to watch the process and suggest improvements.

With just three tweaks to the queuing system, the average wait time fell from an hour and a half to eighteen minutes.

If it happened in a factory, it would be called a process innovation – and measured in the Global Innovation Index and the OECD statistics.

If it happened in a soup kitchen... did it happen at all?

But did it improve people's lives? Absolutely.

Look at the innovation indexes. Where do they account for innovation that takes place outside the commercial realm, where the objectives are social, intellectual or environmental, rather than economic?

So first, we need to measure embodied innovation; second: hidden innovation; third, social innovation.

And FOURTH and finally: Incremental innovation.

On a regular basis, I'm asked to name the big hitters in the innovation economy.

To many people's surprise, I point to university vice-chancellors.

Our education export industry is a testament to their stunning capacity to steal a march.

From the outset, they understood that their biggest asset was their reputation for quality.

To build that reputation, they needed to invest in research.

It is research that determines a university's position in the global rankings and hence its reputation.

Where might that investment come from? International students.

And what attracts international students? The global rankings.

And so the vice-chancellors created a virtuous circle, raising the quality of teaching and research, rising up the global rankings, and attracting international students...

All the while welcoming more and more Australians into tertiary degrees.

Between 2001 and 2016 the total number of students more than doubled – from about 600,000 places to 1.3 million places.

That growth reflects a commitment to excellence, a capacity to adopt new technologies and a sophisticated grasp of the global market.

Incremental innovation for spectacular growth.

So here's where I'm at: four tracts of uncharted territory that we need to map: one, embodied innovation; two, hidden innovation; three, social innovation and four, incremental innovation.

Four things that matter and ought to be counted.

But so what, you might say. Measures are imperfect! Move on.

I can't move on.

If our indicators aren't fit for purpose, if important chunks of our country are falling off the map, then we need to recalibrate.

That's what my colleagues at ISA are seeking to do.

Call me old-fashioned, but I like to think that we go to the trouble of collecting data for a reason.

We need it to inform our policy and help us to judge if our interventions are making a difference.

To our economy, innovation metrics and a strategic plan are like the dashboard and the GPS, respectively, in that Mercedes car I started with.

Relying blindly on imperfect signals is no better than driving blind. It might even be worse.

To my surprise, I have come across some who say that it's better to undercount our performance than to overrate our success.

I disagree.

Though I want to make it clear: I am not for a moment suggesting that we don't need to improve.

Of course we need to improve. We should always aim to do better. We should have bold aspirations linked to concrete measures... and *measurable* targets.

On all the important measures, we ought to be aiming to sit comfortably in the top quartile of the OECD.

But what happens when we persistently sell ourselves short?

First, we struggle to motivate ourselves to progress from our perceived abysmal position to merely very bad.

Second, we dismiss the success of the programs that are actually working.

And third, we might start to wonder... if our record is so dismal, and our economy is apparently thriving in spite of it, why bother with innovation policy at all?

To the contrary: we need metrics that give us an accurate picture of our economy to properly account for the critical role that innovation plays.

Then we can work out how to leverage our strengths and address the gaps.

Both deserve our attention.

Minister Sinodinos spoke this morning about the enormous untapped potential in the digital economy. I agree. Yet again, it's an area where we ought to aspire to sit comfortably in the top quartile of the OECD.

And who are the heavy lifters in industry with the resources to drive that ambition?

When I last checked, our banks contributed more than half of the business R&D spend in ICT.

Our mining sector funds some of the country's most innovative projects in artificial intelligence and big data.

Our universities are global leaders in the provision of online services.

And further, all of them – our banks, our miners and our universities – all of them are actively propagating as well as harvesting the intellectual potential that sprouts as digital start-ups.

Could we nurture that potential more effectively? Of course we could – if we start by measuring it.

And follow up with strategy to provide a more compelling economic framework in which the sprouts can thrive.

As Bill Ferris flagged this morning, watch this space.

But beyond Innovation and Science Australia, beyond public policy, beyond government, we need something else: a culture of striving. A culture of innovation. A collective belief that innovation is the essence of the Australian way.

We need to stop berating ourselves for what we do poorly and take collective responsibility for building the success we want to see.

So my challenge to you is to look for the hidden potential.

And start right now, by looking around you at the audience here today.

Look at the calibre of the speakers on the programme.

Think about all the innovators you know, born in Australia, schooled in Australia, mentored in Australia.

Think of all the people you respect who chose to come to this country, who spun the globe, with every option open, and chose to make this their home.

Something worked. They came, they stayed, they thrived.

Born in Australia. Migrated to Australia. Together, we are potential writ large.

And we're driving on the high road to tomorrow.

With our eyes on the horizon, our innovation scorecard as our dashboard and our upcoming strategy as our GPS.

Skirting the barricades, avoiding the sandpit and arriving at the destination of our own choosing.

THANK YOU