



The ATSE Chaikin Oration
Thursday, 19 September 2024
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Progress for All: hard knowledge and the quest for public good

I begin by acknowledging the Gadigal People of the Eora Nation, the traditional custodians of these lands.

I pay my respects to Elders, past and present, and I extend that respect to Aboriginal and Torres Strait Islander people here today.

It's a profound honour to be invited to give the Chaikin Oration, following in the footsteps of the esteemed orators before me. I'm particularly humbled to stand on the shoulders of Professor Malcolm Chaikin, who was a giant of UNSW.

At just 31 years old in 1955, he became the youngest professor in Australia. He also broke new ground as the youngest Dean in the nation at 36, leading UNSW's Faculty of Applied Science (the faculty that taught me as a young undergrad), and as UNSW's first Pro Vice-Chancellor External Affairs (from 1984 to 1988).¹

He further contributed to the educational landscape and advancement of knowledge as a member of the UNSW Council and a major university benefactor.² Malcolm's enduring legacy is recognised with a prize in his name awarded annually by UNSW's Faculty of Engineering for the best PhD thesis.³

This oration pays tribute to Malcolm Chaikin, not only as a brilliant academic but as someone who was deeply committed to the principles of public service. Malcolm understood the vital importance of deep expertise and collaboration to address society's most pressing challenges and advance progress, not for a select few, but for all.

It is with great pleasure that I deliver this oration in Malcolm's honour.

Let me start by asking you a question.

¹ 'Origins: Newsletter of the UNSW Archives', *UNSW Sydney*. 7 January 2002, viewed on 12 September 2024, <https://www.unsw.edu.au/content/dam/pdfs/unsw-adobe-websites/planning-assurance/records-and-archives/2024-05-origins7.pdf>, p. 4.

² 'Former Members of the Council', *UNSW Sydney*. 1 July 2024, viewed on 12 September 2024, <https://www.unsw.edu.au/content/dam/pdfs/governance/02-council-and-committees/former-members-council.pdf>, p. 1.

³ 'Prizes & awards', *UNSW Engineering*, UNSW Sydney. Viewed on 12 September 2024, <https://www.unsw.edu.au/engineering/student-life/prizes-awards>.

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Do you remember when ‘disruptors’ were the naughty kids up the back of the classroom shooting chewed up bits of paper across the room with a BIC pen? Some of us probably *were* those kids, let’s face it. Ah, that was an easier time.

But today, disruptors keep us up at night. They’re the things that bombard their way into our society, our sectors and our organisations, uprooting established ways of doing things, creating havoc, creating opportunities, and making themselves at home in ways that mean nothing will ever be the same again.

We call them ‘disruptors’, or in a positive mood we might refer to our operating environments as ‘dynamic’, but whatever the language and whatever the mood, it’s plain that there are factors at play in so many spheres of human existence today that it could make your head spin.

We have no choice but to respond, to adapt – it’s that ‘agility’ that was all the rage in business-speak several years ago. We all need it. And we need it now, if not yesterday.

But one of the problems with this state of affairs is that these are not ‘equal opportunity disruptors’ we’re dealing with. Not everyone is ready (or willing, or able) to respond to or adapt to the new posture or the new predicament.

Consider ‘the digital divide’, for example.

The UN is concerned that the widening gap between developing and developed states could exclude some nations from the fourth industrial revolution and severely threaten progress of the Sustainable Development Goals.

Angel Gonzalez Sanz, Head of Science, Technology and Innovation in the UN Conference on Trade and Development, said “the digital divide, and the associated inequalities in technology diffusion, affect people’s access to the benefits of technologies and risk further exacerbating social divides.”⁴

As is too often the case with wholesale change, no matter the sphere, there are always those who are susceptible to being left behind. Often disruptions bear most heavily on those who are ill-equipped to weather them. Or roll with them. Or thrive under them, which would of course be the ideal for us all.

⁴ Coverage of the meeting of the Second Committee of the UN General Assembly on 6 October 2023. ‘Widening Digital Gap between Developed, Developing States Threatening to Exclude World’s Poorest from Next Industrial Revolution, Speakers Tell Second Committee’, *United Nations Meetings Coverage and Press Releases*, United Nations. 6 October 2023, viewed on 17 September 2024, <https://press.un.org/en/2023/gaef3587.doc.htm>.

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Sometimes, too, the notion of ‘innovation’, which is essential for progress or improving the human condition, and which is a concept most people in this room would regard as critical for tackling new and even wicked challenges – sometimes, in other audiences, the concept of ‘innovation’ is daunting or even threatening to people.

In developing UNSW’s strategy, I have recently been in community discussions where innovation is too often associated with the idea of job losses for themselves or their children, being replaced by machines, having old and comfortable ways of doing things tipped on their heads.

I’ve been part of the innovation sphere for virtually my whole career – at McKinsey, CSIRO, UTS and now UNSW, and I know that innovation is and should be daunting at times, but for all the right reasons. However, we have a responsibility to ensure innovation is used to create opportunities to bring everyone along.

So, part of what I’d like to speak about today is how can we, as scientists, engineers and technologists, not only help “create a better Australia and a better world”⁵ —

— but how do we ensure that all Australians – and indeed people in communities around the world, how do we ensure that these disruptions we’re experiencing, be they in economics, technology, the environment, geopolitics, or society at large —

— how do we ensure that amid this whirlwind of change, amid some of the most urgent challenges in generations, that “all Australians can reach their greatest potential” – which is, of course, what ATSE aspires to,⁶ or as UNSW expresses it, how do we ensure ‘Progress for All’?

In my time as a university leader over the past 15 years, I have come more and more strongly to believe in the single, solitary purpose of Australia’s public universities: the public good.

‘Public good’ is why UNSW was established in 1949 – 75 years ago this year – to meet the need for the skills, knowledge and research to advance a modern Australia after World War II.

It’s the reason we educate around 70,000 students at any one time. It’s the reason we conduct world-class, world-leading research. It’s the reason we engage with communities and collaborate with partners in Australia and across the globe.

⁵ ‘About us’, *Australian Academy of Technological Sciences and Engineering*. Viewed on 12 September 2024, <https://atse.org.au/who-we-are/about-us/>.

⁶ ‘About us’, *Australian Academy of Technological Sciences and Engineering*. Viewed on 12 September 2024, <https://atse.org.au/who-we-are/about-us/>.

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Everything we do at UNSW is for the benefit, wellbeing and prosperity of Australia, of Australians, and our global society at large.

But public good can only truly come about when *everyone* can enjoy the benefits. And that raises very necessary but complex questions about equity: equity of opportunity, of access, of inclusion and, what is sometimes lost but I consider the greatest prize – equity of success.

I'd like to set a little more of the scene surrounding the disruptions and transitions we're facing in Australia and in our global setting, and particularly some of the disparities and inequities that we're seeing as a result.

But then I'd like to show you some of the wonderful ways 'hard knowledge' – which I'll explain in a minute, linked to 'deep expertise' – is contributing to the public good, and to realising Australians' potential, and to Progress for All.

What I want to share with you is **a good news story** of collaboration, of true partnership between universities and industry and governments, of multidisciplinary cooperation, of innovation and success.

But first, to the disruptors.

Economic disruptors are a constant. It is an 'economic *cycle*' after all. But whether transitory or endemic, economic disruptors have wide-ranging implications at micro and macro levels.

Consider a range of indicators for Australia. Economic complexity, sovereign capability, productivity, critical skills shortages, wealth distribution, the cost of living, housing affordability. All of these problems are complex and affect the least wealthy in our community the most harshly.

Look at the polarisation of wealth in Australia. The wealth gap is widening. The Australian Council of Social Service (ACOSS) and UNSW published the latest report of our Poverty and Inequality Partnership in April. The report is called *Inequality in Australia 2024: Who is affected and how*. This report showed that over the past 20 years, the average household wealth of the highest 10% of Australia has grown by 84%, whereas the average household wealth of the lowest 60% of Australia has grown by only 55% over that time. That's basically a 30% growth differential.⁷

Australia's economic complexity is very poor. As ATSE's very own Dr Woodthorpe wrote in the AFR in February, we're ranked 93rd in the world, far from nations we

⁷ ACOSS Media / UNSW Media, 'Wealth gap widening: new report', *Newsroom*, UNSW Sydney. 18 April 2024, viewed on 12 September 2024, <https://www.unsw.edu.au/newsroom/news/2024/04/wealth-gap-widening-new-report-acoss>.

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normally see as our peers, like Japan (1), Germany (4), the UK (8) and the US (14). Katherine rightly explained that we “need to build a more resilient and diversified economy” that can “withstand shocks and pivot quickly in responses to crises.”⁸

Our productivity is poor, too, as I’m sure I don’t need to explain. Suffice to say that national productivity growth over the decade to 2020 was the slowest in over half a century.⁹ The end of the big mining boom was a big part of this slowdown,¹⁰ but there are other significant contributing factors, like reduced dynamism in the economy, competitive pressures, slower technological innovation and diffusion,¹¹ and stalling labour productivity.

Given productivity is “the key driver of economic growth and rising living standards”¹² and “the most important source of income growth in Australia over the past 30 years, contributing more than 80% of growth in real gross national income (GNI) per person”,¹³ chronically low productivity does not bode well for distribution of wealth.

If the pace of **technological change** seems greater than ever, it’s because it is.

The World Economic Forum backs this up with an interesting comparison millions of years in the making. It says that “It took 2.4 million years for our ancestors to control fire and use it for cooking, but 66 years to go from the first flight (the Wright brothers in 1903) to humans landing on the moon.”¹⁴ Of course, this only brings us to 1969, but the Forum charts exponential development since then as well: the eradication of smallpox in 1980, the first web browser in 1991, the International Space Station in

⁸ K. Woodthorpe, ‘How to fix Australia’s dire state of economic complexity’, *Australian Financial Review*. 2 February 2024, viewed on 13 September 2024, <https://www.afr.com/policy/health-and-education/how-to-fix-australia-s-dire-state-of-economic-complexity-20240202-p5f1vs>.

⁹ ‘PC Productivity Insights: Recent Developments – June 2021’, *Australian Government Productivity Commission*. June 2021, viewed on 12 September 2024, <https://www.pc.gov.au/ongoing/productivity-insights/bulletins/recent-developments-2021/productivity-insights-2021-recent-developments.pdf>, p. 44.

¹⁰ ‘PC Productivity Insights: Recent Developments – June 2021’, *Australian Government Productivity Commission*. June 2021, viewed on 12 September 2024, <https://www.pc.gov.au/ongoing/productivity-insights/bulletins/recent-developments-2021/productivity-insights-2021-recent-developments.pdf>, p. 46.

¹¹ ‘Working Future: The Australian Government’s White Paper on Jobs and Opportunities’, *Australian Government Treasury*. September 2023, viewed on 13 September 2024, <https://treasury.gov.au/sites/default/files/2023-09/p2023-447996-06-ch4.pdf>, p. 75.

¹² ‘2023 Intergenerational Report: Australia’s future to 2063’, *Australian Government Treasury*. 2023, viewed on 13 September 2024, <https://treasury.gov.au/sites/default/files/2023-08/p2023-435150.pdf>, p. 79.

¹³ ‘2021 Intergenerational Report: Australia over the next 40 years’, *Australian Government Treasury*. June 2021, viewed 13 September 2024, <https://treasury.gov.au/sites/default/files/2021-06/p2021-182464.pdf>, p. 46.

¹⁴ ‘This timeline charts the fast pace of tech transformation across centuries’, *World Economic Forum*. 27 February 2023, viewed 13 September 2024, <https://www.weforum.org/agenda/2023/02/this-timeline-charts-the-fast-pace-of-tech-transformation-across-centuries/>.

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2000, today’s CRISPR gene editing, mRNA vaccines and AI, and whereto the future?¹⁵ What will we see in our lifetime?

I will note here the analysis published in *Nature* early last year which proffered that “Papers, patents and even grant applications have become less novel relative to prior work” and “less disruptive over time”, but even that paper begins by acknowledging the “unprecedented expansion of scientific and technological knowledge” over the past century.¹⁶

As technological change advances, there is the very real risk of people – and institutions, industries, businesses, organisations – who don’t have the access, the skills, the capabilities or the means, being left behind. I referred to the UN’s concerns about this on a global scale earlier. Locally, almost 10% of Australians are “highly excluded” from digital technology. The Digital Inclusion Index score is trending upwards for Australia, but some unacceptable realities remain. There’s an unfavourable divide between capital cities and other parts of the country, particularly in ‘digital ability’. There’s also a significant gap between Indigenous and non-Indigenous people, particularly in the ‘access’ measure, where the gap is more than eight points.¹⁷

I know ATSE is concerned about this too. I note the submission to the ‘Roadmap for First Nations Digital Inclusion’, in which ATSE made nine evidence-based recommendations to “enhance opportunities for Aboriginal and Torres Strait Islander peoples and communities to participate equitably in the digital economy and, through digital technologies, in the full spectrum of society.”¹⁸

None of this is very good, given we’re living in what has been called “the era of compulsory computing”,¹⁹ where participation in society and access to essential

¹⁵ ‘This timeline charts the fast pace of tech transformation across centuries’, *World Economic Forum*. 27 February 2023, viewed 13 September 2024, <https://www.weforum.org/agenda/2023/02/this-timeline-charts-the-fast-pace-of-tech-transformation-across-centuries/>.

¹⁶ M. Park, E. Leahey, and R.J. Funk, ‘Papers and patents are becoming less disruptive over time’. *Nature*, vol. 613, no. 7942, 5 January 2023, pp. 138–144. <https://doi.org/10.1038/s41586-022-05543-x>

¹⁷ J. Thomas, A. McCosker, S. Parkinson, K. Hegarty, D. Featherstone, J. Kennedy, I. Holcombe-James, L. Ormond-Parker and L. Ganley, ‘Measuring Australia’s Digital Divide: Australian Digital Inclusion Index: 2023’, *Digital Inclusion Index*, ARC Centre of Excellence for Automated Decision-Making and Society, RMIT University, Swinburne University of Technology and Telstra. 2023, viewed on 12 September 2024, https://www.digitalinclusionindex.org.au/wp-content/uploads/2023/07/ADII-2023-Summary_FINAL-Remediated.pdf, p. 14.

¹⁸ ‘Submission to the Roadmap for First Nations Digital Inclusion’, *Australian Academy of Technological Sciences and Engineering*. 28 June 2024, viewed 12 September 2024, <https://www.atse.org.au/media/4fqd1f2x/sbm-2024-06-04-first-nations-digital-inclusion.pdf>, p. 1.

¹⁹ K. Allmann and G. Blank, ‘Rethinking digital skills in the era of compulsory computing: methods, measurement, policy and theory’. *Information, Communication & Society*, vol. 24, no. 5, 2021, pp. 633–648. <https://doi.org/10.1080/1369118X.2021.1874475>.

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services and information increasingly require a smart phone and a decent internet connection.

We're at a precipice regarding **environmental sustainability and climate change**. In 2022 the Intergovernmental Panel on Climate Change warned that the window of opportunity to secure a liveable and sustainable future for all is rapidly closing.²⁰ The Paris Agreement target of keeping global warming to no more than 1.5°C above pre-industrial levels,²¹ and the UN's ultimate target of net zero by 2050, a target Australia shares,²² are necessary to ensure human security.

But as we transition to clean energy and a sustainable, net-zero future, we need to consider the notion of 'just transition', which acknowledges both the challenges and opportunities of a systemic change of this magnitude. As the International Labour Organization puts it, a 'just transition' is "Greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind."²³

The risks climate change poses are significant. Risks like:

- Intensifying competition over land and water.
- Impacts on food production and hunger.
- Disproportionate effects on people with the lowest incomes, who are most likely to depend on natural resources like agriculture, forestry and fishing.
- Increased risk to women and girls because of unequal access to resources.²⁴

²⁰ 'Climate change: a threat to human wellbeing and health of the planet. Taking action now can secure our future', Intergovernmental Panel on Climate Change. 28 February 2022, viewed on 17 September 2024, <https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/>.

²¹ 'Paris Agreement', *United Nations Climate Action*, United Nations. Viewed on 17 September 2024, <https://www.un.org/en/climatechange/paris-agreement>.

²² United Nations: 'Net zero', *United Nations Climate Action*, United Nations. Viewed on 17 September 2024, <https://www.un.org/en/climatechange/net-zero-coalition>; Australia: 'Net Zero', *Australian Government Department of Climate Change, Energy, the Environment and Water*. 29 July 2024, viewed on 17 September 2024, <https://www.dcceew.gov.au/climate-change/emissions-reduction/net-zero>.

²³ 'What is just transition? And why is it important?', *UNDP Climate Promise*, United Nations Development Program. 3 November 2022, viewed on 17 September 2024, <https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important>.

²⁴ 'Five ways the climate crisis impacts human security', *United Nations Climate Action*, United Nations. Viewed on 17 September 2024, <https://www.un.org/en/climatechange/science/climate-issues/human-security>.

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- Environmental migration. In 2022, climate-related disasters caused more than 32 million internal displacements, according to the UNHCR.²⁵ On top of that, almost 60% of the world's refugees and internally displaced people live in countries that are the most susceptible to climate change.²⁶

Environmental disruption is existential. And definitely not equitable.

We are living in a **complex geopolitical environment**.

Instability and conflicts in several regions are having not only a terrible human toll, but global repercussions for supply, manufacturing and trade – highlighting once again the importance of economic complexity and sovereign capability.

Do you recall in 2022 there was a global shortage of microchips? A key contributor was the supply of neon, which is a factor in the lasers used to make microchips. Two Ukrainian neon suppliers, which produce about half the world's semiconductor-grade neon, stopped operating because of Russia's attacks.²⁷

Consider the mass-migration of people that **geopolitical instability** can cause.

The UNHCR estimates that at the end of 2023, there were more than 117.3 million forcibly displaced people in the world. These are people forced from their homes because of persecution, conflict, violence, human rights violations and serious public order disturbances. That is more than one in every 69 people in the world, and the number has increased every year for 12 years.²⁸ The global refugee population reached 43.4 million in 2023, which is more than triple what it was 10 years ago.²⁹ I've already mentioned displacements that come about through climate-related events.

Amid all these disruptors – economics, technology, the environment, geopolitics – people in communities in Australia and all around the world are grappling with their

²⁵ K. Siegfried, 'Stories: Climate change and displacement: the myths and the facts', *UNHCR Australia*, UNHCR. 15 November 2023, viewed on 17 September 2024, <https://www.unhcr.org/au/news/stories/climate-change-and-displacement-myths-and-facts>.

²⁶ K. Siegfried, 'Stories: Climate change and displacement: the myths and the facts', *UNHCR Australia*, UNHCR. 15 November 2023, viewed on 17 September 2024, <https://www.unhcr.org/au/news/stories/climate-change-and-displacement-myths-and-facts>.

²⁷ A. Alper, 'Exclusive: Russia's attack on Ukraine halts half of world's neon output for chips', *Reuters*. 12 March 2022, viewed on 17 September 2024, <https://www.reuters.com/technology/exclusive-ukraine-halts-half-worlds-neon-output-chips-clouding-outlook-2022-03-11/>.

²⁸ This is an estimate of people forcibly displaced due to persecution, conflict, violence, human rights violations and events seriously disturbing the public order. It includes people who are internally displaced within their own country. See 'Data and Statistics: Global Trends', *UNCHR Australia*, UNHCR. June 2024, viewed on 12 September 2024, <https://www.unhcr.org/au/global-trends>.

²⁹ 'Data and Statistics: Global Trends', *UNCHR Australia*, UNHCR. June 2024, viewed on 12 September 2024, <https://www.unhcr.org/au/global-trends>.

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livelihoods. And governments are grappling with the very structures that hold society together.

‘Social cohesion’ is one of the latest political buzzwords, though the genesis of the concept is in the late 19th century with Émile Durkheim. His concept had two elements, which remain meaningful today. The first is the absence of any latent social conflict (related to wealth, ethnicity, race or gender, for example). The second is the presence of strong social bonds (like civic society, responsive democracy and impartial law enforcement).³⁰

Of late, ‘social cohesion’ has been used for spurious, populist purposes, such as banning library books in the US, or used in Australia as red herring for migration concerns.³¹ But, despite political rhetoric and divisive headlines, and misuse by political leaders, ‘social cohesion’ is a genuine concern in Australia and across the world.

Last year the Scanlon Foundation Research Institute, alongside ANU, Monash Uni and the Australian Multicultural Foundation, published a report called *Mapping Social Cohesion 2023*. They found that cost of living pressures are having a negative impact on Australians’ sense of worth and belonging; on their connectedness to each other and to Australian values and to society; and on their trust in government.³² They found that only 36% of Australians trusted the federal government “to do the right thing for Australian people ‘all’ or ‘most of the time’.”³³ This report found record, 17-year lows for Australians’ sense of belonging (only 48% positive).³⁴

The Edelman Trust Barometer concurs. Unfortunately, we are seeing less trust in the institutions that are responsible for steering us through change towards a more prosperous future.³⁵

³⁰ ‘What is social cohesion?’, *Scanlon Foundation Research Institute*. Viewed on 12 September 2024, <https://scanloninstitute.org.au/research/mapping-social-cohesion/what-social-cohesion>.

³¹ D. Crowe, ‘Economic stress splinters community cohesion, fuels migration concerns’, *Sydney Morning Herald*. 15 November 2023, viewed on 12 September 2024, <https://www.smh.com.au/politics/federal/economic-stress-splinters-community-cohesion-fuels-migration-concerns-20231114-p5ejvv.html>.

³² ANU Communications & Engagement, ‘Cost of living pressures sees social cohesion hit record low’, *Newsroom*, Australian National University. 15 November 2023, viewed on 12 September 2024, <https://www.anu.edu.au/news/all-news/cost-of-living-pressure-sees-social-cohesion-hit-record-low>.

³³ ‘Mapping Social Cohesion 2023: A tear in the fabric?’, *Scanlon Foundation Research Institute*. November 2023, viewed on 12 September 2024, <https://scanloninstitute.org.au/mapping-social-cohesion-2023>.

³⁴ ‘Mapping Social Cohesion 2023: A tear in the fabric?’, *Scanlon Foundation Research Institute*. November 2023, viewed on 12 September 2024, <https://scanloninstitute.org.au/mapping-social-cohesion-2023>.

³⁵ ‘2024 Edelman Trust Barometer’, *Edelman*. 2024, viewed on 17 September 2024, <https://www.edelman.com.au/trust/2024/trust-barometer>.

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On a global scale, the Ipsos Social Cohesion Index in late 2020 found that twice as many global citizens said their sense of social cohesion was ‘weak’ rather than ‘solid’.³⁶

There is an interesting coincidence occurring in western liberal democracies in recent years. It’s the concurrent coexistence of declining social cohesion and the rise of populist politics. Think of France, the UK with Brexit, Germany, and the US. Populism has arisen from disaffection. Many voters feel excluded from full participation in economic and social opportunities, they feel that perceived elites are enjoying these opportunities at their expense.³⁷ The Australian Senate’s Legal and Constitutional Affairs Committee reported in 2021 that broad trends across western liberal democracies include “declining trust in political institutions, the rising influence of populism, growing socioeconomic inequality and fraying social cohesion.”³⁸

Social cohesion matters. It’s hard to conceive of Progress for All when your ‘all’ is fractured.

And that, my friends, is where ‘deep expertise’ comes in. Trust me, I told you this was going to be a good news story.

I said before that I would explain the title of this oration, ‘hard knowledge’. We live in a time where people expect things to be easy. Any problem can be solved, any information ‘got’ by Googling or asking Siri. But much (probably most) of the knowledge that we need to solve the complex problems I’ve spoken about, much of this knowledge is not easily acquired at all. And we need to embrace that fact. We need to value taking the time and effort required to develop deep knowledge and expertise that surpasses simplistic black and white information that exists in a vacuum or in an echo chamber on the internet.

Deep expertise takes *information* and converts it into the ingrained, almost cellular *knowledge* that leads to true innovation, to real, applied solutions to complex problems.

³⁶ M. Colledge, ‘Social cohesion is under assault globally’, *Ipsos*. 28 October 2020, viewed on 12 September 2024, <https://www.ipsos.com/en/social-cohesion-pandemic-age-global-perspective>.

³⁷ The Commonwealth of Australia Senate Legal and Constitutional Affairs References Committee, ‘Nationhood, national identity and democracy’, *Australian Parliament House*. 2021, viewed on 12 September 2024, https://parlinfo.aph.gov.au/parlInfo/download/committees/reportsen/024372/toc_pdf/Nationhood,nationalidentityanddemocracy.pdf, p. xiv.

³⁸ The Commonwealth of Australia Senate Legal and Constitutional Affairs References Committee, ‘Nationhood, national identity and democracy’, *Australian Parliament House*. 2021, viewed on 12 September 2024, https://parlinfo.aph.gov.au/parlInfo/download/committees/reportsen/024372/toc_pdf/Nationhood,nationalidentityanddemocracy.pdf, p. 12.

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I'd like to offer 'deep expertise' as a concept that synthesizes what Plato said about the status of 'knowledge' with the idea that knowledge is personal.

Plato said that to have the status of 'knowledge', a statement – or a piece of information, if you like – must be all of these three things: justified, true and believed.³⁹ Elizabeth Hauke, a specialist in university learning and teaching at Imperial College London, writes of knowledge as the outcome of “a personal relationship between ideas, sources of evidence and the individual.”⁴⁰ Knowledge, as distinct from information, “entails one who knows”. It requires digestion, rather than simply storage.⁴¹

This interplay is what makes deep expertise powerful in the face of the disruptions and dynamics I've been talking about.

Deep expertise is to be rigorously applied. It enables analysis, critical, creative, higher-order thinking. It brings deep, relevant prior knowledge together with new information to solve complex problems. It enables us to reap the benefits of multidisciplinary and cross-disciplinary work. It motivates us to collaborate, across institutions, industries and borders.

Deep expertise is how we can join forces and bring to life the multifaceted, evidence-based solutions that reach far beyond the populist, the knee-jerk and the mundane to not only address these disruptions, but to unlock and to share and even distribute the opportunities within.

Deep expertise is generous and seeks collaboration, it is not elitist and aloof. It can, deployed correctly, engender trust, confidence and real-world impact for the most pressing problems. Even wicked ones. It's that special amalgam of education, research and industrial ingenuity that foments innovation, that spurs us to critical thinking and problem-solving. That drives solutions in a way that everyone benefits, importantly *with* people rather than by dictating to people.

Deep expertise is the antidote to glib, populist policy and decision-making. It enables delving into the root cause of problems and develops hard, yet robust solutions that

³⁹ E. Hauke, 'Understanding the world today: the roles of knowledge and knowing in higher education'. *Teaching in higher education*, vol. 24, no. 3, 2019, pp. 378–393 at 380. <https://doi.org/10.1080/13562517.2018.1544122>

⁴⁰ E. Hauke, 'Understanding the world today: the roles of knowledge and knowing in higher education'. *Teaching in higher education*, vol. 24, no. 3, 2019, pp. 378–393 at 380. <https://doi.org/10.1080/13562517.2018.1544122>

⁴¹ Hauke, *op cit*, quoting J. Brown and P. Duguid, *The Social Life of Information*, Harvard Business School Press, Boston, 2000.

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do take time but are truly effective when compared with superficial tinkering with the symptoms for short-term populist gains.

Deep expertise enables a range of evidence and effects to be analysed and synthesised. It is open and questioning, not closed and dogmatic. It engages rather than dictates. It listens rather than condescends. Because the deeper your knowledge becomes, the more you know you have to learn.

Deep expertise is the prerequisite for collaboration, for innovation and for solving complex problems in a way that ensures everyone benefits. And that's the clincher: the public good.

Take clean, renewable energy for example. We can deliver clean, renewable energy to wealthy nations: those at the top of the OECD largely benefit already. But how can we deliver a 'just transition' to clean, renewable, inexpensive energy for every nation so that every person benefits? That's one for deep expertise, and collaboration, and more work.

So then. Deep expertise. How do we get more of it?

Well, first of all I look around this room and see exemplars of deep expertise everywhere I look, in each of you. But, more broadly, one would probably expect me to say 'universities' here. And I will.

The education and research that is conducted in higher education institutions like UNSW is one of Australia's greatest assets when it comes to capacity building, filling critical skills gaps, rebooting national productivity, addressing the climate crisis, addressing wealth inequality, promoting social cohesion and a host of the other challenges we're staring down. But there are many other places where deep expertise resides. And to achieve Progress for All, the different areas of deep expertise must collaborate.

Universities don't go it alone in education and research, because we know that two heads are better than one for driving innovation, for taking a brilliant discovery through to a brilliant solution and for bringing science from the lab to those who can benefit most. We know that the deep expertise we have in education and research is matched and complemented by the deep expertise industry partners have in translation, in application, in their own operating environments and markets. That's why we value research partnerships so highly.

It's why UNSW Science launched its 'Pact for Impact' earlier this year, a collective commitment with partners in industry, not-for-profits and government to improve the world through science and to measure and be accountable for our social, economic and environmental impacts. A great example is the partnership between Surf Life

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Saving Australia and UNSW's Professor Rob Brander, aka 'Dr Rip'. Together, they're better educating beachgoers about how to avoid the rip currents that account for almost 40% of Australia's beach drownings each year.

So, UNSW certainly isn't going it alone when it comes to deep expertise – either its development or its application. Much like deep expertise itself, our educational offerings and our research are not passive. They're not benign. They don't exist in a vacuum. They are, by definition, to be applied to complex problems, including – perhaps especially – by engaging with partners and the people whom they affect, or who share our vision for positive societal impact and our aspiration for Progress for All. Like any good chemical reaction, we need *effectors and receptors* to create the intended product. The roles might change but we're in this together.

I'd like to share a few examples of how partnerships are using deep expertise to tackle complex problems and unlock opportunities.

Let's begin with economics.

UNSW has been partnering with the Australian Council of Social Service (ACOSS) since 2018⁴² to address poverty in Australia by driving social policy change. The Poverty and Inequality Partnership (which I mentioned earlier in relation to wealth distribution) provides sound, evidence-based insights and policy advice to leaders and decision makers, including concrete options to support the millions of Australians who experience poverty and inequality. The partnership highlights where policies create unfair outcomes, to prevent increasing injustice and disparity of opportunity.

Filling critical skills gaps is part and parcel of our work at UNSW. Take Australia's massive shortage of engineers. Engineering Australia estimates that about 50,000 engineers will be needed in the next few years⁴³ and a 2021 estimate from the Australian Council of Engineering Deans predicted 100,000 engineers would be needed by 2030.⁴⁴ For our part, we've graduated more than 17,000 students since 2019. Now our Graduate School of Engineering works with and hundreds of business

⁴² UNSW Media, 'UNSW and ACOSS join forces to tackle poverty and inequality', *Newsroom*, UNSW Sydney. 8 February 2018, viewed on 18 September 2024, <https://www.unsw.edu.au/newsroom/news/2018/02/unsw-and-acoss-join-forces-to-tackle-poverty-and-inequality->.

⁴³ M. Bell, P. Briggs, J. Romanis, J. MacMaster, 'Strengthening the engineering workforce in Australia: Solutions to address the skills shortage in the short, medium, and long term', *Engineers Australia*. August 2022, viewed on 17 September 2024, <https://www.engineersaustralia.org.au/sites/default/files/2022-08/strengthening-engineering-workforce-australia.pdf>, p. 4.

⁴⁴ R. King, 'Working Paper: Shortages of Engineers and Supply Projections', *Australian Council of Engineering Deans*. December 2021, viewed on 17 September 2024, <https://www.aced.edu.au/downloads/Engineer%20Shortages%20and%20Projections%20Dec%202021.pdf>, p. 1.

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and industry partners, drawing on their deep expertise to enable research candidates to focus their work on addressing a pressing, real-world problem in an industrial setting,⁴⁵ which then further builds deep expertise in universities and business.

In the **technology sphere**, let's consider a technology that became an overnight sensation many years in the making at the height of COVID: RNA. In early 2022, NSW universities developed a collaboration with the NSW Government, industry and academic partners. This is the NSW RNA Production and Research Network.⁴⁶ The network brings together partners with deep expertise in regulation, policy, manufacturing, therapeutics, mRNA research and more. This initiative is helping to develop and deliver products like vaccines and treatments for diseases like COVID-19 as well as advanced therapeutics for cancers, infectious diseases, rare genetic disorders, and neurological conditions. This is driving the development of an industry that is going to have a profoundly positive impact on human health in Australia and on a global scale. It's just incredible.

Environmental sustainability and climate science are part of UNSW's DNA. You may well know that more than 90% of the world's solar energy uses the PERC technology developed at UNSW.

In recent years, UNSW has put significant effort into research in areas like sustainable production of critical minerals and strategic materials targeting decarbonisation, zero waste and energy efficiency. We have worked closely with industry to upskill the workforce, building new capacity and deep expertise in new areas through postgraduate courses. That's because, when we talk about education at UNSW, we mean lifelong learning – cross-skilling and upskilling for an evolving industry and a career path that probably won't be linear.

We've recently launched an environmental restoration program in Fiji in collaboration with the University of the South Pacific, with support from Swire Shipping. This project is restoring mangrove growth, because as you may know, mangroves provide diverse benefits that support coastal environments and community livelihoods. It's potential blueprint for creating responsible carbon sinks.⁴⁷

The deep expertise that our partners bring is essential for realising the immense potential here. The University of the South Pacific has a wide range of expertise in

⁴⁵ 'AGSE Research Degrees', *UNSW Engineering*, UNSW Sydney. Viewed on 18 September 2024, <https://www.unsw.edu.au/engineering/our-schools/agse/industry-phd>.

⁴⁶ 'NSW-PRN', *UNSW RNA Institute*. Viewed on 18 September 2024, <https://www.rna.unsw.edu.au/partners/nsw-rprn>.

⁴⁷ UNSW Media, 'UNSW to embark on landmark mangrove regeneration project in Fiji', *Newsroom*, UNSW Sydney. 2 May 2024, viewed on 17 September 2024, <https://www.unsw.edu.au/newsroom/news/2024/05/unsw-to-embark-on-landmark-mangrove-regeneration-project-in-fiji>.

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ecology, including appropriate species of mangroves, and monitoring the response of soils, fish and other environmental indicators. USP has vital knowledge of the important cultural and social dimensions of this ambitious restoration project, too. The Fijian Government and Swire provide policy and implementation expertise as well as enabling access and resources that mean the project can have impact at scale. And UNSW's Global Water Institute, especially the Water Research Laboratory, has deep expertise in coastal engineering, nature-based solutions, and the southern hemisphere's largest wave flume, which enables rapid testing of prototypes before deployment in the field.

This is an incredible combination of complementary expertise. By tackling problems like this together, we can accelerate progress towards a global net zero economy. The motto of our Global Water Institute says is perfectly: "In partnership, to do collectively, that which cannot be done individually."

A program that I'm really excited about is just down the coast here in the Shoalhaven. It's a fantastic partnership at the West Nowra Recycling and Waste Depot. Many of you know ARC Laureate Professor Veena Sahajwalla –she's known internationally for her incredible work revolutionising recycling science – the SMART Centre has licensed its 'Green Ceramics MICROfactorie' technology to a company called Kandui Technologies (great name!) and Shoalhaven City Council. On site at the waste and recycling depot, they're using a variety of waste materials to produce a range of 'green' ceramics and products for the built environment. The ceramics they're producing are mainly made from types of waste glass and textiles that aren't traditionally recycled. The ceramics are used as kitchen benches, tabletops, floor tiles, furnishings and for other applications.⁴⁸

I've been down and seen it in action. It's amazing. But it's only possible because of the deep expertise our partners bring to the table. The combined might of Kandui and the Shoalhaven Council in waste management logistics, business management and recycling dovetails with the MICROfactorie technology to create a collaboration with community roots and expansive impact.

Thinking about **geopolitics**, UNSW's Kaldor Centre for International Refugee Law is recognised for its world-leading expertise on displacement in the context of climate change and disasters. The Kaldor Centre combines rigorous legal and archival analysis with in-depth empirical work, engaging key stakeholders and affected communities to inform practical solutions. Its founding (former) director, Professor Jane McAdam AO, is at the forefront of global efforts to ensure protection for people displaced by disasters and the impacts of climate change. The Kaldor Centre brings

⁴⁸ 'Green ceramics', *SMaRT@UNSW*, UNSW Sydney. Viewed on 19 September 2024, <https://www.smart.unsw.edu.au/technologies-products/microfactorie-technologies/green-ceramics>.

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all these community and NGO experts together to provide a credible, non-partisan, expert collective voice in the debate about forced migration. Its expertise and strategic advice is sought by national and global leaders, including the World Economic Forum, the UN Security Council, the UNHCR, the World Bank, the Office of the UN High Commissioner for Human Rights, the International Organization for Migration, the International Bar Association, the European Union and numerous national governments.⁴⁹

These are just a handful of the ways deep expertise is being used to solve some of the most pressing issues society is facing today. They're just some of the great stories that are repeated across UNSW, Australian universities and our research institutions more broadly and they're good indicators of our genuine commitment to solving problems in partnership with industry and governments, and in ways that focus on widespread benefits.

Deep expertise is a powerful answer to a host of contemporary and future challenges. It isn't easy, particularly in today's world, but it is something we can't shy away from.

Deep expertise enables analysis, critical, creative, higher-order thinking. It brings deep, relevant prior knowledge together with new information to solve complex problems. It enables us to reap the benefits of multidisciplinary, interdisciplinary and cross-disciplinary work. It motivates us to collaborate, across institutions, industries and borders. It combats populist policy and politics. And when done properly, it engenders trust.

Edelman's research about trust found that "Australians are more likely to embrace an innovation if they're confident that it will lead to a better future" and that Australians "want technical experts and scientists to lead on implementing innovation."⁵⁰ That's very good news for all of us who value deep expertise and who are immersed in ways to maximise positive impact, or, like ATSE, to help all Australians realise their potential, or like UNSW, to drive Progress for All.

But of course, the ultimate question is "How do we ensure deep expertise is valued, fostered and applied for the benefit of everyone, for progress that extends well beyond economic gain into wide-ranging gains for humanity, for human security, and

⁴⁹ '10 Years of Impact', *Andrew & Renata Kaldor Centre for International Refugee Law*, UNSW Sydney. 2024, viewed on 18 September 2024, <https://www.unsw.edu.au/content/dam/pdfs/law/kaldor/2024-05/2024-05-kaldor-centre-10-years-of-impact-report.pdf> (via 'Our impact', *Andrew & Renata Kaldor Centre for International Refugee Law*, UNSW Sydney. 2024, viewed on 18 September 2024, <https://www.unsw.edu.au/kaldor-centre/our-impact>).

⁵⁰ '2024 Edelman Trust Barometer', *Edelman*. 2024, viewed on 17 September 2024, <https://www.edelman.com.au/trust/2024/trust-barometer>.

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for advancing global society?” This is a fundamental question for leaders in higher education, in research, in industry but also for government.

At universities, we have three levers to pull. Education. Research. And genuine engagement with society, with industry. Over UNSW’s first 75 years, education, research and engagement have been used to extraordinary effect by giants like Professor Malcolm Chaikin.

The challenge as we move towards the disruptions and transitions of our global future is to stand on these giants’ shoulders, to ensure hard knowledge and deep expertise are valued, and to take deep expertise into the new frontiers of knowledge, and to nurture the new intellectual giants, whose passion for innovation will keep driving the world towards Progress for All. As the Global Water Institute motto says, “In partnership, to do collectively, that which cannot be done individually.”

Just like death and taxes, we can be sure disruptions will be constant. But deep expertise is like the Starship Enterprise. It will boldly take us where no one has gone before. Every one of us.

— ENDS —