

Australian Universities Accord
Department of Education
Canberra ACT 2601

11 April 2023

To whom this may concern,

Thank you for the opportunity to provide a submission to the consultation on the *Australian Universities Accord discussion paper*.

The Australian Institute for Machine Learning (AIML), a research-intensive institute at the University of Adelaide with more than 170 members, is recognised globally as a leading research group in artificial intelligence (AI), computer vision, and machine learning.

We work closely with a range of partners including government, industry, SMEs and defence to apply AI and machine learning technology to provide solutions to real world challenges. AIML translates research into impact through:

- building sovereign capability in AI research and development
- collaborating with companies to develop high-tech products and solutions
- providing an interdisciplinary approach to research and consulting
- carrying out pure research to provide benefits to society
- raising the profile of South Australia as the place to be for innovation
- employing and training Australia's bright young minds.

AI is a transformational technology that has the potential to impact every sector of the economy. The ability of countries to harness AI will be a deciding factor for securing economic and social prosperity in the future. Universities play a crucial role in building a pipeline of AI talent and capability, as evidenced by the rich interdependency of Stanford University and Silicon Valley. For Australia to reap the benefits of creating and adopting AI technology, government and industry must lean into our central source of talent and expertise in this field, Australian universities, and foster engagement mechanisms that consider and benefit the interests of all. Only then will our nation be placed to solve the grand challenges that face humanity both here and abroad.

Once again, I thank you for the opportunity to make a submission to this consultation process.

Yours sincerely,



Professor Simon Lucey
Director, Australian Institute for Machine Learning

Q4 Looking from now to 2030 and 2040, what major national challenges and opportunities should Australian higher education be focused on meeting?

Universities play a crucial role in filling Australia's skills gaps, through the development of domestic students or as a conduit for skilled migration. A significant challenge for Australia is to have a sufficiently skilled workforce in critical technologies of national interest, including artificial intelligence (AI), computing and communications. In the field of AI alone, the CSIRO estimates Australia will require up to 161,000 workers with specialist AI skills by 2030. Unless corrective action is taken, Australia will fall well short of reaching this target based on the current trajectory of AI talent growth.

AI is a transformational technology with broad application and large impact. As well as improving the productivity of existing industries, it has the potential to solve humanity's biggest problems. Australia is in a unique position to build sovereign capability in specific areas in AI but we must recognise this position is fleeting. Many comparable nations are investing heavily in fundamental AI research as part of their national AI strategies, recognising the importance of the technology to their economies and the wellbeing of their communities.

Economic complexity is a strong indicator of a countries' future living standards and ongoing prosperity. Surprisingly, Australia is ranked 91st in the world on this measure, between Kenya and Namibia, the lowest of the OECD countries. Australian universities account for a greater share of national research and development as compared to other jurisdictions and thus university research should be a central driver of innovation in our industries to create products and services of greater complexity with significant export potential. Our opportunity lies in carving out niches in disciplines of the technology and expanding the research excellence in these areas. We cannot possibly compete on scale, but we do have the chance to compete on expertise and become leaders in developing highly specialised technology that is responsible and consistent with Australian values.

Q5 How do the current structures of institutions, regulation and funding in higher education help or hinder Australia's ability to meet these challenges? What needs to change?

By virtue of the teaching and research structures in research-intensive universities, there is often cross subsidisation of research with funding from student enrolment fees. As highlighted in the *Australian Universities Accord discussion paper*, half of the \$12.7 billion spent on research by universities in 2020 was sourced from general university funds. In achieving research excellence, universities place higher in global rankings and increase their competitive advantage in attracting students, particularly internationally.

Stated plainly, the current operating model of research-intensive universities over-reward research excellence at the expense of teaching quality. Meanwhile, undergraduate student experience is directly correlated with our ability to cultivate, foster, and retain HDR talent, especially domestic students who are critical to sovereign capability. For the dual components of research-intensive universities to succeed, the funding mechanism of each component must be structured to align with their own success drivers. Research needs to be adequately funded, in its own right, whether through industry or government engagement.

Q9 How should Australia ensure enough students are studying courses that align with the changing needs of the economy and society?

There is a need for greater engagement between industry and universities for both teaching and research activities. Greater incentives for academic roles, including dual appointments with industry, would improve the attractiveness of university teaching to a wider range of professionals with contemporary industry experience.

It is important that industry, particularly those sectors where future demand for talent is greatest, are proactive and invest in outreach to high schools and universities through scholarships, industry-sponsored capstone projects, cadetships etc. These sorts of initiatives can provide a richer student experience, provide greater visibility of the job opportunities in particular industries and incentivise study in broad areas with the greatest demand for skills over the longer term. Further these opportunities need to be made available for students in high school, with subject selection often solidifying interests and future aspirations. Outreach at the secondary school level through teachers, career advisors and students play an important role showcasing careers, demonstrating the relevance of STEM subjects, and inspiring young people to dream big about the impact their career could have for society. Increased visibility and awareness of impactful careers in STEM needs to be a focus, you cannot be what you cannot see.

Q10 What role should higher education play in helping to develop high quality general learning capabilities across all age groups and industries?

Improving general learning capabilities across age groups and industries is a task much broader than universities can realistically undertake on their own. However, there may be opportunities to leverage the talent of postgraduate students and early career researchers to train people outside of the university sector through appropriately targeted incentives.

Q14 How should placement arrangements and work-integrated learning (WIL) in higher education change in the decades ahead?

Greater engagement between universities and industry in coursework design can help integrate industry problems into undergraduate coursework. This approach would have the dual benefit of increasing the relationship between course content and contemporary industry issues and create more opportunities to apply undergraduate student talent to industry problems. Developing relationships with undergraduate students also helps industry secure a pool of potential employees upon graduation, and in some cases before graduation.

Industry PhDs allow for greater partnerships between academia and industry at the postgraduate research level, leveraging academic excellence to solve problems for industry. However, it is also important to recognise that a PhD is a Doctor of Philosophy, which is intended to teach and facilitate critical thinking. Therefore, it is essential that whilst greater integration and collaboration with industry must occur, this must be balanced against the essential role that university-based blue-sky research plays in our society and world. Basic research is an important source of fundamental skills, but also a source of some of the greatest advancements, such as penicillin and wifi.

Q23 How should an Accord help Australia increase collaboration between industry, government and universities to solve big challenges?

There are enormous opportunities for universities, government and industry to solve challenges through collaboration. For this to succeed, there needs to be a clear understanding of the different objectives and incentives of each. Work needs to be done to define collaboration models where these different perspectives can be leveraged to achieve mutually beneficial outcomes, with particular attention to IP ownership and commercialisation opportunities. Mission or challenge-oriented partnerships will be of particular benefit where they are sufficiently large in terms of scope and time horizon. This is vital to building core research capability within universities, and with respect to AI in particular, research capability that can be applied to help solve national challenges and generate knowledge spillovers that deliver sustainable economic and social benefits to Australia.

Q24 What reforms will enable Australian research institutions to achieve excellence, scale and impact in particular fields?

As a middle power Australia cannot expect to compete with the rest of the world in every discipline, running the risk of overspending finite resources and reducing impact. Australia should identify priorities and strive for excellence in those areas. Australia can carve out internationally competitive niches around areas of deep expertise that can be scaled to deliver impact to Australia and the world.

We believe that one such example includes disciplines of AI where Australia is already internationally competitive, such as computer vision, small data AI and responsible AI. Strong support for research priorities in AI has the benefit of being applied broadly to solve Australian challenges, but also create opportunities to export to the world.

A key constraint on Australia's ability to build and scale excellence in fields of AI is the lack of people in Australia with the relevant skills, at all career levels. Reforms need to address how research institutions in Australia can be sustainably resourced to drive growth in both research and education; develop smart policies to improve access to and incentives for STEM education; and create incentives for reskilling to assist in medium to long term growth of domestic talent.

In the short term, immigration is a critical source of talent. Australia needs consistent and fair immigration policy, efficient and transparent visa processing times and clear pathways to citizenship that are attractive, to recruit and retain a highly skilled migrant workforce.

Q25 How should Australia leverage its research capacity overall and use it more effectively to develop new capabilities and solve wicked problems?

Australian universities are an excellent source of critical capability in key fields, such as AI. Universities have the advantage of strong incentives to pursue academic excellence in an open and transparent fashion that is constantly measured against the best in the world. Well-designed government funding programs can better incentivise partnerships between industry and academia, for example through hybrid appointments.

Leading multinational tech companies have a long and intertwined history with university-based AI talent. Naturally, access to talent has a strong influence on where companies might locate their research and development resources. Locations that are successful in attracting a

multinational to establish a base highly benefit two-fold, creating employment opportunities for its residents and creating a magnet to attract additional skilled workers.

For example,

- Google's DeepMind was originally established and remains in London as that is where the lead researchers were based. DeepMind also established a presence in Edmonton, Canada, to co-locate with the key inventor of reinforcement learning, Professor Richard Sutton.
- Uber opened an office in Toronto to hire Professor Raquel Urtasun from the University of Toronto.
- Amazon established a machine learning research team at Lot Fourteen, Adelaide, specifically to access The University of Adelaide's Australian Institute for Machine Learning's computer vision expertise and talent pool.

Hybrid appointments between universities and tech companies are also increasingly common, such as AI legends; Geoffrey Hinton (University of Toronto and Google), Russ Salakhutdinov (Carnegie Mellon University and Apple), and Yann LeCun (New York University and Meta).

Each joined the company while retaining their academic position and each continues to live near their university rather than corporate headquarters. Although rare in Australia, Professor Anton van den Hengel (Director, Centre for Augmented Reasoning, Australian Institute of Machine Learning, The University of Adelaide; and Director of Applied Science, Amazon Australia) holds an industry-academic hybrid appointment

Importantly, large companies often recognise the immense value in establishing an ongoing relationship with academia to access state-of-the-art research capability over the longer term. It is rare to invest in establishing a research agreement only to solve a single discrete problem. Rather, businesses seek to engage and grow local talent over a period of time, and reap the benefits of the first-mover advantage received from direct access to open research and development.

Q26 How can Australia stimulate greater industry investment in research and more effective collaboration?

A key to increasing industry investment in research and more effective collaboration is reconciling the opposing objectives and priorities that exist for universities and industry. Whereas industry entities are seeking a competitive advantage in the market, universities are incentivised to increase their research metrics, namely peer-reviewed publications, research impact, citations etc. Therefore, to successfully increase industry engagement and investment in research, these different priorities need to be managed in such a way where both groups of objectives can be satisfied. Building stronger mutual understanding between academics and industry leaders is important for changing the culture of collaboration and leveraging the advantages that each bring to industry-university partnerships.

Larger funding programs assigned to broad national objectives and challenges, including collaboration with industry, such as cooperative research centres and Australian Research Council centres of excellence, provide the opportunity to build multi-year programs designed with the objectives of both academia and industry in mind. Multi-year programs, for example 7 years, provide a level of certainty that is not afforded to most university research positions and thus are attractive.

Q27 How can we improve research training in Australia including improving pathways for researchers to gain experience and develop high-impact careers in government and industry?

There is enormous demand for undergraduate and higher degree by research students with skills in AI, and our students don't currently face challenges with career pathways. In fact, the challenge in the field of AI is to graduate enough students to fulfill the needs of government and industry.

However, an untapped resource is the opportunities to upskill graduates from other disciplines to incorporate AI and machine learning into their chosen field of study. For success, postgraduate students need access to bridging courses in math, coding and/or data science. One of the barriers in exploring alternative career pathways in AI is the lack of financial resources to fund domestic students for this transition. Access to free courses, dedicated mentors and study scholarships would lessen this barrier.

Incentivising this convergence of disciplines will not only increase Australia's pool of AI talent, but also better integrate domain-specific expertise into the design and application of AI for the benefit of diverse industries.