QUESTION 4

Accessibility to quality education: Education systems in Australia are inefficient, mis-aligned with macro-economic drivers, and inequitable (between socioeconomic groups). Despite having comparable overall outcomes among OECD countries, our education system fails to provide the high-skilled workforce needed for the domestic workforce of 2030 to 2040 and beyond (Ref 1). A decline in the number of students acquiring mathematics skills signals a worrying trend (Ref 2). Every person from every region should have equal access and support to acquire high-quality education. A child in any primary school should have a line of sight to the highest levels of education, with multiple options presented all the way along the education path. Our opportunity is to create a systematic, national, cohesive, and contiguous education framework. It should be designed, implemented, and measured well before 2030. The sustainability and prosperity of the nation in this century will depend on achieving much higher educational outcomes, which in turn will depend on the development and implementation of better systems. There is an opportunity to reform the system before our competitive advantages as a nation are eroded. Higher education should be central to this process.

Equality: Tradition, legacy, incumbency, and entitlement across our modern society tend to hold back participation by disadvantaged and underrepresented groups. The gaps in health, well-being, education and wealth are widening. Serious intervention and reform will be needed in order to ensure cohesion in our society, to work as a nation to achieve common goals, and build resilience in the face of growing external challenges. The opportunity for higher education is to build an understanding of these issues and to contribute to the public debate and advancement of policy.

Productivity: For the past century, Australia has built its prosperity on raw materials. This will not last. Our future prosperity depends on our ability to transition to a more productive, value-adding, and knowledge-enhanced economy, which will require a new and different workforce. The challenge will be re-inventing existing industries, educating our population to drive these industries, and maintaining international competitiveness. Australia has an opportunity to electrify its energy systems, transition to a zero-carbon economy, and to lead the world in establishing a fair and prosperous society that is sustainable. Higher education will need to organise and collaborate (rather than compete), and take the opportunity to address these monumental challenges.

Resilience: Australia will likely face a series of existential pressures and challenges in the coming decades, which will require us to be resilient and to adapt. Our international trading partners, and the commodities we trade, will certainly change, as will the terms of trade. Disease, conflict and natural disasters will all have a degree of measurable impact on our economy and way of life. Australia should examine these threats and devise ways to manage their impacts. We have an opportunity, by leveraging the collective higher education system, to mobilise mission-oriented teaching and research initiatives that address these challenges. The insular, competitive, and low-impact system of public research funding in not capable of supporting the large national frameworks

needed. Our opportunity is to define the major challenges and take them on across the higher education sector as national-scale collaborative initiatives.

Environment: If we continue to cause the degradation of our natural environment, and the loss of biodiversity, our overall quality of life will decline commensurately. Not only will our sense of belonging be affected (if, for example, the great barrier reef dies, koalas become extinct, or groundwater is contaminated by mining), but our economy will be impacted by loss of tourism, loss of productivity, and potential social unrest. We must tackle environmental degradation, climate change, and consumption as a priority. Australia has an opportunity to create a sustainable circular economy. Higher education is central to the solution, as it will require revising our culture into one that is less consumption oriented, and our industries into ones that are less extractive and more productive. It will require a total re-education of our society.

QUESTION 9

Australia's commitment to achieving net zero by 2050 and the resulting growth in the associated energy transition industry is expected to create more than 100,000 additional engineering jobs (Ref 3). Unfortunately, the current rate of domestic student graduation of about 8,000 annually is insufficient to meet even the current demands, and Australia faces a severe shortage of engineers in the coming years. According to Engineers Australia's recent report on the engineering skill shortage, Australia is only ahead of the US in the engineering field's share of graduates among the OECD countries (Ref 4). The report highlights several factors responsible for this shortage, including the lack of pipelines for the primary and secondary schools, the lack of diversity and the lack of retention rate, with only 50 to 60 per cent of the Australian commencing students finishing with an engineering qualification. We endorse the recommendations of EA's report but especially (i) supporting the schools to encourage more young Australians to choose to study maths and engineering studies, (ii) promoting diversity and inclusion, (iii) providing Commonwealth Supported Places (CPS) for accredited engineering coursework master's, and (iv) incentivising retention and completions. Not surprisingly, most of these objectives map closely with the goals of the Performance-Based Funding Scheme that commenced in 2017. Unfortunately, the allocated funding is too small to drive universities to achieve those goals. Finally, many high-performing students are currently taking trades apprenticeships over going to university. This is especially apparent in the regional areas, where there is a reluctance to be the first in the family to Uni and take on debt to study. Industry-supported cadetships with tax concessions (learn and earn) could incentivise the students from the regional areas to enrol in engineering courses. Consideration could also be paid to "special" CSP places for underrepresented groups in areas of economic demand (e.g., engineering). These CSP places would have a lower student contribution (possibly $0) and a higher Federal contribution. The combined contribution would be higher than the current combined contribution to fund universities to provide a greater level of support to these students. This support may be leveraged through investment from industry to attract students to internships, and employment or cadetship.

QUESTION 13

This is challenging question. Very often industry is ignored when setting up the higher education policies. It appears that the industry does not feel adequately invested in the process. Therefore, all sectors of industry should be adequately consulted in the policy development relating to higher education. Also, the government must provide assurance, certainty and incentives (include funding) on metrices for higher education so that it evolves towards desired models of graduates and citizens that promotes social cohesion, regional relevance, economic and sustainable development, and wealth creation and innovation.

QUESTION 14

Australia should look at the Canadian system where Work Integrated Learning is funded by Government. Organisations like Co-operative Education and Work-Integrated Learning Canada (Ref 5), help facilitate WIL opportunities between universities and industry through government assistance. This report notes that in Canada "Each year, over 200,000 students and partner organizations participate in various work-integrated learning experiences in Canada. Since 2017, WIL programs funded by the Government of Canada have decreased barriers and increased access for tens of thousands of students."

At the moment we have the APR.Intern program that provides internship opportunities for PhD and Masters by Research students. However, we have no such programs for undergraduate and postgraduate coursework students.

Furthermore, there are few true Cooperative Education (COOP) programs in Australia and students often revert to the "standard" award to graduate earlier and enter industry. Greater incentives to commence and remain within COOP programs - including overseas and NGO placements should be considered.

QUESTION 23

The Cooperative Research Centres Program (CRC) is a cornerstone of the current landscape of industry, government and University collaboration to address large scale challenges.   A review of the CRC program was published in November 2021 (Ref 6). The review concluded the CRC program is working well, however a number of recommendations were made to expand or improve the CRC program. ACED concurs with those recommendations, in particular "that future efforts to drive industry growth and innovation should leverage the Program's success and consider further investment in both CRCs and CRC-Ps, as proven ways to drive industry-research collaboration."

Australia's R&D tax incentive is another important instrument in the landscape for R&D collaboration. ACED supports the call made by the Group of 8 (Ref 7) to include a collaboration premium in the R&D tax incentive to offer direct support for industry/University collaboration.

University research must be translated into outcomes for industry, government and communities if it is to truly solve big challenges. ACED welcomes the initiatives put forward in the recent University Research Commercialisation Package (Ref 8). However, one crucial point the University sector must consider if commercialisation pathways are going to be embraced by academic staff is how traditional academic careers could be re-conceptualised. Promotion pathways are influenced by publication outcomes i.e. public disclosure of research findings. Academic/Industry collaboration leading to greater commercialisation of outputs needs the University sysem to support industry

secondments for staff into mature organisations, and space to de-risk start-ups (e.g. keeping academic positions open for founders if startup ventures fail).

In New Zealand Uniservices (a wholly owned subsidiary of the University of Auckland) has "helped launch 45 companies and launched over 430 patent families" in the past 10 years (Ref 9). If the Australian University sector wants University/industry/government collaboration should commercialisation be measured/rewarded through the block grant scheme?

Finally, there is a need to assess the ways that we currently get industry, government and universities together to focus on grand challenge problems. Determine their effectiveness or best practice models. Currently, industry, government and universities do not get together enough. It is possible to develop models where we can all get together identify major issues that need to be addressed and rally around them.

QUESTION 26

One of the recommendations of the Australian Council of Engineering Deans (ACED) investigation into what knowledge, skills and attributes would be expected of an engineering graduate of 2035 was an increased collaboration between industry and academia (Refs 10-12). A suite of drivers and barriers to this collaboration has also been identified (Ref 13):

Barriers:

B1 Difficulties in Engaging with the University

B2 Perceptions that University People are Out of Touch with the Industry and Beyond

B3 Time and Inconvenience Involved in Supervising Students on Placement

B4 Industry Experience being Undervalued for Teaching, and Pay Disparity Between University and Industry

Drivers:

D1 Enhancement of the Organisation's Brand among Future Engineers who become their Future Employees, Clients, Contractors and Alliance Partners

D2 Improved Understanding of Working for the Organisation held by Prospective Graduate Recruits

D3 Prospective Recruitment and Opportunities to Influence the Capabilities of Future Graduates

D4 Opportunities for Professional Development for Staff

D5 Appeal to the Organisation's Employees; Personal Satisfaction for those Engaged in Working with Students

D6 Social License for the Organisation

Although there has been a significant body of work done to enhance this collaboration, especially through Work Integrated Learning (WIL) and mentioned elsewhere in this submission, there hasn't been a significant improvement in this liaison.

The following is a list of potential connections between industry and academia, all identified by roundtable discussions: Internships, Scholarships, Industry mentors and financial support, support

innovation education models (for example, higher education apprenticeships, and/or cadetships) and ensuring knowledge, skills and attributes relevance/structure to align with industry requirements.

Collaborative commercialization is an approach used in medical research – this may be scalable across the whole higher education sector (Ref 14).

Overall, there needs to be a significant incentive for both industry and academia to collaborate at a much wider and deeper level. ACED is putting in place a research project to address this issue. The previous 150% tax incentive and the Cooperative Research Centres (CRCs) were appropriate mechanisms but nowadays there needs to be a bold and attractive business incentive.

QUESTION 28

Engineers from female and Aboriginal and Torres Strait Islander populations are under-represented in engineering education and the engineering workforce. According to Engineers Australia (Ref 15), women constitute just 16% of Australian engineering graduates and only 13% of the engineering workforce. Of interest, certain engineering disciplines such as chemical engineering, biomedical engineering, and environmental engineering attract a significant proportion of female engineering students, as compared to Civil, Mechanical, Electrical and Computing/Software Engineering. The research (Ref 15) reveals that when it comes to female participation in engineering, the greatest problem lies in the initial stage of consideration spanning the primary and high school years. Most girls do not even think of engineering as a career option, with only 7% of surveyed women in non-engineering fields saying that they had seriously considered engineering. This is driven by a lack of familiarity in that there is little understanding of what engineers do, or of the breadth of the engineering profession and the career opportunities if offers. Engineering lacks positive perceptions in that it is mainly seen as male-dominated and challenging. It is not perceived as impactful or fulfilling, which are important considerations for many women and girls.

Similarly, participation of indigenous people in engineering is exceptionally low (Ref 16); for example in 2015, only 145 engineering student commenced their engineering studies with only 49 graduating, compared with 20,418 total commencing and 11,545 total graduating in 2015. Increasing the participation of Indigenous people in engineering, developing engineering graduates with greater understanding of Indigenous perspectives, and introducing humanitarian engineering concepts into the curriculum are major priorities for Australian Council of Engineering Deans (Ref 16). ACED has recently sponsored engineering education projects in 2022 to develop capacity in humanitarian engineering and indigenous perspectives in collaboration with the Australasian Association for Engineering Education. However, the inherent requirements (English and Mathematics) for entry into engineering educations remain as structural barriers that discourages many indigenous and female students to consider engineering as a career option. In saying, there are currently many non-traditional entry pathways into engineering programs at various qualification levels that need to be promoted much more broadly into career counselling at schools and the community at large. This is also equally applicable to first-in-family students as well as matured age students who may not be aware of the career opportunities and educational pathways that are available in engineering.

Longer-term initiatives that address the systemic issues outlined above are critical. One exemplar is the "Power of Engineering" (Ref 17), a not-for-profit initiative led by young engineers and engineering students with the goal of changing the perceptions of girls in high schools about a career in engineering. Power of Engineering (Ref 18) brings together universities, the engineering industry, and schools to provide practical and creative experiences for young people to understand

engineering better and how it impacts our world. Since its first outreach event held at QUT in 2012, it has reached 10,000+ students across Australia, with more than 80% considering a career in engineering after their event. Other initiatives should include introducing "Engineering" as a subject in high school such as the one introduced in Queensland in 2019 (Ref 19), and explicit teaching of Engineering in STEM education at the primary school level (Ref 20). Engineering has been traditionally and stereotypically known as a very technical profession with practitioners being very skilled and knowledgeable in mathematics, sciences and use of the scientific method to undertake their work. While this is important it is secondary to the primary function of engineering. Engineers aim to design pro ducts, systems infrastructure and services that produce a safer, healthier and more sustainable world and hence improve the quality of life of everyone. Engineering is social first and then technical (Ref 16). The engineering education pipeline starts at primary education right up to high education. The "E" in STEM education needs an facelift in schools and the community to change perceptions about an exciting and creative possibilities in engineering, thus leading to increased diversity in engineering education and its workforce.

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