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Kingston AI Group Submission to National Robotics Strategy Discussion Paper

The Kingston AI Group of Professors includes fourteen of Australia's top researchers and innovators in artificial intelligence, united in the belief that Australia must invest in building core sovereign capability in artificial intelligence (AI). As well as driving Australia's artificial intelligence (AI) research, the group's members are working with companies to develop transformative commercial AI solutions, many of which enable the development of sovereign robotics technology. The group contends that the development of Australia's domestic AI research capability is of critical importance to the development of the nation's robotics industry. Robotics and AI are increasingly intertwined and Australia must engage proactively with the AI revolution, and establish a commitment to building domestic AI research capability as a national priority.

The Kingston AI Group welcomes the Australian Government's timely development of a National Robotics Strategy to promote the responsible production and adoption of robotics and automation technologies such as AI. This document is our response to your request for submissions on the Discussion Paper on a National Robotics Strategy.

Definitions

We welcome the recognition of AI as an important enabler in the development of robotics and automation solutions. Indeed the evolution of robots, from factory robots with zero autonomy to fully autonomous machines, is dependent on advances in AI. Artificial Intelligence is the enabling technology that allows a programmable machine (a traditional factory robot) to make sense of its dynamic surroundings and to respond in a sophisticated and sensible way, that is, AI is the autonomy-enabler.

The distinction between artificial intelligence (AI) and robotics is unclear in the public mind. AI systems are referred to colloquially as "bots", for example chatbots, shopbots, search engine crawler bots, scraper bots, spam bots, and a collective is a botnet (used for denial of service attacks).

A purer definition of AI is an ICT system (computer hardware and software) that receives input information from people, databases or the internet, transforms it in some way, and outputs new information to people, databases or the internet. All the "bots" mentioned above fit this definition. An AI system has no physical agency, it can effect change in the virtual world but not in the physical world.

Even the "father of robotics" Joseph Engelberger was unable to define what a robot is, and famously said "I can't define a robot, but I know one when I see one". Today, most definitions of robots mention "sensing, planning and acting". A robot senses its environment using sensors (cameras, lidars, radars, GPS) to gain information about where it is in the world, and where everything else in the world is. The robot uses that information, together with a goal, to plan some action. The action might be to move the tool of a robot manipulator arm to grasp an object, or it might be to drive a mobile robot to some place.

In human terms, we can think of AI as a pure brain, while a robot is a brain and a body, an AI plus a machine. For this reason, robotics is sometimes referred to as embodied AI. All robots contain AI, but not all AI is part of a robot. AI for robotics has some particular challenges: the brain must be small enough to fit inside the robot, it must not consume too much power, and it must plan quickly enough that the robot can be useful in the real world.

The overlap between AI and robotics is significant. Artificial intelligence techniques and algorithms are often used to develop the "intelligence" of robots. For example, machine learning algorithms can be used to teach a robot how to recognize objects or navigate through an environment. Natural language processing techniques can be used to enable robots to understand and respond to human commands. Computer vision algorithms can be used to enable robots to "see" and interact with their surroundings.

Moreover, robotics can also be seen as a testbed for AI techniques, as it allows researchers to experiment with their AI algorithms in real-world scenarios. The embodiment aspect of AI on robots is crucial because no matter how sophisticated the simulation or virtual testing environment, testing in the physical world always reveals often unexpected limitations and shortcomings of pure AI systems that can then be remedied to make them more robust, reliable and applicable. By building robots that can interact with their environment and perform tasks autonomously, researchers can test and refine their AI algorithms in a variety of scenarios and applications.

Together, robotics and AI have the potential to revolutionise many industries and transform the way we live and work.

The current definitions fail to recognise the opportunity and importance for Australia of creating sovereign artificial intelligence products in the robotics space, rather than simply applying them. For this reason we would suggest that a definition of artificial intelligence, as it relates to robotics, be added, as follows:

Artificial intelligence (AI) is a field of computer science and engineering that focuses on the development of intelligent machines that can perform tasks that typically require human intelligence, such as recognizing speech, understanding natural language, making decisions, and solving complex problems. Artificial Intelligence is critical for enabling robots and autonomous systems to interact with the physical world in intelligent and adaptive ways. By incorporating AI algorithms and techniques, robots can be programmed to navigate through complex environments, recognize objects, learn from experience, and adapt to changing situations.

Many AI companies in Australia may not be recognised as part of the robotics ecosystem because they do not produce hardware, although they directly contribute to the robotics companies that do produce hardware. Recognising this is important in designing policy interventions that will support the entire ecosystem.

Australia's Robotics Opportunity

Our vision is for Australia to be a global leader in robotics-related AI research and the development and adoption of trustworthy, secure and responsible AI-enabled robotic and automation solutions. To achieve this Australia must proactively engage with the technology and build a sovereign capability—that is, AI developed and owned here in Australia, which is inclusive, safe, secure and reliable.

Artificial intelligence is a disruptive technology that is transforming the global economy. It will impact every sector of Australian industry, challenge our national security, and test our democracy. The first movers in AI gain a disproportionate advantage, because of the importance of capturing and controlling the data that drives AI technology.

Modern robotics increasingly relies on artificial intelligence to interpret voluminous, complex data from sensors, to aid in autonomous decision-making, and to learn from both simulations and experience of the world. Robots are increasingly capable of autonomously doing useful work in the complex unstructured environments that we humans inhabit.

Countries and companies that have invested in high-level AI capability, data and computing infrastructure, have reaped enormous rewards, and have set the agenda for the quality and performance of the technology that we all now use. If Australia does not invest in the development of sovereign capability, we relinquish control of our technology to foreign commercial and national interests.

We believe that Australia has an opportunity to:

- create our own AI that services Australia's unique needs
- build the skilled workers and entrepreneurs required to build an AI-enabled robotics industry
- enable Australian businesses to be the early adopters and developers of AI and robotics, and gain a global trade advantage
- protect important national datasets of sovereign importance to create Australian value
- create sovereign AI capability for Australia's national security needs
- adopt the Australian principle of a 'fair go' for everyone through the production and use of our own AI-enabled robotics technology, that does not become exploitative.

Australia has a strength in both robotics and computer vision research that represent an opportunity for the nation. Australia has a particular opportunity in field robotics¹, a real-world testbed for innovative AI solutions.

¹ Is Australian Robotics Making a Comeback? 2023 Asian Robotics Review <https://asianroboticsreview.com/home645-html>

To measure the growth and success of AI-enabled robotics in Australia we should consider adopting firm targets (and measures), just as countries such as South Korea have done.

National Capability measures

- Develop AI/robotics as a key industry: expand our sovereign AI and robotics industry to be worth AUD 25 billion by 2026, and AUD 50 billion) by 2030
- Strengthen AI/robotics infrastructure: invest in AI/robotics infrastructure such as data centres, cloud computing, high-speed networks, rapid prototyping, high-fidelity experimental testbeds and environmental sensing infrastructure to support the development and deployment of AI/robotics technologies
- Support networks between research organisations, e.g., supporting Australian researchers to integrate into EU-ERC, NSF, JSPS funding.
- Also support stronger linkages between research and industry, and collaborate with other countries to promote the development and adoption of AI technologies that can be applied to robotics, and to reassert Australia as a global leader in this field
- AI and Robotics Venture Capital Investment of \$5b per annum by 2025, with Australia increasing its venture capital per capita to at least \$500 per person by 2030²
- Number of pure play Robotics companies 500 by 2027 and number of pure play AI companies 1,000 by 2027
- Number of Series A funding to robotics and AI start-ups, 5 robotics start-ups per year by 2025 and 10 AI start-ups per year by 2025
- Number of Robotics Unicorns 1 by 2025, 4 by 2027, 8 by 2032 and the number of AI Unicorns 2 by 2025, 8 by 2027, 16 by 2032, or develop a measure of # of companies above a value cap of \$200m and work to increase this number.
- 5% of Australia's largest tech companies be hardware/software companies with a further 10% of Australia's largest tech companies to be AI-led by 2030
- Increase in export value of AI/robotics to Australian economy by 30% by 2030 above current benchmark data
- Raise the level of Australian R&D as percentage of GDP to 3% by 2030, with dedicated investment in AI and robotics of \$50 million per annum by 2025
- Increased investment in commercialisation initiatives to develop AI and robotics solutions based on our world-leading research capabilities
- Reduce barriers to movement of people between academia and industry by encouraging industry professorships and addressing the superannuation penalty academics face to move into industry
- Map Australia's AI and robotics supply chain to identify where companies have access to Australian products, e.g., motors, semi-conductors, etc
- Proactive measures to encourage relevant multinationals to create clusters of AI and robotics activity in Australia, support the local ecosystem and develop a pipeline for graduates (beyond SMEs).
- Incentivise ex-pat Australians to invest back into Australian start-ups and to locate an R&D office in Australia to leverage the talent and skills located here.

² <https://news.crunchbase.com/startups/countries-most-startup-investment/>

Trust, Inclusions and Responsible Development and Use measures

- Increase trust in AI and Robotics to 90% across Australia by 2030 (as measured by sentiment analysis)
- Increase AI and Robotics literacy by 20% by 2030 compared to current levels (benchmarked according to understanding of what the technology is and how it is applied)

Skills and Diversity measures

- Train and educate 10,000 AI/robotics specialists by 2026, including researchers, engineers, technicians and entrepreneurs.
- Increase AI and Robotics graduates to 20,000 per year by 2026 and 40,000 per year by 2030 (as measured by graduates from relevant university degree programs)
- Develop an AI and Robotics Specialist Workforce of 100,000 by 2026 using mechanisms such as skilled migration (as measured by identification as specialist workers within the tech sector)
- Support upskilling with 20 high quality open online universally recognised AI and robotics courses and microcredentials by 2030
- Improve diversity of graduates and workforce to 30% women in technical roles by 2030 and with representative indigenous participation.

Adoption measures

- Increase uptake of AI/robotics by Australian companies to 30% by 2030 to be measured by ABS (like innovation)
- Industrial robot population density of 500 by 2030 to aid high value add manufacturing
- Develop a measure of Field and Service robot intensity and set a target based on benchmark data
- Increase in multifactor productivity in Australia to 2.5% by 2030 and 2.75% by 2040 attributable to AI-enabled robotics and automation initiatives.

National Capability

If properly incentivised and supported, Australia has the intellectual capability to support expanded AI-enabled robotics technology creation. AI and robotics research and development brings enormous opportunities, particularly in the creation of new tools that can help solve previously stubborn problems and deliver productivity gains across Australia's industries to the economic and social benefit of the wider community.

Australia has one of the lowest population densities in the world. We have an ageing population, highly concentrated in cities and then sparsely populated over enormous areas serviced. We are custodians of unique, megadiverse and fragile ecosystems; and we have a highly variable climate compared to other countries. These elements all create unique needs for AI and robotics technology that are best developed in-house by developing our own AI and robotics

capability in some key areas. We cannot simply rely on a few international technology giants to meet all of our requirements³⁴, indeed we may not wish to release nationally sensitive data to overseas companies. Some of Australia's unique AI opportunities include:

- deliver health and other services to regional areas cost-effectively and to the same standards as the services received in the cities
- transport minerals and goods over vast distances safely and cheaply
- optimise and maintain domestic control of Australia's food production in a fragile and unpredictable environment to achieve social, economic and environmental outcomes
- manage a highly distributed and complex energy supply system
- deliver housing services to fast growing cities and regional centres cost effectively and fairly
- provide an ageing population with safety, dignity and purpose
- support our first nations communities to thrive and protect their cultural heritage
- monitor for biosecurity threats to better protect our unique natural environment
- measure carbon at huge scale and low cost
- save billions of dollars of infrastructure losses due to climate change
- safeguard Australian lives, homes, businesses, plants and animals from bushfire, flood and other natural disasters
- protect the public from information warfare, our businesses from cybersecurity threats, and our defence forces from AI-enabled weapons systems
- deliver higher quality public services at reduced costs
- maintain sovereignty of Australia's large land mass and extensive coastline.

Australia has strengths in key fields of AI research relevant to robotics, including 'small data' AI, an important enabler of edge computing. Global AI giants like the United States and China are developing better AI by training it on enormous datasets, using powerful supercomputers and employing thousands of machine learning engineers. The results are impressive and have led to the creation of many billion-dollar companies. Australia does not have the human or financial resources to compete against this type of AI. But where we can compete is in designing AI systems from small datasets where large datasets cannot be collected, or where the resources to build 'big AI' are not available.

Small data AI requires research into the careful and clever use of mathematics and coding to achieve disproportionate performance with more limited resources. These systems can be trained accurately and efficiently on smaller datasets that better reflect the datasets that actually exist in the real world, and which robots are able to process in real-time. Small data AI requires greater responsible collaboration with humans to develop machines that learn faster, adapt quickly and interact much better with humans in the 'real world' than those systems built solely on data learning. As a fundamental capability these collaborative intelligence tools have the

³ [Government of Canada launches second phase of the Pan-Canadian Artificial Intelligence Strategy](#). Government of Canada. 22 June 2022

⁴ Panchanathan S. and Prabhakar A. (2023) [Strengthening and Democratizing the U.S. Artificial Intelligence Innovation Ecosystem: an implementation plan of the national artificial intelligence research resource](#). National Artificial Intelligence Research Resource Task Force.

potential to bring about enormous opportunities across a wide range of challenges and industries, and potentially enable AI to be applied to problems where insufficient data currently exists to train big AI.

In terms of AI research and development impact and output, Australia performs well internationally relative to its size. A Netherlands AI insights startup, Zeta Alpha, recently ranked countries by research and development impact for the last three years (number of papers in 100 most-cited papers per year 2020-23). On this measure Australia is ranked an impressive sixth place⁵. However, a close look at the numbers indicates that after the United Kingdom in third place, only a handful of publications separate Germany, Singapore, Australia, Canada, France, Switzerland and South Korea. The AI index report published by Stanford University shows Australia is ranked 15th in the world in terms of total number of peer-reviewed AI publications⁶, while the ASPI critical technology tracker ranks Australia 7th in Advanced Robotics publications and 6th in Autonomous Systems Operation technology⁷. Australia is typically one of the most over represented countries per capita in terms of publications at the top large international robotics conference including ICRA, IROS. Many of the robotics academics at Australian universities are highly ranked in international citation indices such as those produced by Stanford⁸.

One factor limiting Australia's ability to leverage its existing research strengths is the prohibitive cost of computational processing power. The United States, United Kingdom and Canada are seriously considering, or have made, large investments in sovereign computing infrastructure, as these nations recognise the benefits to the wider community of democratising the development of AI technology, rather than it being restricted to a small number of very large corporations.

While international private investment in AI has grown exponentially in recent years, private investment in Australia has only increased modestly; where we are now ranked ninth in the world in 2021, up from 11th for the period 2013 to 2021⁹. The risk is that with the dramatic increase in investment in many comparable nations, Australia will quickly fall behind.

Trust, inclusion and responsible development and use

For Australia to gain the full benefits of AI, it is important to ensure that the robotics and AI systems we develop are safe and trusted by the public and the people who are expected to rely on them. To achieve this, the development and adoption of robotics and AI systems must be responsible and aligned with ethical and human values. Australia was one of the first countries

⁵ Castella, S. (2023) [Must read: the 100 most cited AI papers in 2022](#). Zeta Alpha blog post. Accessed 6 March.

⁶ Zhang, D. *et al.*, (2021) "[The AI Index 2021 Annual Report](#)," AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford

⁷ Gaida, J, Wong-Leung, J., Robin, S., and Cave, D. (2023) ASPI's Critical Technology Tracker The global race for future power, <https://www.aspi.org.au/report/critical-technology-tracker>

⁸https://www.researchgate.net/publication/366646447_World's_Top_2_Most-cited_Scientists_by_Stanford_University_Ranking_2022_Scopus

⁹ Zhang, D. *et al.* (2022) "[The AI Index 2022 Annual Report](#)," AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford

to propose an AI ethics framework. Since then, a vibrant, responsible AI ecosystem is emerging in Australia, not only proactively reducing risks in both AI and robotics, but also turning responsible AI and related digital trust into a competitive advantage for Australian robotics and automation companies.

The performance of AI depends on the quality of the data on which it is trained. Google's search engine, for instance, is trained on billions of search queries and website clicks—it uses our search behaviour to train its algorithms. Companies that control robotic and AI systems end up learning a lot about the people that use them. Imagine if foreign companies (and governments) knew more about Australians and Australian businesses than we did ourselves. Imagine if we lost control of our agricultural and mining industries to foreign-controlled software &/or hardware, or that foreign companies knew more about our health than our own doctors and health system.

In areas where national interests need to be protected, we must insist on Australian owned robotics and AI for the core functioning of related digital systems and datasets. This is well-recognised by our Defence forces in their identification of robotics, autonomous systems and artificial intelligence as strategic industrial capability priorities¹⁰. For these sectors, we need to be the early developers and adopters, with government support and protection (e.g. healthcare built from our public health data).

Skills and Diversity

If properly incentivised and supported, Australia can increase the number of Australians with specialist AI and robotics skills. Australia currently is at risk of experiencing a significant shortfall in skilled AI workers by 2030. CSIRO's Data61 is estimating that Australia will need as many as 161,000 specialists¹¹ but there are currently no mechanisms in place to reach this number. University research and development is a key pathway for helping expand the talent pipeline for specialist skills in AI and robotics.

Without investment in skilling, reskilling and up-skilling of Australia's workforce, our ability to sustain a complex, prosperous economy, and sovereign control over key industry sectors, and our democracy are at risk. We are strongly of the view that we need a profound increase in skills development at all levels, including AI and robotics experts from the university sector, technicians trained in the VET sector; and to increase AI and robotics literacy across government, business and the community.

Our focus is on the development of the high-end AI and robotics skills that are needed to:

- provide the technology leaders required in government and industry
- support the development of unique Australian AI for all of the reasons listed above
- generate unique IP that can lead to a new class of business unicorns

¹⁰ Fact Sheet, Sovereign Industrial Capability Priorities
<https://www.defence.gov.au/sites/default/files/2021-09/Sovereign-Industrial-Capability-Priorities-Factsheet.pdf>

¹¹ Hajkowicz S.A., *et al.*, (2019) *Artificial intelligence: Solving problems, growing the economy and improving our quality of life*. CSIRO Data61, Australia

- feed the startup community with technical experts and leaders.

It's no accident that industry clusters form around universities that have leading expertise in particular areas. Silicon Valley could not exist without Stanford University. Pittsburgh Robotics Cluster recently received USD\$62m to enhance the robotics cluster it forms around Carnegie Mellon University (CMU)¹² - with more than 100 robotics companies in the region¹³, and a robotics factory to help create, accelerate and scale the development of robotics start-ups. MassRobotics¹⁴, the Boston robotics cluster, would not exist without close proximity to the robotics research being done by MIT and Harvard, which has attracted the location of Amazon Robotics to the region¹⁵.

Australia cannot hope to build a world-class AI sector that can solve Australian challenges and protect Australian sovereignty and jobs without a vibrant and productive research effort. It is the PhD students and postdoctoral fellows who lead the growth of advanced technology industries. The field of machine learning and artificial intelligence is advancing at a rate even the experts struggle to keep up with. It is only by building deep understanding in the core and emerging technology areas and leveraging its 'fair go' principles and trust-enhancing technologies that Australia can hope to maintain any sort of advantage in this rapidly growing, and fast developing field. We need investment in core research and postgraduate skills development at between two and ten times the current rate to match investment by global peers. And we need to invest in targeted areas where we can maintain global leadership, and which match Australia's needs. These sentiments are echoed by the Australian Academy of Technology and Engineering in its statement, Strategic Investment in Australia's Artificial Intelligence Capability, in July 2022.

An important component of building is also retaining. The Kingston AI Group support current government reforms to the skilled migration program that would make it easier for highly skilled AI and robotics workers to obtain visas and residency to Australia¹⁶. Anecdotally we know that more than 50% of Australian postgraduates in AI and robotics leave Australia for overseas to access better opportunities. There are no large companies in Australia for graduates to join with the scale of US-based companies like Google, Amazon and Meta. Major global robotics companies like Softbank, ABB, Kuka and Fanuc only locate their sales arms in Australia, which does little to contribute to the development of a sustainable local AI and robotics ecosystem. In addition, many of our start-up AI and robotics companies seek funding overseas and incorporate in other countries, further reducing opportunities for a suitably qualified workforce to gain hands-on experience in these fields. There are currently no mechanisms in place to ensure that overseas companies founded by Australians have an incentive to maintain their local connections, create offices in Australia and contribute to building the ecosystem here.

¹² <https://nextpittsburgh.com/latest-news/pittsburgh-region-granted-62-7-million-to-grow-the-robotics-industry/>

¹³ <https://robopgh.org/cluster-profile/>

¹⁴ <https://www.roboticsfactory.org/>

¹⁵ <https://www.massrobotics.org/>

¹⁶ A Migration System for a More Prosperous and Secure Australia Outline of the Government's Migration Strategy, April 2023

A major strategic investment to build (and retain) our AI and robotics workforce Australia will result in Australia becoming one of the leading countries in AI and robotics, and that would:

- stimulate productivity across the economy, and support wage growth
- improve Australia's economic complexity
- address the skills shortage facing some of our key industries and sectors
- transform how we manage our energy systems for the 21st century
- assist in faster and cheaper adaptation to the effects of climate change
- bring improvement in food security, and dramatic improvements in public health
- ensure greater sovereign security and protection

Some members of the Kingston AI Professors Group have contributed to the *Women in Robotics* submission on the topic of diversity and we endorse the recommendations in that submission.

Increasing adoption

Artificial intelligence (AI) and robotics are transformative technologies that are impacting virtually every sector of the global economy, helping solve previously intractable problems, and delivering dramatic improvements to the safety and productivity of industries. Globally, AI, robotics and automation is supporting workers to become more productive. It has shifted human work effort from more repetitive, dangerous and low-paid tasks, to more creative, safe, interesting and higher paying work that is more suited to a highly diverse workforce.

Without our own home-grown expertise in the design and delivery of high quality AI and robotics systems, it will be very difficult for Australia to assess AI and robotics systems that are purchased from international vendors, or develop technically informed guidelines and standards for robotics and robotics-related technologies. We need to have our own home-grown technical expertise to draw upon to inform our understanding of the technologies we are buying, its sovereign risks, and how we should regulate it and further adapt it.

The increased contribution to the global economy by 2030 from AI is estimated by PwC at USD\$16 trillion¹⁷ and McKinsey & Company at USD\$13 trillion¹⁸. No other new technology shows this level of promise, but the benefits will be gained disproportionately by the early adopters. In addition, as the world becomes more unstable geopolitically, the group agreed with

¹⁷ PricewaterhouseCoopers, *PWC's Global Artificial Intelligence Study: Sizing the prize*, PwC. Available at:

<https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html>

¹⁸ Bughin, J. et al. (2018) *Notes from the AI Frontier: Modeling the Impact of AI on the World Economy*, McKinsey & Company. McKinsey Global Institute. Available at:

<https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy>

multiple reviews¹⁹, which have identified that to make Australia safe and secure, AI is absolutely critical for protecting Australia from cybersecurity attacks, biosecurity risks, technology supply chain disruptions and asymmetric conflict wherein Australia will be the weaker combatant. AI and autonomy is one of the four initial capabilities to be developed under the AUKUS alliance.

To grow Australia's advanced manufacturing capability and create jobs for future generations and improve Australia's economic complexity, AI is driving a new wave of robotics and automation of systems and processes across the economy. In the United States there is an active movement to reshore manufacturing through robotics. The US Reshoring Initiative 1H 2022 report estimates that 1.6 million jobs have returned to the country by reshoring and inward-bound foreign direct investment since 2010²⁰. While the leading factors driving this activity since the Covid-19 pandemic have been supply chain gaps and a growing need for greater self-sufficiency, automation-driven increases in domestic productivity have been among the leading factors every year since 2010. In Germany, manufacturers were found to deploy three times more robots than US companies, but still employ more people. Relative to the size of its economy, the German manufacturing workforce is twice that of the United States²¹.

Automation increases the size of the workforce, rather than decreasing it, as human creativity and productivity is unleashed within organisations²². **The National Robotics Strategy is the opportunity for Australia to develop and promote AI-enabled robotics as a tool to kick-start productivity increases across all sectors of the economy, and create more and better jobs for all Australians.**

¹⁹ Moy, G. et al. (2020) *Recent advances in artificial intelligence and their impact on Defence*, Defence Science and Technology Group. Department of Defence. Available at: <https://www.dst.defence.gov.au/publication/recent-advances-artificial-intelligence-and-their-impact-defence>

²⁰ Moser, H. & Kelley, M. (2022) *Reshoring Initiative 1H 2022 Data report*. Reshoring Initiative.

²¹ Graetz, G. & Michaels, G. (2018) *Robots at work*. The Review of Economics and Statistics. 100(5):753-768

²² Taylor, C. et al. (2019) *Australia's automation opportunity: Reigniting productivity and inclusive income growth*, McKinsey & Company. Available at: <https://www.mckinsey.com/featured-insights/future-of-work/australias-automation-opportunity-reigniting-productivity-and-inclusive-income-growth>

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