Senate Inquiry into the Australian Manufacturing Industry

Cooperative Research Centres Association

30 August

The Cooperative Research Centres Association acknowledges the traditional custodians of the land on which we operate, the Ngunnawal people. We also acknowledge the traditional custodians of the various lands across Australia upon which Cooperative Research Centres operate.

We pay our respects to Elders past, present and emerging and celebrate the diversity of Aboriginal peoples and their ongoing cultures and connections to our lands and waters.

For further enquiries contact:
Jane O'Dwyer
Chief Executive Officer
[redacted]

The Cooperative Research Centres (CRC) Association welcomes the opportunity to comment on the Senate Inquiry into the Australian Manufacturing Industry

The CRC Association represents CRCs and CRC-Ps, research institutes, post-CRC entities, and associated businesses. Our 24 CRC members represent an estimated $4 billion in collective co-investment into innovation and commercialisation by industry, research institutions, and the Australian Government.

Our members form a lynchpin in the Australian innovation system and are focused on creating new products, industries, and value in our economy for the benefit of all Australians.

This submission proposes two key policy initiatives to transform the Australian manufacturing industry through greater investment in research and development and collaboration with industry.

- **Recommendation 1:** tap into Australia's latent potential by scaling up collaborative research through the CRC model and like-programs to increase sovereign manufacturing capability.
- **Recommendation 2:** invest in an industry-ready workforce and create jobs for the future by establishing an Industrial PhD program to build on existing programs and internships to give students experience in working on industry-identified problems.

The role of CRCs and collaborative research in driving innovation

The future role of collaborative research in driving innovation in the Australian economy cannot be understated. Australia's industry is not characterised by a high proportion of research-intensive businesses, and collaboration between public research institutions and industry has not yet reached its full potential.

The 2013 OECD Science, Technology and Industry Scoreboard ranked Australia last out of the thirty-three countries surveyed in firms' collaboration with the higher education/public research institutions, with equal weighting between SMEs and large firms.

We will have succeeded in transformation when a greater proportion of Australian businesses are willing and able to take calculated risks, investing in R&D and collaboration with research institutions as a core business activity. This requires exposure to and trust with research institutions.

The Cooperative Research Centres Program (CRC Program) was established 30 years ago to increase Australia's global competitiveness and de-risk companies investing in research. It is an Australian success story and is looked to internationally[1] as an exemplar to foster medium to longer-term collaborative research between industry, the research sector, and end-users, and forms one of the key pillars in the Australian innovation system.

[1] Growth through Innovation and Collaboration – A review of the Cooperative Research Centres Programme

It is the most tried and tested program in the Federal Government's innovation toolkit.

The CRC Program is a whole-of-government program that has been generating impact in the sectors of Mining and Infrastructure, Information and Technology, Agriculture, Environment, and Manufacturing[2]. CRCs are unique in that they cover the full spectrum from fundamental to applied research, making them an effective vehicle to address market failure and complex issues of national importance.

CRC-Projects (CRC-P) grants are for short-term, industry-led research collaborations on a project basis and were implemented to encourage small to medium enterprise (SME) participation and collaboration in the CRC Program.

The success of the CRC model has inspired like-programs both domestically and internationally. Eight Drought Resilience Innovation Hubs were announced by the Minister for Agriculture and Northern Australia on 19th April 2021 with $66 million in Commonwealth investment. This forms part of the government's $5 billion Future Drought Fund. Like CRCs, these hubs will also leverage considerable co-investment from partner organisations.

The British Catapult Network was also inspired by the CRC Program. Set up in 2011 by the UK's Innovation Agency, Innovate UK, they foster collaboration between industry, government, research organisations, academia, and others.[3] There are now nine centres that form part of the network and range from Cell and Gene Therapy to Satellite Applications. One of the key centres in the network is the centre for High Value Manufacturing which is made up of seven innovation and technology centres and companies.

The Defence Materials Technology Centre (DMTC) which was set up in 2008 under the Defence Future Capability Technology fund[4] to deliver manufacturing solutions to enhance Australia's defense capability, used the CRC model and was administered by the CRC Program. Likewise, the Trusted Autonomous Systems Defence CRC (DCRC) was established under the Next Generation Technology Fund [5] to develop and deliver world-leading autonomous and robot technologies. Like DMTC, it also leverages the model and was administered by the CRC Program.

Variations of the model and the cultural change it has fostered can be seen in the many post-CRC entities, including commercial spinoffs. Examples of this include:

- Plantic Technologies is a for-profit company set up to commercialise the IP from the CRC for International Food Manufacture and Packaging Science. Plantic is now a world-leading innovator in high barrier bioplastics and produces recycled plastic for Coles and other companies.

[2] Round 23 grant opportunity guidelines
[3] https://catapult.org.uk/wp-content/uploads/2020/12/Catapult-Network-Impact-Brochure-2020-FINAL.pdf
[4] https://www.dmtc.com.au/about/about-dmtc/
[5] First Defence Cooperative Research Centre launched | DST

- The RoZetta Institute is the post CRC entity of the CRC for Capital Markets and delivers ground-breaking industrial research in a range of global market contexts. The Capital Market CRC was responsible for developing the SMARTs fraud detection technology that was then sold to NASAQ and is used in many exchanges around the world.
- GroundProbe was set up to commercialise the technology out of the CRC for Signal and Information Processing and developed a slope detection radar used in mining to detect falling rocks. GroundProbe was sold to Orica in 2017 for $205m.

CRC bids are industry and end-user-driven and are formed through consortiums between industry and the research sector in an area where there is industry demand, market failure, and excellence in research capacity. On average, 50% of the bids that are received in Stage 1 consideration progress to Stage 2, and of those, on average 50% are then funded.

Generally, the other 50% are not funded, not because of a lack of quality but because of a lack of funding. The unsuccessful bids in stage 2 tell us where great potential lays in the Australian landscape, where business interests and ambition meet research expertise and talent. Australia has world-class research and there is no shortage of potential.

The CRC program has a proven track record and is well understood within the Australian innovation ecosystem for its capacity to generate significant leverage from Commonwealth investment. However, it does not operate on the scale of programs overseas such as the Catapult Network. We propose scaling up that impact by boosting the program.

A scale comparison of CRCs to international programs

CRC Program

The Australian Government's spend on the CRC Program over the last decade has been on average approximately $160 million or 1.6% of Australia's total spend on research and development during that time, yet it continues to deliver return on investments that exceeds its cost three to one. [6]

The German Fraunhofer Institutes

The German Fraunhofer Institutes were funded in 1949 to carry out applied research and development for the benefit of industry and society. There are now 70 institutes in operation, and it employs over 29,000 people in Germany. In 2020, the base funding from the German government was approximately $1.3 billion and this was further backed by $1.4 billion and $1.0 billion of revenue from public-funded projects and industrial revenue. This equates to approximately $3.9 billion in funding. [7]

[6] Science, Research and Innovation (SRI) Budget Tables | Department of Industry, Science, Energy and Resources
[7] https://www.fraunhofer.de/content/dam/zv/en/Publications/fraunhofer-annual-report-2020_web.pdf

The Japanese Moonshot Research Program

The Moonshot Research Program was launched in 2019 to fund and promote promotes high-risk, high-impact R&D aiming to achieve ambitious Moonshot Goals and solve issues facing future society such as super-aging populations and global warming. $1.25 billion dollars was allocated as seed money over a 5-year period. [8]

The British Catapult Network

Set up in 2011 by the UK's Innovation Agency, Innovate UK, they foster collaboration between industry, government, research organisations, academia, and others. [9] There are now nine centres that form part of the network and range from Cell and Gene Therapy to Satellite Applications. These centres have directed over $4.7 billion of public and private sector investment since 2011. [10]

Recommendations 1

Tap into Australia's latent potential by scaling collaborative research through the CRC model and like-programs to increase sovereign manufacturing capability.

The Impact of CRCs

The most recent published impact assessment of the CRC Program, undertaken by Allen Consulting in 2012, conservatively estimated that by 2017 the program would have contributed:

- $14.5 billion in direct economic impacts from CRC produced technologies, products, and processes; and
- a net benefit to the economy of around 0.03 percentage points of additional GDP growth per annum since 1992.

A new impact assessment of the CRC Program is being conducted by ACIL Allen and the outcomes are expected in the near future. We expect the impact will have grown considerably.

Since the inception of the CRC Program in 1991, 14 CRCs have been funded with the direct remit of solving Australia's manufacturing problems. These include the Rail Manufacturing CRC, CRC for Advanced Composite Structures, CRC for International Food Manufacture and Packaging Science, and the Innovative Manufacturing CRC.

These CRCs have had considerable ongoing impact and have contributed to developing, maintaining, and promoting sovereign manufacturing capability in Australia. Countless other CRCs have also tangentially contributed through their research and sectors such as mining and infrastructure for example.

[8] https://www.jst.go.jp/moonshot/en/

[9] https://catapult.org.uk/wp-content/uploads/2020/12/Catapult-Network-Impact-Brochure-2020-FINAL.pdf

[10] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/975595/catapult-network-review-april-2021.pdf

CRC-Projects

The CRC-Projects (CRC-P) were implemented in 2016 after the 2015 Miles Review of the CRC Program [11] to engage better with small to medium enterprises (SMEs) on a project basis. CRC-Ps focus on research that is further along the technology readiness level and is closer to commercialisation. This often involves manufacturing, prototyping, and bringing products to market.

The CRC Projects have been effectively used to address government priorities in the areas of plastic waste and recycling, artificial intelligence, critical material, and funds were allocated from the Advanced Manufacturing Fund in Round 5 of CRCs to fund CRC-Ps with a manufacturing focus.

Since the CRC-Ps began in 2016, 49 CRC-Ps (approximatley 75% of all CRC-Ps), have been funded with a focus on manufacturing and many others have involved manufacturing in some capacity.

How CRCs and collaborative research contribute to an industry-ready workforce

A common thread across CRCs has been their education and training programs, which builds research and development capacity within industry. According to the Department of Industry, Science, Energy, and Resources, over 4,000 PhD graduates have been supported by the CRC Program over its lifetime and over 121,000 industry and research publications have been produced.

While CRC education and training programs typically support PhDs, there is an increasing focus on vocational skills and training.

- The Innovative Manufacturing CRC has successfully designed and deployed its proprietary futuremap® platform to the leaders and owners of more than 600 manufacturing SMEs as part of a manufacturing education and awareness raising program.
- The Future Battery CRC is planning to graduate 40 higher degree research and undergraduate students and is also working closely with South Metropolitan TAFE in Perth, to ensure future workforce capability need and skills are met.
- Building 4.0 CRC is working closely with the VET and university sector to address current skill shortages and address new skill demand in the building industry.

[11] Growth through innovation and collaboration – Review of the CRC Program https://business.gov.au/-/media/grants-and-programs/crc/cooperative-research-centres-miles-review-growth-through-innovation-and-collaboration-pdf.

Investment in Industrial PhDs puts industry at the heart of the government's scientific agenda. The CRC Association support the creation of a PhD program that requires candidates to spend most of their PhD undertaking research for an industrial organisation partnered with their university.

This produces commercially applicable research, gives industry an ability to co-create research education that meets their needs, and creates a highly skilled, industry-ready workforce. We further propose that a new Industrial PhD scheme be established under the Research Training Program (RTP) that extends some RTP scholarships to industry who are partnered with a university for PhD programs where students spend most of their time in industry.

Recommendation 2

Invest in an industry-ready workforce and jobs for the future by establishing an Industrial PhD program that goes beyond internships to ensure students are based in industry or a CRC for most of their program.

How do CRCs and collaborative research align to the National Manufacturing Priorities?

The CRC Program is well-positioned to address the National Manufacturing Priorities and build sovereign capability in Australia. CRCs and CRC-Ps are already working effectively and generating impact in each key priority area and have had a rich history of addressing complex issues in these priorities over the Program's 30 years.

CRCs effectively foster collaboration between industry, the research sector, and end-users to transform the industries and sectors they operate in. The Collaboration and Translation stream of the Modern Manufacturing Initiative is effectively encompassed in the CRC Program model.

Some impacts and activities across the Modern Manufacturing Priorities

- The Innovative Manufacturing CRC manages a $225m investment into manufacturing R&D and innovation, that sees around 70% of all projects and research aligning with the Modern Manufacturing Priorities, despite the CRC commencing projects in 2016.

Resources Technology & Critical Minerals Processing

- The CRC for Deep Exploration Technology CRC developed a coiled tubing drill rig for mineral exploration that uses a continuous spool rather than individual segments. Coupled with their lab at rig technology, this can increase safety and significantly reduce the cost of exploration.
- The Energy Pipeline CRC developed advanced materials, coatings, welding techniques to deliver safer, more efficient, and reliable pipelines for the industry.

Food & Beverage

- The Fight Food Waste CRC is working with nutraceutical manufacturers to turn waste wine into products.
- The research from the CRC for International Food Manufacture and Packaging Science was spun off into a company called Plantic.

Medical Products

- The Vision CRC developed extended wear soft contact lenses, first commercialised as the Focus® Night & Day™ lens, which has generated over US$20 million a year in patent royalties.
- Over half the hearing aids on earth are fitted using technology from the Hearing CRC, which is licensed to all major international hearing aid companies. The CRC is also working with colleagues in China to improve how cochlear implants convey tonal languages.

Recycling & Clean Energy

- CRC CARE developed matCARE™ a modified clay that can clean up toxic such as PFAS found in firefighting foams.

Defense

- The Defence Materials Technology Centre (DMTC) was established in 2008 under the Defence Future Capability Technology fund to deliver manufacturing solutions to enhance Australia's defense capability. DMTC was administered by the CRC Program and used the CRC model, structure, and reporting requirements. The CRC developed Boron Carbide body armor in collaboration with Australian Defence Apparel.
- The Trusted Autonomous Systems Defence CRC (DCRC) was established under the Next Generation Technology Fund to develop and deliver world-leading autonomous and robot technologies. Like DMTC, it is administered by the CRC Program and uses the same model, structure, and reporting as a CRC.

Space

- The CRC for Space Environment Management designed and constructed three adaptive optic systems to generate high-resolution images to categorise and track space debris.
- The SmartSat CRC is working to develop and manufacture next-generation and advanced satellite systems and sensors.

Other sectors of manufacturing excellence

- Australia has world-leading expertise when welding together composite materials. Much of this expertise was developed and refined through the CRC for Advanced Composite Structures. The CRC collaborated with Boeing to develop the trailing edge of the 787 Dreamliner which resulted in a $4 billion contract over 25 years which is made in Melbourne.
- The CRC-Project run by Sleeptite developed integrated and unobtrusive micro-sensors into bedding materials to monitor patients in age care facilities. Their core product REMi, will assist with response times, helping carers prioritise their time and

assure facility owner's that best practice personalised care is always provided while the resident is safe and receiving a good night's rest.

SmartSat CRC – a case study on the Australian Space Industry

The Australian Manufacturing industry should play a critical part in the growth of the domestic space industry and supply chain. Our precision manufacturing and high-quality standards make Australia an ideal place for building, integrating, testing and assembly of space component/systems (and other specialised components such as in the medical industry).

One of the main issues is that the Australian market is limited and not sufficiently large to enable scale growth and hence the business case and ROI is a hard one to balance. Our products need to have export opportunities to enable growth. This will be tough given the low-cost manufacturing capabilities of our international friends, and this is where the Government needs to support the industry (i.e. through export opportunities; showcases; support the capital cost of growth; encourage domestically manufactured goods over imported goods, etc).

Government procurement policy (one of the specific issues raised in the inquiry terms of reference) is critical. Globally, space manufacturing is seen by most advanced nations as a strategic security capability meaning international trade is heavily distorted by protection. If Australia seeks to develop a self-sustaining space sector, including the ability to manufacture, we must take the same perspective and ensure Australian companies are not disadvantaged in government procurement due to subsidies provide by other nations.
We have strengths in materials science and some elements of precision manufacturing (e.g. optics) and cannot take this for granted. R&D investment is critical to provide challenges for science and engineering experts to maintain world leading capabilities.

There are a range of specialist facilities critical to the spacecraft manufacturing process that would probably struggle to attract investment from commercial entities without long term funding commitments from large organisations (e.g. government). These include testing facilities, integration facilities (e.g. to assembly complex structures such as antenna systems) and EMC/radiation facilities. Australia has an opportunity to become competitive in the design, manufacture and launch of small satellites (not cubesats but 150 – 400kg satellite but needs seed funding to build the infrastructure for this purpose. As an example, Oneweb/Airbus build a custom facility in Florida to mass produce One Web satellite for less than $100m. Within a multi-billion dollar program, this is easy to justify but much more challenging for the ad-hoc way capabilities are acquired in Australia. This is an example of where scale destroys competitive advantage because without access to these capabilities, Australia will struggle to win a contract to supply high-end systems to the global market.

Space is inherently 'heritage driven', so Australia must build that experience. Tapping into an international export market will help with volume, provided we can offer some value

(technical, financial, etc). However, spacecraft are inherently specialized and even off-the-shelf satellite buses undergo some degree of customisation for each user which results in longer schedules.

The 2030 Space and Spatial Industry Growth Roadmap is exploring in detail point a. in the terms of reference but is not yet able to provide meaningful input to this inquiry. A short discussion piece developed within a consultation paper on space manufacturing can be found at https://2030spaceandspatial.com/5-11/

The implication of Industry 4.0 for the construction industry: towards smart prefab

The Australian construction industry has faced severe challenges over the past two decades. Spiralling costs of building materials and construction have made housing less affordable. Productivity, sustainability, health and wellbeing, and safety imperatives, together with the market-wide expectation for high-quality design, have further challenged traditional construction.

Advanced manufacturing of prefabricated housing is a viable alternative. The building industry in Australia has recognised the productivity and efficiency gains that advanced manufacturing and Industry 4.0 techniques can offer.

Advanced Manufacturing Growth Centre (AMGC) is engaging with Building 4.0 CRC to develop a roadmap for Smart Prefab and Industry 4.0 for the broader Australian building industry. The project will effectively bring together leading companies and research organisations to develop the pathway for the growth of prefab buildings in Australia, and the adoption of the Industry 4.0 approach.

Prefab Housing Solutions for Bushfire & Disaster Relief

This project aims to develop prefab housing designs that are fire safety compliant and resilient to different natural hazards, low cost and sustainable for both temporary and long-term accommodation.

The team will bring together the leading experts in the field to develop prefab housing solutions for bushfire & disaster relief in Australia and to provide recommendations and strategies for improving disaster preparedness.

A coordinated approach by the AMGC Prefab Innovation Hub will be used, and the research team will work closely with the other projects on Sustainability and DfMA.

The outcome will also contribute to lowering the carbon footprint of housing in Australia and improving the resilience of building industry against natural hazards.