

Policy Brief

Collaboration in the Australian Quantum Ecosystem

Enablers and blockers of effective collaboration

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Executive summary

This policy brief draws on research funded by an Australian Academy of Law Research Grant 2025. This scoping analysis of collaboration was undertaken in the context of the 2025 Strategic Examination of Research and Development (SERD) and the 2024 reforms of the *Defence Trade Controls Act 2012* (Cth) (DTCA). The research finds that in research and development contexts the concept of collaboration is repeatedly used. It frequently frames discussions and drives research priorities. Yet, the concept of collaboration is regularly left undefined. Collaboration is integral to research and innovation for new and emerging technologies. Leaving collaboration undefined, especially when communicating about research security frameworks, risks causing confusion and misunderstandings about the nature of scientific research, who may work with whom, and when collaboration might drift into criminal conduct under Australia's export control regime and foreign interference laws. The research also identifies potential blockers and enablers of collaboration as expressed by a subset of submitters who made submissions to both the SERD and DTCA reviews. The research will be used to inform future work on the theoretical and practical definitions of collaboration and to enquire into how evolving national and international research security frameworks might block and enable effective collaboration in the Australian quantum ecosystem.

Key points



Quantum technology is listed as a critical technology in the national interest and is subject to dual-use regulation under Australia's export controls regime. Collaboration is a key component of the success of Australia's quantum technology research and innovation.



Collaboration is a foundational concept in research and development. This research identifies finds that collaboration requires more nuanced and precise definition in policy and guidelines, especially as research security frameworks continue to evolve.



Research security is an evolving body of law and policy. Countries around the world are revising and refreshing their research security posture beyond export controls to manage strategic threats and geopolitical uncertainty.



Legal frameworks are central for determining the nature and scope of research relationships around critical and dual-use technologies. Legal frameworks operate as potential blockers and enablers of collaboration in research and innovation.

Context: the Australian quantum technology ecosystem

Australia's quantum ecosystem is strategically important and built on over 2 decades of collaboration across universities, industry and government.³

According to the State of Quantum in Australia report published in November 2024, the Australian quantum ecosystem is comprised of:

- 26 organisations pursuing quantum research and development, including 16 universities, 4 government research agencies and 6 Australian Research Council Centres of Excellence.⁴
- There are over 50 facilities and laboratories, approximately 38 quantum businesses and several multi-million-dollar public-private investments in Australian and international quantum start-ups⁵.

Quantum technologies are listed⁶ as critical technologies in the national interest, and they appear on the Defence Strategic Goods List.⁷

Defining collaboration

Collaboration is essential for the discovery and commercialisation of new and emerging technologies, such as quantum technology. Many technologies are constrained by research security legal frameworks, such as the export controls regime and foreign interference laws because of their status as dual-use goods.⁸

Collaboration is often defined in academic literature as co-authorship or co-publication.⁹ However, collaboration is a nuanced and paradoxical concept that entails much more than mere authorship counting. It includes mentoring, shared space, formal and informal exchange and international mobility.¹⁰ Other studies have demonstrated that collaboration can accelerate transformative research, cross-disciplinary problem solving, skills formation and commercialisation of research.¹¹

The Organisation for Economic Cooperation and Development (OECD) views collaboration as essential to basic research, which is facilitated by the exchange and mobility of researchers to advance knowledge.¹² At its simplest:

- Collaboration is a way of working together to address a shared problem.¹³
- It is a form of organisation or arrangement that can achieve a collective outcome.¹⁴

What is missing from the Australian conversation is a deeper, nuanced scrutiny of what is meant by collaboration, especially in the context of strategic dual-use and critical technologies research and development, and how research security frameworks, such as the export controls and the foreign interference regime¹⁵, are impacting collaboration.

Collaboration is a paradox

Collaboration in both theory and practice is a paradoxical concept. At best, it encapsulates the spirit and practice of open research. At worst, it means treasonous cooperation with an adversary¹⁶ and risks enlivening offences under espionage and foreign interference laws.¹⁷

International collaboration underpins the global quantum technology ecosystem but is increasingly shaped and impacted by geopolitics and research security policies worldwide.¹⁸

The link between critical technologies, national security and research security is an active and evolving conversation between academics, industry and government in many countries.¹⁹

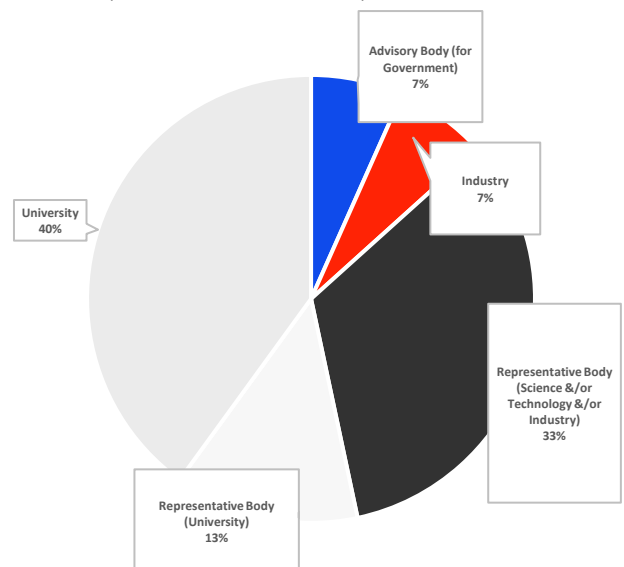
The result is that collaboration can mean both essential cooperative scientific work and prohibited cooperation with adversaries.

For these reasons, the definition of collaboration matters beyond mere authorship counts or formal contractual relationships.

Research and development versus export controls

The preliminary analysis of collaboration in the context of the Strategic Examination of Research and Development (SERD) and the *Defence Trade Controls Act 2012* (Cth) (DTCA) reforms of 2024 provided an indication of how stakeholders talked about collaboration in the context of research and development on the one hand and export controls on the other.

FIGURE 1: TYPE OF ORGANIZATION THAT SUBMITTED TO BOTH SERD AND DTCA (COUNT OF 15 SUBMISSIONS)



Strategic Examination of Research and Development (SERD)

Collaboration was a centerpiece of the recent Strategic Examination of Research and Development (SERD), which, among other things, enquired into the blockers of effective collaboration.²⁰

SERD published its discussion paper findings and analysis in July 2025. The SERD panel delivered its report with recommendations to government at the end of 2025.²¹

Collaboration was identified as a key theme in submissions but was mostly left undefined.

Partnerships between universities and industry were seen as crucial to fostering cultures of collaboration and innovation.²²

Submissions suggested, among other things, the creation of a 'national innovation collaboration compact' to strengthen partnerships.²³

SERD submitters prioritised system level review that prioritises collaboration, research translation and structural reforms, including physical co-location and research 'precincts'.²⁴

Enablers and blockers of collaboration were also identified.

SERD submissions subset summary: Enablers and Blockers of Collaboration included:

Enablers	Blockers
Secondments	Funding complexity
Dual appointments	Fragmented processes
Funding for collaboration	Complex intellectual property negotiations
National facilities access	Visa and immigration restrictions
International collaboration opportunities	

Reform of Defence Trade Controls Act 2012 (Cth) in 2024

DTCA is an operational export control regime governing tangible and intangible supplies of DSGT technologies, comprising a permit scheme, exemption framework and offence provisions.²⁵

The DTCA is part of the defence export controls legislative framework that is comprised of the *Customs Act 1901* (Cth) and Customs (Prohibited Exports) Regulation 1958, the *Weapons of Mass Destruction (Prevention of Proliferation) Act 1995* (Cth).

The DTCA controls the support, publication and brokering of tangible and intangible goods and technology listed on the Defence Strategic Goods List (DSGL).²⁶ It contains criminal offences for the supply of goods, software and technology, and the provision of certain services without a permit.²⁷ It also establishes the permit regime for certain activities and entities.²⁸

Fundamental research is a key enabler of collaboration under the export controls regime. The DTCA exempts 'basic

or applied' research from the export controls regime where the results are intended for public disclosure or would ordinarily be published or shared broadly. However, the results must not be subject to any restrictions on disclosure (however imposed) for purposes connected with the security or defence of Australia or any foreign country.²⁹

The definition of fundamental research was enacted in the DTCA as part of the 2024 reform process after extensive consultation. Many submitters were concerned that a narrow definition of fundamental research would expose researchers, including those outside science and engineering, to liability and impede collaboration.³⁰

In 2021, Australia, along with the United Kingdom and the United States entered the AUKUS arrangements.³¹ Part of the AUKUS arrangements involved changes to the export control regimes of the three countries to 'enable collaboration at the speed and scale required' to meet the challenging and evolving geopolitical environment.³²

In 2024, following the Defence Strategic Review 2023, Australia began its reform of the export control framework. The UK and the US followed suit and implemented a licence-free environment under the auspices of the AUKUS partnership.

The Group of Eight Australia noted that the exemption for fundamental research was "[T]he single most important factor that will impact the ongoing effectiveness and operation of Australia's research and higher education sector, and, in turn, our capacity to advance the outcomes of the AUKUS partnership."³³

DTCA submissions subset summary: blockers and enablers of collaboration in the export controls framework reform process:

Enablers	Blockers
Statutory exemptions for fundamental research	Legal ambiguity
Expanded Foreign Countries List	Narrow Foreign Country List
Streamlined permit system	Administrative burden of compliance
Proportional liability	Extensive permit regime
Detailed guidance for researchers and industry participants	Harsh penalties for non-compliance

International collaboration

The Department of Industry, Science and Resources of the Australian Government describes Australia as a country 'recognised as a global quantum leader' and the National Quantum Strategy of Australia envisions Australia to be the 'leader of the global quantum industry in 2030'.³⁴ The importance of international collaboration in the quantum ecosystem cannot be overstated. In July 2024, the Quad Investors Network (QUIN) committed to increasing collaboration in the quantum ecosystem at all levels among the Quad nations of Australia, India, Japan and the United States.³⁵

However, international collaboration is under pressure from evolving research security frameworks in the context of global geopolitical uncertainty.³⁶ To begin understanding these pressures, this research reviewed international

collaboration from the perspective of SERD and DTCA submitters.

Joint submitters to both SERD and DTCA raised formal collaboration as a means of building research collaborations nationally and internationally.³⁷

At the national level, industry-university partnerships were favoured in both the SERD and DCTA reviews.³⁸

- SERD submitters advocated leveraging global collaboration through diversification of both sources of funding and collaboration, such as Horizon Europe, seeking opportunities to embed multilateral research programs and better deployment of Commonwealth foreign relations capability for research.³⁹
- In its SERD submission, Group of Eight Australia⁴⁰ recommended that Australia pursues an association with Horizon Europe and its successor from 2028, the European Union's Framework Programme for Research and Innovation (FP10).⁴¹
- In its submissions to SERD and DCTA, the University of Sydney recommended that international research consortia and collaborations should be facilitated.⁴²

International collaboration case study: Quantum Economic Development Consortium (QED-C)

In the United States, the Quantum Economic Development Corporation (QED-C) is an industry consortium whose mission is to advance quantum technologies through innovation and collaboration.⁴³ QED-C's purpose is to foster collaboration between businesses, research institutions and government agencies.

QED-C was founded in 2019 with support from the National Institute of Standards and Technology (NIST) and is part of the United States' quantum strategy for advancing quantum information science as called for by the *National Quantum Initiative Act of 2018*.⁴⁴

QED-C is a vehicle for a range of collaboration, from formal and structured collaboration through to networking relationship building. QED-C appears to be inclusive, with membership available to various types of members (corporations, academics, research institutions and other entities related to the quantum industry), and not limited to those in the US. It is also open to the rest of the international community; it extends to members that are headquartered in or have most of the ownership or control in 39 countries.⁴⁵

This inclusivity significantly enhances the potential, efficiency and strength of QED-C's collaborative work, such as identifying gaps in technology and standards.

Conclusion

Collaboration sits at the intersection of innovation policy, national security, international engagement, geopolitical strategy and immigration policy.

Collaboration is essential for both research and development and research security. It is critical to successful research and innovation.

Universities see collaboration as necessary for participation in global science, for accessing the best researchers and gaining access to research laboratories and other infrastructure.⁴⁶

Industry views collaboration with caution but recognises it can lead to innovation, commercialisation and solving complex technological challenges.⁴⁷

Peak industry and sector bodies see collaboration in mixed terms as both good for productivity but questioning university centric focus and value of R&D.⁴⁸

Government considers collaboration to be vital for an increasingly complex, geopolitically challenging global environment.⁴⁹

SERD and DTCA submissions highlight the paradox of collaboration in the different responses to collaboration by submitters to both reviews, highlighting the challenges of context for collaboration:

- On the one hand, collaboration needs to be encouraged through investment, coordination and shared infrastructure.
- On the other hand, collaboration needs to be protected from security threats, uncertainty and fear of criminal sanctions.

Australia, like the rest of the world, must balance openness with security.

Future research

Australian quantum technology researchers and companies are some of the most successful and mobile in the world.

Continuing to foster collaboration in the quantum ecosystem in Australia is important to its future success.

Research security frameworks have the potential to both enable and block collaborations.

For this reason, future research should consider:

- Review and analysis of the final report of SERD and its views on collaboration.
- Theoretical and practical research into the definition of collaboration in research contexts for more nuanced and precise understanding and use of the concept and thus understanding of the impact of research security frameworks.
- Qualitative research on how the export controls scheme and the foreign interference regime impact research collaboration in the quantum technology ecosystem.
- Explore how different concepts of collaboration operate in research security contexts.
- Examine how collaborative quantum technology research and innovation will be impacted by national and global research security frameworks.

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³Department of Industry, Science and Resources (DISR), 'State of Australian Quantum' (Report, Australian Government, November 2024) 15.

⁴Ibid 6-7.

⁵Ibid.

⁶Department of Industry, Science and Resources, *List of Critical Technologies in the National Interest* (19 May 2023) Department of Industry, Science and Resources < <https://www.industry.gov.au>>.

⁷*Defence Strategic Goods List 2024* (Cth) s 4.2, s 4.A.901, s 5.A.002.c.

⁸Gary Marchant et al, 'Learning from Emerging Technology Governance for Guiding Quantum Technology' (2025) 31(2) *Richmond Journal of Law & Technology* 266, 383.

⁹Bruce Macfarlane (2017) The paradox of collaboration: a moral continuum, *Higher Education Research & Development*, 36:3, 472-485, 475.

¹⁰Pauline Leonard & Lawrence Leonard, 'The collaborative prescription: remedy or reverie?' (2001) 4(4) *International Journal of Leadership in Education* 383-399, 389; see also that the Australian Research Council (ARC) defines collaboration with more nuance to include "[t]he types of international collaboration include face-to-face meetings, correspondence such as emails and phone calls, attending or hosting a conference, collaborative fieldwork, hosting an international collaborator, or travelling to an international collaborator." See Australian Research Council, 'NCGP Trends: International Collaboration' (Web page)< <https://www.arc.gov.au/ncgp-trends-international-collaboration>>.

¹¹Anna Ystrom et al, 'From science management to innovation management: new forms of science-industry relations and knowledge transfer' (2025) 145 *Technovation* 103257,

¹²Organisation for Economic Cooperation and Development ("OECD"), *International collaboration in science*, OECD (nd) < <https://www.oecd.org/en/topics/international-collaboration-in-science.html>>.

¹³OECD, *International collaboration in science*, OECD (nd) < <https://www.oecd.org/en/topics/international-collaboration-in-science.html>>.

¹⁴Ibid.

¹⁵The *National Security Legislation Amendment (Espionage and Foreign Interference) Act 2018* (Cth) introduced new offences into the *Criminal Code Act 1995* (Cth) under Division 92. The Department of Home Affairs administers the Countering Foreign Interference in Australia regime. The University Foreign Interference Taskforce (UFIT) developed the *Guidelines to Counter Foreign Interference in the Australian University Sector*: < <https://www.education.gov.au/countering-foreign-interference-australian-university-sector/resources/guidelines-counter-foreign-interference-australian-university-sector>>.

¹⁶Bruce Macfarlane, above n 9, 473.

¹⁷Senate Standing Committees on Foreign Affairs, Defence and Trade, Parliament of Australia, *Defence Trade Controls Amendment Bill 2023 [Provisions] Report* (2024) 9 [2:10].

¹⁸OECD, *OECD Science, Technology and Innovation Outlook 2025: Driving Change in a Shifting Landscape* (2025) OECD Publishing <<https://doi.org/10.1787/5fe57b90-en>>, 16-17.

¹⁹In Australia, there have been several developments, including University Foreign Interference Taskforce, *Guidelines to Counter Foreign Interference in the Australian University Sector* (October 2021) < <https://www.education.gov.au/countering-foreign-interference-australian-university-sector/resources/guidelines-counter-foreign-interference-australian-university-sector>>; Australian Security and Intelligence Organisation, *Protect Your Research: Collaborate with Care* (Booklet, May 2023) <<https://bjbs-news.csu.edu.au/wp-content/uploads/sites/4/2023/05/Protect-Your-Research-Collaborate-with-Care-Booklet.pdf>>; Australian Research Council, *Research Security* (1 July 2024) Australian Government < <https://www.arc.gov.au/funding-research/research-security#arc-countering-foreign-interference-framework>>.

²⁰Strategic Examination of Research and Development (“SERD”), Discussion Paper Consultation Findings and Analysis (Report, Australian Government, July 2025) 15.

²¹SERD, *Strategic Examination of Research and Development: about the examination*, <<https://www.industry.gov.au/science-technology-and-innovation/strategic-examination-research-and-development>>.

²²SERD, above n 20, 15.

²³SERD, above n 20, 26.

²⁴SERD, above n 20, 38.

²⁵Department of Defence, *Export Controls Framework* <<https://www.defence.gov.au/business-industry/exporting/export-controls-framework>>.

²⁶Department of Defence, *Export Controls Framework - Legislation* <<https://www.defence.gov.au/business-industry/exporting/export-controls-framework/legislation>>.

²⁷*Defence Trade Controls Act 2012* (Cth) pt 2.

²⁸*Defence Trade Controls Act 2012* (Cth) s11, s16, s17, s18.

²⁹*Defence Trade Controls Act 2012* (Cth) s4.

³⁰Senate Standing Committees on Foreign Affairs, Defence and Trade, Parliament of Australia, *Defence Trade Controls Amendment Bill 2023 [Provisions]* (2024) 8-11 [2.9] – [2:21].

³¹Department of Prime Minister and Cabinet, ‘Fact Sheet: Implementation of the Australia-United Kingdom – United States Partnership (AUKUS)’ (Fact Sheet, Australian Government, September 2021) 1-3 <<https://pmtranscripts.pmc.gov.au/sites/default/files/AUKUS-factsheet.pdf>>.

³²Kate B, ‘Generational export reforms set to bolster AUKUS trade and collaboration’ (Web page, Australian Manufacturing, 16 August 2024) <<https://www.australianmanufacturing.com.au>>; see also, United States Studies Centre, ‘Australia’s innovation, science and technology environment: Providing a rationale for universities’ contributions to AUKUS Advanced Capabilities’ (Webpage, 3 February 2026) <<https://www.uscc.edu.au/australias-innovation-science-and-technology-environment-providing-a-rationale-for-universities-contributions-to-aukus-advanced-capabilities>>.

³³Senate Standing Committees on Foreign Affairs, Defence and Trade, above n 30, 9 [2.14]. See also Group of Eight, DTCA Submission #14, 3.

³⁴DISR, ‘National Quantum Strategy: Building a thriving future with Australia’s quantum advantage’ (Strategy, 3 May 2023) 6.

³⁵Quad Investors Network, ‘Quantum Science & Technology in the QUAD nations: Landscape and Opportunities’ (Report, Quad Investors Network, July 2024) 3.

³⁶OECD, ‘What is research security and why does it matter to global science?’ (Blog, OECD, November 2025) <<https://www.oecd.org/en/blogs/2025/11/what-is-research-security-and-why-does-it-matter-for-global-science>>.

³⁷See, eg, Australian Academy of Science, SERD Submission #436, 3. “By formalising collaboration through a partnership model, Australia can better align national and regional priorities, optimise resource allocation, and drive innovation.”

³⁸See, eg, University of Melbourne, SERD Submission #363, 3; University of Melbourne, DTCA Submission #11, 3.

³⁹Australia has commenced ‘non-binding exploratory talks with the European Union on a possible association with Horizon Europe.’ See Department of Industry, Science and Resources, ‘Possible Association to Horizon Europe: request for information’ (Web page, 10 September 2025) <<https://consult.industry.gov.au/association-to-horizon-europe>>.

⁴⁰The Group of Eight is a partnership between Australia’s leading research institutions: Adelaide University, the Australian National University, the University of Melbourne, Monash University, UNSW Sydney, the University of Queensland, the University of Sydney and the University of Western Australia: <<https://go8.edu.au/about/the-go8>>.

⁴¹Group of Eight, SERD Submission #428, 17.

⁴²See, eg, The University of Sydney, SERD Submission #464, 4; The University of Sydney, DTCA Submission #13, 1-2.

⁴³Quantum Economic Development Consortium, 'About QED-C: Our Mission' (Web page) < <https://quantumconsortium.org/about/>>.

⁴⁴Quantum Economic Development Consortium, 'About QED-C: Our History' (Web page) < <https://quantumconsortium.org/about/>>.

⁴⁵Quantum Economic Development Consortium, 'About QED-C: Our Members and Their Impact' (Web page) < <https://quantumconsortium.org/about/>>.

⁴⁶See, eg, University of Melbourne, SERD Submission #363, 3; University of Melbourne, DTCA Submission #11, 3; Australian Academy of Science, SERD Submission #436, 3.

⁴⁷Strategic Examination of Research and Development, Discussion Paper Consultation Findings and Analysis (Report, Australian Government, July 2025) 15-16.

⁴⁸SERD, above n 20, 15-16; See also Australian Industry Group, SERD Submission #430, 7.

⁴⁹See, eg, Department of Defence, DTCA #22, 2-4; see also Department of Industry, Science and Resources, 'Partnering with Australia on Innovation, Science and Research' (Booklet, March 2020) 14.