POLICY REPORT

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Australia-ASEAN Cooperation on Emerging Technologies

Quantum Technology Research and Governance as a Case Study

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Executive Summary

This report examines Australia-ASEAN cooperation on emerging technologies through a quantum computing case study, focusing on research collaboration, innovation capacity and governance development. It finds that quantum ecosystems across the region remain uneven, with Australia and Singapore serving as primary hubs of research productivity and international connectivity while the other ASEAN member states are weakly integrated into regional networks. Collaboration is limited and largely academic, with insufficient industry participation and a dominant focus on foundational science over applied engineering. The resulting hub-and-spoke structure raises concerns for innovation diffusion and regulatory preparedness, underscoring the need for stronger regional linkages and early governance coordination.

Introduction

Australia and ASEAN have a long history of cooperation agreements. One aspect of cooperation often touched on in these agreements is cooperation in science and technology (S&T). As an organisation, ASEAN signed a comprehensive strategic partnership with Australia in 2021, which included pledges of greater cooperation in science and technology fields relevant to both Australia and ASEAN.[1] Australia also has comprehensive strategic partnerships with a number of individual ASEAN member states, including Singapore, Malaysia, Indonesia and Vietnam, and defence agreements of various commitment levels with Singapore, Malaysia, Indonesia and the Philippines. Australia and Singapore have a longstanding memorandum of understanding on cooperation in innovation and science.[2] The plan of action for Australia and Indonesia's Comprehensive Strategic Partnership includes a clause in which the two countries agree to enhance cooperation in science and technology and to boost joint research efforts and exchanges, including in digital transformation.[3]

How to implement this promised cooperation is a separate question. While promises of science and technology cooperation are often made at the state level, actual cooperation generally occurs at the firm or individual level, with states easing regulations and providing funds. Also, the context in which Australia-ASEAN cooperation occurs is increasingly uncertain. Strategic competition between the United States and China has continued to be a source of uncertainty and risk for both Australia and ASEAN member states, and in the past 10 years has spilled into science and technology issues.

Australia and ASEAN countries thus face the challenge of how to do cutting-edge research in emerging technologies, how to enhance their sovereign capabilities, and how to minimise outside influence by leveraging and enhancing interstate cooperation with other middle powers. ASEAN, as a regional organisation and a collective of states, has an interest in enhancing the capabilities of its less developed members.

Quantum technologies provide a useful case study for examining Australia-ASEAN cooperation because they combine strategic, economic, scientific and governance dimensions within a single emerging technology domain. Although quantum capabilities remain concentrated in a small number of countries, decisions made today regarding research partnerships, talent development, standards and governance will shape future technological competitiveness and strategic autonomy. As ASEAN and Australia seek to deepen cooperation under their Comprehensive

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[1] See Australian Mission to ASEAN, "The ASEAN-Australia Comprehensive Strategic Partnership – a Year of Progress", https://asean.mission.gov.au/aesn/CSP_02.html

[2] "Australian Government and Government of the Republic of Singapore, *Memorandum of Understanding on Cooperation on Innovation and Science*", Department of Foreign Affairs and Trade (DFAT), Australia, 13 October 2016, https://www.dfat.gov.au/sites/default/files/singapore-cooperation-on-innovation-and-science-mou.PDF

[3] "Plan of Action for the Indonesia–Australia Comprehensive Strategic Partnership (2025–2029)", DFAT, 15 May 2025, https://www.dfat.gov.au/geo/indonesia/plan-of-action-for-the-indonesia-australia-comprehensive-strategic-partnership-2025-2029

Strategic Partnership,[4] quantum technologies offer an opportunity to assess how both sides can collaborate on a frontier technology before global technological and regulatory structures become entrenched. Rather than replicating great-power technology competition, Australia-ASEAN cooperation offers a middle-power model centred on openness, trust and capacity building. In this context, Australia-Singapore quantum cooperation can serve as a regional anchor that helps diffuse expertise and governance capacity across Southeast Asia while supporting broader ASEAN resilience and technological autonomy.

In this policy report, we consider the challenges and opportunities for innovation, governance and cooperation within and between Australia and the ASEAN countries in emerging technologies, specifically quantum computing as an emerging field that has seen a plethora of strategies and investment in recent years. After discussing the policy background of quantum computing in Australia and ASEAN, we assess the state of Australia and ASEAN's quantum computing research and what this means for understanding the challenges and opportunities for innovation and governance and for navigating emerging technologies. We generally find that quantum computing research and innovation is uneven throughout the region, that international cooperation is not very advanced, and that research is potentially not as focused on application and commercialisation as the national strategies would desire. We close with policy considerations for policymakers in Australia and the ASEAN countries.

The Policy Background of Quantum Computing in Australia and ASEAN

Australia and ASEAN increasingly frame quantum technologies as strategic, critical and emerging technologies with far-reaching economic and security implications. Yet, across both contexts, policy instruments remain heavily skewed towards research, talent development and ecosystem building. Governance, standards and security frameworks are only beginning to firm up. This imbalance reflects an early-stage policy environment in which technological ambition has outpaced institutional preparedness.

Both Australia and ASEAN are building quantum ecosystems in an environment where innovation policy has outpaced governance. Australia is moving towards a more integrated model that combines R&D leadership with norm-shaping ambitions, though regulatory instruments remain underdeveloped. ASEAN, by contrast, faces a strategic coordination deficit, with fragmented national initiatives and limited regional oversight.

[4] "Remarks by Secretary-General of ASEAN H.E. Dr. Kao Kim Hourn at the Opening of the ASEAN–Australia Panel Exhibition, 26 May 2026", ASEAN, 26 May 2026, https://asean.org/wp-content/uploads/2026/05/SG-Dr-Kao-Remarks-at-the-Opening-of-ASEAN-Australia-Panel-Exhibition-26-May-2026_As-Delivered.pdf

R&D-centric Policy Foundations

In both Australia and Southeast Asia, quantum policy is embedded within the broader digital economy and science, technology and innovation agendas that privilege capacity building over regulation. Australia's 2023 National Quantum Strategy[5] articulates a vision of global leadership by 2030, structured around research excellence, commercialisation, workforce development, secure infrastructure and the creation of trusted frameworks. While governance is acknowledged, the primary emphasis remains on accelerating innovation and market formation.

Within the ASEAN member states, quantum posture is fragmented and dependency-prone, with most lacking domestic capability.[6] Quantum initiatives are either nested within broader national digitalisation plans,[7] niche roadmaps,[8] or dedicated strategies.[9] These documents prioritise scientific capability, demonstrator projects and industry linkages, reflecting a focus that is largely on technological catch-up (with the possible exception of Singapore[10]). The pattern reveals a shared assumption: governance can be deferred until technologies approach maturity. While understandable in resource-constrained environments, it risks creating regulatory lag and fragmented oversight as quantum applications begin to diffuse.

Australia's Emerging Governance Architecture

Australia represents a more developed policy case vis-à-vis ASEAN. Its National Quantum Strategy provides a whole-of-government framework designed to convert research leadership into economic and strategic advantage. Implementation is supported by federal funding, the National Reconstruction Fund,[11] and the establishment of Quantum Australia[12] as an industry growth centre. These initiatives build on a strong base of university research and a growing start-up ecosystem.

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[5] Department of Industry, Science and Resources, Australia, "National Quantum Strategy", 3 May 2023, https://www.industry.gov.au/publications/national-quantum-strategy

[6] Karryl Kim Sagun Trajano, "Can ASEAN Secure a Quantum Future?", *The Interpreter* (Lowy Institute), 19 November 2025, https://www.lowyinstitute.org/the-interpreter/can-asean-secure-quantum-future

[7] Faiqah Kamaruddin, "Malaysia Takes Quantum Leap in Cybersecurity Readiness", New Straits Times, 4 November 2025,https://www.nst.com.my/business/corporate/2025/11/1308127/malaysia-takes-quantum-leap-cybersecurity-readiness

[8] See event flyer at https://quantum2025.org/iyq-event/thaiyq2025-reviewing-thailands-quantum-technology-roadmap-2020-2029/

[9] See Singapore's National Quantum Strategy on the website of the National Quantum Office, https://nqo.sg/nqs/

[10] PostQuantum.com, "Quantum Technology Initiatives in Singapore and ASEAN", 27 December 2024, https://postquantum.com/quantum-computing/quantum-singapore-asean/

[11] National Reconstruction Fund Corporation (Australia), "National Reconstruction Fund Corporation Backs Next Generation Quantum Computing Startup Diraq with $20 Million Equity Investment", 3 February 2026, https://www.nrf.gov.au/news-and-media-releases/national-reconstruction-fund-corporation-backs-next-generation-quantum-computing-startup-diraq-20-million-equity-investment

[12] Quantum Australia website, https://www.quantum-australia.com/

Notably, governance and international norm-shaping are integral to Australia's policy narrative. The strategy highlights export controls, critical infrastructure protection and participation in global standards bodies. It also frames quantum development within a trusted, ethical and inclusive ecosystem, signalling early recognition of social licence, workforce diversity and responsible innovation. Through mechanisms such as strategic technology partnerships, Australia positions itself as both a technology developer and a rule shaper. Nevertheless, much of its governance agenda remains programmatic rather than regulatory, relying on existing national security and innovation instruments rather than dedicated quantum legislation.

Australia's National Quantum Strategy focuses on research and development, commercialisation and application of quantum technologies within Australia.[13] The University Technology Sydney is home to the Centre for Quantum Software and Information, and the University of Sydney hosts the Nano Institute. The National Quantum Strategy envisions some role for every state and territory in the country (a political decision), with some states and territories taking on more research roles, while others provide materials. It does not have a large new pot of funding specifically for quantum research but encourages universities and companies to apply for funding through existing funding streams (including a AUD$16 billion National Reconstruction Fund) that prioritise applications and commercialisation in areas such as defence, agriculture and medicine. [14] The strategy focuses specifically on the use of quantum technology in sensing, communications and computing.[15]

One of the main challenges identified in the strategy is developing the ability to attract long-term capital to support technology development and new quantum companies while creating an ecosystem of organisations that can improve Australia's sovereign capabilities. These are the main challenges for every high-tech organisation in Australia, not just those involved in quantum technology. To address these challenges, a peak organisation, Quantum Australia, was founded in 2024 by the Australian federal government, several state governments and 13 universities to develop Australia's quantum industry ecosystem.[16]

ASEAN's Strategic Gap

At the regional level, ASEAN lacks a coordinated quantum strategy or formal governance framework. The absence of quantum from the ASEAN Digital Masterplan 2025[17] underscores its marginal status in collective policymaking. While there is growing awareness of quantum's strategic implications, institutional follow-through remains limited.

ASEAN's consensus-driven governance model and emphasis on non-interference constrain rapid regional policy integration. As a result, cooperation is

[13] Department of Industry, Science and Resources, Australia, "National Quantum Strategy".
[14] Department of Industry, Science and Resources, Australia, "National Quantum Strategy".
[15] Department of Industry, Science and Resources, Australia, "National Quantum Strategy".
[16] https://www.quantum-australia.com/about-us
[17] "ASEAN Digital Masterplan 2025", ASEAN, n.d., https://asean.org/wp-content/uploads/2021/09/ASEAN-Digital-Masterplan-EDITED.pdf

largely indirect, mediated through digital infrastructure development, cybersecurity dialogues and science and technology networks. The region recognises the risks of future technological dependency but has yet to develop collective mechanisms for capacity building, standard setting or regulatory coordination.

This gap creates space for external actors and leading member states to shape emerging norms in a relatively unstructured environment. Within ASEAN, national approaches vary significantly. Singapore stands out as the regional frontrunner, supported by substantial public investment and institutional coordination through the National Quantum Office.[18] Its strategy integrates quantum into the broader digital economy and national security planning, positioning Singapore as Southeast Asia's de facto quantum hub. Governance elements are embedded through standards participation and cybersecurity trials, although no standalone quantum regulatory regime exists. Thailand has pursued a more programmatic approach through its long-term roadmap, linking universities, national laboratories and industry.[19] Malaysia's efforts are anchored in academic and agency-led initiatives framed within digital sovereignty narratives.[20] Indonesia[21] and Vietnam[22] remain at early stages, relying on general policies and international partnerships rather than dedicated quantum strategies. These divergent trajectories reflect uneven resource endowments and policy capacities, complicating prospects for regional harmonisation.

The State of Australia-ASEAN Emerging Research Networks in Quantum Computing

A review of the networks created by researchers in Australia and across the ASEAN countries allows for an assessment of the state of the field in Australia and ASEAN, and reveals the central individuals and institutions in quantum computing research, and the connections between and within Australia and ASEAN.[23] In Figure 1, the colours of the

[18] National Quantum Office, https://nqo.sg/nqs/

[19] Boonrucksar Soonthornthum, "ThaiYQ2025: Reviewing Thailand's quantum technology roadmap (2020–2029)", International Year of Quantum Science & Technology 2025, 14 August 2025, https://quantum2025.org/iyq-event/thaiyq2025-reviewing-thailands-quantum-technology-roadmap-2020-2029/

[20] Cierra Choucair, "Malaysia's First Quantum Computing Centre Launched Through SDT Inc., and MIMOS Partnership", Quantum Insider (TQI), 13 November 2024, https://thequantuminsider.com/2024/11/13/malaysias-first-quantum-computing-centre-launched-through-sdt-inc-and-mimos-partnership/

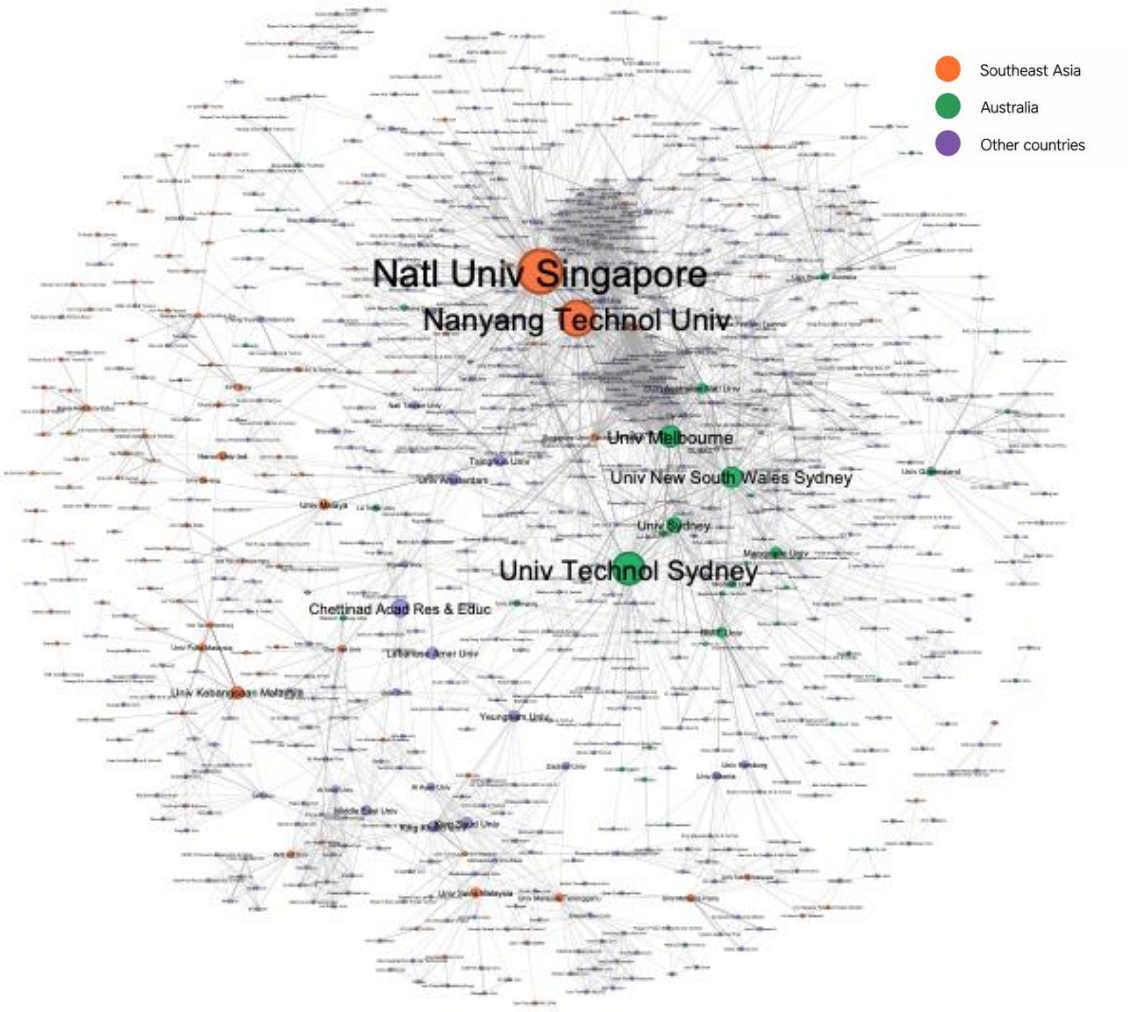
[21] Wibawanto Nugroho Widodo and Alexander Yahya Datuk, "Quantum Geopolitics and Indonesia's Grand Strategy 2025–2045", *Jakarta Post*, 13 December 2025, https://www.thejakartapost.com/opinion/2025/12/13/quantum-geopolitics-and-indonesias-grand-strategy-2025-2045.html

[22] Matt Swayne, "Vietnam's New National Technology Networks Includes Quantum Initiative", Quantum Insider (TQI), 27 August 2025, https://thequantuminsider.com/2025/08/27/vietnams-new-national-technology-networks-includes-quantum-initiative/

[23] In these research networks, the nodes can consist of authors, institutions, keywords, research areas or countries. The nodes are linked through presence on the same papers (that is, co-authorship) on quantum computing between 2022 and 2024. Taking all these nodes and links together for this time period, this leads to 11,831 nodes and 125,390 links. The papers were derived from a search for papers on quantum computing in the Web of Science database for the years 2022 to 2024 in which at least one researcher from Australia or ASEAN countries was a co-author.

nodes indicate the region where the institutions are located. The links signify co-authoring relationships between researchers at the relevant institutions, while the node and label size indicate the relative betweenness centrality.[24]

Figure 1. Quantum Computing Research Network Institutions (betweenness centrality, whole world)



In a network of institutions, those with high betweenness centrality are the nodes that serve as collaboration brokers between otherwise disparate parts of the research network. In Southeast Asia, Singapore's National University of Singapore and Nanyang Technological University serve as brokers in the entire network in which Australian and ASEAN institutions are embedded, while Australia's broker institutions are more evenly distributed. Other countries in ASEAN are significantly less central to the combined network: only Universiti Kebangsaan Malaysia, Universiti Sains Malaysia

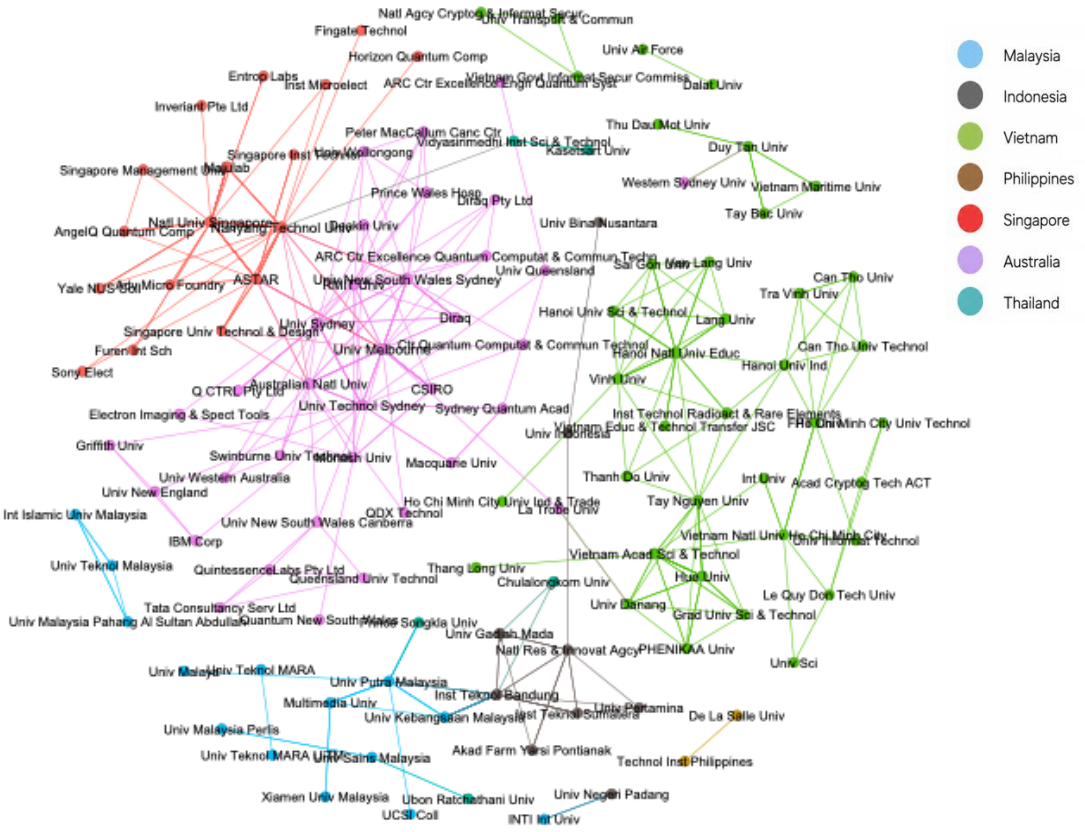
[24] Degree centrality is the number of connections that a given node has. Depending on the type of node, the degree of a node may be the number of co-authors (in the case of author-only networks) or the number of papers in which authors from one institution co-authored with authors from other institutions (in the case of affiliation-only networks). Betweenness centrality measures the extent to which a given node is on the pathway between other nodes in the network.

and Universiti Malaya, all in Malaysia, have a role in connecting other institutions in the network.

In terms of sheer volume of publications, with authors affiliated with them, Singaporean and Australian institutions dominate the landscape. In Australia, the University Technology Sydney, University of New South Wales, University of Melbourne, the University of Sydney, and, to a lesser extent, the Australian National University and RMIT University are all in the top 25 institutions. Conversely, within Southeast Asia, the National University of Singapore has the highest number of publications and authors in the field, while Nanyang Technological University and A*STAR, Singapore's national research agency, also rank highly.

When considering institutions collaborating within Australia and ASEAN, we see that the density of collaborative networks within and between countries varies significantly (Figure 2).

Figure 2. Quantum Computing Research Network Institutions: Australia and ASEAN Only

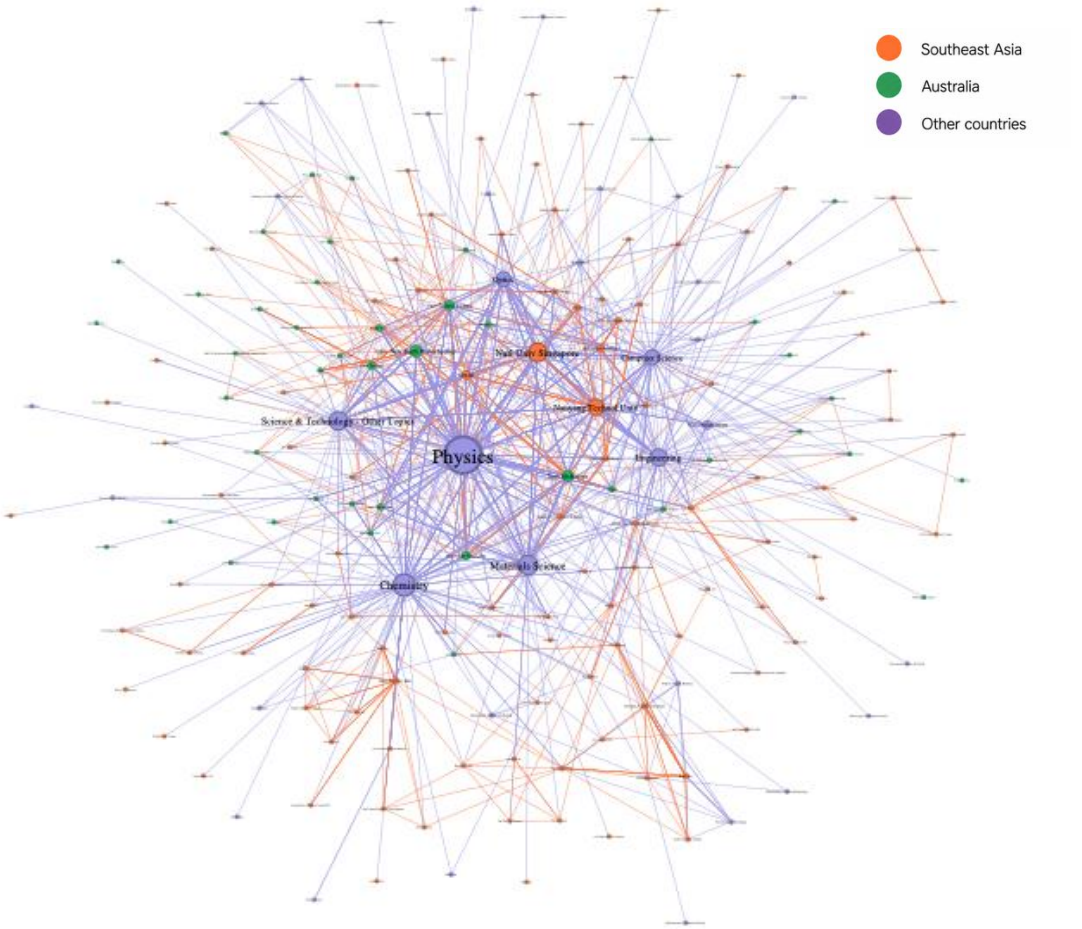


Australian and Singaporean institutions are well networked with each other, both within each country and between Singapore and Australia. The few institutions in Thailand that are doing related research are not integrated. The two Philippine institutions are not integrated with the rest of ASEAN, nor are they connected with Australia. Vietnamese institutions are well integrated with each other but poorly

connected to the rest of ASEAN or Australia. While the research output from Vietnam is not high, the number of institutions involved in the country is high, suggesting a diffused ability to participate in issues relevant to quantum computing, although all the institutions are linked to the Vietnamese government in some way. Malaysian and Indonesian institutions are connected by Institut Teknologi Bandung (the premier S&T university in Indonesia) but are otherwise isolated from Australia and much of the rest of ASEAN.

The network of Australian and ASEAN institutions and what they research within the broader topic of quantum computing also suggest strengths and weaknesses in specialisation in the region (Figure 3). Each node represents an institution or a research area, while each link represents a co-authoring relationship (between institution nodes), a paper that touches on the research area (if connecting an institution and a research area), or a paper that contains two research areas (if connecting two research area nodes). The colours of the nodes represent regions where the institutions are located.

Figure 3. Quantum Computing Research Areas: Australia and ASEAN Only



Despite the research being on quantum computing, the region's greatest concentration of research in that field is in physics, and, to a lesser extent, chemistry and materials science. Computer science and engineering, the research areas arguably most directly connected to application and commercialisation of quantum computing technologies, are secondary focal areas within Australia and the ASEAN countries. There are also tertiary areas of focus such as optics, transportation and telecommunications.

Implications

Assessing the state of quantum computing research networks in and between Australia and ASEAN has implications for innovation, governance and Australia-ASEAN cooperation in the face of US-China competition. While the findings suggest that Singapore currently plays a prominent role in ASEAN, they should not be interpreted as suggesting that Singapore represents ASEAN as a whole. Rather, Singapore currently functions as a regional entry point and capability hub within an otherwise uneven ASEAN quantum landscape. While Australia-Singapore collaboration constitutes the most developed component of the regional ecosystem, its long-term value will depend on its ability to facilitate broader participation from other ASEAN member states. Malaysia appears to be the most immediate candidate for deeper engagement while emerging capabilities in Vietnam, Indonesia, Thailand and the Philippines present opportunities for future expansion.

Implications for Innovation

While creating quantum networks between Australia and the ASEAN countries is the explicit goal of published quantum strategies, the ecosystems that have been created so far remain uneven in extent and intensity. Only Australia and Singapore have ecosystems of multiple academic and industrial research centres collaborating with each other and with overseas institutions. Other ASEAN countries have multiple institutions engaged in quantum-related research, but they are not necessarily interconnected, and industry participation remains limited.

This uneven ecosystem structure has several implications for the region's ability to innovate and commercialise quantum technologies. First, the concentration of research networks in a small number of institutions risks creating a hub-and-spoke innovation model in which knowledge flows through a handful of central nodes, primarily Singaporean and Australian universities, while the rest of the region remains dependent on these hubs for expertise and collaboration. While this structure may accelerate early-stage research productivity, it may also slow the diffusion of knowledge and technical capacity across ASEAN.

Second, the disciplinary orientation of the research networks suggests that the region's quantum research remains heavily science-driven rather than application-driven. The dominance of physics, materials science and chemistry indicates that Australia and ASEAN remain focused on foundational research rather than the engineering, software development and systems integration necessary for

commercially viable quantum technologies. This imbalance has created a gap between policy aspirations and the current structure of the research ecosystem.

Third, the limited participation of private industry raises questions about the region's capacity to translate scientific advances into marketable technologies. In countries where quantum initiatives remain primarily university-led, pathways for technology transfer, start-up formation and venture capital investment remain underdeveloped. Australia's policy focus on attracting long-term capital and building a start-up ecosystem reflects recognition of this challenge, but similar mechanisms remain largely absent across Southeast Asia.

These patterns suggest that Australia and ASEAN remain in an early phase of ecosystem development in which scientific collaboration precedes industrial participation. Without deliberate policies to expand participation beyond a small group of leading institutions, the current configuration may reinforce regional inequalities in technological capability.

Implications for Governance

The structure of the regional research network carries important implications for governance and regulatory preparedness. Emerging technologies such as quantum computing raise policy questions related to cybersecurity, cryptography standards, data protection and export controls. However, the research ecosystem mapped in this report suggests that governance discussions have yet to develop in parallel with technological research across much of Australia and ASEAN.

One implication is that governance capacity is likely to remain concentrated in a small number of countries with technical expertise and institutional resources. Australia and Singapore are best positioned to shape emerging governance frameworks because of their stronger research ecosystems, participation in international standards bodies and more developed technology policy institutions. As a result, these countries may become agenda-setters for quantum governance in the broader region.

A second implication is the risk of regulatory fragmentation within Southeast Asia. Because most ASEAN member states have not yet developed dedicated quantum governance frameworks, national approaches to encryption policy, export controls and quantum communications infrastructure may evolve independently. Divergent regulatory regimes could complicate cross-border collaboration, research partnerships and commercial deployment of quantum technologies.

Third, the absence of coordinated regional governance mechanisms creates the possibility that external actors will play a disproportionate role in shaping the emerging quantum ecosystem. Without coordinated regional engagement, Southeast Asian states risk becoming rule-takers rather than rule-makers in the global governance architecture of quantum technologies.

For Australia and Singapore, this governance gap also presents an opportunity. Both countries could help facilitate governance dialogue, regulatory capacity building, and standards participation among ASEAN partners, reinforcing their position as trusted technology partners in the region.

Policy Considerations

The analysis above suggests several policy considerations for Australia and ASEAN policymakers seeking to strengthen cooperation on emerging technologies such as quantum computing.

First, policymakers could prioritise the development of regional research linkages beyond existing hubs. While Singapore and Australia currently dominate the regional research ecosystem, targeted funding schemes, joint laboratories and researcher mobility programmes could help integrate institutions in other ASEAN member states into the broader network. Strengthening these linkages would help diffuse expertise across the region and reduce capability gaps.

Second, governments could place greater emphasis on industry participation and commercialisation pathways. The current research network is heavily academic in nature, which limits opportunities for translating scientific advances into practical applications. Expanding start-up support, venture financing and university–industry partnerships would help bridge the gap between research and market deployment.

Third, Australia and ASEAN could develop mechanisms for early dialogue on governance and standards for quantum technologies. Such discussions could take place within existing ASEAN science and technology platforms or through new Australia-ASEAN technology policy dialogues. Early engagement could help reduce regulatory fragmentation and position regional actors to participate more effectively in global standards-setting processes.

Fourth, Australia and Singapore could expand their roles as capacity-building partners in the region's emerging technology ecosystem. This could include introducing scholarships, joint research programmes, training initiatives and shared access to specialised research infrastructure. By supporting capability development across ASEAN, Australia and Singapore would also strengthen their own positions as trusted partners in the region's technology landscape.

Fifth, both Australia and the ASEAN states could pursue diversification strategies in their international research partnerships. Maintaining broad global collaboration networks will be essential for accessing knowledge and avoiding excessive dependence on any single technological bloc in an era of intensifying geopolitical competition.

Finally, a differentiated approach could also be considered as it may be more effective than a one-size-fits-all regional strategy. For advanced ecosystems such as those of Australia and Singapore, priorities should include commercialisation, venture financing, standards-setting and international governance leadership. For emerging

participants such as Malaysia and Vietnam, priorities should be research partnerships, talent development and specialised capability niches. For countries at earlier stages of development, including Indonesia, Thailand and the Philippines, efforts should concentrate on foundational workforce development, scholarships, infrastructure access and participation in regional research networks.

Conclusion

Australia and ASEAN have both identified quantum technologies as strategically important, yet capabilities across the region remain uneven. The research networks identified in this report suggest that quantum innovation in the Australia-ASEAN ecosystem is concentrated around a small number of institutions, particularly in Australia and Singapore, while much of Southeast Asia remains weakly integrated into the regional ecosystem. The predominance of foundational scientific research over engineering and application-oriented work also highlights the early stage of the technology and the challenges of translating research strengths into commercial and strategic capabilities. Expanding research collaboration, building innovation ecosystems and initiating dialogue on governance and standards could help reduce technological fragmentation and convert emerging research capabilities into long-term technological and strategic advantage.

The concentration of capabilities in Australia and Singapore should not necessarily be viewed as a weakness. In many emerging technology sectors, regional ecosystems initially develop around a limited number of leading hubs before knowledge and investment diffuse more broadly. A pragmatic model for Australia-ASEAN quantum cooperation could therefore allow willing and capable partners to advance specific initiatives while ensuring that mechanisms remain open for broader ASEAN participation over time.

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