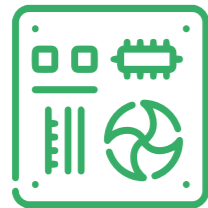




Protective Cyber Security Technologies



Systems, algorithms and hardware that are designed to enable a cyber security benefit. Applications for cyber security technologies include but are not limited to; operational technology security, trust and authentication infrastructures, protection of aggregated data sets, protection of AI systems and supply chain security.

Key Sectors

Influences all sectors of the economy, including:

- Agriculture
- Banking & Finance
- Communications
- Defence & Defence Industry
- Energy & Environment
- Health
- Transport & Logistics
- Education and Research
- Mining and Resources
- Manufacturing
- Space

Estimated impact on national interest	Low	Med	High
	Economic Prosperity		
National Security			X

Key Australian Government Actions	Example Outcomes	Underpinning Science	Example Applications
<p>Initiatives</p> <ul style="list-style-type: none"> • Australia's Cyber Security Strategy 2020 • Australian Cyber Security Centre • Australia's Cyber and Critical Tech Cooperation Program • International Cyber and Critical Technology Engagement Strategy • Cyber Security Cooperative Research Centre • Australian Cyber Security Growth Network • Australian Information Security Evaluation Program • Digital Economy Strategy <p>Regulations</p> <ul style="list-style-type: none"> • Defence and Strategic Goods List 2021 	<ul style="list-style-type: none"> • More automation and less human involvement in routine cybersecurity activities • Proactive identification of, and response to, cybersecurity threats • Doing business online is no less secure than doing business offline • Secure smart cities • Secure smart grids • Secure and privacy preserving use of government data holdings • Secure IoT and home automation • Sovereign cyber security capabilities • Availability of low-cost, high-efficacy secure by design principles and tools • Reduced downtime due to cybersecurity incidents • More secure use of shared computer infrastructure 	<p>ANZ Standard Research Classification Category</p> <ul style="list-style-type: none"> • Communications Engineering • Artificial intelligence • Cybersecurity and privacy • Data management and data science • Distributed computing and systems software • Machine learning 	<p>Readiness Level – Now</p> <ul style="list-style-type: none"> • Automated detection of potential indicators of malicious cyber activity • Data loss prevention • End-to-end encryption • Hardware security module, ubiquitous hardware authentication and secure hardware root trust • Network diodes • Additional multifactor authentication methods, including passwordless, biometric and ubiquitous hardware authentication • Security Information and Event Management (SIEM) • Virtual private networks (VPNs) <p>Readiness Level – 2–5 years</p> <ul style="list-style-type: none"> • AI-assisted tools for secure software design • AI-assisted software security auditing tools • Content Disarm & Reconstruction (CDR) • Network detection and response (NDR) technology • Sovereign cloud • Zero trust network access (ZTNA) • Secure multi-level terminal (Cross Domain Desktop Compositor) for secure information sharing across domains <p>Readiness Level – Beyond 5 years</p> <ul style="list-style-type: none"> • Automated detection and response to novel cyber threats • Autonomous cyber security for low power and resource-constrained devices, such as connected health devices • Format-preserving encryption • Homomorphic encryption

Australia's place in the world

The United States leads public research in this field well ahead of China, the United Kingdom and Australia. Although Australia's research does rank in the top 5 globally, at 4th. Swinburne University of Technology is Australia's leading institution by research impact, ranking 11th worldwide. These rankings should be treated cautiously as different research and publication practices in this field (particularly a greater preference for informal publication methods) mean the underlying data is likely incomplete.

Australia is ranked 8th for venture capital (VC) investment, well behind the investment levels of the United States. China and the United States have the highest number of patents in this field, with Australia is ranked 20th.

Opportunities and Risks

Australians depend on cybersecurity technologies to protect the digital and connected devices and systems that underpin Australia's economy and security.

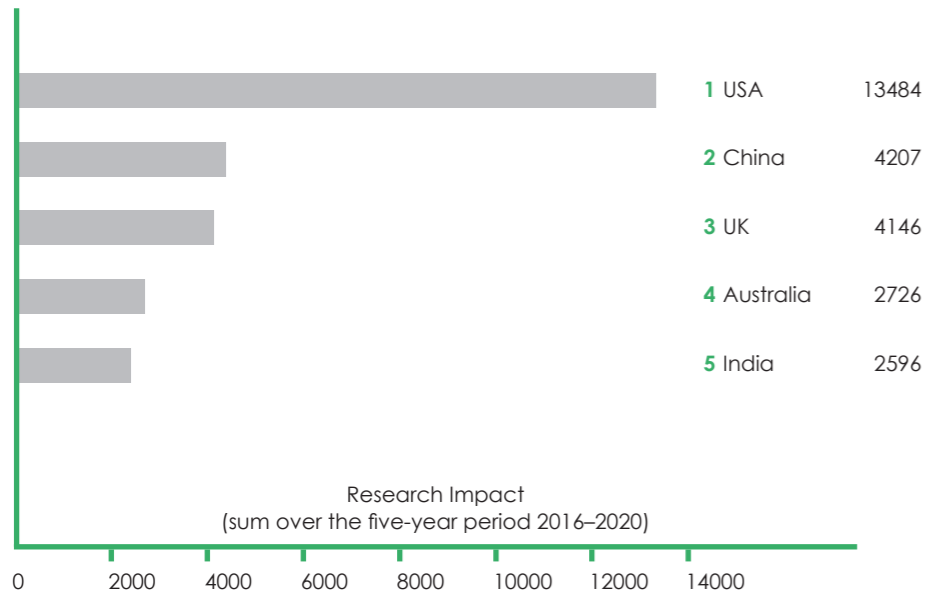
Opportunities for Australia from advances in protective cyber security technologies include exporting cybersecurity goods and services to the world, increasing business and consumer confidence and uptake of cyber-enabled technologies, and reducing the costs of combatting and responding to malicious cyber activities.

Advances in protective cyber security technologies also pose risks for Australia. Malicious actors can benefit from protective cyber security technologies by using those technologies to conceal their unlawful activities and increase the costs of detection and response.

Risks for Australia from not keeping pace with global advances in protective cyber security technologies include increased theft or destruction of personal and commercially sensitive digital information, less reliable critical infrastructure and government services, increased spending on cyber security imports and services, and decreased confidence in Australia's digital economy.

Research Impact (RI)

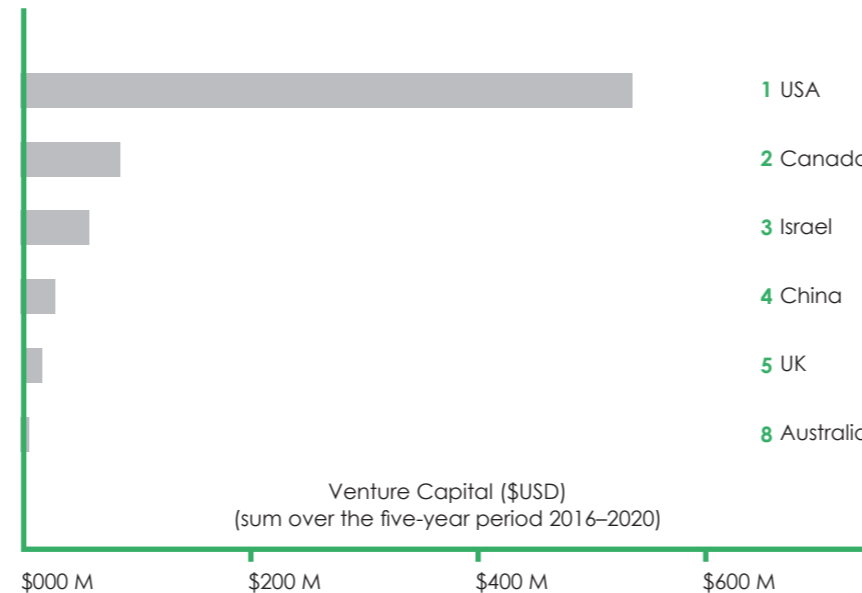
Australia ranks 4th for research impact, with the United States having the highest research impact. The total volume of research publications has been increasing at 18% p.a. over the 5 year period 2016–2020, with 18% of research involving international collaboration.



The research impact provides an indication of the productivity of a country or institution. Here, productivity was assumed to be represented by the volume of publications (i.e. scholarly output) as an indicator of the resources & facilities, and the level of interest in the publications as an indicator of quality.

VC Investment

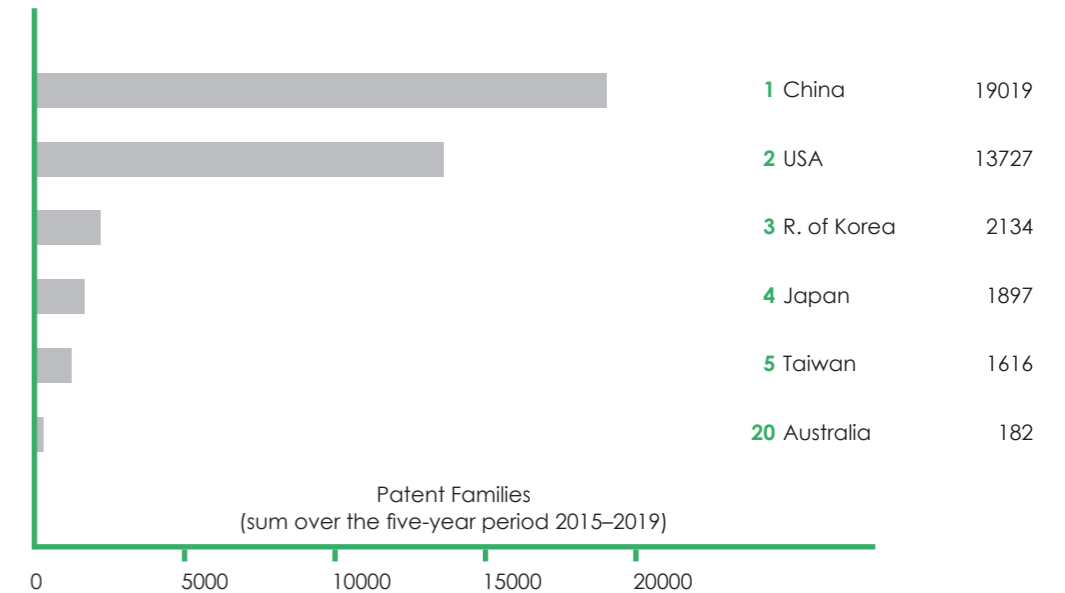
The United States has significantly higher venture capital investment (VC) in this area, well above that of Canada and Israel. Australia is ranked 8th for VC investment. Since 2016, VC investment has been decreasing at around 5% p.a.



Data from Crunchbase. The Crunchbase database provides a partial view of the global VC landscape. However the quantity, quality and richness of the data are considered to be statistically significant, and indicative of global trends.

Patents – International

The highest number of patents for this technology were filed by applicants or inventors from China and the United States. Overall patent applications have been increasing at 6% annually since 2015. Australia is ranked 20th.



Research Institutions – International

The United States has 6 institutes in the top 10 international institutions for research impact.

Rank	Top International Institution	Research Impact
1	Johns Hopkins University United States	666
2	George Mason University United States	545
3	Virginia Polytechnic Institute and State University United States	466
4	Singapore University of Technology and Design Singapore	452
5	Pace University United States	422
6	Tsinghua University China	402
7	Norwegian University of Science and Technology Norway	390
8	Amrita Vishwa Vidyapeetham India	387
9	Florida International University United States	348
10	Massachusetts Institute of Technology United States	342

Research Australian – Australia

Based on the publicly available information, within Australia, Swinburne University of Technology has the highest research impact nationally, and is ranked 11th internationally. The top 4 Australian institutions are ranked in the top 50 internationally.

Rank	Top Australian Institution	Research Impact
1	Swinburne University of Technology	337
2	Charles Darwin University	270
3	University of Technology Sydney	257
4	Defence Science & Technology Group	167
5	University of Melbourne	166
6	Deakin University	164
7	Macquarie University	157
8	University of New South Wales	154
9	Edith Cowan University	148
10	Queensland University of Technology	126

Patents – Australia

Top 5 Australian Patent Applicants	Patent Families
New South Innovations	3
Introspectus	3
Atlassian	3
CSIRO	2
Aristocrat Technologies Australia	2

Patents filed by Australian businesses, 2015–2019.