

ASPI's Critical Technology Tracker

Top 5 country visual snapshot

Below is a visual snapshot showing the top 5 countries ranked by their (%) proportion of high-impact research output across 44 technologies. We have added a column (far right), which we've called 'Technology monopoly risk'. This metric seeks to highlight *concentrations of technological expertise in a single country*. It includes:


















- number 1 country's share of world's top 10 institutions
- number 1 country's lead over closest competitor (ratio of respective share of top 10% publications)
- a traffic-light rating:
 - **high** = 8+/10 top institutions in no. 1 country *and* at least 3x times research lead
 - **medium** = 5+/10 top institutions in no. 1 country *and* at least 2x times research lead
 - **low** = medium criteria not met

Advanced information and communication technologies

Technology	Top 5 countries					Technology monopoly risk
Advanced radiofrequency communications (incl. 5G and 6G)	29.9%	9.4%	5.4%	5.0%	4.8%	8/10 3.17 high
Advanced undersea wireless communication	44.6%	11.1%	7.1%	6.5%	3.9%	8/10 4.03 high
Advanced optical communications	37.7%	12.8%	5.6%	3.9%	3.5%	8/10 2.95 medium
Distributed ledgers	28.4%	11.3%	8.9%	5.6%	4.8%	6/10 2.51 medium
Mesh networks/infrastructure independent communication technologies	29.0%	14.4%	8.6%	4.3%	3.4%	6/10 2.01 medium
High performance computing	29.3%	25.6%	6.3%	4.7%	4.0%	3/10 1.15 low
Protective cybersecurity technologies	22.3%	16.8%	7.7%	5.7%	5.3%	3/10 1.33 low

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Advanced materials and manufacturing

Technology	Top 5 countries					Technology monopoly risk
Coatings	 58.5%	 7.3%	 6.0%	 3.2%	 2.8%	8/10 7.96 high
Nanoscale materials and manufacturing	 58.3%	 6.7%	 4.9%	 4.1%	 3.8%	10/10 8.67 high
Advanced composite materials	 40.8%	 14.0%	 7.3%	 4.0%	 3.9%	8/10 2.92 medium
Advanced explosives and energetic materials	 47.1%	 21.3%	 4.9%	 4.0%	 3.2%	5/10 2.21 medium
High-specification machining processes	 36.2%	 13.8%	 11.8%	 3.6%	 2.9%	8/10 2.62 medium
Novel metamaterials	 45.6%	 16.9%	 4.0%	 3.9%	 3.0%	7/10 2.70 medium
Smart materials	 42.6%	 8.1%	 7.0%	 6.7%	 3.3%	7/10 5.24 medium
Wide bandgap and ultrawide bandgap semiconductor technologies	 39.8%	 19.5%	 7.0%	 4.5%	 4.3%	6/10 2.04 medium
Additive manufacturing (incl. 3D printing)	 20.4%	 20.2%	 6.7%	 5.3%	 4.3%	5/10 1.01 low
Advanced magnets and superconductors	 33.4%	 16.4%	 7.5%	 7.1%	 5.0%	4/10 2.04 low
Advanced Protection	 35.1%	 18.7%	 5.3%	 4.7%	 3.0%	6/10 1.87 low
Continuous flow chemical synthesis	 24.6%	 13.9%	 5.7%	 5.1%	 3.8%	4/10 1.77 low
Critical minerals extraction and processing	 36.7%	 13.4%	 4.5%	 2.8%	 2.7%	4/10 2.74 low



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Artificial intelligence technologies

Technology	Top 5 countries					Technology monopoly risk
Advanced data analytics	31.2%	15.4%	6.0%	4.3%	3.9%	8/10 2.02 medium
Artificial intelligence (AI) algorithms and hardware accelerators	36.6%	13.3%	4.2%	4.2%	3.5%	7/10 2.76 medium
Advanced integrated circuit design and fabrication	24.2%	21.2%	7.2%	4.5%	3.6%	4/10 1.14 low
Adversarial AI	30.9%	25.2%	4.9%	4.1%	3.6%	6/10 1.23 low
Machine learning (incl. neural networks and deep learning)	33.2%	17.9%	4.9%	3.9%	3.3%	7/10 1.85 low
Natural language processing (incl. speech and text recognition and analysis)	25.7%	23.6%	5.7%	4.6%	3.4%	5/10 1.09 low




































Biotechnology, gene technology and vaccines

Technology	Top 5 countries					Technology monopoly risk
Synthetic biology	52.4%	16.8%	3.3%	3.1%	2.9%	9/10 3.12 high
Biological manufacturing	26.0%	10.4%	9.1%	3.8%	3.2%	6/10 2.49 medium
Vaccines and medical countermeasures	28.3%	12.6%	6.2%	6.2%	5.1%	8/10 2.26 medium

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Genetic engineering	 41.3%	 25.6%	 4.6%	 4.3%	 2.4%	8/10 1.61 low
Genome and genetic sequencing and analysis	 31.3%	 25.8%	 4.7%	 4.2%	 2.6%	6/10 1.21 low
Novel antibiotics and antivirals	 27.8%	 14.3%	 10.7%	 5.3%	 3.6%	4/10 1.95 low
Nuclear Medicine and Radiotherapy	 29.0%	 20.3%	 6.2%	 5.4%	 5.1%	5/10 1.42 low

Defence, space, robotics and transportation

Technology	Top 5 countries					Technology monopoly risk
Hypersonic detection, tracking, and characterisation	 73.2%	 14.3%	 4.1%	 1.0%	 1.0%	9/10 5.13 high
Advanced aircraft engines (incl. hyper-sonics)	 48.5%	 11.7%	 7.0%	 3.9%	 3.6%	7/10 4.15 medium
Drones, swarming and collaborative robots	 36.1%	 10.3%	 6.1%	 5.1%	 4.6%	5/10 3.50 medium
Advanced robotics	 27.9%	 24.6%	 5.5%	 4.8%	 3.8%	4/10 1.13 low
Autonomous systems operation technology	 26.2%	 21.0%	 5.3%	 5.1%	 3.6%	3/10 1.25 low
Small satellites	 24.5%	 17.2%	 7.8%	 4.4%	 4.2%	5/10 1.43 low
Space launch systems	 19.7%	 18.2%	 9.8%	 8.2%	 6.5%	1/10 1.08 low

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Energy and environment






























Technology	Top 5 countries					Technology monopoly risk
Electric batteries	65.5%	11.9%	3.8%	2.8%	2.4%	10/10 5.51 high
Hydrogen and ammonia for power	60.4%	6.7%	4.7%	2.8%	2.8%	9/10 8.96 high
Supercapacitors	64.2%	7.3%	4.9%	4.8%	2.0%	10/10 8.81 high
Directed energy technologies	39.1%	19.1%	5.9%	5.3%	2.9%	7/10 2.05 medium
Nuclear waste management and recycling	36.0%	16.6%	6.5%	4.5%	4.3%	8/10 2.17 medium
Photovoltaics	39.3%	9.2%	5.4%	4.9%	3.3%	7/10 4.28 medium
Biofuels	23.2%	15.5%	5.5%	4.4%	3.7%	3/10 1.50 low
Nuclear energy	26.9%	20.4%	6.1%	4.4%	4.3%	3/10 1.32 low

Quantum

Technology	Top 5 countries					Technology monopoly risk
Quantum computing	33.9%	15.0%	6.2%	5.5%	4.1%	8/10 2.26 medium
Post-quantum cryptography	31.0%	13.3%	6.8%	4.7%	3.7%	4/10 2.33 low
Quantum communications (incl. quantum key distribution)	31.5%	16.7%	7.7%	6.5%	3.8%	5/10 1.89 Low
Quantum sensors	23.7%	23.3%	7.8%	4.3%	4.3%	5/10 1.02 low















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Sensing, Timing, and Navigation

Technology	Top 5 countries					Technology monopoly risk
Inertial navigation systems	 44.0%	 12.5%	 4.2%	 4.1%	 4.1%	9/10 3.52 high
Multispectral and hyperspectral imaging sensors	 48.9%	 11.4%	 4.4%	 3.6%	 3.3%	9/10 4.29 high
Photonic sensors	 43.7%	 12.4%	 5.1%	 3.9%	 3.1%	8/10 3.53 high
Sonar and acoustic sensors	 49.4%	 12.5%	 6.3%	 3.9%	 2.9%	9/10 3.96 high
Atomic clocks	 36.0%	 17.9%	 12.7%	 5.3%	 4.6%	7/10 2.01 medium
Radar	 40.0%	 15.7%	 5.1%	 4.7%	 4.6%	7/10 2.54 medium
Satellite positioning and navigation	 36.3%	 14.2%	 5.4%	 4.2%	 3.7%	6/10 2.56 medium
Gravitational-force sensors	 20.5%	 16.1%	 9.3%	 7.0%	 6.2%	3/10 1.27 low
Magnetic field sensors	 28.4%	 17.2%	 8.8%	 8.4%	 3.7%	3/10 1.65 low

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Unique AUKUS Technologies

Technology	Top 5 countries					Technology monopoly risk
Autonomous underwater vehicles	 56.5%	 9.6%	 3.3%	 3.0%	 2.9%	10/10 5.89 high
Electronic warfare	 46.0%	 14.4%	 4.0%	 3.6%	 3.4%	9/10 3.20 high
Air-independent compact energy generation	 41.5%	 11.3%	 7.8%	 4.3%	 3.8%	5/10 3.65 medium