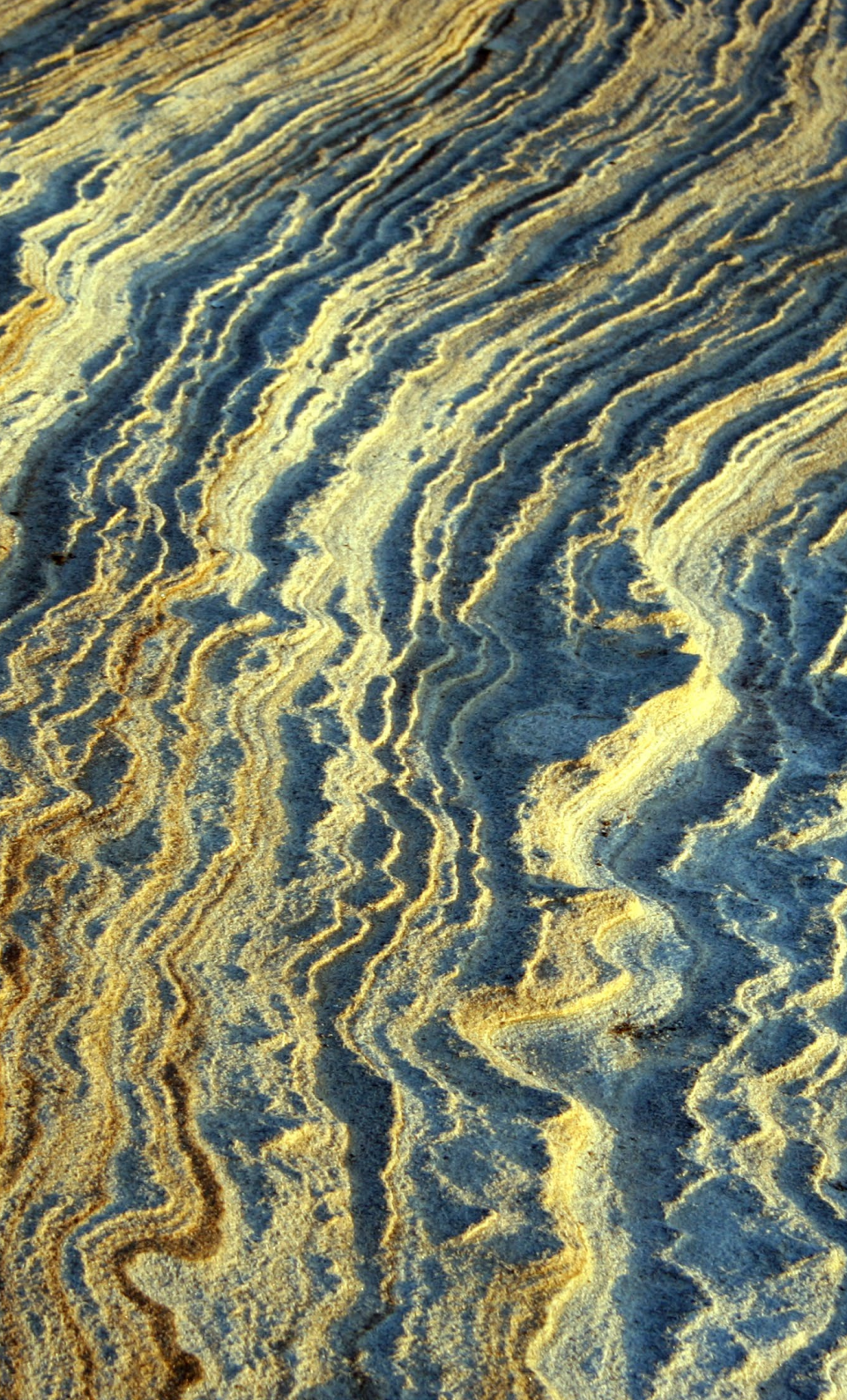


2022 NSW Innovation and Productivity Scorecard

Benchmarking our performance

April 2022



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Acknowledgment of Country

We acknowledge the traditional custodians of the land and pay respects to Elders past and present. We also acknowledge all the Aboriginal and Torres Strait Islander staff working within NSW Government at this time.

Champions' Foreword



Professor Barney Glover AO
Vice-Chancellor and President, Western Sydney University
IPC Project Champion



Dr Richard Sheldrake AM
Board Member, Academy of Technological Sciences and
Engineering, and The Crawford Fund
IPC Project Champion

Welcome to the third NSW Innovation and Productivity Scorecard.

It is our pleasure to co-champion the third edition of the NSW Innovation and Productivity Scorecard. Our Scorecard is unique – benchmarking NSW's performance on innovation and productivity metrics against comparable jurisdictions and leading international economies.

This year we introduce a new theme on Net Zero Economy, highlighting our ongoing focus on performance in crucial areas of the innovation ecosystem, informing policy, business and investors. It shows that NSW is growing strongly in the share of renewable energy generation but is still a much higher per capita emitter of greenhouse gases than many of the international benchmark countries.

Highlights from the 2022 Scorecard include NSW moving to the top spot on the Scorecard's ranking for the number of Global Top 200 universities, ranking 3rd for top 1% cited papers ahead of all benchmarked international economies bar Singapore, and a higher percentage of researchers in the top 10 of their field than any of the benchmarked international economies.

NSW also ranked 3rd for venture capital firms on social media, behind only Singapore and the UK, and now has more startup founders on social media on a population-adjusted basis than any of the benchmarked international economies, bar California.

These are important leading indicators for the future strength of our innovation economy.

But our performances in total R&D intensity and university-industry collaboration on published papers have not improved since the last Scorecard. There have also been declines in Business and Government R&D intensity. These results highlight the importance of implementing the recommendations from the IPC's *Let's Collaborate: SMEs using research to drive innovation*, and the State's Action Plan, *Turning ideas into jobs: Accelerating R&D in NSW*.

The insights in this report demonstrate some strengths in our ecosystem but there is much work still to do. The NSW Innovation and Productivity Council (IPC) is proud to work with the NSW Government to drive innovation and strengthen the economy for our continuing prosperity.

We thank CSIRO's Data61, Knowledge Commercialisation Australasia, the Electric Vehicle Council and Clarivate Analytics for their valuable data collaborations, and our IPC colleagues for their contributions to this report.

We also thank the team in Investment NSW for their work on this report.

We hope the insights from our 2022 Scorecard help inform your work.

About the 2022 NSW Innovation and Productivity Scorecard

Good decisions need quality data

The 2022 NSW Innovation and Productivity Scorecard is an important product for understanding NSW's performance on a range of innovation and productivity measures.

It is produced by the NSW Innovation and Productivity Council (IPC), comprised of highly respected industry, education and research leaders who advise the NSW Government on how to improve innovation and productivity in NSW.

Innovation creates new jobs, provides opportunities for investment and is an important ingredient for productivity growth. And it's productivity growth that supports our continued living standards.

As the COVID-19 pandemic moves over time to a more endemic state, more and more jurisdictions around the world are actively increasing their efforts to grow their innovation economies.

The data released in this Scorecard is the starting point for good advice and good decisions that will grow the NSW economy and its innovation ecosystem, enabling NSW's citizens to prosper.

The use of a variety of measures and data sources relevant to innovation ecosystems globally allows for a better understanding of our strengths and weaknesses, relative to other economies.

Continuing the benchmarking of NSW against comparative economies

The report compares NSW's performance against a range of international jurisdictions and comparable Australian states, including Canada, Germany, New Zealand, Singapore, the United States, the United Kingdom, Australia and the Australian states of Victoria and Queensland. NSW is also compared with the OECD average and the US states of Georgia and California where such data exists.

The 2022 Scorecard continues the 2018 and 2019 editions' tradition of complementing conventional measures of innovation with measures and new insight made available through data science.

New data partners are Knowledge Commercialisation Australasia (KCA), the Electric Vehicle Council and Clarivate Analytics.

Collaboration with KCA has allowed the use of metrics and data from KCA's *Survey of Commercialisation Outcomes from Public Research (SCOPR)*. KCA's SCOPR continues the prior work of the Department of Industry, Science, Energy and Resources' *National Survey of Research Commercialisation (NSRC)*.

Collaboration with Clarivate Analytics was on the existing metric for top research papers, and with the Electric Vehicle Council for new metrics on EV sales and fleet share.

Enabling tracking of performance over time

By collecting data on the measures regularly, NSW continues building a data bank to track performance over time.

This enables us to respond promptly to areas of weakness and celebrate areas of strength in our ecosystem.

The 2022 Scorecard reports on most of the same measures as the 2018 and 2019 Scorecards. Only where no new data is available since the 2019 Scorecard has a metric been excluded in this edition.

A new theme introduced in the 2022 Scorecard is Net Zero Economy. Metrics on emissions, renewable energy generation and electric vehicles support the monitoring of progress toward NSW's greenhouse emissions reduction objectives. NSW is committed to achieving net zero by 2050 and has set out its emissions reduction plan for the next decade in the *Net Zero Plan Stage 1: 2020-2030*.

Future Scorecards will introduce more new themes and metrics. New understanding will be crucial for NSW's competitive positioning as countries emerge from the COVID-19 pandemic and compete for the investment and jobs that will fuel their innovation economies.

2022 Scorecard Highlights



Research & Collaboration

NSW values research and development

\$11.4b

A total of \$11.4 billion was invested in R&D in NSW in 2019, an increase of \$0.3 billion from 2017.



NSW has strong researchers and universities.

3rd

NSW ranks third for the number of top 1% papers, ahead of all international economies benchmarked in the Scorecard, bar Singapore.



1st

NSW ranks first for the number of top 200 ranked universities. Six of NSW's 11 public universities rank in the global top 200, twice as many as in 2019.



Research commercialisation is a focus.



NSW universities and research institutes outperform the Australian benchmarks in 2020 on Invention Disclosures and Licensing and related deals.

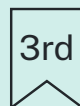


Skills & Enterprise

NSW is Australia's startup capital

30%

Nearly a third (30%) of Australia's startups and spin-outs came from NSW universities and research institutes in 2020.



3rd

NSW now ranks third only to Singapore and the UK for the number of venture capital firms on social media, an increase of 304 firms since 2019.



3rd

NSW ranks third for number of startup founders and co-founders on social media, now ahead of Singapore but just behind Victoria.



NSW has a highly-educated and skilled workforce.



Over half (51.5%) of NSW workers are tertiary-qualified, an increase of 3 percentage points since the 2019 Scorecard.



Net Zero Economy

The Net-Zero Economy is a seismic investment opportunity

100%

Percentage increase in the share of renewable energy generation in total NSW energy generation since 2018.



1st

NSW leads the Australian benchmarks on annual EV sales.



Growth & Productivity

NSW has a resilient and dynamic economy with many new businesses



NSW GSP declined less than all the international benchmarks except New Zealand following the COVID-19 pandemic.



4%

In 2021, the net business creation rate strengthened to 4%, up from 3.6% in 2017 and 3.8% in 2018.



NSW has Australia's strongest multi-factor productivity growth over the last 10 years.



NSW has widened its lead over the Australian benchmarks on the Multi-Factor Productivity Index since the 2019 Scorecard.

NSW at a Glance

International comparison

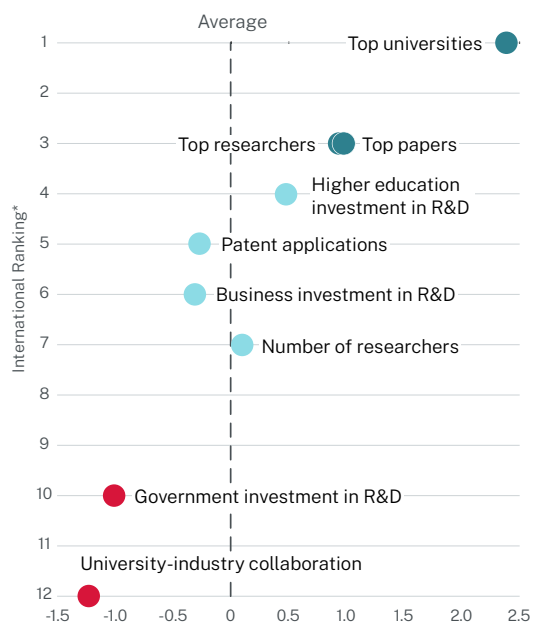
Current performance

- NSW performs above average
- NSW performs at average
- NSW performs below average

Scores within 0.5 standard deviations (in either direction) of the mean get a light blue dot, >0.5 get a dark blue dot and <-0.5 get a red dot.

Research & Collaboration

Investments to generate knowledge and innovations

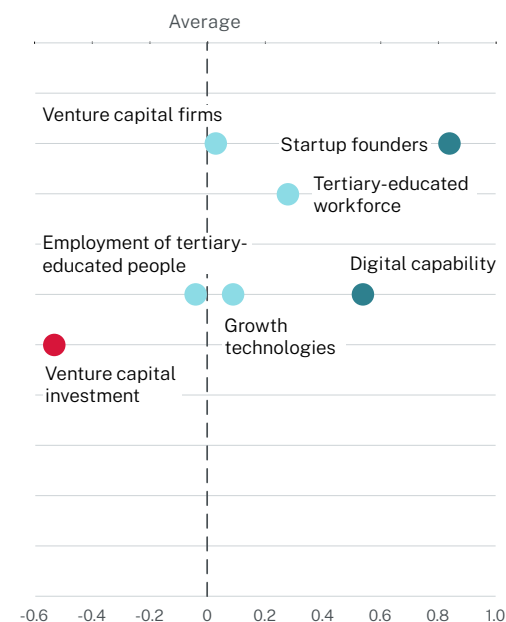


NSW has strong researchers and universities

- NSW is ranked 3rd for top 1% cited papers on a population-adjusted basis, ahead of all benchmarked international economies bar Singapore.
- NSW has a higher percentage of researchers in the top 10 of their field than any of the benchmarked international economies.
- NSW ranks first for top universities on a population-adjusted basis, although university-industry collaboration remains a challenge.

Skills & Enterprise

Capacity to support innovations in the market

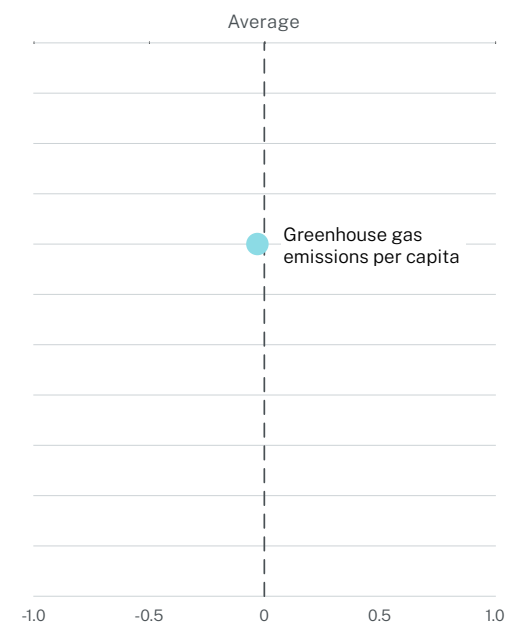


NSW has growing investor interest and entrepreneurial workforce

- NSW is ranked 3rd for venture capital firms on social media on a population-adjusted basis, behind only Singapore and the UK. However, NSW still lags the leading jurisdictions on venture capital investment.
- NSW now has more startup founders on social media on a population-adjusted basis than any of the benchmarked international economies, bar California.
- NSW has increased by 93% the proportion of NSW businesses using digital 'growth technologies' since the 2019 Scorecard.

Net Zero Economy

Driving NSW in the race to Net Zero

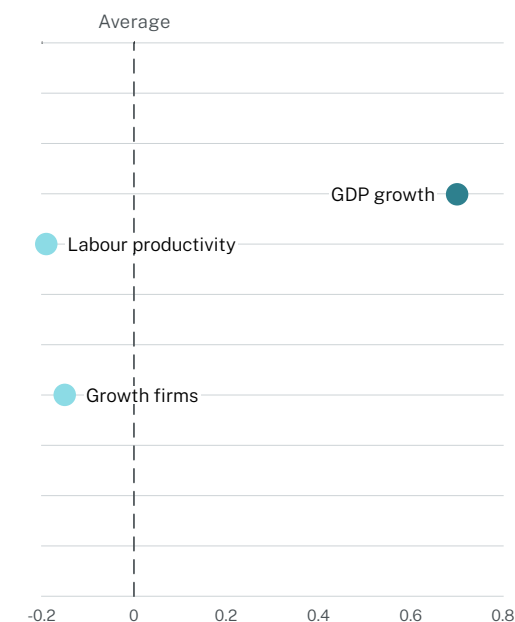


The Net-Zero Economy is a seismic investment opportunity

- NSW's per capita total greenhouse gas emissions fell 16% between 2014 and 2019, more than Canada, the US, New Zealand and Germany.

Growth & Productivity

Measures of economic performance and efficiency



NSW has a resilient and dynamic economy with many new businesses

- NSW GSP declined less than all the international benchmarks following the COVID-19 pandemic except New Zealand, and has a strengthening net business creation rate.
- NSW has a similar proportion of businesses that have grown by more than 10% over a two-year period as the US, but is now behind Victoria and Queensland.

* This ranking compares NSW to the US, the UK, Canada, Singapore, Germany, New Zealand, the Australian average, the Australian states of Queensland and Victoria, and, where data are available, the US states of California and Georgia on a range of metrics. The y-axis shows where NSW ranks against those 11 comparison economies. The x-axis shows how close NSW's performance is to the average.

Current performance and recent trends



Research & Collaboration

NSW compared to international and state benchmarks

● Business investment in R&D	↓
● Government investment in R&D	—
● Higher education investment in R&D	↑
● Total investment in R&D	↓
● Number of researchers	—
● Top 1% cited papers	↑
● Researchers who are top 10 in their field	↑
● Top 200 universities	↑
● University and industry collaboration index	↑
● Patent applications	↓

NSW compared to Australia and state benchmarks only

● Government investment in R&D	—
● Higher education research funded by industry	↑
● Australian Research Council grants	—
● Research commercialisation income	—
● New and active licences, options and assignments	—
● Invention disclosures	—



Skills & Enterprise

NSW compared to international and state benchmarks

● Number of venture capital firms	↑
● Venture capital investment	—
● Share of startup founders	↓
● Digital capability	↓
● Growth technologies	—
● Tertiary-educated workforce	↑
● Employment of tertiary-qualified people	↓

NSW compared to Australia and state benchmarks only

● Startups from research institutes	—
● Commercialisation staff in universities	—
● Vocationally trained workforce	↓

Current performance

- NSW performs above average
- NSW performs at average
- NSW performs below average

Scores within 0.5 standard deviations (in either direction) of the mean get a ● light, >0.5 get a ● light and <-0.5 get a ● light.



Net Zero Economy

NSW compared to international and state benchmarks

● Emissions per capita	—
------------------------	---

NSW compared to Australia and state benchmarks only

● Renewable energy generation	—
● Electric vehicles sales	—
● Electric vehicles in vehicle registrations	—

Change from 2019 Scorecard values

- ↑ increase for NSW
- ↓ decrease for NSW
- no change for NSW or not available/new metric



Growth & Productivity

NSW compared to international and state benchmarks

● Labour productivity	↑
● Growth firms	—
● Annual GDP growth	↓

NSW compared to Australia and state benchmarks only

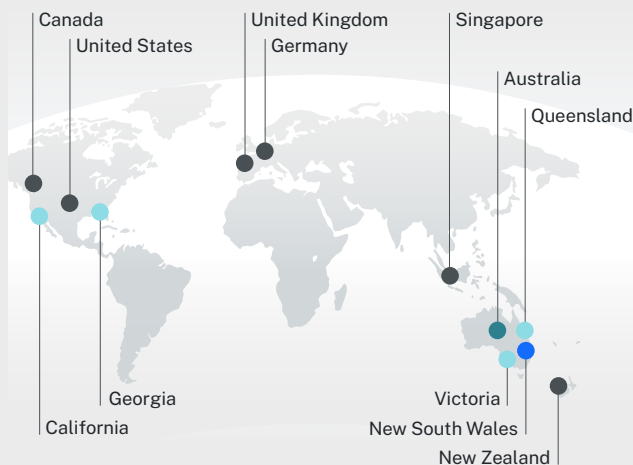
● Net business creation	↑
● Multi-factor productivity	—

* This ranking compares NSW to the US, the UK, Canada, Singapore, Germany, New Zealand, the Australian average, the Australian states of Queensland and Victoria, and, where data are available, the US states of California and Georgia on a range of metrics. The y-axis shows where NSW ranks against those 11 comparison economies. The x-axis shows how close NSW's performance is to the average.

International and State Benchmarks

GSP figures below are expressed in current international dollars, converted by a purchasing power parity (PPP) factor. PPPs seek to equalise the purchasing power of countries' currencies by removing differences in price levels between countries, using a market "basket of goods" approach. Two currencies are in PPP when a market basket of goods (taking into account the exchange rate) is priced the same in both countries.

● NSW ● Australia ● States ● Nations



Canada ●

GDP 2019: \$1,899B
4.5 x NSW GSP¹

Population 2020: 38.0M
Majority service industries. Strong primary sector – forestry, petroleum and agriculture. Sizeable manufacturing sector.

- Global Innovation Index rank 2021: 16
- Human Development Index rank 2020: 16
- Environmental Performance Index rank 2020: = 20

United States ●

GDP 2019: \$21,433B
51.1 x NSW GSP¹

Population 2020: 329.5M
Diverse economy with abundant natural resources and well developed infrastructure. Ranks second in the world for highest estimated value of natural resources.

- Global Innovation Index rank 2021: 3
- Human Development Index rank 2020: 17
- Environmental Performance Index rank 2020: 24

California ●

GDP 2019: \$3,133B
7.5 x NSW GSP³

Population 2020: 39.4M
Diverse economy, known for technology, entertainment and agriculture. Largest economy in the United States.

Georgia ●

GDP 2019: \$626B
1.5 x NSW GSP³

Population 2020: 10.7M
Majority service industries. Significant manufacturing – textiles, pulp and paper products. Sizeable agricultural sector.

United Kingdom ●

GDP 2019: \$3,237B
7.7 x NSW GSP¹

Population 2020: 67.1M
Majority service industries. Strong financial services industry. Significant defence, aerospace and pharmaceutical sectors.

- Global Innovation Index rank 2021: 4
- Human Development Index rank 2020: 13
- Environmental Performance Index rank 2020: 4

Germany ●

GDP 2019: \$4,644B
11.1 x NSW GSP¹

Population 2020: 83.2M
Majority services and IT industries. Strong manufacturing sector – vehicles, machinery, chemical goods, electronic products, equipment, pharmaceuticals. Third largest exporter in the world.

- Global Innovation Index rank 2021: 10
- Human Development Index rank 2020: 6
- Environmental Performance Index rank 2020: 10

Singapore ●

GDP 2019: \$581B
1.4 x NSW GSP¹

Population 2020: 5.7M
Regional hub for financial services. Significant exports in electronics and chemicals. Dependent on imports of natural resources.

- Global Innovation Index rank 2021: 8
- Human Development Index rank 2020: = 11
- Environmental Performance Index rank 2020: 39

Australia ●

GDP 2019: \$1,324B
3.2 x NSW GSP¹

Population 2020: 25.7M
Majority service industries. Wealthiest nation (median wealth per adult) in 2020. Eighth highest globally for total estimated value of natural resources.

- Global Innovation Index rank 2021: 25
- Human Development Index rank 2020: = 8
- Environmental Performance Index rank 2020: 13

Queensland ●

GSP 2019: \$241B
0.6 x NSW GSP²

Population 2020: 5.2M
Third largest economy in Australia. Strong mining, agriculture, tourism and financial services. Main exports are coal, metals, meat and sugar.

New South Wales ●

GSP 2019: \$420B
1 x NSW GSP²

Population 2020: 8.2M
NSW is Australia's largest economy. It has a diverse range of industries and is highly competitive in the financial services, education and tourism sectors. It also has a strong primary sector, with high exports of both agricultural products and mineral resources.

Victoria ●

GSP 2019: \$313B
0.7 x NSW GSP²

Population 2020: 6.7M
Second largest economy in Australia. Finance and insurance sectors produce most income. Health care and social assistance employ the most people.

New Zealand ●

GDP 2019: \$224B
0.5 x NSW GSP¹

Population 2020: 5.1M
Majority service sector. Large scale manufacturing industries – aluminium, food processing, metal fabrication, wood and paper.

- Global Innovation Index rank 2021: 26
- Human Development Index rank 2020: = 14
- Environmental Performance Index rank 2020: 19

1



Research and Collaboration

R&D investment

Research and development (R&D) expenditure is the money spent on creative work undertaken on a systematic basis to increase the stock of knowledge and the use of this knowledge to devise new applications.⁴

Recent research from the CSIRO shows for every dollar invested in innovation, including R&D, Australia sees \$3.50 value generated and an average 10% annual return.⁵

NSW continues to rank 5th for total investment in R&D, with 1.8% of NSW GSP spent on R&D. The headline rankings are very similar to the 2019 Scorecard. Most R&D investment in NSW still comes from business.

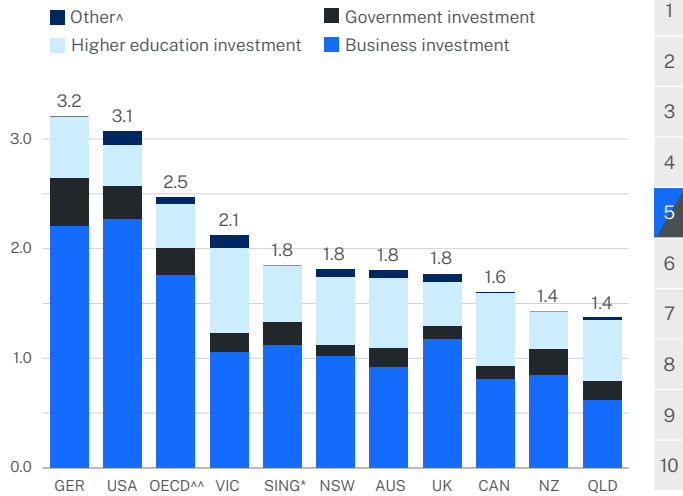
But the data shows NSW lost ground to Victoria, driven by a relatively sharper fall in Business Expenditure on R&D (BERD) as a share of GSP. At the same time, Germany and the US have increased their lead on the intensity of their R&D.

This continues to be a focus area for the NSW Government. R&D NSW is developing a 20-year Research and Development Roadmap to assist the NSW Government prioritise its own R&D investments, and provide a signal to industry and researchers on what R&D investment opportunities exist in NSW.⁶

In parallel, the NSW Government is increasing its investments in R&D through new programs such as the \$24 million Small Business Innovation & Research (SBIR) program and the \$28 million Bushfire Response R&D Mission.⁷ These new programs build on existing programs such as the Physical Sciences Fund and the NSW Research and Innovation Networks which have supported university and industry collaboration in the translation of R&D in NSW.

Total R&D Investment

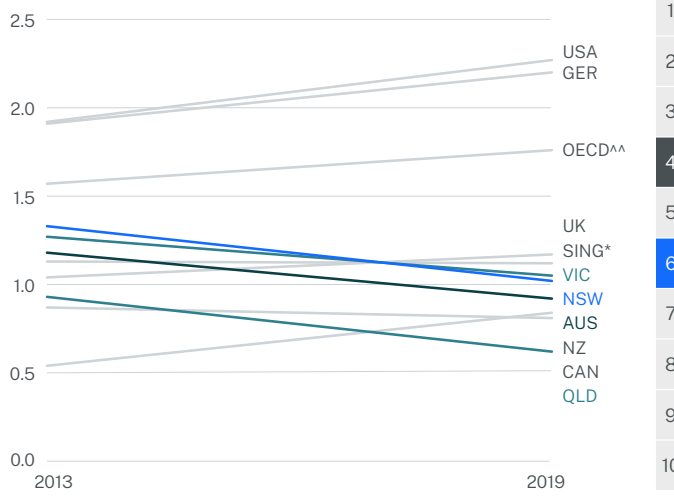
Gross Investment in R&D as a percentage of GSP, 2019



Sources: OECD Main Science & Technology Indicators (MSTI), September 2021; ABS, Research and Experimental Development, Businesses, Australia, 2019-20 ABS, Australian National Accounts: State Accounts, 2019-20.

Business R&D

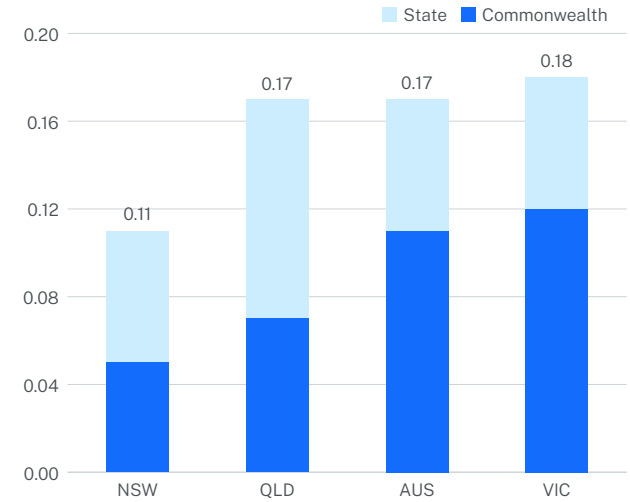
Business investment in R&D as a percentage of GSP, 2013-2019



Sources: OECD MSTI, September 2021; ABS, Research and Experimental Development, Businesses, Australia, 2019-20 ABS, Australian National Accounts: State Accounts, 2019-20.

Government R&D in Australia

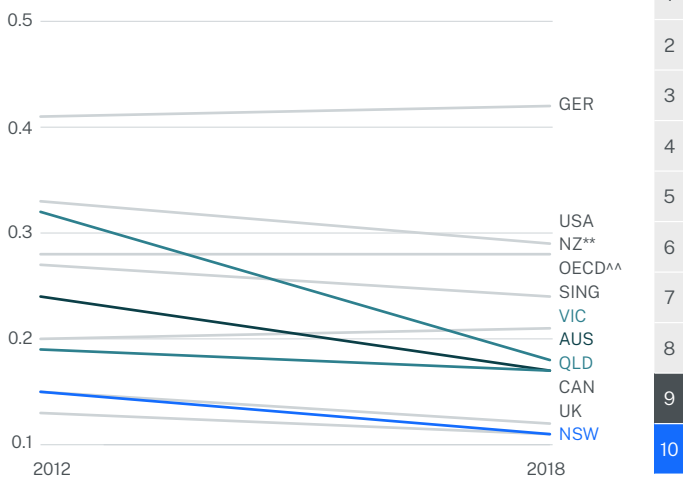
Australian and state government expenditure in R&D as a percentage of GSP, 2018-19



Sources: ABS, Research and Experimental Development, Government and Private Non-Profit Organisations, Australia, 2018-19; ABS, Australian National Accounts: State Accounts, 2018-19.

Government R&D

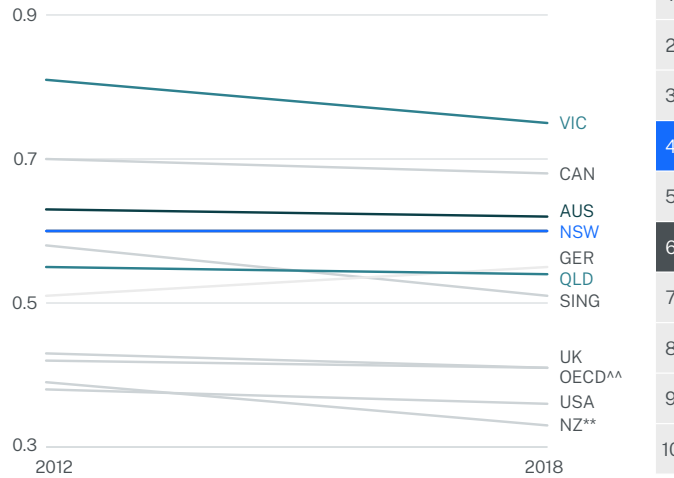
Government expenditure in R&D as a percentage of GDP/GSP, 2012-2018



Sources: OECD MSTI, September 2021; ABS, Research and Experimental Development, Government and Non-Profit Organisations, Australia, 2018-19; ABS, Australian National Accounts: State Accounts, 2018-19.

Higher Education R&D

Higher education investment in R&D as a percentage of GDP/GSP, 2012-2018



Sources: OECD MSTI, September 2021; ABS, Research and Experimental Development, Higher Education Organisations, Australia, 2018; ABS, Australian National Accounts: State Accounts, 2018-19.

* Singapore data are for 2018.

^ Includes Private non-profit R&D expenditure for Australia and states; residual value not specified for other countries.

** NZ data are for 2011 and 2017.

^^ OECD average not included in rankings.

Research workforce

NSW research and researchers are strengthening. NSW now tops the ranking for top 200 universities per million population, up from third in 2019. Six of the 11 public universities in NSW are now ranked in the top 200 of the QS World University Rankings.

NSW researchers now also outperform all the international benchmarked economies in the percentage of researchers at the top of their fields.

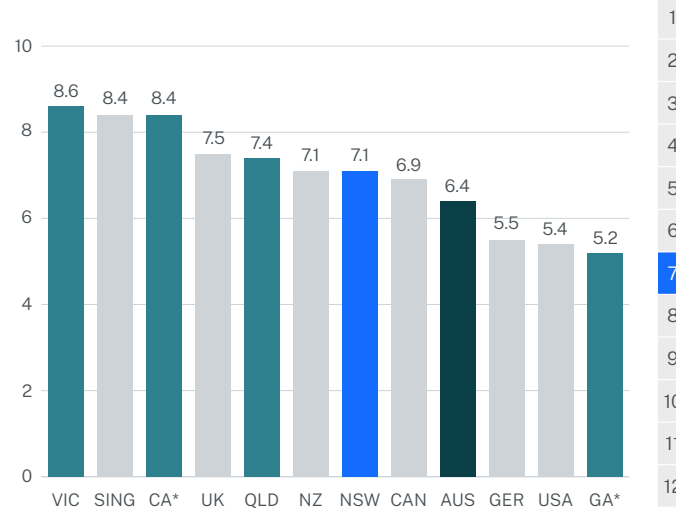
Along with the other Australian states' strong showing, this measure of research talent reveals the quality of Australian researchers extends across many disciplines, fields and topics.

The number of top papers produced in NSW over a ten-year period to 2020 also grew significantly, lifting NSW's ranking to third from fifth in 2019. This outperformance over most of the international benchmarked economies is consistent with the strength of NSW's research talent.

NSW has the largest cohort of full-time equivalent researchers in any Australian state or territory (30%).⁸ NSW has an average number of researchers per 1,000 users on LinkedIn, but NSW has now fallen behind the other Australian benchmark states.

Researchers

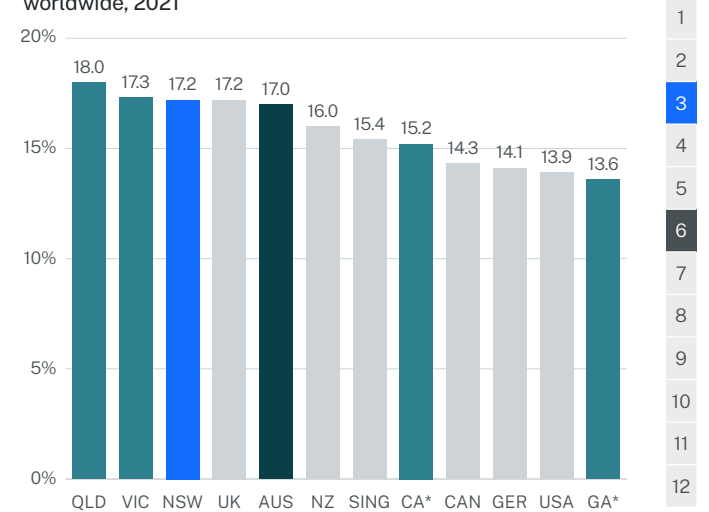
Number of researchers per 1,000 users on social media, 2021



Source: CSIRO's Data61 analysis of LinkedIn data, 2021
Time series data has not been calculated.

Top Researchers

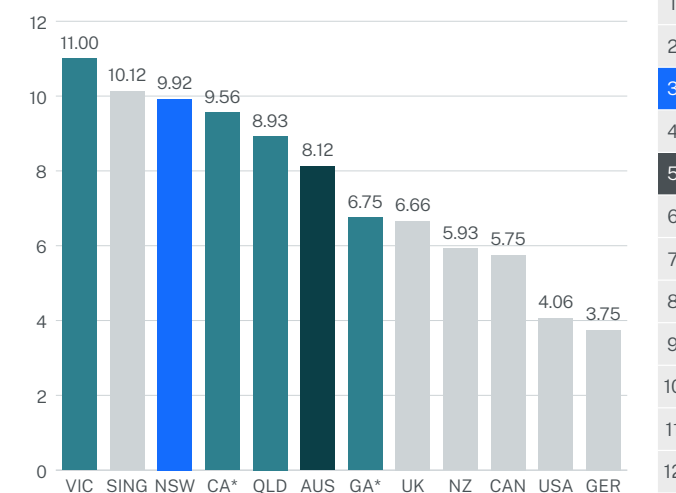
Percentage of researchers who are top 10 in their field worldwide, 2021



Source: CSIRO's Data61 analysis of League of Scholars Data, 2021
Time series data has not been calculated.

Top Papers

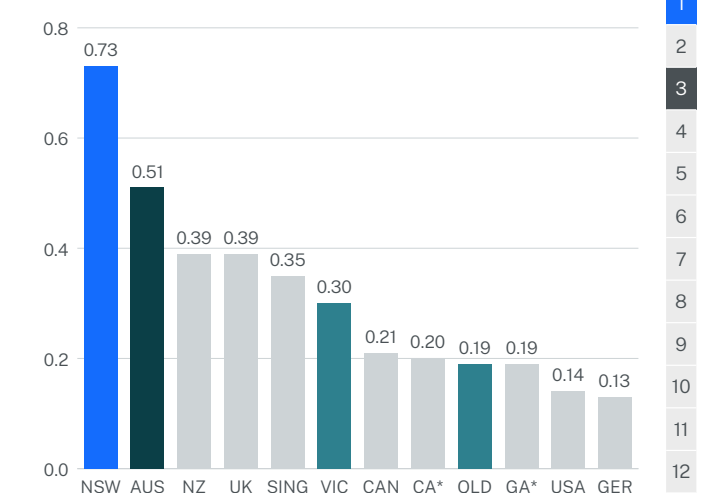
Number of top 1% cited papers from 2011-2020 per 10,000 population



Sources: InCites™, Clarivate, InCites data as of 29th Oct 2021; ABS, National, state and territory population, December 2020; various national statistical agencies data as at December 2020 in most cases.
Time series data has not been calculated.

Top Universities

Number of top 200 universities per million population, 2022



Sources: QS World University Rankings, 2022; ABS, National, state and territory population, December 2020; various national statistical agencies data as at December 2020 in most cases.

* US states of California and Georgia.

Collaboration

All benchmarked economies continue to outperform NSW for university-industry collaboration, based on university-industry co-authored papers. While NSW's share of research co-authored with industry has grown since the 2019 Scorecard, so too has the rest of the world's.

The benefits for NSW of improving university-industry collaboration are clear. The IPC's research has shown doubling our 2020 rate of collaboration could see a productivity increase worth up to \$150 million per year for NSW.⁹

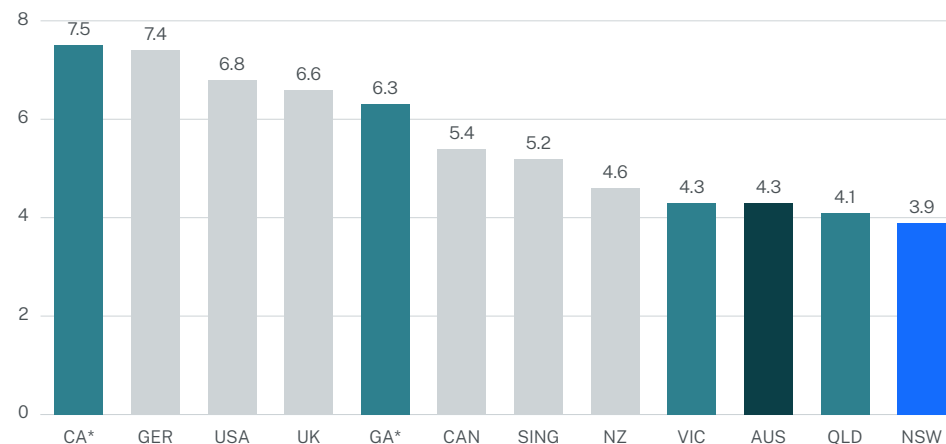
The most recent data shows NSW's percentage of higher education research funded by industry remains at almost the same level as in 2015, whereas Victoria has significantly increased its lead compared to the Australian benchmarks.

NSW outperforms the Australian benchmarks on the total value of competitive grants per researcher over the last two decades.¹⁰ But recent ARC grant data shows NSW was awarded between 3% and 6% less funding for research grants per researcher than the Australian benchmarks.

As economies recover from the COVID-19 pandemic and try to capture more of the innovation economy, collaboration and the translation of research is more critical than ever for our continued prosperity.

University and Industry Collaboration

University-industry research co-authorship, percentage of papers, 2021

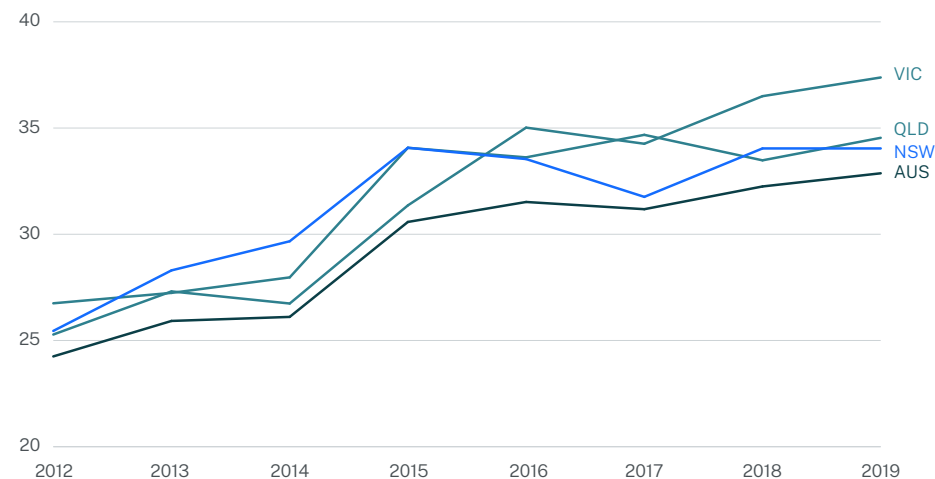


Source: CSIRO's Data61 analysis of CWTS Leiden Ranking University-Industry Collaboration data, 2021 (percentage of a university's publications that have been co-authored with one or more industrial organisations; average across all universities in a jurisdiction) Time series data has not been calculated.

NSW Rank Previous
1
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12

Higher Education Research Funded by Industry

Percentage of higher education research funded by industry, 2012 - 2019

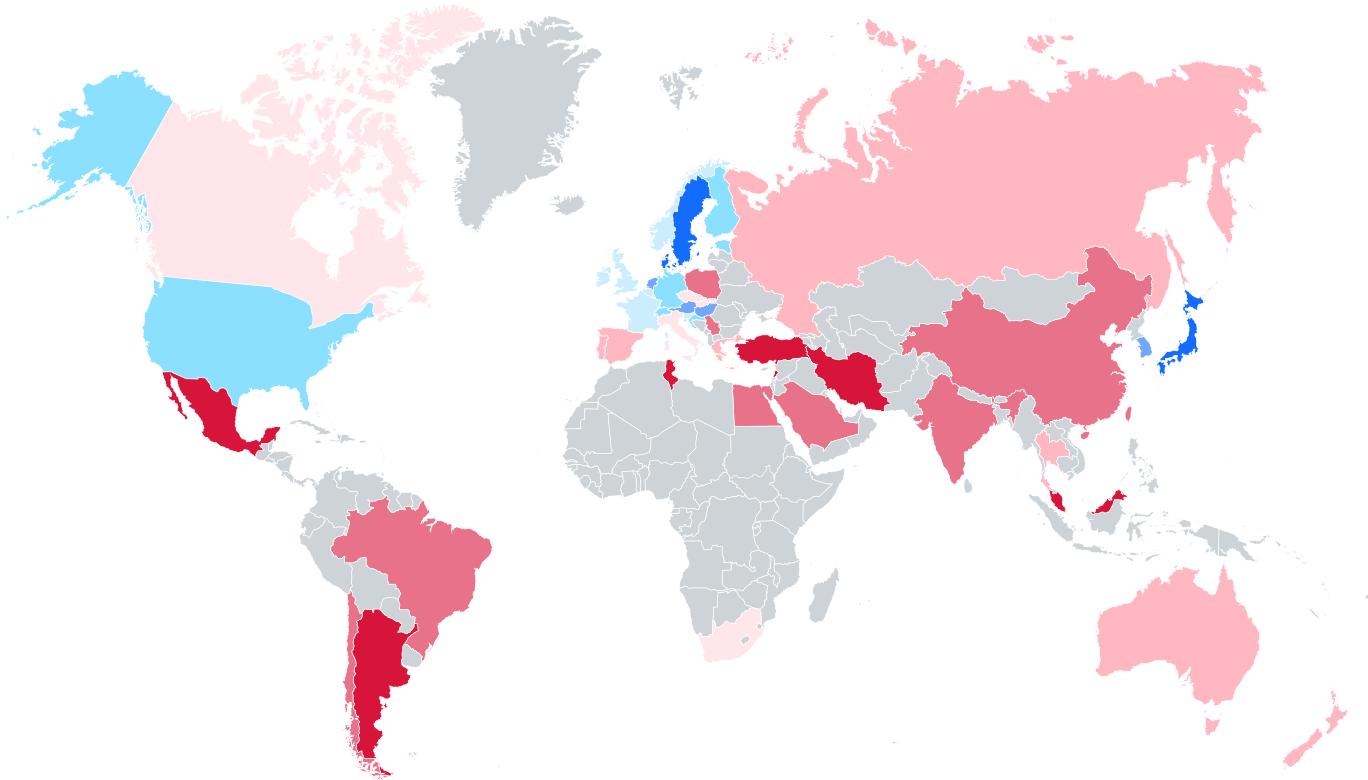


Source: Australian Government Department of Education, Skills and Employment, Higher Education Research Data Collection (HERDC), Research Income (1994-2019).

University and Industry Collaboration

World heat map of highest and lowest collaboration, 2021

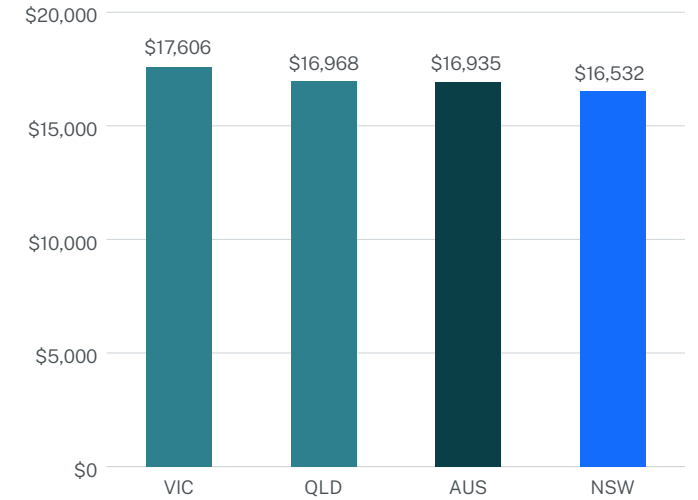
High  Low



Source: CSIRO's Data61 analysis of CWTS Leiden Ranking University-Industry Collaboration data (2021).

Research Grants

Competitive grants awarded for calendar year 2020 per researcher



Source: CSIRO's Data61 analysis of all competitive ARC awarded grants and full time equivalent researchers, Australian Government Department of Education, Skills and Employment, (2021).



Doubling our 2020 rate of collaboration could see a productivity increase worth up to \$150 million per year for NSW.

Ideas and inventions

NSW's patent applications ranking is largely as the 2019 Scorecard. NSW continues to outperform the Australian benchmarks, but the UK has marginally overtaken NSW.¹¹

Research commercialisation is a key success factor in the innovation economy, driving many ideas and inventions and delivering a commercial return on R&D. Most of the commercialisation metrics in the 2022 Scorecard use the latest data from Knowledge Commercialisation Australasia's *Survey of Commercialisation Outcomes from Public Research (SCOPR)*.¹²

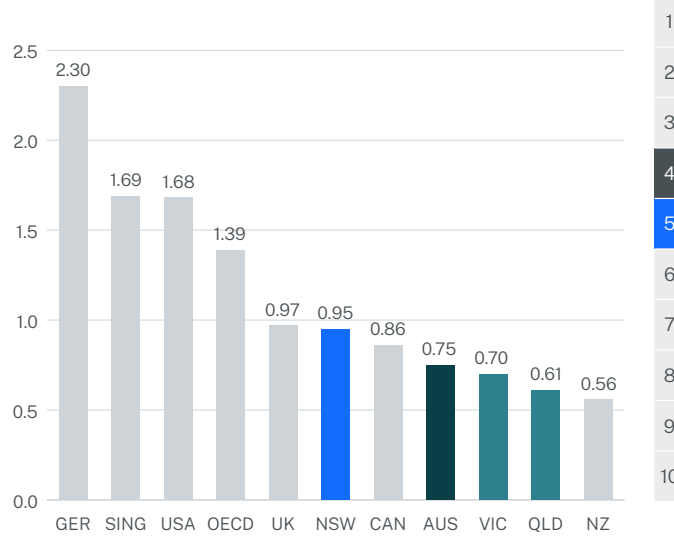
The data shows the number of confidentially-disclosed inventions per NSW institute in 2020 is the highest of the Australian benchmarks.

NSW research institutes also outperform the Australian benchmarks on New and Active Licences, Options and Assignments (LOAs).¹³ While NSW research institutes are outperformed by the Australian benchmarks on research commercialisation income, the uplift in LOAs suggests higher future commercialisation income and commercial opportunities.^{14, 15}

Not all universities and research institutes provided data for SCOPR. Encouragingly the SCOPR reports show the number of reporting institutions is rising, from 49 in 2019 to 56 in 2020.

Patent Applications

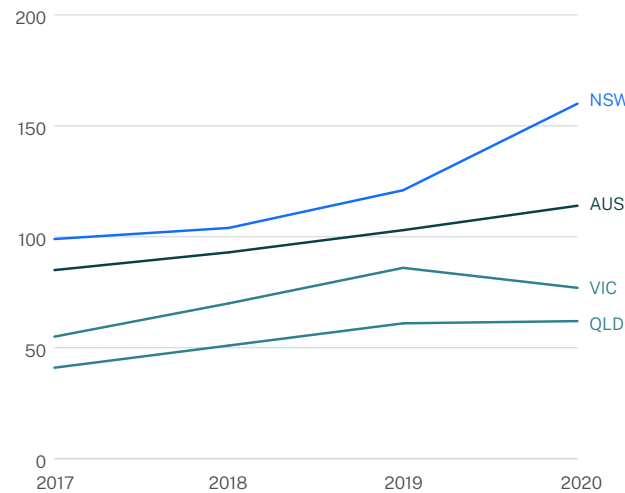
Patent applications per 10,000 population, 2018



Sources: IP Australia, Australian Intellectual Property Report, 2019; ABS, National, state and territory population, December 2020; OECD MSTI, September 2021. OECD average not included in ranking.

New and Active Licences, Options and Assignments

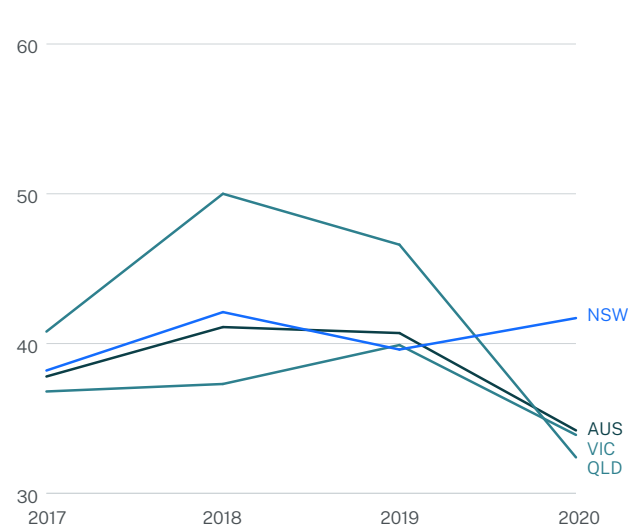
New and active licences, options and assignments arising from universities and research institutes, per institute, 2017-2020



Source: Survey of Commercialisation Outcomes from Public Research (SCOPR) 2017-2020, Knowledge Commercialisation Australasia. Excludes cumulative values for CSIRO of 2,096 and ANSTO of 74 over this period.

Invention Disclosures

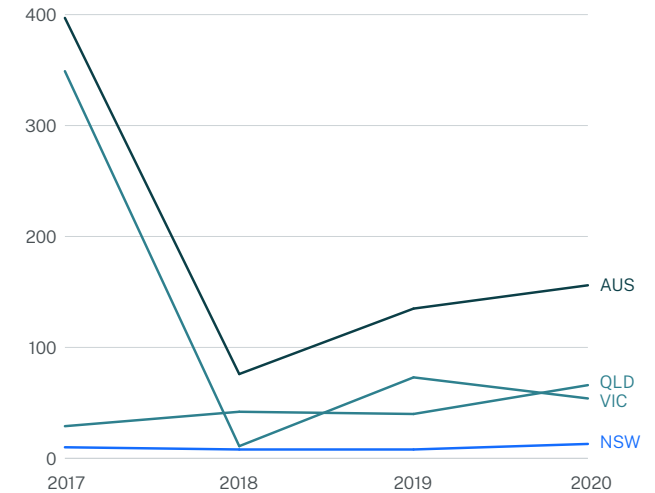
Invention disclosures per institute, 2017-2020



Source: Survey of Commercialisation Outcomes from Public Research (SCOPR) 2017-2020, Knowledge Commercialisation Australasia. Excludes cumulative values for CSIRO of 391 and ANSTO of 9 over this period.

Research Commercialisation Income

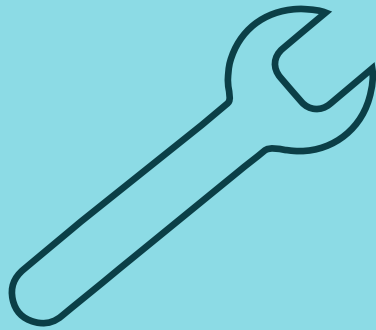
Research commercialisation income by universities and research institutes, 2017-2020 (\$m)



Source: Survey of Commercialisation Outcomes from Public Research (SCOPR) 2017-2020, Knowledge Commercialisation Australasia. Excludes cumulative values for CSIRO of \$186m and ANSTO of \$43m over this period.

2

Skills and Enterprise



Venture capital and startups

NSW is Australia's standout startup capital and Sydney is the only Australian ecosystem in the Top 30 of Startup Genome's *Global Startup Ecosystem Ranking 2021*. Startup Genome also ranks Sydney as #1 in Oceania for both Ecosystem Talent & Experience and Ecosystem Funding.¹⁶

Following the success of the Sydney Startup Hub, Tech Central will be a home for the innovation and technology community to thrive and create the jobs of the future.¹⁷ The NSW Government's initial commitment of \$48.2 million will provide up to 25,000 square metres of affordable space for startups and scaleups.¹⁸

Innovation investment is becoming an important feature of the NSW economy and NSW is becoming a magnet for financial investors.

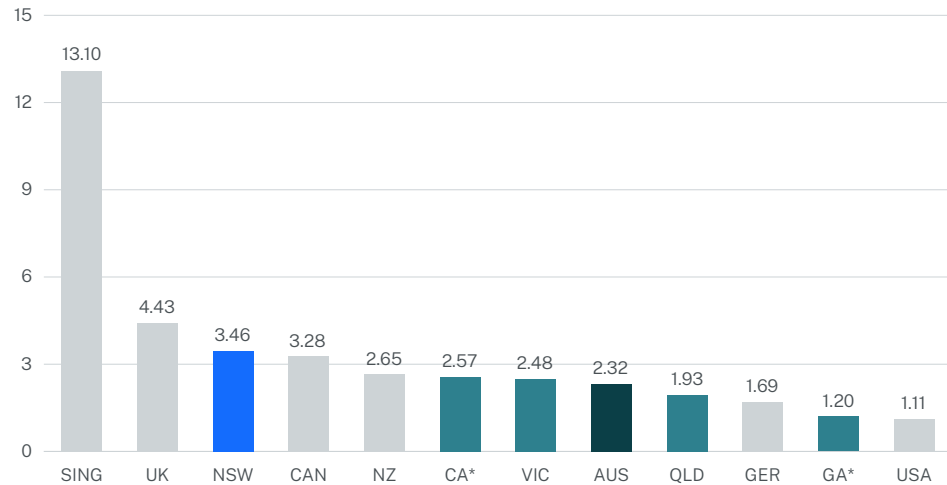
Since the 2019 Scorecard, strong growth in venture capital firms lifts NSW one spot in the number of venture capital firms per 1,000 firms on social media, third only to Singapore and the UK.

Data from Knowledge Commercialisation Australasia's *Survey of Commercialisation Outcomes from Public Research* shows NSW had the largest share of startup and spinout companies from universities and research institutes of any Australian state during 2017-20.

The 2019 Scorecard's measure for location of Australian startup founders has not been repeated in this edition. The Startup Muster survey has not run since 2018.

Venture Capital Firms

Venture capital firms per 1,000 firms on social media, 2021

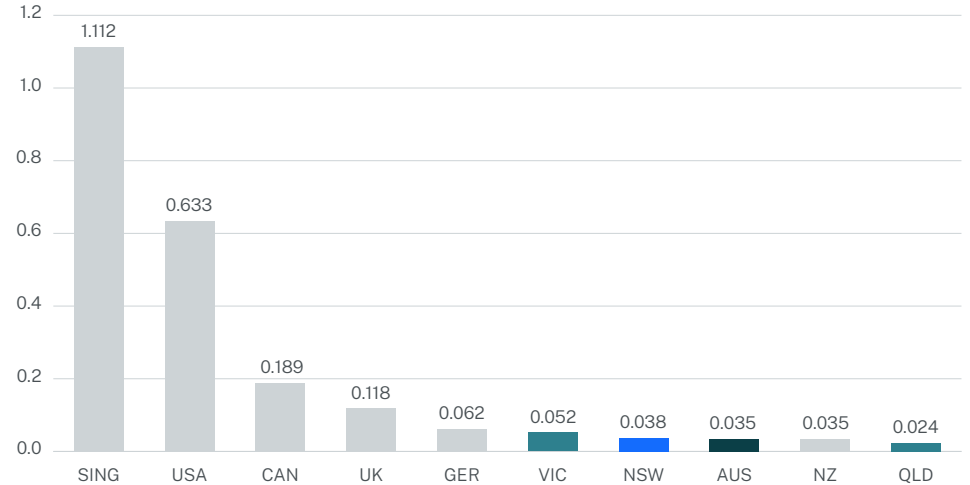


Source: CSIRO's Data61 analysis of CrunchBase and LinkedIn data, 2021. Time series data has not been calculated.



Venture Capital Investment

Venture capital as a percentage of GDP, 2019

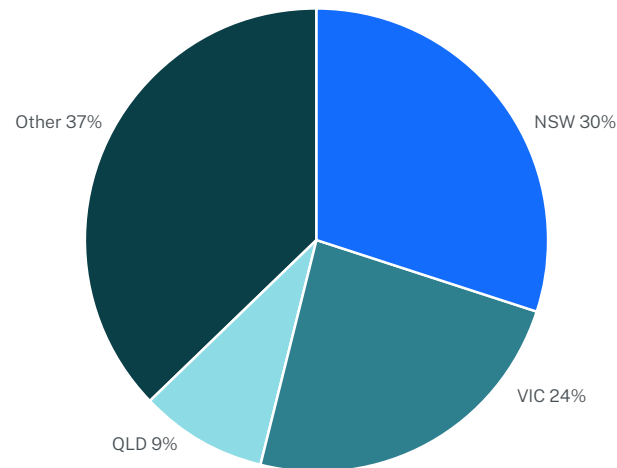


Sources: OECD Enterprise Statistics, downloaded from OECD.Stat on 13 September 2021; ABS, Venture Capital and Later Stage Private Equity, Australia, 2018-19; ABS, Australian National Accounts: State Accounts, 2019-20; Duff & Phelps, Transaction Trail Report, 2020.



Startups from Research Institutes

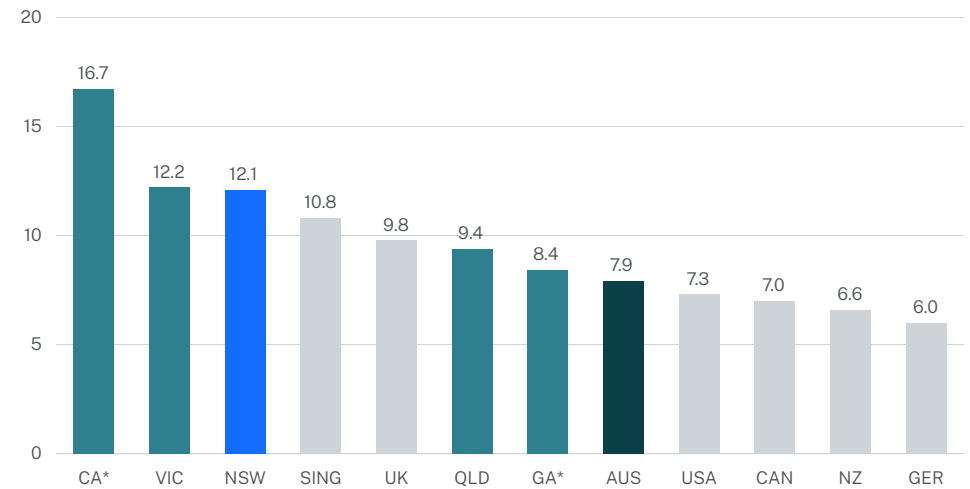
Location of new startup and spinout companies arising from universities and research institutes, 2017-2020



Source: Survey of Commercialisation Outcomes from Public Research (SCOPR) 2017-2020, Knowledge Commercialisation Australasia CSIRO included in "Other".

Startup Founders

Percentage of people on social media who identify as startup founders and co-founders per 1,000 users, 2021



Source: CSIRO's Data61 analysis of LinkedIn data, 2021. Time series data has not been calculated.



Digital capability

Digital Capability is a measure of how widely businesses are using leading digital technologies that are associated with high growth. CSIRO's Data61 analysis of LinkedIn and BuiltWith Data for the 2018 Scorecard showed that the median headcount growth for companies that use certain digital technologies was 8% higher than for companies that do not use these technologies.¹⁹

Canada and the UK now lead in the widespread diffusion of online technologies associated with high growth, including cloud productivity apps, search engine optimisation tools and services and technologies to enable responsive services to work via mobile.

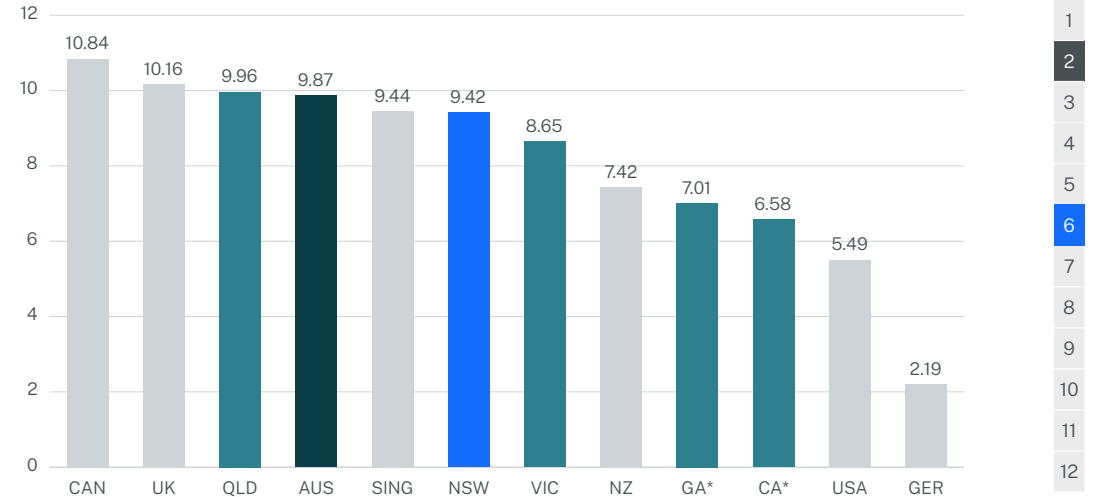
NSW is now slightly behind Queensland but ahead of Victoria and New Zealand. Lower penetration of these technologies among US and German businesses may reflect more low-growth business moving online or use of different technology stacks.

Since the 2019 Scorecard, there has been a 93% increase in the number of NSW firms using technologies associated with higher-growth companies. Similar to Digital Capability diffusion data, Queensland leads the Australian benchmarks, with NSW also trailing Victorian and Australian growth rates.

The US states of Georgia and California have had relatively modest expansion in the number of firms using growth technologies as their markets potentially approach saturation.

Digital Capability

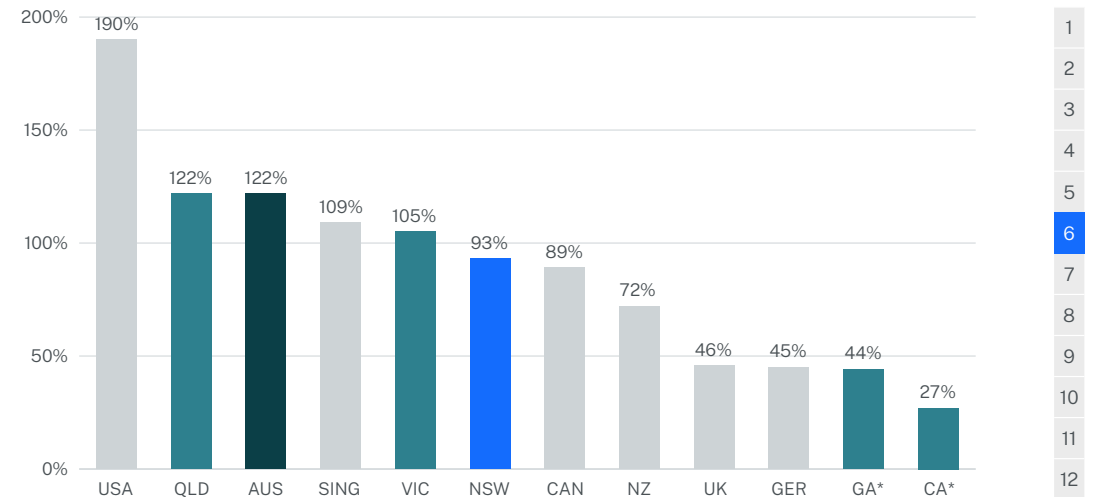
Percentage of businesses using technologies that are correlated with growth, 2021



Source: CSIRO's Data61 analysis of LinkedIn and BuiltWith data, 2021.

Growth Technologies

Increase in firms using technology associated with higher-growth companies since 2019



Source: CSIRO's Data61 analysis of LinkedIn and BuiltWith data, 2021.

Skilled workforce

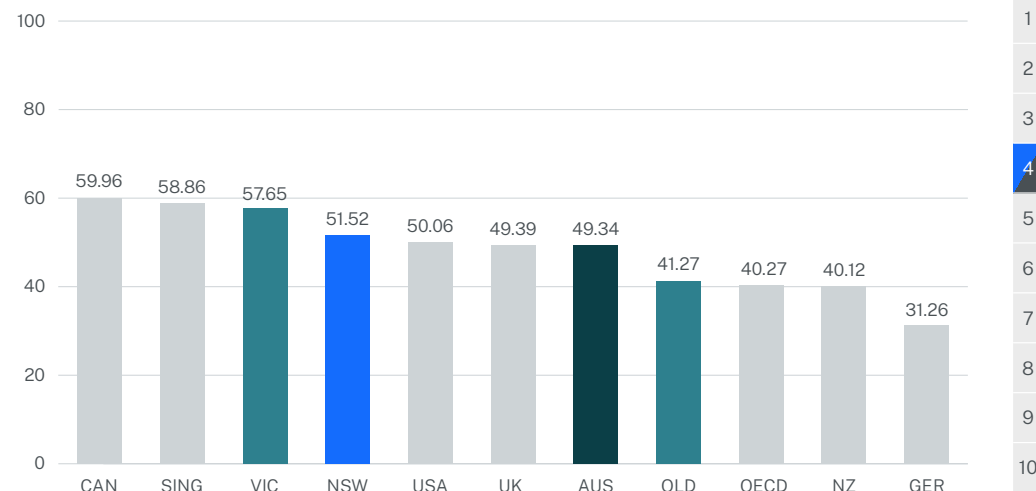
NSW continues to have a highly-skilled workforce, ranking 4th again on the percentage of the labour force that are tertiary-qualified, and retaining its 6th ranking on the percentage of the labour force with tertiary qualifications that are employed.

NSW continues to lead Australian benchmarks on the rate of managers and professionals on Australian skilled worker visas. This reflects Sydney's and NSW's position as a place with the best of both worlds – world-leading economic strength and lifestyle, making it the best place to work in the world and grow businesses.²⁰

Research commercialisation workforce data from Knowledge Commercialisation Australasia's *Survey of Commercialisation Outcomes from Public Research (SCOPR)* shows NSW's dedicated commercialisation workforce share in universities is ten percentage points smaller than Queensland's. As not all Australian universities and research institutions provided data for SCOPR in 2020, NSW's share may be slightly underestimated.

Tertiary-Qualified Workforce

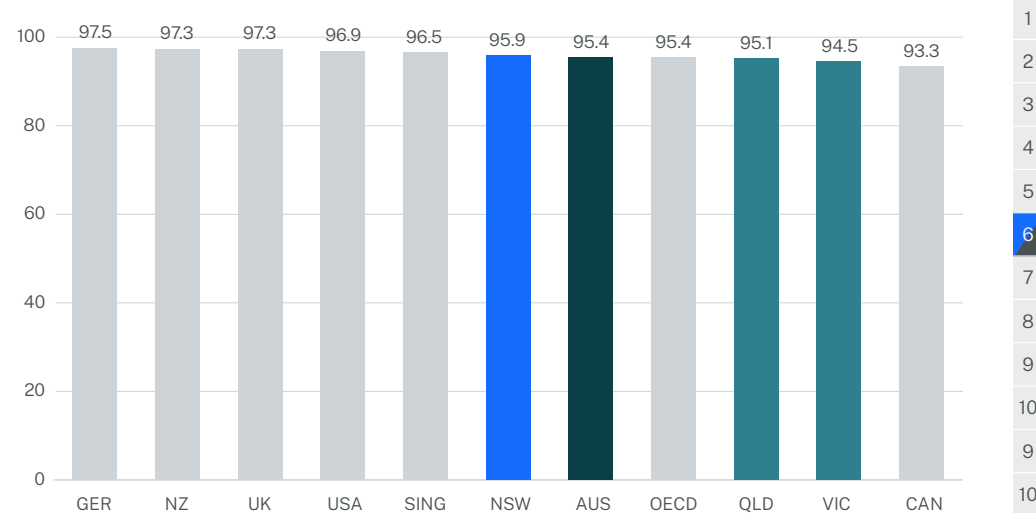
Percentage of labour force with tertiary qualifications, 2020



Sources: OECD Education at a Glance, 2021; ABS, Labour Force, Australia, Detailed, August 21; Singapore Ministry of Manpower, Comprehensive Labour Force Survey, July 2021.

Employment of Tertiary-Qualified People

Percentage of tertiary qualified people in the labour force who are employed, 2020



Sources: OECD Education at a Glance, 2021; ABS, Labour Force, Australia, Detailed, August 21; Singapore Ministry of Manpower, Labour Force Survey, March 2021.

Skilled Worker Visas

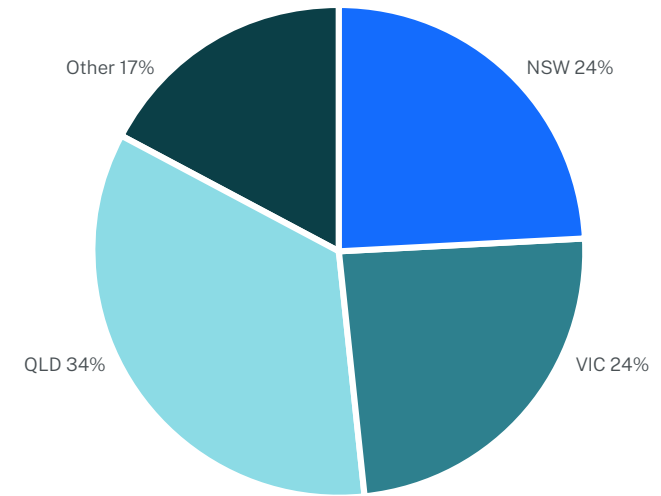
Percentage of managers and professionals employed on subclass visa 482 (Temporary skill shortage), 2020



Sources: Australian Government Department of Home Affairs, Temporary resident (skilled) visas granted to 30 June 2020 pivot table; ABS, Labour Force, Australia, Detailed, August 2021.

Commercialisation Skills

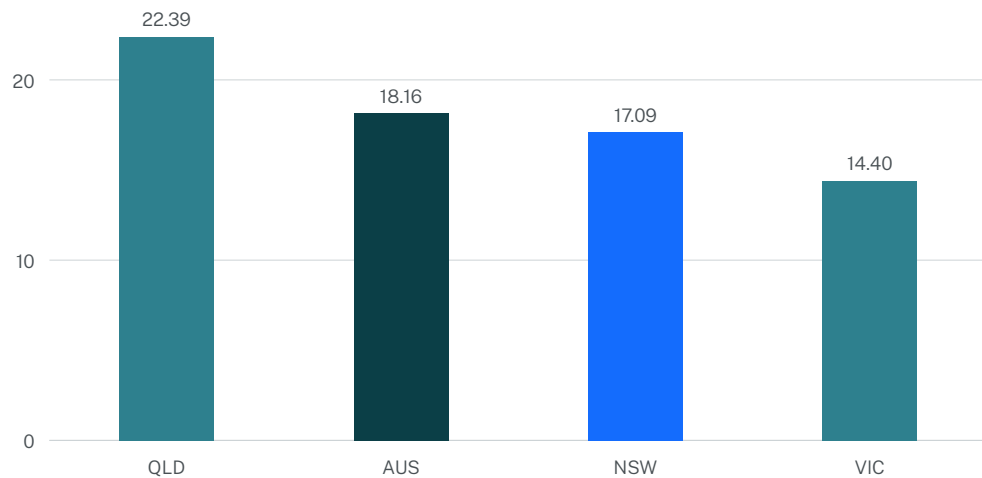
Dedicated research commercialisation full time employees (FTEs) in universities, 2020



Source: Survey of Commercialisation Outcomes from Public Research (SCOPR) 2020, Knowledge Commercialisation Australasia.

Vocationally-Trained Workforce

Percentage of labour force with vocational education and training qualifications (up to Certificate IV), 2020



Source: ABS, Labour Force, Australia, Detailed, August 21.

3



Net Zero Economy

Race to net zero

Net Zero Economy is a new theme in the 2022 Scorecard. Achieving sustainable economic growth, while reducing harmful greenhouse gas emissions and achieving net zero, will require greater innovation in new products, services and business models.

NSW is committed to achieving net zero by 2050. The *Net Zero Plan Stage 1: 2020–2030* is the foundation for NSW's action on climate change. It outlines the NSW Government's plan to grow the economy, create jobs and reduce emissions over the next decade.²¹

NSW's total greenhouse emissions have fallen 17.2% between 2005 and 2019, versus 24.8% for Victoria and 13.7% for Queensland.²²

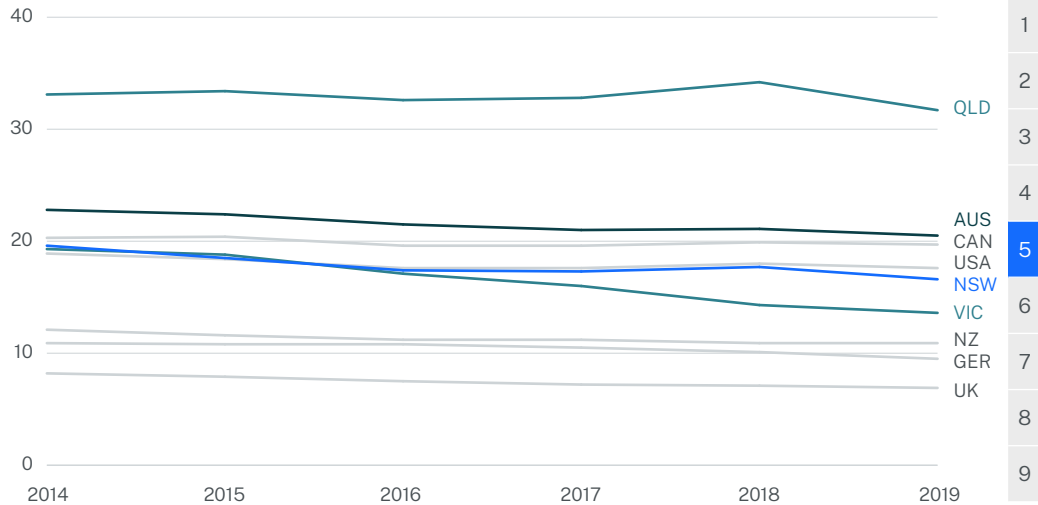
The bulk of NSW's emissions come from energy. The data shows NSW doubled its share of renewable energy generation in total energy generation since 2018, compared with Victoria's 66% increase. Queensland recorded a 200% increase off a lower base.

Electric vehicles (EVs) also have a big role to play in reducing transport sector emissions and provide new opportunities for industry in manufacturing, infrastructure and supply chains. Electric Vehicle Council data shows NSW EV sales (excluding Teslas) have led the country since 2016, but still only accounted for around 0.13% of total passenger vehicle registrations between 2010-2020.²³

The NSW Government's EV Strategy will drive sales of EVs to more than 50% of new car sales by 2030-31, preparing the NSW road network for a low-emissions future. The Strategy includes a nation-leading \$171 million investment in charging infrastructure.²⁴

Greenhouse Gas Emissions

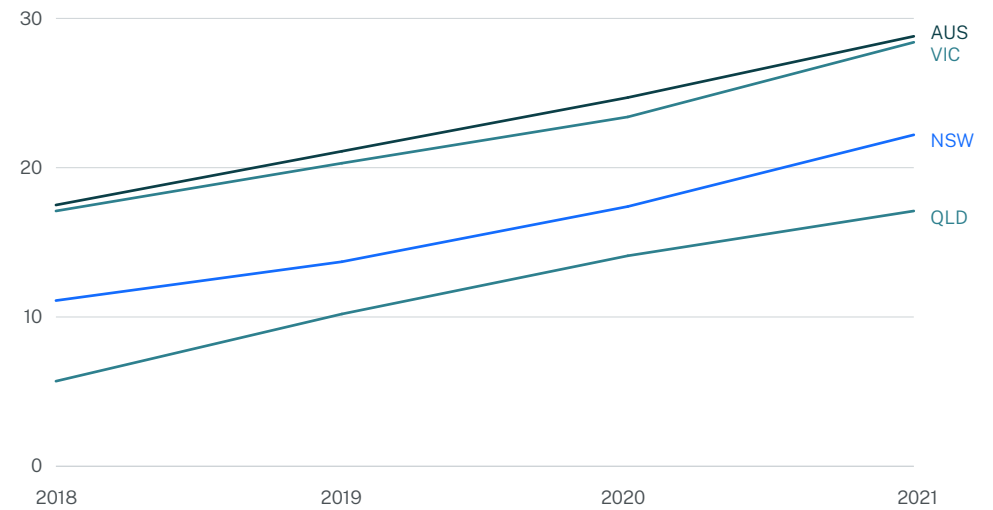
Greenhouse gas emissions per capita (t CO₂-e), 2014-2019



Sources: United Nations Framework Convention on Climate Change (UNFCC), 2021; Australian Government Department of Industry, Science, Resources and Energy, State and Territory Greenhouse Gas Inventories, 2019; ABS, National, state and territory population, December 2020; OECD MSTI, September 2021. Greenhouse gas emissions include land use, land use change and forestry sector (LULUCF). Data for Singapore not available on this basis.

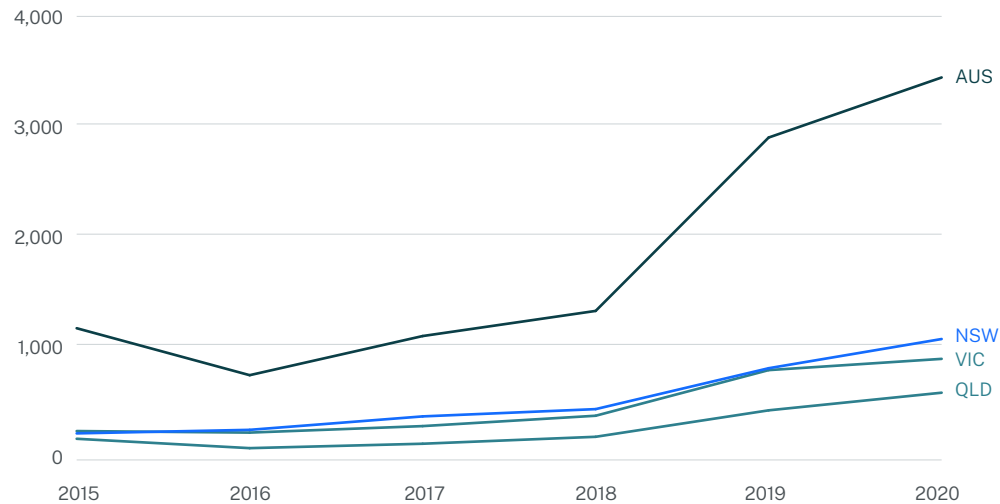
Energy Generation

Renewable energy generation as a share of total energy generation (%), 2018-2021



Source: OpenNEM (National Energy Market) data, downloaded 4 November 21 NSW includes ACT; Australia includes WA but excludes NT. Data are on a financial year basis, where 2021 refers to 2020-21.

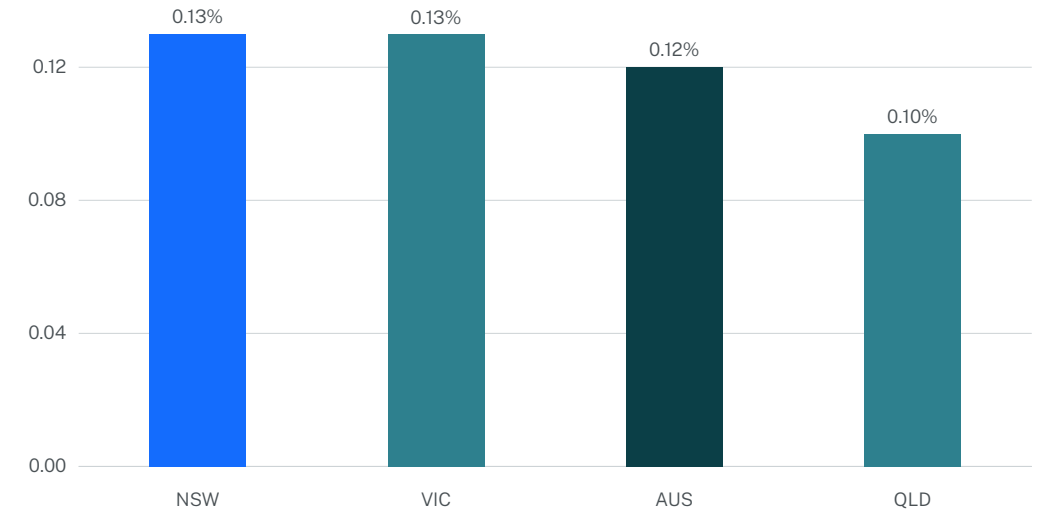
Electric Vehicle Sales



Source: Electric Vehicle Council, November 2021. Includes Plug-in Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles (BEVs), excludes Tesla sales.

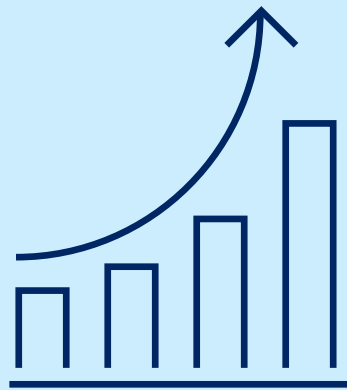
Vehicle Registrations

Electric vehicles as a share of total passenger vehicle registrations, 2010-2020



Source: Electric Vehicle Council, November 2021. Includes Plug-in Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles (BEVs), includes estimates of Tesla sales.

4



Growth and Productivity

Economic performance

During 2019-2020, overall economic performance declined for all jurisdictions, due to the COVID-19 pandemic. NSW and the benchmarked Australian economies and New Zealand fared considerably better than the international economies. The NSW Government's COVID-19 Recovery Plan will ensure NSW remains resilient and builds a future-proof economy.²⁵

In 2021, NSW lifted its net business creation rate from 3.6% in 2017 to 4%, equal with Victoria and ahead of Queensland.

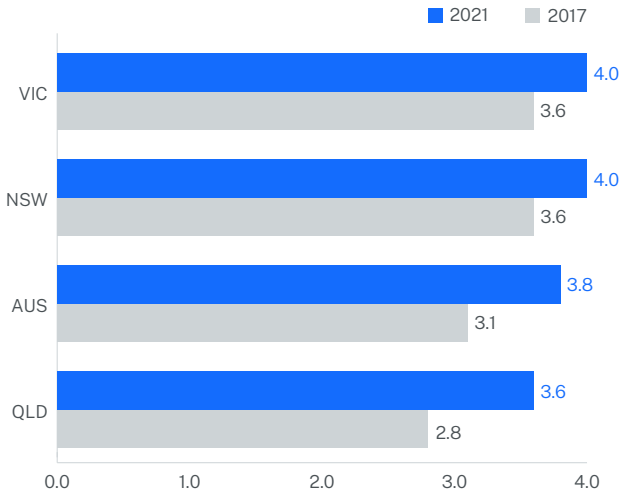
NSW recorded an average result on the number of firms that have grown their employee headcount by more than 10% per annum over a two-year period.

NSW labour productivity has increased by 1.1% since 2018. While this is below that recorded in Victoria and Australia, NSW's growth has been ahead of all other economies presented in the Scorecard, except the US.

The most recent multi-factor productivity growth data shows NSW widening its lead on the MFP Index since the 2019 Scorecard. All Australian benchmarked economies saw a principally COVID-19-related fall in 2019-20.

Net Business Creation

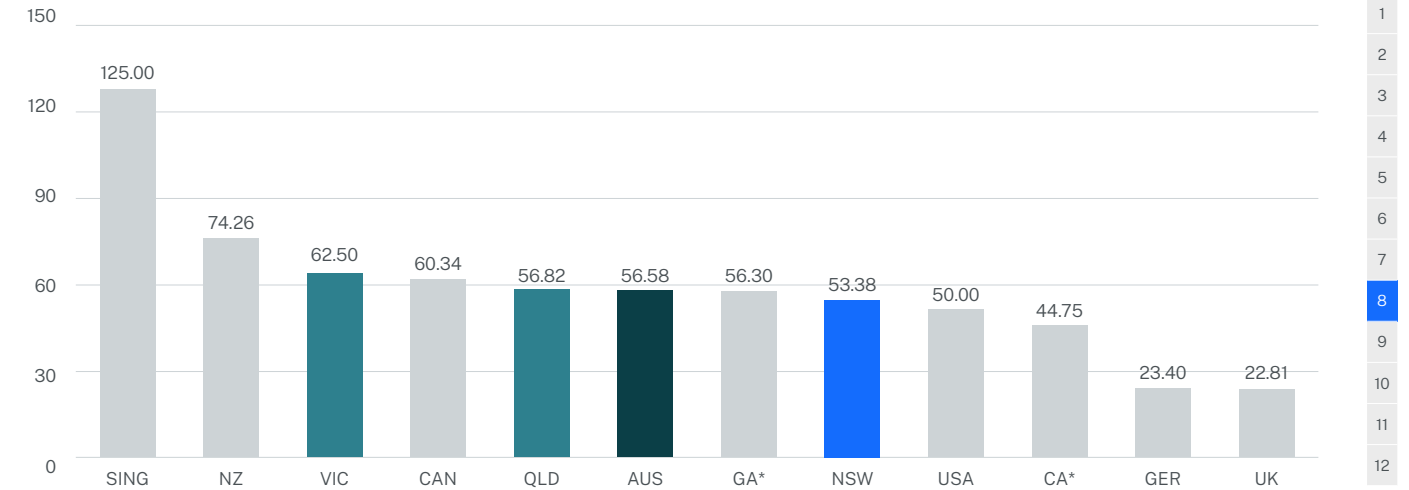
Net business creation rate (business entry rate minus business exit rate), 2017 and 2021



Source: ABS, Counts of Australian Businesses, including Entries and Exits, as at June 2017 and June 2021.

Growth Firms

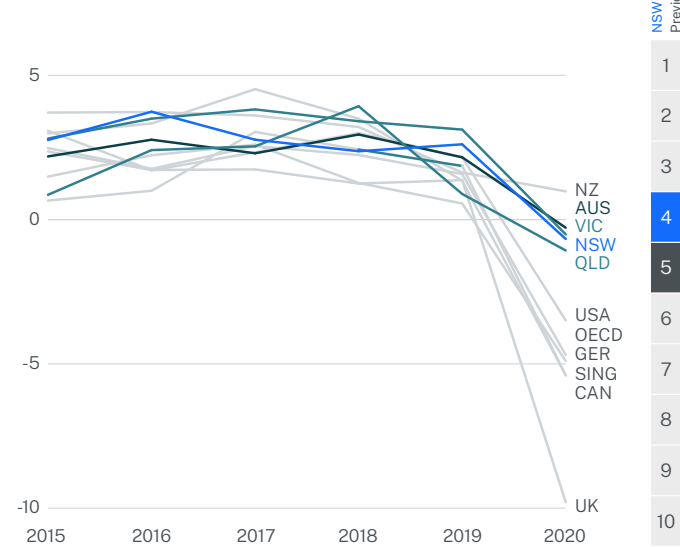
Firms per 1,000 firms where the headcount grew by >10% per annum over two years to 2021



Source: CSIRO's Data61 analysis of LinkedIn data, 2021. Time series data has not been calculated.

* US states of California and Georgia.

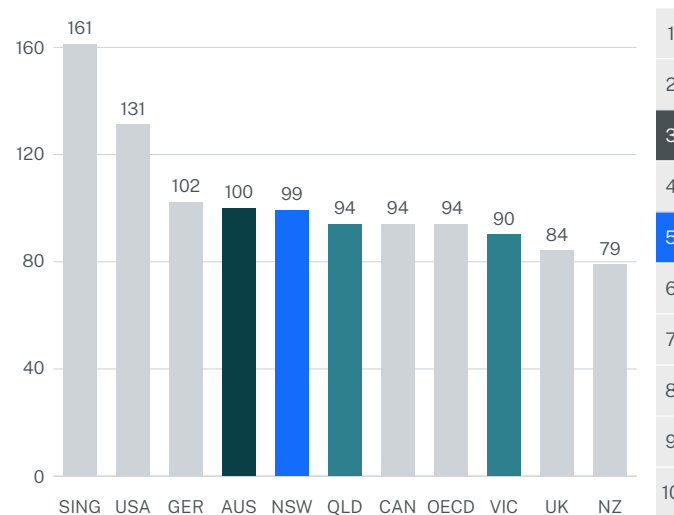
Annual GDP Growth



Sources: World Bank, World Development Indicators, June 2021; ABS, Australian National Accounts: State Accounts, 2019-20; OECD average is not included in rankings.

Labour Productivity

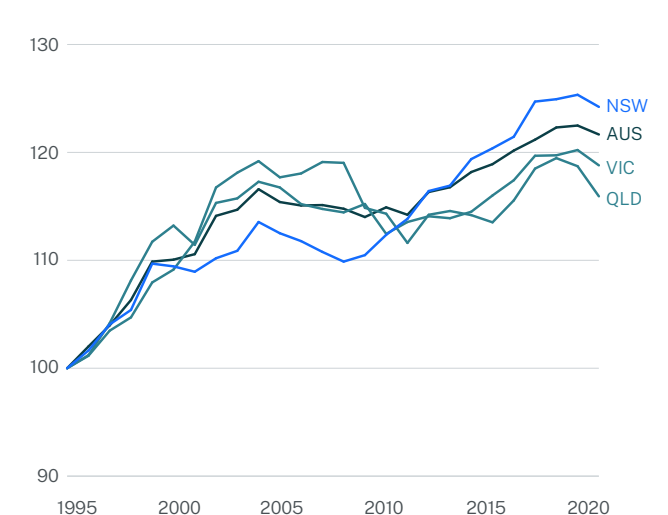
GDP (2017 international dollars, '000s) per person employed, 2020



Sources: World Bank, World Development Indicators (as at 30 June 2021); ABS, Australian National Accounts: State Accounts, 2019-20; ABS, Labour Force, Australia, July 2021.

Multi-Factor Productivity

Multi-factor productivity for the market sector indexed to 1995

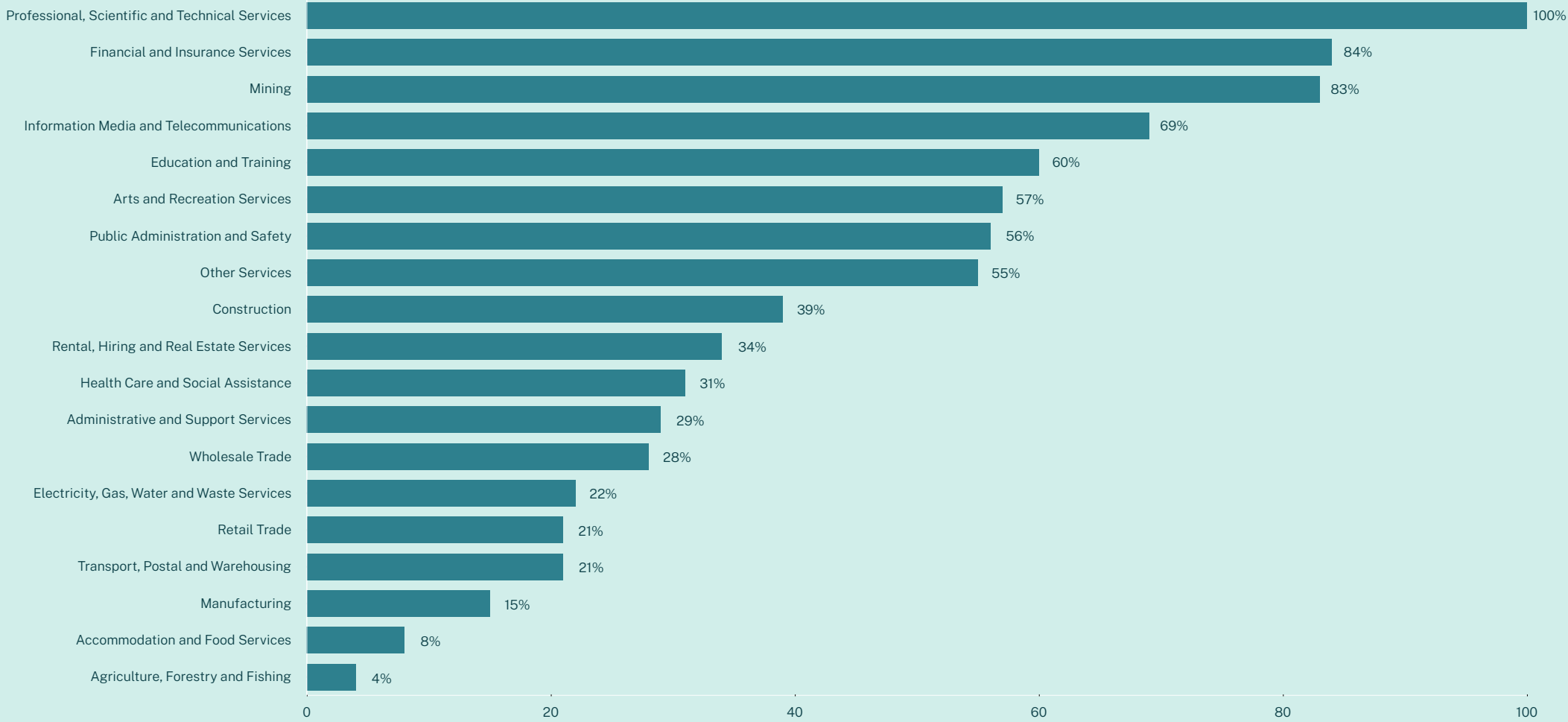


Source: ABS, Estimates of Industry Multifactor Productivity, 2019-20 (data are on a financial year basis, where 1995 refers to 1994-95).

Endnotes

1. World Bank (2021) - International Comparison Program, World Development Indicators database (last updated 26 March 2021). See data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?locations=AU-CA-DE-SG-GB-US-NZ
2. ABS (Nov 2020) - Year ending June estimates from ABS Cat. No. 5220.0 - Australian National Accounts: State Accounts, 2019-20 - Table 1 (current prices). Converted using outcomes in PPP terms for Australia.
3. US Bureau of Economic Analysis (2021) - Regional Economic Accounts, Annual GDP by State for 2019 (current prices). See apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=1#reqid=70&step=1&isuri=1&acrdn=1
4. OECD Glossary of Statistical Terms: 'Research and development expenditure'. See stats.oecd.org/glossary/detail.asp?ID=2315
5. CSIRO Futures (2021) Quantifying Australia's returns to innovation. CSIRO, Canberra. See: www.csiro.au/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/Futures-reports/Quantifying-Australias-returns-to-innovation
6. Office of the Chief Scientist and Engineer | R&D NSW (2022); See: <https://www.chiefscientist.nsw.gov.au/news/twenty-year-nsw-r-and-d-roadmap-takes-shape>
7. Office of the Chief Scientist and Engineer | R&D NSW (2021). See: <https://www.chiefscientist.nsw.gov.au/rdsnsw>
8. CSIRO's Data61 analysis of Higher Education Employment Data, Australian Government Department of Education, Skills and Employment (2021).
9. NSW Innovation and Productivity Council, *Let's Collaborate: SMEs using research to drive innovation*, Council Research Paper, Sydney, 2020. See: www.investment.nsw.gov.au/living-working-and-business/nsw-innovation-and-productivity-council/our-publications/lets-collaborate-smes-using-research-to-drive-innovation/
10. CSIRO's Data61 analysis of all competitive ARC awarded grants and full time equivalent researchers, Australian Government Department of Education, Skills and Employment, (2021).
11. Comparable data on patent and trademark applicants has not been released since the 2019 Scorecard. These measures are not included in this edition.
12. Knowledge Commercialisation Australasia, *Survey of Commercialisation Outcomes from Public Research* (SCOPR). See: techtransfer.org.au/metrics-data/
13. Licences grant another party (licensee) the rights to make/sell/use the IP owned by the licensor. Options grant the potential licensee time to evaluate the IP and negotiate the terms of a licence agreement. Assignments convey all rights and title to, and interest in, the licensed IP to the assignee. (Per definition in Knowledge Commercialisation Australasia's SCOPR reports.)
14. Research commercialisation income measures gross income from all Licences, Options and Assignments, commercial material transfers and sales of products or services based on expertise or IP, plus cashed-in equity, minus any cost of acquiring the equity. (Per definition in Knowledge Commercialisation Australasia's SCOPR reports.)
15. Knowledge Commercialisation Australasia's 2019 SCOPR report notes that in 2017, Walter and Eliza Hall Institute of Medical Research (WEHI) made a landmark deal worth \$325 million from the partial sale of royalty rights in anti-cancer treatment venetoclax – a result of collaboration between WEHI and companies Genentech and AbbVie. This helps explain the elevated 2017 research commercialisation income result for Victoria and Australia. See: techtransfer.org.au/wp-content/uploads/2020/09/SCOPR-REPORT-FINAL-for-web.pdf
16. The Global Startup Ecosystem Report 2021. See: startupgenome.com/reports/gser2021
17. Tech Central – Australia's Innovation Engine. See: www.tc.sydney/
18. Investment NSW (December 2021). See: www.investment.nsw.gov.au/living-working-and-business/precincts/tech-central/
19. CSIRO's Data61 analysis of LinkedIn and BuiltWith Data (2018)
20. Subclass visa 482 (Temporary Skill Shortage) came into effect on 18 March 2018 and Subclass visa 457 (Temporary Work Skilled) was abolished at the same time. In the year to 30 June 2020, there were only 20 people in NSW employed as managers or professionals on 457 visas.
21. NSW Department of Planning, Industry and Environment (2021), *NSW Net Zero Action Plan Stage 1: 2020-30*. See: www.environment.nsw.gov.au/topics/climate-change/net-zero-plan
22. State and Territory Greenhouse Gas Inventories 2019 (Australian Government Department of Industry, Science, Resources and Energy, 2021). See: www.industry.gov.au/data-and-publications/national-greenhouse-accounts-2019/state-and-territory-greenhouse-gas-inventories-annual-emissions
23. Electric Vehicle Council (2021), BEV and PHEV annual sales by state, excluding Tesla. Tesla does not report vehicle sales.
24. NSW Government (2021), NSW Electric Vehicle Strategy. See: <https://www.environment.nsw.gov.au/topics/climate-change/net-zero-plan/electric-vehicle-strategy>
25. NSW Government (2021), NSW Covid-19 Recovery Action Plan. See: www.nsw.gov.au/covid-19/covid-19-recovery-plan

LinkedIn Data Coverage



Source: CSIRO's Data61 (2021). LinkedIn coverage based on CSIRO's Data61 estimates derived from ABS 8165.0 Counts of Australian Businesses, including Entries and Exits, 2018 & LinkedIn Australian business counts by Industry 2019. Values show relative coverage of Australian businesses on LinkedIn by industry.

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Attributions

This work should be attributed as follows:

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