

NSW Innovation and Productivity Scorecard

August 2018



Foreword

Welcome to the first NSW Innovation and Productivity Scorecard.

The Hon John Barilaro MP

Deputy Premier of NSW
Minister for Regional NSW
Minister for Skills and
Minister for Small Business



This document marks the first time an Australian state has produced such a comprehensive innovation and productivity benchmark to compare against both similar economies and world leading economies on a wide range of metrics.

The NSW Government is serious about increasing our State's productivity – the key factor that will help maintain our prosperity into the long-term.

We launched a new Innovation Strategy in November 2016 and rejuvenated the NSW Innovation and Productivity Council with the appointment of new members. This Scorecard is their first major research report.

The Scorecard reveals some of the strengths of the NSW economy and, crucially, the areas that can be improved if we are to step up our competition against some of the best performing knowledge driven economies in the world.

It shows NSW has a strong research sector, an active startup sector, a highly qualified workforce and a thriving economy.

The NSW Government is working hard to maintain our economic strength. Through Jobs for NSW we are helping companies grow and create more highly skilled jobs, invest in the latest technology and maintain their position at the forefront of industries of the future.

Through the Sydney Startup Hub and the Sydney School of Entrepreneurship, we are helping grow the size and strength of the NSW startup sector. These are essential to create future jobs – between 2008 and 2014, new or growing SMEs that make up just 6% of businesses created over 1 million new jobs.

The NSW Government has previously identified gaps in our innovation ecosystem.

We launched the Boosting Business Innovation Program and the Knowledge Hubs Program specifically to help businesses tap into our world-class research expertise. Our initiatives are beginning to bear fruit with a number of exciting projects, which we expect will be reflected in a boost to the University and Industry Collaboration metric in future scorecards.

The data shows that science and research remain major priorities in NSW. Our state has not received its proportionate share of Australian Government funding for research and development, and while this has affected our score on this metric, government expenditure is only a small fraction of total R&D expenditure.

I thank the Council under its new chair, Neville Stevens AO, for their insights. This Scorecard will prove a valuable resource as we refine and extend the NSW Innovation Strategy.

The Hon John Barilaro MP

Deputy Premier of NSW

NSW Innovation and Productivity Scorecard

Productivity Council

Innovation and productivity strengthen the economy, and help ensure that the NSW Government can fund services and infrastructure for the community.

The NSW Innovation and Productivity Council (IPC) comprises leading thinkers from the business, higher education and research sectors.

The NSW IPC supports NSW as Australia's economic powerhouse and advises the NSW Government on the best ways to boost innovation and productivity.

To this end, the NSW IPC has created the first NSW Innovation and Productivity Scorecard.

This unique scorecard provides internationally comparable data at the NSW level for the first time

At the national and international level, innovation is measured using a range of business, university and government data on research, collaboration, skills and enterprise activity. Many of these standard metrics are not available at the state level.

To understand NSW's innovation performance we took a new approach. This scorecard uses both traditional data sources and new metrics that have only been made possible through recent advances in data science technology. These use contemporary web analytics created in collaboration with CSIRO's Data61 to provide complementary measures of innovation. The scorecard starts to paint a picture at a state level across three theme areas: Research and Collaboration, Skills and Enterprise, and Growth and Productivity.

It offers a snapshot of the strengths and weaknesses of NSW's innovation ecosystem

For the first time, we can see how NSW performs against comparable state economies and a range of international jurisdictions: Canada, Germany, New Zealand, Singapore, the US, the UK, Australia, and the Australian states of Victoria and Queensland. Where data is available, we can also compare ourselves against the OECD average and the US states of Georgia and California.

This scorecard provides a starting point for meaningful comparison to other jurisdictions and a way to track NSW performance over time. As new approaches are developed and additional state-level data becomes available, it can evolve to provide a more comprehensive profile of NSW's performance.





Scorecard Highlights

Scorecard Year

● 2018

○ 2019



Research & Collaboration

NSW invests well in research and development



NSW ranks 4th for business investment in R&D behind only the USA, Germany and Singapore.

\$10b

A total of over \$10 billion was invested in R&D in NSW in 2014. The not-for-profit and government sectors are a small proportion of R&D spend in NSW and across all comparative jurisdictions.

NSW produces quality research



In the last 10 years, NSW has produced 3,115 research papers that were in the top 1% most highly cited in the world.



13% of researchers in NSW are in the global top 10 in at least one specialised topic.



Three of NSW's 11 public universities rank in the top global 200.

NSW is taking action to improve collaboration

\$18m

Several new programs aim to improve NSW's university-industry collaboration, including the \$18 million Boosting Business Innovation Program and the Sydney Startup Hub.

83.8

NSW universities lead the nation with 83.8 research collaborations per institute, compared to an average of 59.8 for Australia.



Skills & Enterprise

NSW has a skilled workforce



47% of the NSW workforce held a tertiary qualification in 2016, ranking NSW 4th behind only Singapore, Canada and Victoria.

NSW has an active startup sector



NSW ranks 3rd behind California and Singapore for its number of startup founders.



44% of Australian startup founders are based in NSW.

NSW can look to boost its venture capital activity

\$199m

NSW attracted \$199m of venture capital investment in 2017 and had 100 local venture capital firms.

7/10

NSW ranked 7/10 for venture capital investment as a percentage of GDP in 2016.

NSW businesses are building their digital capability



12.6% of NSW businesses are using digital technologies associated with higher growth, ranking 5/12 for digital capability.



Growth & Productivity

NSW has strong GDP growth



In 2016, the NSW GDP growth rate was 3.9%, ranking 2/10 behind only New Zealand.

NSW businesses are growing



NSW ranks 3rd behind the UK and California on firms that have increased their staff by >10% per annum for two years.

NSW is improving its energy productivity



Energy productivity has been steadily improving in NSW.

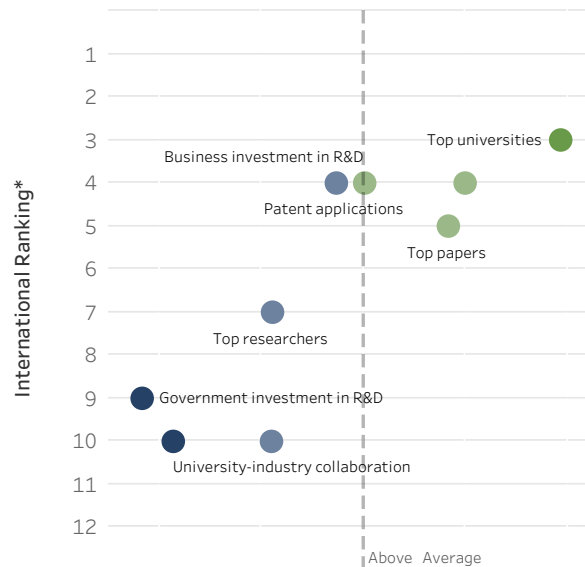
2.8
MEGA JOULES
OF ENERGY

For every dollar of GDP in 2015, NSW used 2.8 megajoules of energy.

International Comparison

Research & Collaboration

Investments to generate knowledge and innovations



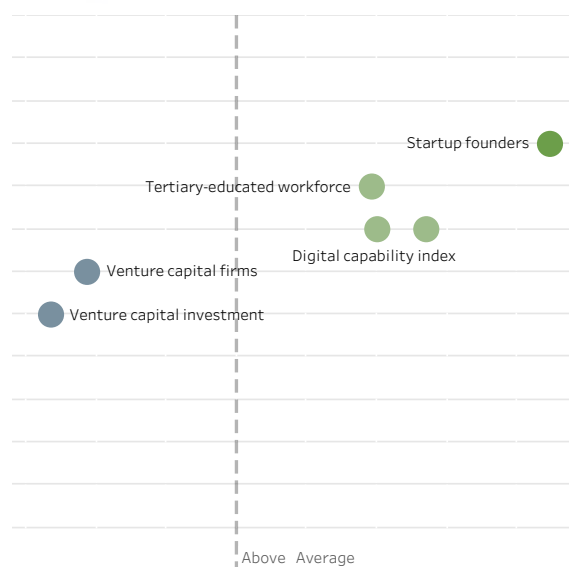
NSW invests well in research and development

NSW investment in research and development (R&D) by higher education and business compares well internationally. Government and non-profit investment in R&D is relatively low, but makes up a small proportion of R&D spend in every jurisdiction.

NSW universities and researchers perform strongly and produce a high number of highly cited publications. The number of researchers is relatively low and there is scope to improve collaborative research efforts in NSW and nationally.

Skills & Enterprise

Capacity to support innovations in the market



NSW has a skilled workforce and active startup sector

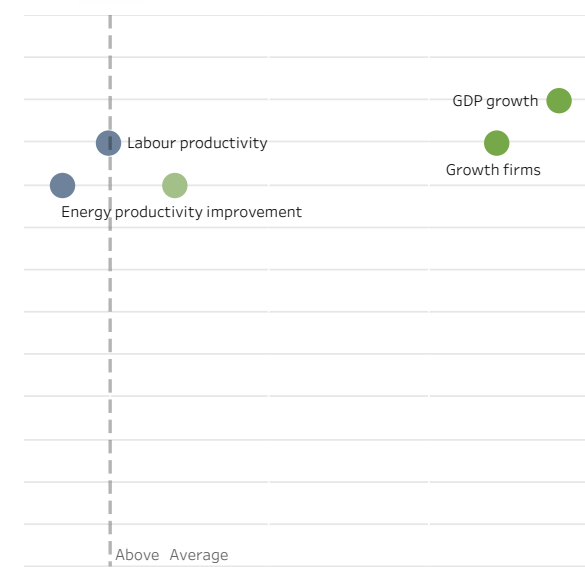
The NSW workforce has a high proportion of tertiary educated workers.

NSW ranks highly on its number of startup founders but sits below the leading jurisdictions on the number of local venture capital firms and investment.

NSW businesses are building their digital capability by moving to top digital technologies that are positively associated with company growth.

Growth & Productivity

Measures of economic performance and efficiency



NSW has a thriving economy

NSW is one of the leaders on annual GDP growth. It also ranks highly on the number of its firms that have grown by more than 10% in the last two years.

NSW ranks third internationally for labour productivity. The resource productivity of the NSW economy is linked to its industry profile. The state performs better than average on energy productivity and has been steadily improving this productivity over recent years.

* 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 & Recent Trends

LEGEND	Current performance	NSW five year trend
	● NSW performs above average	↗ Upward trend
	● NSW performs at average	↘ Downward trend
	● NSW performs below average	- No trend data

Research & Collaboration

NSW COMPARED TO INTERNATIONAL AND STATE BENCHMARKS

●	Business investment in R&D	↓
●	Government and not-for-profit 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 and not-for-profit investment in R&D	↓
●	Higher education research funded by industry	↑
●	Australian Research Council linkage project grants	-
●	Patent applicants	↓
●	Trademark applicants	↓
●	Invention disclosures	↓

Skills & Enterprise

NSW COMPARED TO INTERNATIONAL AND STATE BENCHMARKS

●	Number of venture capital firms	-
●	Venture capital investment	↑
●	Number of startup founders	-
●	Digital capability index	-
●	Tertiary-educated workforce	↑
●	Employment of tertiary-qualified people	↑

NSW COMPARED TO AUSTRALIA AND STATE BENCHMARKS ONLY

●	Startups from research institutions	-
●	Australian startup founders	-
●	Commercialisation staff in universities	↑
●	Vocationally trained workforce	↑

Growth & Productivity

NSW COMPARED TO INTERNATIONAL AND STATE BENCHMARKS

●	Labour productivity	↑
●	Growth firms	-
●	Annual GDP growth	↑
●	Energy productivity	↑
●	Energy productivity improvement	↑

NSW COMPARED TO AUSTRALIA AND STATE BENCHMARKS ONLY

●	Net business creation	↑
●	Multi-factor productivity	↑

International and State Benchmarks

Scorecard Legend

■ NSW
 ■ Australia
 ■ Nations
 ■ States
 ■ OECD average

Scorecard Year

● 2018
○ 2019

These figures are in US Dollars. The calculations in the Scorecard are based on USD PPP. Purchasing Power Parity (PPP) compares different countries' currencies through 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.

CANADA

GDP 2016: \$1,625 B 4.5 x NSW GDP¹

Population 2016: 36.3M

Majority service industries. Strong primary sector – forestry, petroleum and agriculture. Sizeable manufacturing sector.

Global Innovation Index rank 2017: 18

Human Development Index rank 2016: 10

Environmental Performance Index rank 2016: 25

UNITED STATES

GDP 2016: \$18,707 B 51.3 x NSW GDP¹

Population 2016: 323.9M

Diverse economy with abundant natural resources and well developed infrastructure. Ranks second in the world for highest estimates value of natural resources.

Global Innovation Index rank 2017: 4

Human Development Index rank 2016: 10

Environmental Performance Index rank 2016: 26

CALIFORNIA

GDP 2016: \$2,663 B 7.3 x NSW GDP³

Population 2016: 39.3M

Diverse economy, known for technology, entertainment and agriculture. Largest economy in the United States.

GEORGIA

GDP 2016: \$538 B 1.5 x NSW GDP³

Population 2016: 10.3M

Majority service industries. Significant manufacturing – textiles, pulp and paper products. Sizeable agricultural sector

UNITED KINGDOM

GDP 2016: \$2,819 B 7.7 x NSW GDP¹

Population 2016: 65.6M

Majority service industries. Strong financial services industry. Significant defence, aerospace and pharmaceutical sectors.

Global Innovation Index rank 2017: 5

Human Development Index rank 2016: 16

Environmental Performance Index rank 2016: 12

GERMANY

GDP 2016: \$4,111B 11.3 x NSW GDP¹

Population 2016: 82.5M

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 2017: 9

Human Development Index rank 2016: 4

Environmental Performance Index rank 2016: 30



OECD

The Organisation for Economic Co-operation and Development (OECD) is an association of 35 developed nations founded 'to promote policies that will improve the economic and social well-being of people around the world'.

SINGAPORE

GDP 2016: \$513 B 1.4 x NSW GDP¹

Population 2016: 5.6M

Regional hub for financial services. Significant exports in electronics and chemicals. Dependent on imports of natural resources.

Global Innovation Index rank 2017: 7

Human Development Index rank 2016: 5

Environmental Performance Index rank 2016: 14

AUSTRALIA

GDP 2016: \$1,145 B 3.1 x NSW GDP¹

Population 2016: 24.5M

Majority service industries. Second wealthiest nation (wealth per adult). Eighth highest globally for total estimated value of natural resources.

Global Innovation Index rank 2017: 23

Human Development Index rank 2016: 2

Environmental Performance Index rank 2016: 13

QUEENSLAND

GDP 2016: \$204 B 0.6 x NSW GDP²

Population 2016: 4.8M

Strong mining, agriculture, tourism and financial services. Main exports are coal, metals, meat and sugar.

NEW SOUTH WALES

GDP 2016: \$364 B 1 x NSW GDP²

Population 2016: 7.7M

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

GDP 2016: \$260 B 0.7 x NSW GDP²

Population 2016: 6.2M

Finance and insurance sectors produce most income. Health care and social assistance employ the most people.

Second largest economy in Australia

NEW ZEALAND

GDP 2016: \$184 B 0.5 x NSW GDP¹

Population 2016: 4.7M

Majority service sector. Large scale manufacturing industries – aluminum, food processing, metal fabrication, wood and paper.

Global Innovation Index rank 2017: 21

Human Development Index rank 2016: 13

Environmental Performance Index rank 2016: 11



R&D Investment

Research & development is the creative and systematic work undertaken in order to increase the stock of knowledge... including knowledge of humankind, culture and society... and to devise new applications of available knowledge.

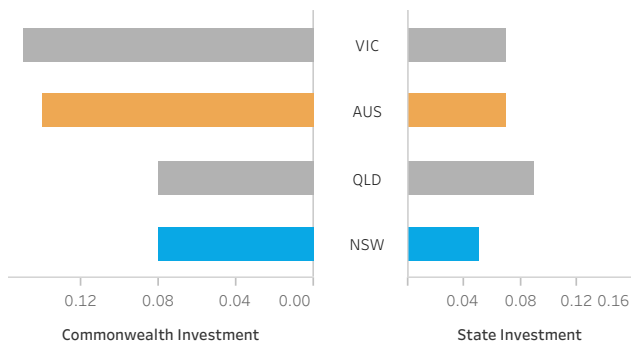
Consistent with Australia's performance in the Global Innovation Index (GI), NSW has high levels of annual business investment in R&D at \$6.4b. This includes business R&D funding that may have been received from government. Three-quarters of this R&D investment is spent by the manufacturing, science and technical, IT and finance sectors.

NSW outperforms the international average for higher education investment in R&D at \$3.2b. This amount also captures government funding to universities. At 7.7%, NSW higher education R&D has one of the highest rates of annualised growth in the last decade.

Government and Private Non-Profit Organisations R&D measures spending within government departments and non-profit organisations. It does not include R&D funds provided by governments to higher education, businesses or partnerships with the private sector. It is a small component of R&D investment across the jurisdictions, representing on average less than 12% of total R&D spending.

GOVERNMENT & NOT-FOR-PROFIT R&D IN AUSTRALIA

Australian and state government and non-profit organisations expenditure in R&D as a percentage of GDP, 2014-15

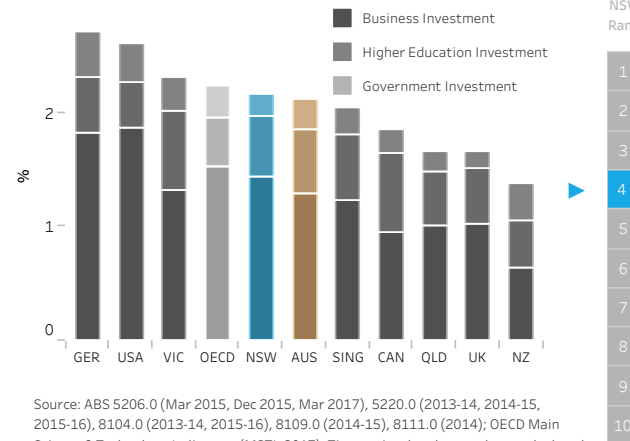


Source: ABS 5206.0 (Mar 2015), 5220.0 (2013-14), 8109.0 (2014-15).

*Different time periods have been used to reflect the latest available data

TOTAL R&D INVESTMENT

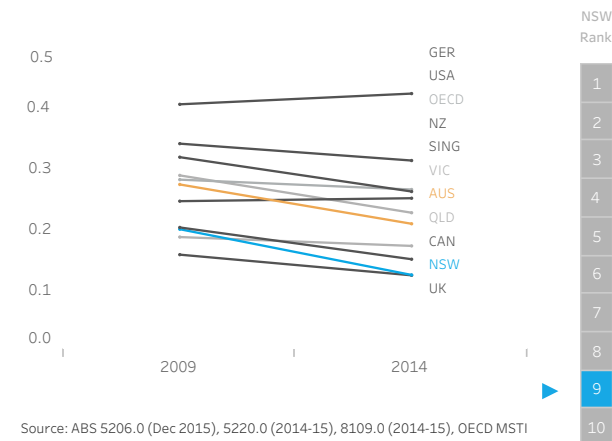
Gross investment in R&D as a percentage of GDP, 2013



Source: ABS 5206.0 (Mar 2015, Dec 2015, Mar 2017), 5220.0 (2013-14, 2014-15, 2015-16), 8104.0 (2013-14, 2015-16), 8109.0 (2014-15), 8111.0 (2014); OECD Main Science & Technology Indicators (MSTI; 2017). Time series data has not been calculated. OECD average is not included in rankings.

GOVERNMENT & NOT-FOR-PROFIT R&D

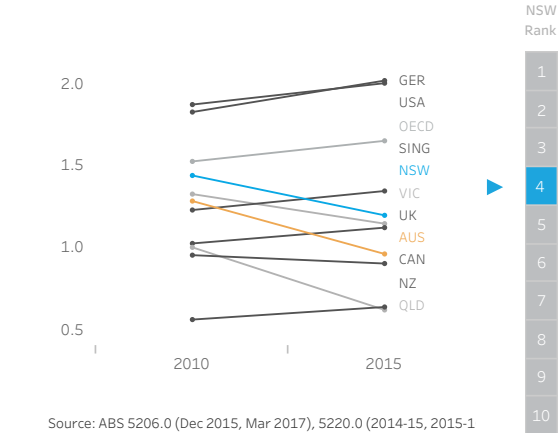
Other government and non-profit organisation expenditure in R&D as a percentage of GDP, 2009-2014



Source: ABS 5206.0 (Dec 2015), 5220.0 (2014-15), 8109.0 (2014-15), OECD MSTI (2017). OECD average is not included in rankings.

BUSINESS R&D

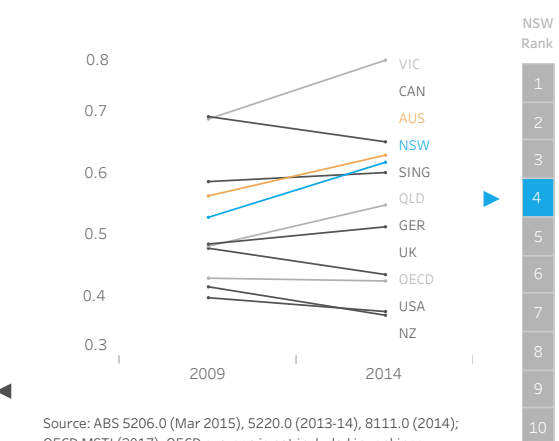
Business investment in R&D as a percentage of GDP, 2010-2015



Source: ABS 5206.0 (Dec 2015, Mar 2017), 5220.0 (2014-15, 2015-16), 8104.0 (2013-14, 2015-16); OECD MSTI, 2017. OECD average is not included in rankings

HIGHER EDUCATION R&D

Higher education investment in R&D as a percentage of GDP, 2009-2014



Source: ABS 5206.0 (Mar 2015), 5220.0 (2013-14), 8111.0 (2014); OECD MSTI (2017). OECD average is not included in rankings.



Research Workforce

NSW has a lower proportion of researchers in the workforce than most of the benchmark jurisdictions, but a strong rate of highly-cited papers, producing 3,115 top 1% cited papers over the last 10 years.

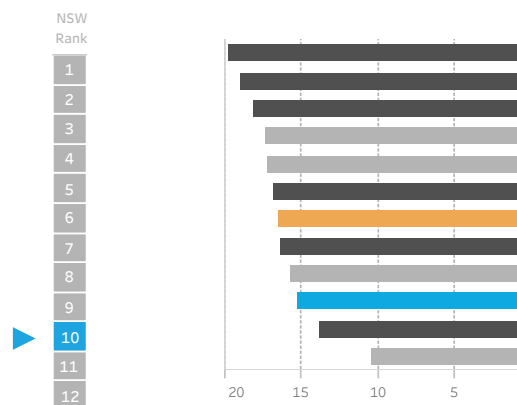
In NSW, 13% of researchers are among the top 10 globally in at least one specialised topic, as ranked by the League of Scholars, which rates scholars on citations, industry collaboration and public engagement. NSW performance is on par with most jurisdictions, with the exception of the United States, which continues to lead the table on this metric.

NSW has 11 public universities, with three of these ranked in the top 200 in the QS World University Rankings 2018, which rates the quality of universities by academic and employer reputation, citations and faculty to student ratios.

NSW universities are ranked number one for research in over 50 diverse topics, including photovoltaics, water filtration, and cryptography and network security.⁶

RESEARCHERS

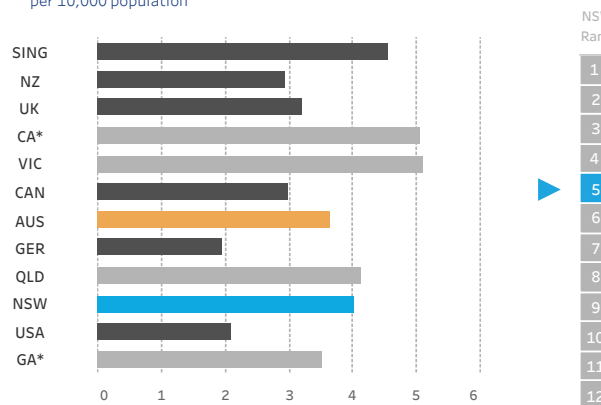
Number of researchers per 1,000 workers, 2017



Source: CSIRO Data61 Rikit.net analysis of LinkedIn data (2017); OECD MSTI, 2017
Time series data has not been calculated.
*The US State of California and Georgia.

TOP PAPERS

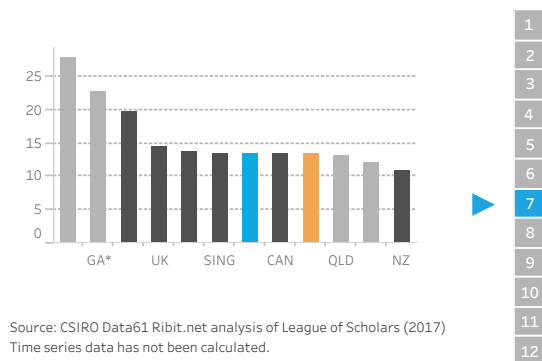
Number of top 1% cited papers over 10 years to 2016 per 10,000 population



Source: InCites (2006-2016); ABS 3101.0 (Mar 2017); OECD MSTI (2017); US Census Bureau (2016) Time series data has not been calculated.
*The US State of California and Georgia.

TOP RESEARCHERS

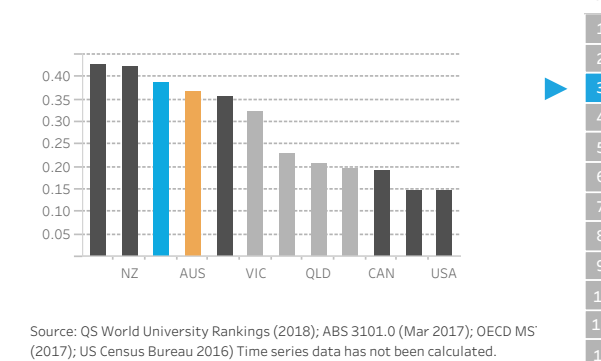
Percentage of researchers who are top 10 in their field, 2017



Source: CSIRO Data61 Rikit.net analysis of League of Scholars (2017)
Time series data has not been calculated.
*The US State of California and Georgia.

TOP UNIVERSITIES

Number of top 200 universities per million population, 2018



Source: QS World University Rankings (2018); ABS 3101.0 (Mar 2017); OECD MSTI (2017); US Census Bureau 2016) Time series data has not been calculated.
*The US State of California and Georgia.





Collaboration

Industry collaboration with research organisations and universities can more than triple the likelihood of reporting annual productivity growth.⁸

University/industry collaboration is measured internationally by The Netherlands' Leiden University at their Centre for Science and Technology Studies (CWTS) by looking at the rate of university publications co-authored with private sector for-profit enterprises. Co-publication is strongly associated with the number of patents issued, licences executed and spin-offs formed.⁹

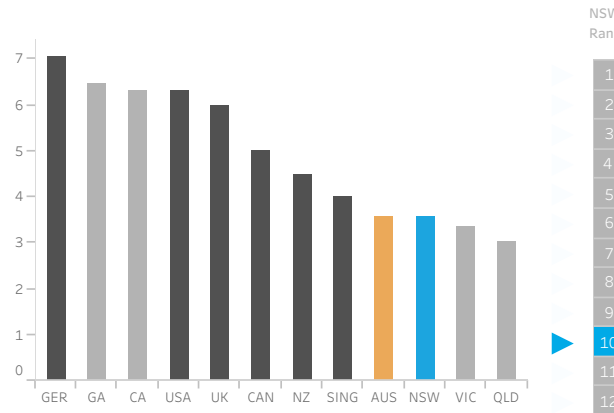
By this metric, NSW and Australia lag against international benchmarks. Australia's collaboration performance in the 2017 Global Innovation Index confirms that active university-industry collaboration remains a challenge across the nation.

Australian universities report annually on the proportion of their research that is funded by industry, which has seen an increase across the board in the last five years. NSW attracts a marginally higher rate of Australian Research Council (ARC) Linkage grant funding for collaborative research projects and partnerships.

The National Survey of Research Commercialisation has recently begun to collect self-reported data on the number of research collaborations. In the last two survey years NSW universities lead the nation with 83.8 research collaborations per institute, compared to an average of 59.8 for Australia.¹⁰

UNIVERSITY AND INDUSTRY COLLABORATION

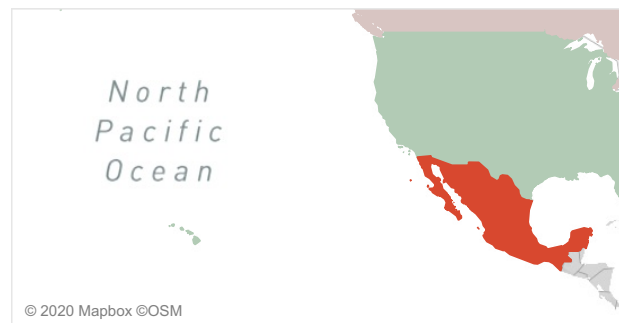
CWTS Leiden Ranking University-Industry Collaboration score, 2017



Source: CSIRO Data61 Ribit.net analysis of CWTS Leiden Ranking University-Industry Collaboration data (2017) (average across all universities in a jurisdiction) Time series data has not been calculated. *The US State of California and Georgia.

UNIVERSITY AND INDUSTRY COLLABORATION

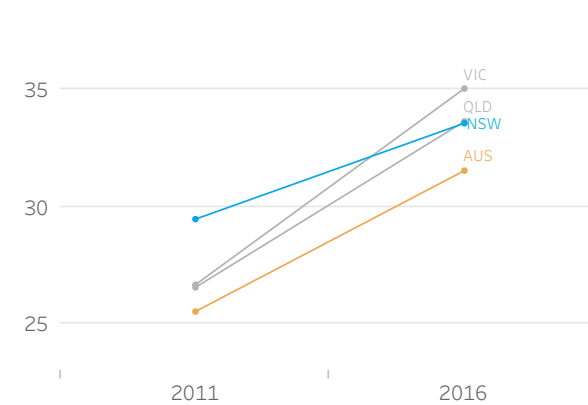
World heat map of highest (green) and lowest (red) collaboration, 2017



Source: CSIRO Data61 Ribit.net analysis of CWTS Leiden Ranking University-Industry Collaboration data (2017).

HIGHER EDUCATION RESEARCH FUNDED BY INDUSTRY

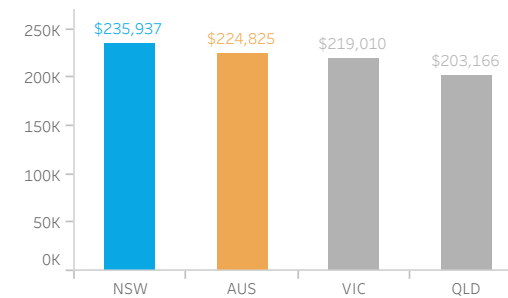
Percentage of higher education research funded by industry, 2011–2016



Source: Department of Education and Training (DET) Higher Education Research Data Collection (HERDC), Research Income (1994-2016).

RESEARCH GRANTS

Australian Research Council (ARC) Linkage Project funding per researcher, 2016



Source: CSIRO Data61 Ribit.net analysis of Australian Research Council data, DET, (2017).



Ideas & Inventions

Companies and individuals apply for patents to protect new inventions and trademarks to identify a unique product, service or business brand. These application rates can indicate levels and trends in innovation in the marketplace.

However, patent applications are becoming less reliable as a comparative measure of innovation as they are highly dependent on the composition of the economy and emerging industries. For instance, economies with a high proportion of software development may have lower patent levels than those that focus on pharmaceutical development, although the levels of innovation may be comparable.

The relatively low level of patenting in NSW compared to Germany, the US and Singapore is consistent with their different industry structures. The majority of Australia's traded goods are either services, such as tourism and education, or commodities. Neither of these are correlated to high levels of formal IP protection through patents. In contrast, Germany's strong exports in complex manufactured goods and pharmaceuticals are highly suited to patenting.¹¹

An invention disclosure is a confidential description of an invention that is potentially patentable or may have commercial value. In the past five years, the self-reported number of invention disclosures per university/research institute has declined slightly in NSW

PATENT APPLICATIONS

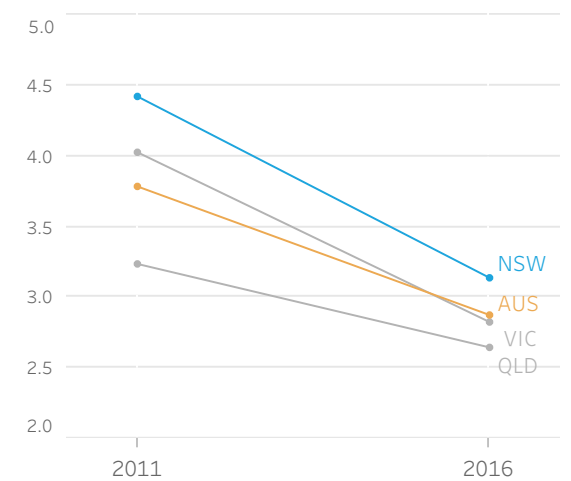
Patent applications per 10,000 population, 2015



Source: ABS 3101.0 (Mar 2017); IP Australia (2016); OECD MSTI (2017) Time series data has not been calculated. OECD average is not included in rankings.

PATENT APPLICANTS

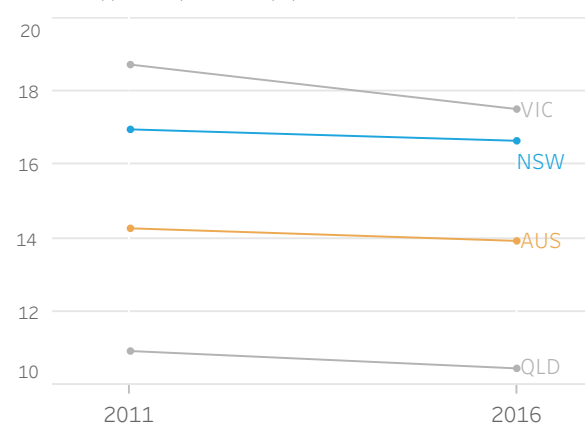
Patent applicants per 10,000 population, 2011-16



Source: ABS 3101.0 (Mar 2017); Office of Chief Economist, Innovation Map, accessed 5 December 2017

TRADEMARK APPLICANTS

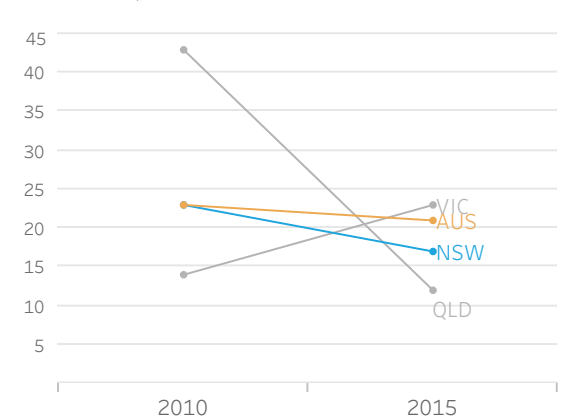
Trademark applicants per 10,000 population, 2011-2016



Source: ABS 3101.0 (Mar 2017); Office of Chief Economist, Innovation Map, accessed 5 December 2017.

INVENTION DISCLOSURES

Invention disclosures per institute, 2010-2015



Source: Department of Industry, Innovation & Science, National Survey of Research Commercialisation 2000-2015 (NSRC).

PATENT

In Australia in 2016
IP Australia received
28,394 STANDARD PATENT applications and
71,344 APPLICATIONS FOR TRADE MARKS¹²



Venture Capital & Startups

Innovation is more than just generating novel ideas or disseminating knowledge ... Only those novel ideas that are implemented can lead to economic and social progress.¹³

Domestically, NSW outperforms the benchmark Australian states on both venture capital investment and the number of venture capital firms on social media, with 100 local firms listed on LinkedIn in 2017.

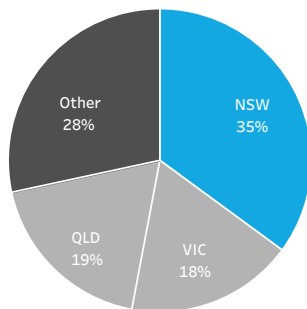
NSW lags behind leading international jurisdictions on local venture capital firms and investment. However, NSW businesses are increasingly attracting venture capital from overseas companies. In the last decade more than 50 NSW businesses have attracted investment from the world's top technology venture capital funds including Accel, Sequoia, Insight Venture Partners and 500 Startup.¹⁴

NSW attracts the bulk of venture capital and private equity investments made in Australia. The national outlook for investment in the near future is also positive, with high stocks of 'dry powder' (liquid asset reserves to cover future obligations and acquisitions) among venture capital investors.¹⁵

California is the leader when it comes to startup founders on social media, but NSW also does well on this metric. NSW is..

STARTUPS FROM RESEARCH INSTITUTIONS

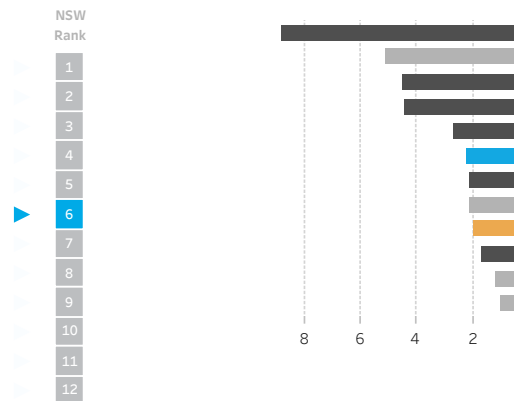
Location of startups arising from universities and research institutions, 2010-2015



Source: Department of Industry, Innovation & Science, NSRC (2000-2015).

VENTURE CAPITAL FIRMS

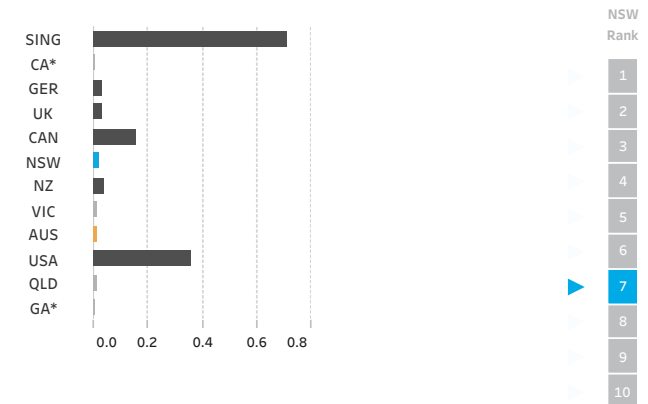
Venture capital firms per 1,000 firms on social media, 2017



Source: CSIRO Data61 Ribit.net analysis of LinkedIn data (2017) Time series data has not been calculated. *The US State of California and Georgia.

VENTURE CAPITAL INVESTMENT

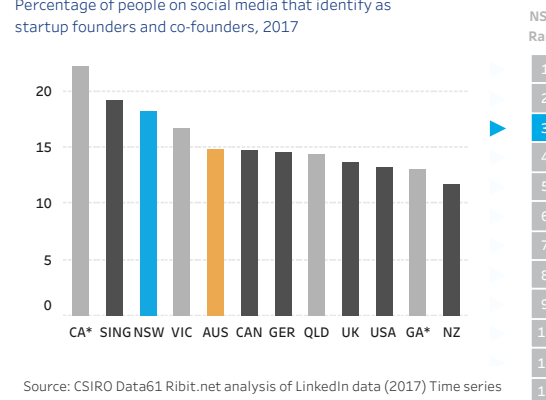
Venture capital as a percentage of GDP, 2016



Source: OECD, Entrepreneurship at a glance (2017); OECD MSTI (2017); ABS 5206.0 (Mar 2017), 5220.0 (2015-16), 5678.0 (2015-16); Duff & Phelps, Transaction Trail (2017) Time series data has not been calculated. *The US State of California and Georgia.

STARTUP FOUNDERS

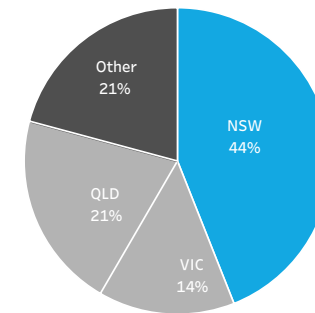
Percentage of people on social media that identify as startup founders and co-founders, 2017



Source: CSIRO Data61 Ribit.net analysis of LinkedIn data (2017) Time series data has not been calculated. *The US State of California and Georgia.

AUSTRALIAN STARTUP FOUNDERS

Location of startup founders, 2016



Source: Startup Muster Annual Report (2017).



Digital Capability

Digital Capability is a new measure of how widely businesses are using a basket of leading digital technologies that are associated with high growth.

In 2017, research by CSIRO Data61 showed that the median headcount growth of companies that use certain digital technologies was 8% higher than companies that didn't use these technologies. This applied across a range of industry types, from technology-based industries such as software and online services to industries as varied as construction, specialty retail and apparel.

With 12.6% of NSW businesses on LinkedIn using these 'growth technologies', the State's performance is above average on Digital Capability, with some room to improve.

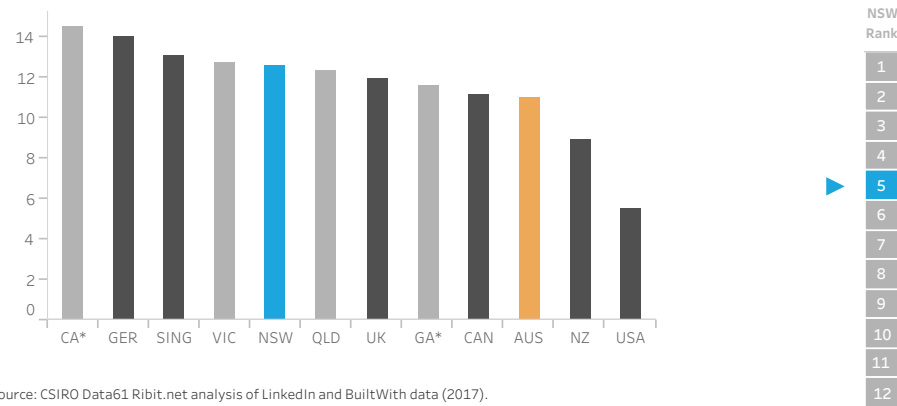
The leading digital technologies assessed by CSIRO Data61 include cloud productivity apps, search engine optimisation tools and services, and websites that are designed for mobile usage as well as desktop.

As technology changes, the specific technologies that predict growth companies will also evolve and the list of growth technologies will be updated

Headcount growth is **8% HIGHER FOR FIRMS** that use digital **'GROWTH TECHNOLOGIES'**

DIGITAL CAPABILITY

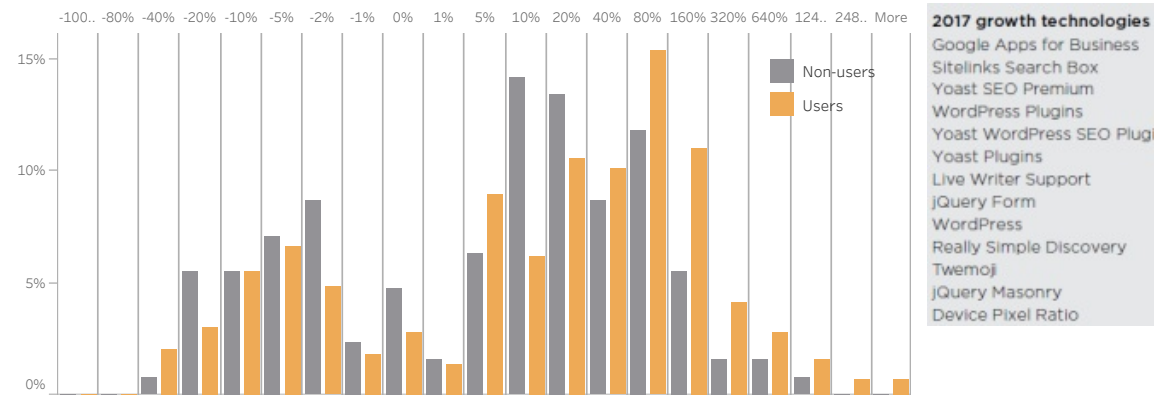
Percentage of businesses using technologies that are correlated with growth, 2015-2017



Source: CSIRO Data61 Ribit.net analysis of LinkedIn and BuiltWith data (2017).

GROWTH TECHNOLOGIES

Distribution of employment growth and users and non-users of growth technologies, 2015-2017



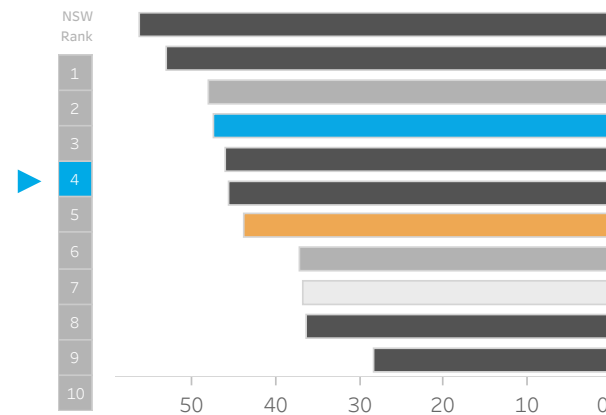
Source: CSIRO Data61 Ribit.net analysis of LinkedIn and BuiltWith data (2017).

Skilled Workforce

The NSW workforce is highly educated. Only Canada, Singapore and Victoria outperform NSW on the percentage of tertiary qualified people. Germany's tertiary education ranking is low, as it is known to have high rates of vocational training qualifications, which aren't reflected in this metric. Qualifications are also being utilised effectively in NSW and the employment rate of NSW tertiary-employed workers is on par with most international benchmarks. Within Australia, NSW attracts the highest rate of skilled workers of the state benchmarks, with skilled worker visas making up 1.1% of managers and professionals in the workforce. Overall, the NSW workforce is highly qualified. A lower level of vocational education and training (VET) in NSW compared to the benchmark Australian states is connected to its higher rate of tertiary education and more diverse economy. NSW has implemented a contestable VET market to ensure training responds to emerging skill shortages. The NSW Government provides subsidies for VET qualifications that are in demand by industry and that increase students' employment prospects. Self-reported data shows that NSW is home to 26%..

TERTIARY-QUALIFIED WORKFORCE

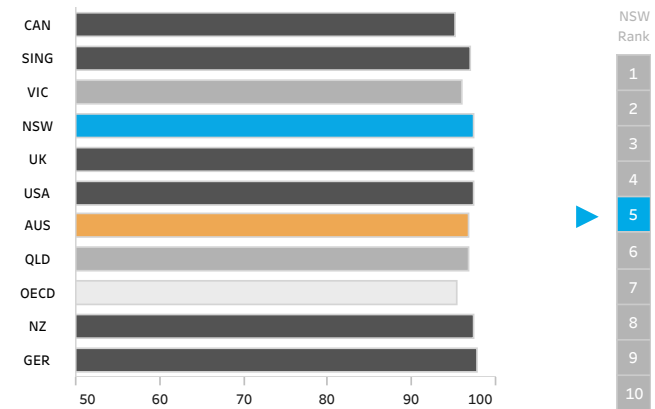
Percentage of labour force with tertiary qualifications, 2016



Source: ABS 6291.0 (Aug 2017); OECD Education at a glance (2017, 2016); Singapore Ministry of Manpower (2017) Time series data has not been calculated. OECD average is not included in rankings.

EMPLOYMENT OF TERTIARY-QUALIFIED PEOPLE

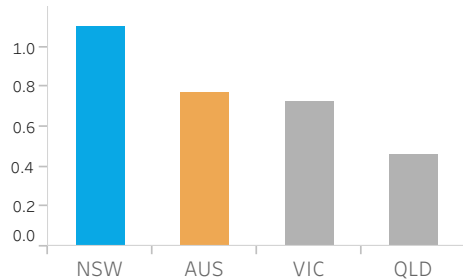
Percentage of tertiary qualified people in the labour force who are employed, 2016



Source: ABS 6291.0 (Aug 2017); OECD Education at a glance (2017, 2016), Singapore Ministry of Manpower (2017) Time series data has not been calculated. OECD average is not included in rankings.

SKILLED WORKER VISAS

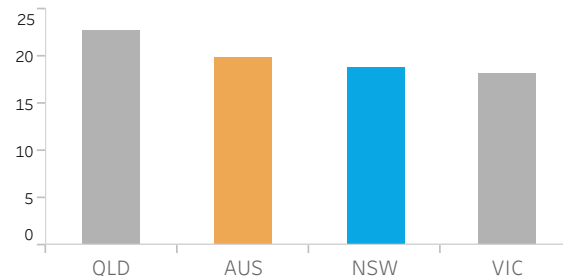
Percentage of managers and professionals employed on subclass 457 visas, 2017



Source: Department of Immigration & Border Protection Temporary Work (Skilled) visas granted 2017-09-30; ABS 6291.0 (1986 onwards).

VOCATIONALLY TRAINED WORKFORCE

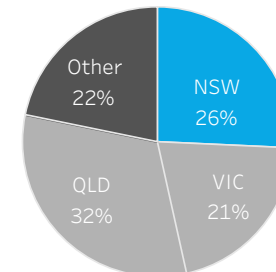
Percentage of labour force with vocational education and training qualifications (up to Certificate IV), 2016



Source: ABS 6291.0 (Aug 2017).

COMMERCIALISATION SKILLS

Dedicated research commercialisation full time employees (FTE) in universities, 2015



Source: Department of Industry, Innovation & Science NSRC (2000-2015).

Economic Performance

NSW has one of the highest rates of GDP growth, with recorded growth of 3.9% in 2016. Singapore and the United States still hold the top positions on labour productivity, but NSW ranks third, performing above both the Australian and OECD average over the five years to 2017.

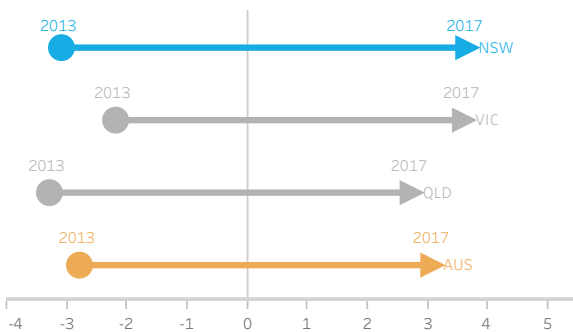
NSW is also ranked third internationally on the number of firms that have grown their employee headcount by more than 10% per annum in the last two years. Within Australia, NSW also had the greatest increase in net business creation over three years, with more businesses starting up than exiting the market.

Multi-factor productivity is the volume of output relative to the volume of the combined input of capital and labour. Australian MFP for the market sector contracted 2.1%, while it grew 4.7% in NSW between 2007-08 and 2015-16.¹⁶

MFP growth represents the change in output that cannot be directly credited to changes in observed capital and labour. Research has shown that innovation, and an organisation's abili..

NET BUSINESS CREATION

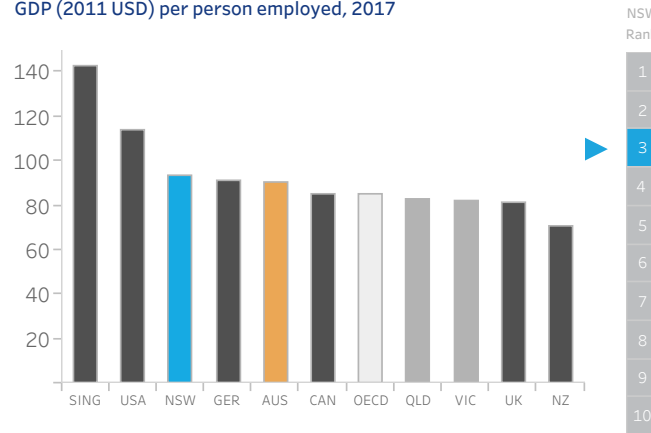
Change in annual growth of net business creation (business entry rates – exit rates) between 2013 and 2017



Source: ABS 8165.0 (Jun 2012 - Jun 2017).

LABOUR PRODUCTIVITY

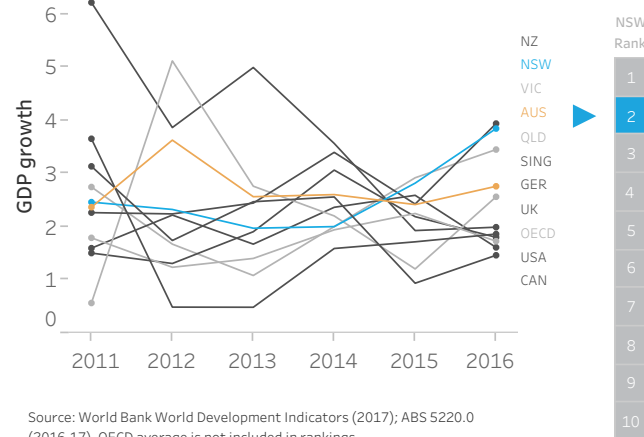
GDP (2011 USD) per person employed, 2017



Source: World Bank World Development Indicators (2017); ABS 5220.0 (2016-17), 6202.0 (Oct 2017). OECD average is not included in rankings.

ANNUAL GDP GROWTH

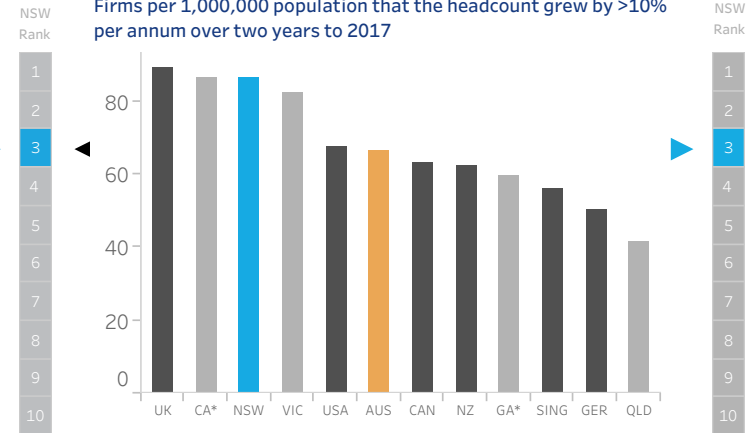
Annual percentage growth in GDP



Source: World Bank World Development Indicators (2017); ABS 5220.0 (2016-17). OECD average is not included in rankings

GROWTH FIRMS

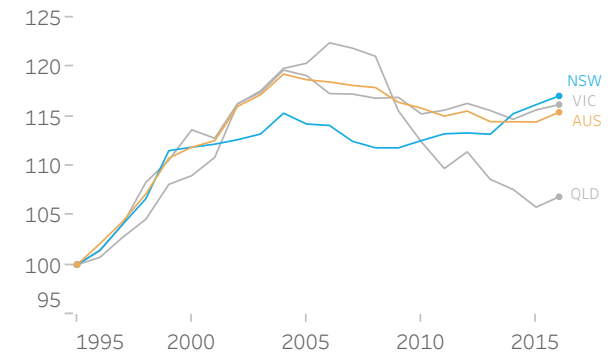
Firms per 1,000,000 population that the headcount grew by >10% per annum over two years to 2017



Source: CSIRO Data61 Ribit.net analysis of LinkedIn data (2017); OCED MSTI (2017); ABS 3101.0 (Mar 2017); US Census Bureau (2010-2016) Time series data has not been calculated. *The US State of California and Georgia

MULTI-FACTOR PRODUCTIVITY INDEX

Multi-factor productivity for the market sector indexed to 1995



Source: NSW Centre for Economic and Regional Development (Oct 2017).

Energy Productivity

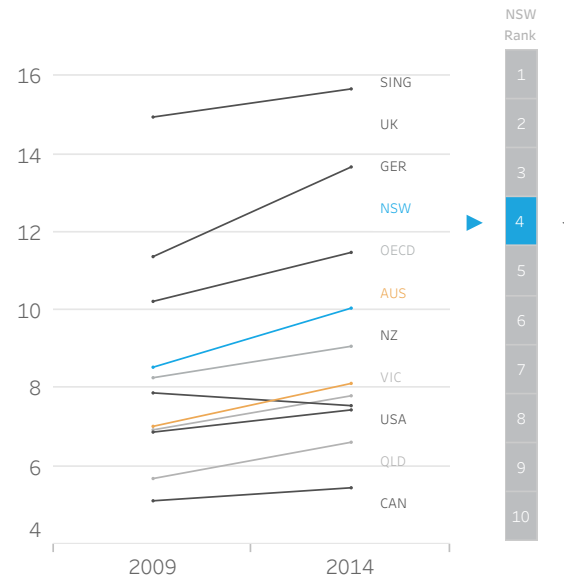
Making more efficient use of energy resources can reduce ongoing costs for businesses and improve both economic competitiveness and environmental performance.

Direct comparison of energy productivity between jurisdictions can be affected by their economic profile, so that economies with major extractive industries tend to rank lower than those with a focus on financial services. An index that measures energy productivity as improvement against a baseline year is a useful supplementary metric.

NSW's energy productivity is mid-table compared to international benchmarks, and ahead of Australian states and the national average. On the 10-year energy productivity index, Singapore significantly outperforms the benchmark jurisdictions. NSW is also showing improvement, particularly in the manufacturing sector.

ENERGY PRODUCTIVITY

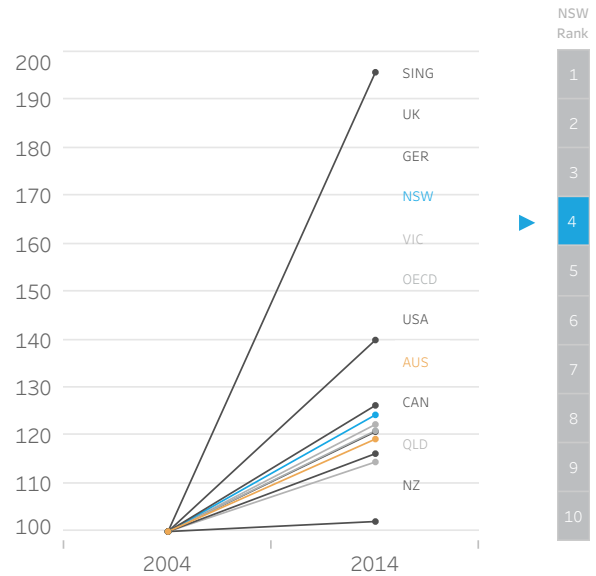
Energy productivity (2011 USD GDP/kg oil equivalent), 2014



Source: World Bank World Development Indicators (2017); Office of the Chief Economist Australian Energy Statistics (2016), ABS 5220.0 (2016-17). OECD average is not included in rankings.

ENERGY PRODUCTIVITY IMPROVEMENT

Energy productivity indexed to 2004, 2004-2014



Source: World Bank World Development Indicators (2017); Office of the Chief Economist Australian Energy Statistics (2016), ABS 5220.0 (2016-17). OECD average is not included in rankings.



For every dollar of GDP in 2015, NSW USED 2.8 MEGAJOULES OF ENERGY

Endnotes

1. World Bank (2019) - International Comparison Program database - see <https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD?locations=AU-CA-DE-SG-GB-US-NZ>
2. ABS (Nov 2018) - Year ending June estimates from ABS (Nov 2018) 5220.0 - Australian National Accounts: State Accounts, 2017-18 - Table 1. Converted using outcomes for Australia.
3. US Bureau of Economic Analysis (2019) - see <https://apps.bea.gov/itable/itable.cfm?ReqID=70&step=1#reqid=70&step=1&isuri=1>
4. Organisation for Economic Co-operation and Development (OECD) standard definition of research and development in OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, OECD Publishing, Paris, p 44.
5. ABS (2015), 8104.0 – Research and Experimental Development, Businesses, Australia, 2013-14
6. League of Scholars (November 2017) CSIRO Data 61 analysis
7. Ibid.
8. Office of the Chief Economist (2016) Australian Innovation System Report 2016, p.12
9. Wong, PK & Singh, A (2013) Do co-publications with industry lead to higher levels of university technology commercialization activity? Scientometrics 97(2), pp245-265
10. Department of Industry, Innovation & Science, National Survey of Research Commercialisation, 2000–2015
11. Simoes, AJG & Hidalgo, CA (2011) The Economic Complexity Observatory: An Analytical Tool for Understanding the Dynamics of Economic Development. Workshops at the Twenty-Fifth AAAI Conference on Artificial Intelligence.
12. IP Australia (2017) IP Report 2017, pp.6,11
13. Office of the Chief Economist (2016) Australian Innovation System Report 2016, p.11
14. Crunchbase (October 2017)
15. Australian Private Equity and Venture Capital Association Limited (2017) Yearbook 2017
16. NSW Centre for Economic and Regional Development (2017). Multifactor Productivity:...

All data in this scorecard is the latest available for all jurisdictions as at 31 March 2018.

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LinkedIn data coverage

Scorecard Year

● 2018

○ 2019

In NSW, LinkedIn data covers an estimated 99% of large businesses employing over 200 people, and more than 95% of all businesses employing 10 or more people.

The estimated coverage by sector is:

Sector	COVERAGE
Information media and telecommu..	100%
Mining	89%
Education and training	78%
Electricity, gas, water and waste s..	75%
Professional, scientific and technic..	71%
Public administration and safety	66%
Arts and recreation services	61%
Administrative and support services	52%
Other services	47%
Health care and social assistance	46%
Manufacturing	46%
Financial and insurance services	35%
Accommodation and food services	28%
Rental, hiring and real estate servi..	26%
Transport, postal and warehousing	19%
Construction	17%
Retail trade	13%
Wholesale trade	11%
Agriculture, forestry and fishing	4%

The lower penetration of LinkedIn in sectors such as construction, retail, finance and insurance reflects the large number of individual contractors, sole traders, owner-operators, family trusts and other accounting entities in these sectors.

Sources: CSIRO Data61 Ribit.net, January 2018, based on data from ABS 8165.0 Counts of Australian Businesses, including Entries and Exits 2015; and LinkedIn Australian counts November 2017.