

Australasia & Pacific Islands

The research landscape could not be more disparate between Australia and New Zealand. Strong Australian results are undermined by recent budget cuts, while New Zealand's output has fallen despite science spending boosts.

ARTICLE COUNT: 2,782
 FRACTIONAL COUNT (FC): 1,270
 WEIGHTED FRACTIONAL COUNT (WFC): 1,064

Australia's weighted fractional count (WFC) of 944 in the Nature Index for 2013 is up from 865 in 2012. Although this keeps it in twelfth place globally, it is one of the few countries that improved its WFC. On the policy front, however, a pall has descended across research this year. When the current conservative coalition government — facing a budget deficit of AU\$41.8 billion (US\$36.5 billion) when it was elected in September 2013 — delivered its first budget in May, there were swingeing cuts across the board in the AU\$9 billion research budget.

Twelve industry innovation programmes, worth AU\$846 million (US\$740 million), were abolished. Another AU\$378 million was lopped from six organizations, including the Australian Research Council, which funds much basic research, and the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the country's largest scientific agency. CSIRO is seventh in the country by WFC in the Nature Index. These cuts meant the loss of several hundred jobs and a decline in output. Environmental and climate science were particularly hard hit — an area of traditional strength for Australia. In the Nature Index, this research accounts for 12% of Australia's output, which is double the global average.

The cuts, along with the government's failure

to appoint a science minister, indicated to many in the science community that research is undervalued. Pre-budget rumours of widespread cuts led Melbourne's *Sunday Age* to warn in an editorial, "this is the era of technology, and to throttle back on funding is more than merely stupid or blinkered; it is vandalism."

"EXPENDITURE IN NEW ZEALAND IS STILL WELL BELOW THE OECD AVERAGE."

The new government did announce the creation of AU\$1 billion dollar Medical Research Future Fund, which it plans to grow to AU\$20 billion by 2020. But this has stalled in the Senate, largely because its funding relies on an unpopular policy to make people pay AU\$7 towards general practitioner visits — the first such fee in the national health scheme.

And more recently, in a statement on 14 October, 2014, the Prime Minister reiterated his view that science matters can be handled by the Minister for Industry. Indeed, the government is attempting to forge closer ties between science and commerce, announcing

an AU\$400 million "Industry, Innovation and Competitiveness Agenda" to fund industry-led non-profit growth centres. Companies may also have a greater role in the school system.

AUSTRALIAN INSTITUTIONS TIED

The index shows that there's little to separate the country's institutions: by article count (AC), the University of Sydney and the Australian National University are the top institutions, having contributed to 474 and 424 papers respectively. WFC gives a measure of the relative contribution of an institution to each paper; using this metric shuffles the order so that the University of Queensland is strongest with a WFC of 95.89, but the University of Sydney (95.07), Monash University (94.69) and the Australian National University (94.09) are close behind.

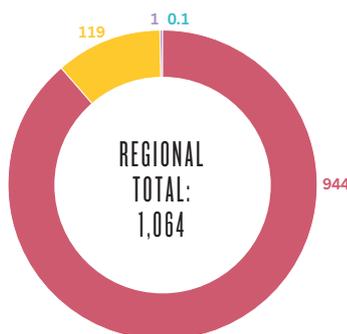
Focusing on output by subject area reveals further jostling among institutions, with some smaller facilities moving into the top ten in a single subject area, for example Swinburne University of Technology for physical sciences, and the Walter and Eliza Hall Institute of Medical Research in life sciences.

University of Queensland president Peter Høj says the institution's highlights in 2013 included a paper in *Science*, in collaboration with researchers from Massachusetts Institute of Technology, exploring a boson-based

AUSTRALASIA & PACIFIC ISLANDS ANALYSIS

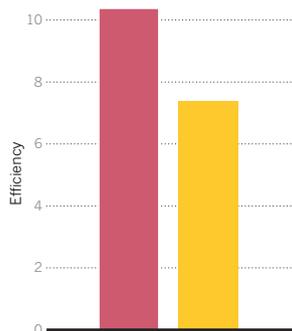
Countries' weighted fractional count (WFC)

Australia accounts for the lion's share of high-quality research.



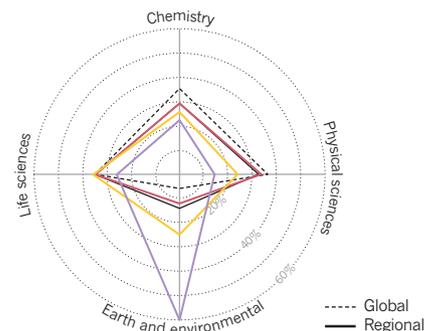
Researcher efficiency

WFC per 1,000 researchers¹.



Research strengths

Smaller countries focus more on earth and environmental sciences².



1. Source: UNESCO (Papua New Guinea and Fiji data not available). 2. Subjects overlap, so the total for each country can be >100%.

alternative to quantum computing, which has potential for the future of quantum devices and supercomputers. This paper was widely shared on social media. Høj adds that such papers illustrate the ability of the university's researchers to participate in "projects with great potential for people worldwide".

Meanwhile, Monash University in Melbourne shows particular strength in the fields of chemistry and life sciences, which heavily overlap. The university is home, for example, to the development of the influenza treatment zanamivir, a neuraminidase inhibitor sold by GlaxoSmithKline under the trade name Relenza. Monash is also strong when it comes to publications in *Nature* and *Science*. A little over 5% of its WFC came from papers in these two journals, which is notably higher than the global average. Its researchers contributed to a total of 15 *Science* or *Nature* papers in 2013, including a report in *Science* on a technique for using graphene as a material for compact energy storage, for which all contributors were from Monash. However, leading the charge on this metric is CSIRO, with 5.5% of its output, or 14 papers, in *Nature* or *Science* (see 'Nature and Science output'). All of these were collaborative works.

NEW ZEALAND BOOSTS ITS BUDGET

Politically, New Zealand is a much different story from Australia. Two days after its neighbour received its bleak science funding news, the New Zealand government revealed a surprise surplus of NZ\$372 million (US\$292 million) in its 2014 budget, and announced an extra NZ\$57 million of science funding in the form of competitive grants as well as NZ\$58 million of increased tax deductions for research and development.

Another NZ\$53 million over four years was allocated to its Centres of Research Excellence programme, and an 8.5% increase – or another NZ\$67.9 million – for university science education.

Nicola Gaston, president of the New Zealand

Association of Scientists, welcomed the boost in funding, but said it was more indicative of the government's shift in focus: the vast majority of competitive grants now require co-funding from industry. Given the nature of the country's industries – largely focused on tourism and primary industries with only a small manufacturing sector, "this has led to serious distortions in the overall balance of science," she said. "Science expenditure in New Zealand is still well below the OECD average, as it has been for some time," she added.

Such a funding deficit is taking its toll. In the Nature Index, New Zealand has a WFC in 2013 of 119, a decrease from its 127 in 2012 (although it retained 28th place).

The University of Auckland contributed to the largest number of papers, with an AC of 123, but on the basis of WFC, the University of Otago topped it. Based in Dunedin and with campuses in Christchurch and the capital Wellington, Otago is the country's oldest university with a good record in the biomedical sciences. Indeed, more than half of the university's WFC comes from the life sciences, with only 13% from the physical sciences (see 'Institutional subject spread').

Richard Blaikie, Otago's deputy vice-chancellor for research, is reluctant to name standouts among the university's 1,100 researchers. But, when pressed, he highlights the university's leadership in an international consortium that identified a new set of genes that instruct stem cells in the human brain how to increase in number and take up position *in utero*. This was one of seven papers the university published in *Nature Genetics*.

The index additionally shows Otago's strength in neuroscience: out of seven papers it contributed to in the *Journal of Neuroscience* in 2013, five were wholly authored by Otago researchers.

Otago's ratio of AC to FC (a proxy for level of collaboration) of 3.0 is above the average for New Zealand of 2.4. Blaikie says this shows that "our staff are engaged in fruitful

PAPUA NEW GUINEA

Pacific positivity

Although Australia and New Zealand dominate the region's science output, the Nature Index also lists papers from the Pacific Island nations. These include one from the Secretariat of the Pacific Community, based in New Caledonia, and five from institutions based in Papua New Guinea, which appears at number 92 on the global list by WFC.

Papua New Guinea's publications in the index focus heavily on environmental science. They include a study from The Nature Conservancy on grouper larvae in coral reefs, and one from Ok Tedi Mining Limited on the effect of the Madden-Julian Oscillation, the largest atmospheric factor in tropical rainfall cycles, on rainfall in the Fly River system in Papua New Guinea. This river system is the wettest place on Earth, and sustained heavy damage from the 1984 OK Tedi Mining disaster — one of the worst environmental disasters ever caused by humans.

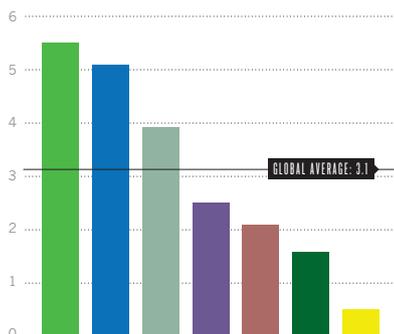
The funding outlook for science in Papua New Guinea is positive, with increases for the Institute of Medical Research and the National Agriculture Research Institute, and a call by the Research, Science & Technology Council for 5% of GDP to be spent on R&D as part of a government-wide National Vision 2050 plan.

international collaborations at the forefront of scientific progress across many areas of enquiry." Some papers also score highly in terms of online visibility as measured by altmetrics.com. Otago researchers were part, for example, of a large global team that published a paper in *Science* detailing how slippery clay was responsible for the 2011 Tohoku earthquake, which was widely picked up by news outlets (see 'Otago's online visibility'). ■



Nature and Science output

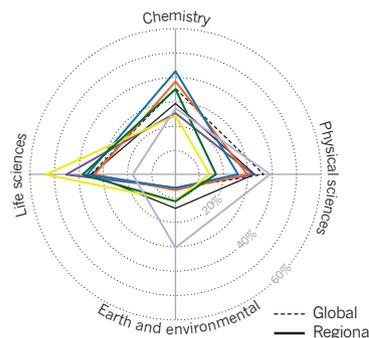
Governmental research agency CSIRO* has the largest proportion of its WFC in these two journals.



*The Commonwealth Scientific and Industrial Research Organisation. 1. Subjects overlap, so the total for each country can be >100%. 2. DOI: 101126science.1238041. Data from altmetrics.com, taken 22 Sept. 2014.

Institutional subject spread

Biomedical sciences are strong for University of Otago, whereas Australian institutions tend to have a more even distribution¹.



Otago's online visibility

Researchers helped reveal how slippery clay was responsible for the 2011 Tohoku earthquake².

