

UNESCO Science Report: the Race Against Time for Smarter Development

FACTSHEET

DATA TRENDS AT A GLANCE

Growth in global research spending outpaced global economic growth:

- Global research spending grew faster than the global economy over 2014–2018 but the level of spending and rate of growth remain geographically uneven. China accounted for 44% of growth, the USA for 19%, the European Union for 11%, the Republic of Korea for 5% and India for 4%.
- In 32 countries, research spending rose by at least 1.0% of GDP and fell for another 13 countries by at least as much between 2014 and 2018.
- In two regions, research expenditure receded: Latin America (-7% in purchasing power parity dollars; from 0.73% to 0.66% of GDP; expenditure per researcher in purchasing power parity dollars = -15%) and Central Asia (-15% in purchasing power parity dollars, from 0.17% to 0.12% of GDP, expenditure per researcher in purchasing power parity dollars = -5%).
- Only 37 countries spent 1% or more of their GDP on research and development in 2018, the most recent year for which there are data for countries of all development levels.
- Globally, the ratio of research spending to GDP was 1.79% in 2018, up from 1.73% in 2014.

The number of researchers is growing:

- The global researcher pool grew almost three times faster (+13.7%) than the global population (+4.6%) over 2014–2018. By 2018, there were 8.854 million (full-time equivalent) researchers in the world, up from 7.790 million in 2014.
- In 38 countries, the number of (full-time equivalent) researchers per million inhabitants grew by at least 15% over 2014–2018. Researcher density has grown most rapidly in low-income countries (+36%) but they still account for 0.2% of the global researcher pool (and 12.4% of global population).
- Women represented 33.3% of all researchers in 2018, up from 28.4% in 2013, with the caveat that data are only available for 107 countries for at least one year over the period 2015–2018. For details, see: <https://en.unesco.org/news/one-three-researchers-woman>
- Women accounted for 28% of tertiary graduates in engineering and 40% of those in computer sciences in 2018, fields which are central to the Fourth Industrial Revolution and where there is a skills shortage.

Publication output continues to climb:

- Worldwide, the annual output of scientific publications surged by 21% between 2015 and 2019.
- International collaboration is growing as more scientists publish with their peers abroad: 23.5% of global publications in 2019 involved co-authors from at least two countries, up from 18.6% in 2011 and 21.7% in 2015. Growth was greatest in high-income economies over 2015–2019: from 30% to 36% of publications.

Health and tech dominate research agenda:

- Health research accounted for 34% of scientific publications in 2019 and cross-cutting strategic technologies for a further 18% in 2019.¹
- Environmental research showed the fastest growth rate (45.7%) over 2015–2019 but from a low starting point: from 3.6% of publications worldwide in 2015.
- High-income countries' global share of scientific publications shrank from 69.3% to 62.9% as developing countries increased their own output. This trend was even stronger for cross-cutting strategic technologies, where high-income countries' global share slipped from 60.5% to 52.2%.

¹ These cross-cutting technologies are: artificial intelligence and robotics; energy; materials science; nanotechnology; biotechnology; bioinformatics; opto-electronics; the Internet of Things; strategic, defence and security studies; and blockchain technology.

- Over 2017–2019, international scientific collaboration was greatest in geosciences (34.4% of publications) and other environmental sciences (31.6%), followed by animal and plant biology (30.3%), physics and astronomy (27.9%) and ICTs, maths and statistics (23.8%).
- Over 2017–2019, international scientific collaboration was lowest in the built environment and design (20.9%), cross-cutting strategic technologies (20.3%) and engineering (18.6%).
- Among cross-cutting strategic technologies, the field of artificial intelligence (AI) and robotics leads by volume of research output, followed by energy and materials science. The field of AI and robotics has seen a resurgence of attention since 2015: 102 347 publications in 2015 and 147 806 in 2019 (+44%).
- Among the five top fields for strategic technologies, nanotechnology enjoyed one of the strongest growth rates over 2015–2019: 48%. Growth was largely driven by China, which produced just under half of publications on nanotechnology.
- Biotechnology showed one of the slowest growth rates: +12% (to 18 714 publications).
- The number of publications on opto-electronics actually dropped over 2015–2019 from 29517 to 26 651.
- The number of publications worldwide on the Internet of Things remains modest: 3 430 in 2019.

Sustainability science is small and growing slowly:

- Proportionately, developing countries are publishing the most on sustainability science topics, according to a unique UNESCO study of 56 sustainability science research topics, even if output is low. Their economies also tend to be most reliant on natural resources and they are bearing the brunt of climate change.
- Of the 56 research topics, that of floating plastic debris in the ocean showed the fastest growth, albeit from a low starting point. Over nine years, the global research effort on this topic ballooned from 46 (2011) to 853 (2019) publications. There were also 5 247 publications worldwide on ecological alternatives to plastics (0.03% of publications).
- Based on bibliometric trends, research topics related to limiting the impact of climate change and ecology received less attention than subjects of advanced technology. For example, in 2019, scientists published almost 148 000 articles on artificial intelligence and robotics but only 4 769 on climate-ready crops (0.02% of scientific publications), 1 276 on minimizing poaching and trafficking of protected species (0.01%) and 1 039 on local disaster risk reduction strategies (0.01%).
- Publications on nine topics related to sustainable energy (SDG7), including cleaner fossil fuel technology and renewable sources of power, only accounted for 2.4% of global scientific output over 2016–2019, up from 2.1% over 2012–2015.
- Scientific output grew by at least 0.02% for only 19 of the 56 research topics over 2012–2019. Examples are agro-ecology (+0.03%), ecological construction materials (+0.03%), wind turbine technologies (+0.04%), taking an ecological approach to industrial waste management (+0.04%) and wastewater treatment, and recycling and re-use (+0.06%). Growth was strongest for the topic of greater battery efficiency (0.20%).

The scientific playing field remains uneven:

- The G20 countries still account for nine-tenths of researchers (88.8%), research spending (93.2%) and scientific publications (90.6%).

ABOUT THE REPORT

The UNESCO Science Report (2021) is:

- global in scope, reporting on trends in over 193 countries;
- expert-led, with 70 authors from 52 different countries;
- the 7th in a series dating to 1993 which tracks global trends in science governance and scientific practice;
- a monitoring tool for the Sustainable Development Goal targets on increasing research investment as a share of GDP (SDG 9.5.1) and researchers per million inhabitants (SDG 9.5.2), for which the UNESCO Institute for Statistics is the global custodian; and
- freely available via the report's web portal, with accompanying datasets and interpretive resources.