Institute for Scientific Information

# G20 Research and Innovation Scorecard 2025

## Executive Summary

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# Author biography

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# Foundational past, visionary future

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# Introduction

## Ubuntu and the G20: Solidarity in global research

**The Institute for Scientific Information (ISI) promotes the responsible evaluation of research through qualitative narratives informed by comprehensive profiles. Whether analyzing researchers, universities, journals, funders or countries, research can never, and should never, be summarized in a single metric.**

The G20 is a self-described forum of "both developing and developed countries which seeks to find solutions to global economic and financial issues." Its members comprise many of the largest countries by population and GDP and are evenly split between the Global South and the Global North. They represent nearly 80% of the world population and produce nearly 85% of its GDP.

The United Nations Sustainable Development Goals (SDGs) were launched in 2015 as part of its 2030 Agenda. In acknowledgement of this impending deadline, South Africa, which holds the G20 presidency this year, has made solidarity, equality and sustainability the theme. South Africa has approached the presidency in the spirit of Ubuntu – an African philosophy which emphasizes connectedness and collaboration and is often translated as "I am because we are". Its aim is to encourage members to work together to solve the problems that affect us all.

Reflecting this spirit, the Institute for Scientific Information (ISI) has refined the scorecard's format this year to better highlight collaboration, inclusivity, and impact. Through interactive charts and dynamic visualizations, readers can explore the research and development performance of each member.

Alongside economic context of each member's performance, the scorecard presents academic input and trends in research output, now broken down by OECD field to highlight each member's priorities and facilitate comparison with data from other sources. The scorecard also highlights the focus given to the SDGs, including the academic impact of this research.

In the spirit of Ubuntu, the scorecard shows how members are making their research more accessible through open access and collaborating to tackle the world's issues – again, summarized by OECD field.

New this year, data from the Emerging Sources Citation Index (ESCI) are included in the scorecard. This dataset includes journals that have passed rigorous editorial tests for quality and help provide an even more comprehensive overview of global research performance.

While we encourage readers to examine the rich and comprehensive data in the scorecard for themselves, and combine these data with those from other sources to identify narratives that are relevant or interesting to them, the following pages offer a brief summary of key findings in this year's scorecard.

**Explore the G20 research and innovation scorecard 2025.**

## Key:

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|---|---|
| BERD | Business Sector Expenditure on R&D |
| CNCI | Category Normalized Citation Impact – a standard method that compares the accumulated citation count for an article (or a review) to other articles (or reviews) published in the same year and in the same journal based subject category in the Web of Science. A CNCI value of 1.0 is the global average. |
| Collab-CNCI | Collaboration CNCI – whereby the accumulated citation count for each paper is normalized against other papers of the same publication year, the same subject category, the same document type and – critically – the same collaboration type. A value of 1.0 is the global average. |
| GDP | Gross Domestic Product |
| GERD | Gross Domestic Expenditure on R&D |
| SDG | United Nations Sustainable Development Goals |

# G20 members' performance

## African Union

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|---|---|
| Impact | Category Normalized Citation Impact (CNCI) improved from 0.89 in 2015 to 1.12 in 2024, averaging at 1.00 over the period. However, when collaboration is accounted for, Collab-CNCI is lower, but increased from 0.72 to 0.89, averaging at 0.81, over the same period. |
| SDGs | Above G20-average focus on SDG 1 No Poverty (1.87 times average). CNCI is around average in most SDGs. |
| Collaboration | Relatively small increase in overall international collaboration rate from around 55% to 60%, with 95% of these involving collaboration with a country or region outside of the Union. An increase in collaboration with Saudi Arabia, from 6.9% in 2015 to 13.6%, to become the lead partner for AU nations contrasts with a fall for France from 9.5% to 5.8% over the same period. Collab-CNCI with Saudi Arabia has increased from 0.80 to 1.15. |

## Argentina

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| Gender | High female research percentage, around 53%, whether measured by head count or full-time equivalent (FTE). |
| Disciplines | Above G20-average focus on Agricultural & Veterinary Sciences. At 10.8%, this is 1.65 times the G20 average percentage. The focus on Humanities and the Arts is higher at 2.44 times the G20 average, but this only represents 10.1% of Argentina's output. |
| Impact | CNCI of Medical & Health Sciences research is high, rising from 1.31 in 2015 to 2.11 in 2024. Less than half (48%) of papers where all authors are located in a single institution are cited. |
| SDGs | Focus on SDG 15 Life on Land is very high at 2.16 times average. |

## Australia

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| Population | Smallest member by population, but second, behind the United States, for GDP per capita. |
| Impact | CNCI is high, rising from 1.42 to 1.50. Collab-CNCI is also consistently above average at around 1.16, including for both domestic and international papers separately. |
| Disciplines | Around a fifth (20.7%) of papers are in Social Sciences, 1.6 times the G20 average, with an above average focus on Law. |
| SDGs | High focus on SDG 16 Peace, Justice and Strong Institutions. Impact is high in most SDGs, although around average (0.99) in SDG 17 Partnerships for the Goals. |
| Open Access | Increase in open access (OA) rate from around 40% in 2015 to around 65% in 2024. This is mostly driven by an increase in papers published as both gold/hybrid/bronze OA (i.e. in free-to-read journals) and green OA (author repositories). |
| Collaboration | Collaboration rate with Mainland China has doubled from 9.7% in 2015 to 19.5% in 2024 to become the lead partner ahead of the United States, with more than half of this collaboration bilateral. While 56.3% of this research is in Natural Sciences, 45.4% is in Engineering and Technology. This contrasts with collaboration with the United States where Natural Sciences (44.2%) and Medical and Health Sciences (42.9%) are the lead collaborative fields. |

## Brazil

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| Impact | While CNCI has remained relatively constant at around 0.79 between 2015 and 2024, this masks trends by discipline. CNCI in Medical & Health Sciences remains constant, just above 1.0, while CNCI in most fields has fallen over period, offset by a rise in CNCI in Social Sciences. |
| Disciplines | Focus on Agricultural & Veterinary Sciences is 2.18 times the G20 average, with 14.3% of papers. |
| SDGs | Above G20-average focus on SDG 2 Zero Hunger and SDG 15 Life on Land at 1.63 and 1.55 times average respectively. |
| Open Access | OA rate remains consistent between 50% and 60% – however, while the majority of this is published in gold/hybrid/bronze journals (84.9% of all OA papers in 2015; 90.4% in 2023), the percentage of these papers that is also published via green OA is falling (75.5% in 2015; 47.6% in 2023). |

## Canada

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| Disciplines | Above G20-average focus on Medical & Health Sciences with 38% of papers. CNCI in this field is high, although falling through the period from 1.63 in 2015 to 1.51 in 2023, with a rise back to 1.66 in 2024. |
| SDGs | Above G20-average focus on SDG 16 Peace, Justice and Strong Institutions, SDG 5 Gender Equality and SDG 10 Reduced Inequalities. CNCI is above average in all SDGs, but Collab-CNCI is below average in SDG 1 No Poverty and SDG 17 Partnerships for the Goals. |
| Collaborations | Collaboration with the United States remains consistently high, with 26.8% of Canadian papers published in 2024 having a co-author based in the U.S. Nearly half (47.2%) of these papers are in Medical and Health Sciences, with 39.5% in Natural Sciences. |

## China, Mainland

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| GDP (PPP) | Highest in G20, but relatively low GDP per capita. |
| Patents | Performance remains high, with more than 1.6 million patents filed with WIPO in 2023, and more than 2,300 patents per million international dollars of business enterprise expenditure on R&D (BERD (million PPP$)). |
| Output | Highest output of any G20 member in 2024, with nearly 900,000 papers, three times that of 2015 output. |
| Impact | Above average CNCI and Collab-CNCI both rising from 1.04 and 1.03 to 1.17 and 1.19 respectively. |
| SDGs | Above average focus on SDG 7 Affordable and Clean Energy, SDG 11 Sustainable Cities and Communities, SDG 6 Clean Water and Sanitation and SDG 12 Responsible Consumption and Production. These reflect the needs of a large population. |
| Collaboration | As output has increased over the past decade, this has increasingly led to domestic collaboration over international collaboration. More than half of all papers in 2024 involved domestic collaboration. Leading collaborative partner is the United States, although with Mainland China's increase in output, this accounts for a decreasing share. Collaboration rates with other partners have shown small levels of increase between 2015 and 2019 but have declined since. Collaboration with most partners tends to be bilateral and focused on Natural Sciences. |

## European Union

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| Output | Highest output of any G20 member between 2015 and 2024 inclusive, with 6.2 million papers. |
| Impact | While CNCI is consistently above average at around 1.07, Collab-CNCI is consistently below average at 0.93. CNCI in Medical & Health Sciences has risen from 1.12 in 2015 to 1.25 in 2024. |
| Open Access | Overall rate of OA publications has increased from just above 40% in 2015 to around 75% in 2023. Much of this increase is in papers published both in gold/hybrid/bronze journals and in green repositories (20.7% in 2015 to 42.9% in 2023). |
| Collaboration | While collaboration rates with the United States (12%) and United Kingdom (9%) have remained steady over the past decade, collaboration with Mainland China has increased from 3.0% in 2015 to 6.6% in 2024. |

## France

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| Output | Generally flat at around 90,000 papers each year over the past decade. |
| SDGs | While output is around average in most SDGs, CNCI is high in SDG 5 Gender Equality (1.55) and SDG 9 Industry, Innovation and Infrastructure (1.54). Collab-CNCI is lower, but still above average in both SDGs (1.05 and 1.18 respectively). |
| Collaboration | Collaboration with leading partners – the United States, the United Kingdom, Germany, Italy and Spain – has increased over the past decade, mostly as part of large quadrilateral+ collaborations. These are mostly in Natural Sciences and Medical and Health Sciences. |

## Germany

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| Gender | Only a quarter (24.1%) of FTE researchers are female. |
| Impact | Collab-CNCI around average, albeit with a slight fall from 1.04 in 2015 to 0.98 in 2024. |
| SDGs | High focus on SDG 10 Reduced Inequalities. CNCI and Collab-CNCI are both above average in this SDG at 1.34 and 1.15 respectively. |

## India

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| Research density | Low, at around 250 FTE researchers per person. |
| Gender | Low FTE female research percentage (<20%). |
| Output | Paper count doubled between 2015 (85k papers) and 2024 (181k papers). Ranked third among G20 countries/regions in 2024, behind Mainland China and the United States. |
| SDGs | High focus on SDG 7 Affordable and Clean Energy and SDG 12 Responsible Consumption and Production, reflecting the needs of a large population. |
| Collaboration | Although the United States is the lead partner, with 7.4% of papers involving collaboration in 2024, Saudi Arabia's share has increased from 1.5% in 2015 to 6.6% in 2024. Collaborations in Medical and Health Sciences with South Korea and Mainland China tend to be very highly cited, with Collab-CNCIs of 2.10 and 1.95 respectively. |

## Indonesia

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| Investment | Low GERD as a percentage of GDP (0.28%). |
| Output | Very large increase in output between 2015 (4k papers) and 2024 (20k papers) as Indonesia grows its domestic research base. Output in Social Sciences has increased eight-fold. |
| SDGs | Very high focus on SDG 1 No Poverty (3.11 times the G20 average) and SDG 4 Quality Education (2.08 times average). |
| Open Access | Gold/hybrid/bronze OA rates have increased from 19.6% in 2015 to 40.8% in 2023, helping to boost overall OA rates from 46.6% to 68.7% over the same period. |
| Collaboration | Reflecting geography, leading collaborative partners are Malaysia, Japan and Australia. While collaborations with Malaysia and Japan tend to be in Natural Sciences or Engineering and Technology, those with Australia tend to be in Natural Sciences or Medical and Health Sciences. Only collaborations in Medical and Health Sciences tend to be well-cited, however, with Collab-CNCI above 1.75 for all five leading partners. |

## Italy

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| Impact | CNCI remains above average, rising from 1.23 to 1.34 between 2015 and 2024. However, Collab-CNCI is around average, rising from 0.98 to 1.03. |
| SDGs | High Collab-CNCI in SDG 9 Industry, Innovation and Infrastructure (1.36) and SDG 12 Responsible Consumption and Production. |
| Collaboration | Levels of collaboration with leading partners have generally remained constant with a small rise in some cases. Collab-CNCI is similar for all five leading partners rising from 1.20 to 1.30 between 2015 and 2024. Collaboration focuses on Natural Sciences and Medical and Health Sciences, with the latter tending to have higher impact. |

## Japan

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| Patents | Nearly 2,500 patents per BERD (million PPP$) in 2023. |
| Efficiency | Low efficiency with around 0.14 papers per researcher (FTE) and 0.47 papers per million GERD (PPP$). |
| SDGs | Below average focus in most SDGs, except SDG 3 Good Health (1.29) and SDG 7 Affordable and Clean Energy (1.10). Collab-CNCI is below average in all SDGs. |
| Collaboration | Relatively low level of collaboration compared with other members at less than 35% over the decade, although comparing favorably with other Asian members. Leading partners are the United States and Mainland China, although Mainland China's share is on trend to overtake that of the U.S. in 2025. U.S. collaboration is focused on Natural Sciences and Medical and Health Sciences, while Mainland China's is on Natural Sciences and Engineering and Technology. |

## Mexico

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| Investment | GERD as a percentage of GDP is low at 0.27%. |
| SDGs | High focus on SDG 15 Life on Land (1.65 time average), SDG 2 Zero Hunger (1.51) and SDG 14 Life below Water (1.44). |

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| Open Access | Steady increase in overall OA rate from 37.8% in 2015 to 63.8% in 2023, mostly driven by output in gold/hybrid/bronze journals. |
| Collaboration | Reflecting geography and language, lead partners are the United States and Spain. Collaborations in Medical and Health Sciences with the United Kingdom and France both lead to very high Collab-CNCI of 2.50 and 2.71 respectively. |

## Russia

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| Output | Rose between 2015 (47k papers) and 2021 (72k papers) but has fallen since back to (57k papers). |
| Impact | Low Collab-CNCI at 0.48, with nearly 30% of papers remaining uncited – around double the G20 average. CNCI in Medical & Health Sciences is above average, growing from 1.01 to 1.11, although output in this field only comprises 9.7% of overall output. |
| Disciplines | Around 60% of output is in Natural Sciences, with the largest proportion of this in the Physical Sciences and Chemical Sciences. |
| SDGs | High focus on SDG 17 Partnerships for the Goals (1.59 time average), SDG 7 Affordable and Clean Energy (1.56) and SDG 13 Climate Action (1.55). |
| Collaboration | Fell between 2021 and 2024 with leading partners: the United States, Germany, the United Kingdom and France. However, collaboration with Mainland China has increased over the period. As a result, collaboration levels for 2023 and 2024 remain similar. More than 65% of collaboration with each of these partners is in Natural Sciences, although the impact of research in Medical and Health Sciences tends to be higher. |

## Saudi Arabia

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| Output | Trebled between 2018 and 2024 from 20k to 61k papers. This increase initially led to a fall in CNCI and Collab-CNCI, although impact has recovered since. |
| SDGs | Focus on SDG 7 Affordable and Clean Energy and SDG 6 Clean Water and Sanitation. CNCI in SDG 8 Decent Work and Economic Growth is very high at 2.01 with Collab-CNCI at 1.41. |
| Open Access | Rate of OA overall has increased from 36.8% in 2015 to 64.6% in 2023, mostly driven by an increase in output in gold/hybrid/bronze journals. |
| Collaboration | High levels of international collaboration as output has increased, with a shift towards larger internationally collaborative projects between 2020 and 2022 (rate of quadrilateral+ and trilateral collaboration have increased while bilateral partnerships declined). Leading partners are Egypt and, increasingly, India and Pakistan. |

## South Africa

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| Efficiency | High papers per researcher (FTE) at 0.98 and high papers per million GERD (PPP$) at 4.75. |
| Impact | Above average CNCI at 1.19, although Collab-CNCI is below average at 0.87. |
| SDGs | Focus on SDG 1 No Poverty and SDG 4 Quality Education are both high at 2.08 and 2.03 times the G20 average. |
| Collaboration | Leading partners are the United States and, increasingly, the United Kingdom. Collaborations with both are near evenly split between Natural Sciences and Medical and Health Sciences, with the latter having the higher impact. |

## South Korea

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|---|---|
| Researcher density | Highest at more than 9,400 FTE researchers per person. |
| Investment | GERD as a percentage of GDP is high at 5.2%. |
| Patents | More than 2,500 patents per BERD (million PPP$). |
| SDGs | High focus on SDG 7 Affordable and Clean Energy at 1.76 times the G20 average, with above average CNCI (1.16) and Collab-CNCI (1.09) in this SDG. |
| Collaboration | While level of collaboration with leading partner the United States has remained relatively steady just below 15%, collaborations with Mainland China and India are both increasing. These latter collaborations tend to have a higher Collab-CNCI: rising from 1.09 to 1.17 for the United States compared with 1.18 to 1.48 for Mainland China and 1.15 to 1.30 for India. |

## Türkiye

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| Disciplines | More papers in Medical & Health Sciences (38.5%) than in any other discipline, with a particular focus in Clinical Medicine (73% of output in the field). |
| SDGs | Focus on SDG 8 Decent Work and Economic Growth is high at 1.63 times the G20 average, with high CNCI (1.83) and Collab-CNCI (1.48) in this SDG. CNCI and Collab-CNCI are also high in SDG 9 Industry, Innovation and Infrastructure (1.66 and 1.40 respectively) and SDG 12 Responsible Consumption and Production (1.51 and 1.32). |
| Open Access | While OA output has increased from around 35% in 2015 to just over 50% in 2024, non-OA papers are more likely to be cited: 26% of OA papers are uncited compared with 19% of non-OA papers. However, if they are cited, OA papers are likely to pick up more citations. This could partly reflect the fact that newer papers, which are more likely to be OA, haven't yet had time to accumulate citations. However, this pattern is not seen with most other countries/regions. |
| Collaboration | Low level of international collaboration, increasing from around 20% in 2015 to just over 30% by 2024. Leading partner is the United States, while sixth and seventh most common partners Iran and Saudi Arabia reflect geography. |

## United Kingdom

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|---|---|
| Impact | High CNCI, consistently around 1.46-1.49. Collab-CNCI is also high, albeit falling, from 1.18 to 1.10. |
| Disciplines | Above average focus on Social Sciences with 21.5% of papers, as well as above average focuses on Law, Political Science and Sociology. |
| SDGs | Very high focus on SDG 16 Peace, Justice and Strong Institutions (2.41 times the G20 average) and SDG 10 Reduced Inequalities (1.80). CNCI is above 1.5 and Collab-CNCI is above 1.2 in most SDGs. |
| Collaboration | High level of international collaboration, increasing from around 55% in 2015 to around 70% in 2024. Much of this growth is from larger quadrilateral+ projects (10.4% of output in 2015 to 18.3% in 2024). Leading partner is the United States; however, Mainland China's share of output has increased from 5.5% to 14.4% over the period (this is consistent with Mainland China trebling overall output). |

## United States

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|---|---|
| Impact | Collab-CNCI is above average but has fallen from 1.26 to 1.07. CNCI has fallen in most fields but has leveled off since 2020 in Medical & Health Sciences. |
| SDGs | High focus on SDG 16 Peace, Justice and Strong Institutions (1.88 times the G20 average) and SDG 10 Reduced Inequalities (1.57). |
| Collaboration | While international collaboration has risen over the decade, from around 35% in 2015 to 43% in 2024, this is still low compared with other advanced research economies. Of course, this may reflect the size of the U.S. economy – there are many opportunities for domestic collaboration. Largest collaborative partner is Mainland China, predominantly through bilateral partnerships. |

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