The Annual G20 Scorecard – Research Performance 2021

Jonathan Adams and Gordon Rogers
Author biographies

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About the Institute for Scientific Information

The Institute for Scientific Information™ at Clarivate has pioneered the organization of the world’s research information for more than half a century. Today it remains committed to promoting integrity in research whilst improving the retrieval, interpretation and utility of scientific information. It maintains the knowledge corpus upon which the Web of Science™ index and related information and analytical content and services are built.

It disseminates that knowledge externally through events, conferences and publications whilst conducting primary research to sustain, extend and improve the knowledge base. For more information, please visit https://clarivate.com/isi.

The G20:

- Represents 63% of world population (World Bank, 2020)
- Produces 80% of global GDP (World Bank, 2020)
- Spends 93% of global R&D (UNESCO, 2018*)

- Employs 89% of the world’s researchers (UNESCO, 2018*)
- Publishes 83% of global research papers (Web of Science, 2020)

*Refers to the UNESCO Science Report 2021, p.32
## Executive summary

<table>
<thead>
<tr>
<th>Region</th>
<th>Snapshot of research footprint</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Argentina</strong></td>
<td>Research spend (Gross Expenditure on R&amp;D, or GERD) continues to rise although it is still relatively low at 0.58% GDP. Indexed output per researcher is low and while open access output is high, in line with other nations in Latin America, this is mainly in the social sciences and humanities. Citation impact is around world average and international collaboration trends are typical of the G20. However, a dip in citation impact continues and patents/BERD are low.</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>Output continues to rise, doubling in a decade and driven by exceptional international collaboration. Productivity per researcher and per GERD is consequently relatively high. International collaboration boosts citation impact and share of highly cited papers (above G20 average and the highest overall) but domestic impact is marginally lower.</td>
</tr>
<tr>
<td><strong>Brazil</strong></td>
<td>Output is rising both domestically and for international collaboration. Open access output – especially for international papers – is very strong across all disciplines except technology. Citation impact, particularly for domestic output, is below the relevant G20 averages and continues to fall slightly on average, perhaps affected by a drop in funding.</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td>Output per researcher continues to rise and overall output has risen by one-half in the past decade. However, although open access output has nearly trebled as a percentage of overall output over the same period, it remains below the G20 average. Citation impact is well above G20 averages with 38% of publications above world average citation impact compared with 12% for the G20 as a whole.</td>
</tr>
<tr>
<td><strong>Mainland China</strong></td>
<td>Two million researchers is a very large workforce and exceptional investment (GERD over 2% of a rising GDP) supports patents/Business Expenditure on R&amp;D (BERD) that are twice that of most other G20 nations, aside from Japan and South Korea. The domestic research base continues to diversify, growing in all areas with an expanding focus on social sciences added to an established technology base. It has a growing share of world publications and gradually rising impact.</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>The domestic research base has some weakness where output is in decline on both per researcher and per GERD funding indices. Domestic impact is also below the G20 average. While citation impact remains relatively high in life sciences, this is boosted by a high 60% international collaboration. Open access remains well below G20 average in most fields despite EU initiatives.</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>GERD, as a share of GDP, is 3.2% and higher than EU neighbors while output per researcher is around G20 average. The citation impact of the research is relatively good, especially in life sciences, and it has a 14% share of the world’s top 10% of papers. Output per GERD and per researcher is below the G20 average but has recently picked up.</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>Output remains relatively low for such a large economy (it has 20 times the population of Italy but slightly fewer papers). However, we cannot index productivity as there are no recent data on GERD or researchers. Open access has been adopted only in biomedicine. Low international collaboration (half the G20 average) contributes to a weak Impact Profile and low citation impact in all areas.</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>Output is low and, although volume has trebled in all disciplines since 2012, domestic output is only 20% of the total. Average citation impact (peaking above world average in 2012/2017) is therefore driven by the internationally collaborative output, which also shapes the Impact Profile. Average citation impact is relatively good where collaboration is substantial but more than 20% of domestic papers are uncited. Open access is driven by publications in medicine.</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td>Productivity per GERD is well above G20 average, so output has not been constrained by consistently low government investment which leads to low GERD/GDP. Output is only just above G20 median. Citation impact is good in all areas and the impact of domestic research is rising. The Impact Profile shows that average performance is further boosted by international collaboration, accounting for 55% of total output.</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>Productivity is markedly below G20 average and citation impact is low for a well-established G7 research economy with a high level of GERD/GDP (3.3%). This may be associated with relatively low (20%) international collaboration Patents/BERD is one of the highest in the G20, but women represent only 17% of the researcher population.</td>
</tr>
<tr>
<td><strong>Mexico</strong></td>
<td>Research investment is low and continues to fall (GERD/GDP is 0.28%), but rising output is boosted by high and rising productivity. Citation impact is now slowing including international collaboration. The Impact Profile shows that the impact of the domestic base output is well below world average. However, average impact is good in medicine and health.</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td>Russia’s research profile is affected by slow recovery from post-Soviet disruption and recent incentives to publish in Russian-language outlets. This results in an artifically low recorded output volume (and indexed productivity) leading to low international collaboration (24%) and recognition. Only 18% of papers have above world average citation impact and domestic research is cited much less.</td>
</tr>
<tr>
<td><strong>Saudi Arabia</strong></td>
<td>Domestic papers have been 20% of total output since 2010 so the Impact Profile reflects a strategic focus on international collaboration or affiliation. This has grown steeply while domestic research does not yet reflect this investment as domestic researcher numbers are not disclosed. Impact by discipline appears high and rising but this is largely international.</td>
</tr>
<tr>
<td><strong>South Africa</strong></td>
<td>International collaboration makes up 60% of output and the overall Impact Profile is close to G20 average. This has fallen slightly but is boosted by a strong performance in medicine and health research. Productivity is high and output has been rising. There are consistently high levels of publication via open access across disciplines and the country has the second-highest proportion of female researchers (45%).</td>
</tr>
<tr>
<td><strong>South Korea</strong></td>
<td>A large workforce and the highest G20 GERD/GDP (4.6%) translate into strong academic output in engineering, reflecting excellent private sector funding and activity. Citation impact is lower than expected but this may be due to below-average international collaboration. Open access is rising in all areas.</td>
</tr>
<tr>
<td><strong>Turkey</strong></td>
<td>Recent declines in output and productivity have been reversed but output is low for the size of the economy. Domestic impact has declined slightly. International collaboration remains low but boosts overall impact. Citation impact is in fact below world average in all areas and collaboration lifts the Impact Profile above the G20 average. Open access is declining, in contrast to the rest of the G20.</td>
</tr>
<tr>
<td><strong>United Kingdom</strong></td>
<td>The share of papers in the global top 10% (16.2% and rising) is the highest in the G20. The Impact Profile shows that even domestic research performs above G20 average. By discipline, average citation impact is strongest in life sciences and relatively high (above 1.2) in most other areas except art and design. International collaboration is exceptionally high, and rising, for such a large economy. The proportion of female researchers (49%) is above G20 average.</td>
</tr>
<tr>
<td><strong>United States</strong></td>
<td>Output is now second to Mainland China – the highest in the G20 in all areas and citation impact is good, though less than the United Kingdom. The strong domestic research base is boosted less by international collaboration than other countries, as the Impact Profile shows. However, although investment is rising (GERD/GDP = 3.1%), output has plateaued and output per researcher is below the G20 average.</td>
</tr>
</tbody>
</table>
The G20 economies are a leading force in the global research system. Together, they represent more than 80% of Gross Domestic Product (GDP) and two-thirds of the global population. The Institute for Scientific Information (ISI) is uniquely placed to deliver a comparative research snapshot for each G20 nation, setting Web of Science™ data alongside other key metrics on people, finance, and patenting. It shows that collectively, the 19 nations of the G20 (the EU is an additional member) accounted for more than five million articles and reviews indexed in the Web of Science research publication and citation index for the last three years – over 70% of the global total.

This year’s G20 Summit is scheduled for Rome, Italy, on October 30 and 31, 2021. Like last year’s event scheduled for Riyadh, the meeting will be uniquely impacted by the COVID-19 pandemic, and so our 2021 Annual G20 Scorecard includes a special analysis of the G20 contribution to recent COVID-19 research. Complementing last year’s audit, this year focuses on the different national responses and the link to each region’s research investment and subject diversity.

Evidence from many studies in economics and ecology shows that diversity provides benefits, notably in resilience and responsiveness. The global pandemic caused by COVID-19 must represent one of the most severe challenges to the research base and its capacity to respond to citizens’ needs. The question is therefore whether the data throw any light on the relationship between current research response and prior research diversity.

Our methodology for measuring subject diversity uses the 254 established Web of Science journal categories. We compare the distribution of articles and reviews that have at least one author affiliation for a region with the global background. We do so on an annual basis, using the global data to “normalize” counts that naturally vary between categories of different sizes and from year to year. We then calculate a Gini index for these data, illustrating diversity graphically as (1-Gini) since that index is intended to express concentration and not evenness.

During the pandemic, innovative research topics emerged to tackle societal, economic and health issues that often draw on contributions from a broad spectrum of academic disciplines and are not aligned with conventional subject categories. Consequently, we turn to topic modelling to create a bespoke classification system of COVID-19 research rather than using national reference data. We identified 67,756 papers (articles or reviews) indexed in the Web of Science and published in 2020-2021 that are related to COVID-19. We did so by searching titles, abstracts and keywords for terms such as COVID-19, SARS-COV-2, novel coronavirus, etc. Text from the titles and abstracts of these papers was used to create a topic model which includes 40 topics. These covered areas of clinical practice, molecular biology, virology, immunology, epidemiology, virtual learning, mental health, food security, economics, crisis management, environmental impact, and so on. This model was then used to profile nations according to the number of papers produced in each topic, revealing the range of the responses to the pandemic and providing a mechanism for comparison. In the same manner, for each region, the relative paper count for each topic (i.e., the number of papers in each topic with an author from the region divided by the total number of papers in the topic) was used to calculate a measure of relative evenness (1-Gini). We use these data to compare the relative evenness of that region’s research topics on COVID-19 with the diversity of each national research base over a recent period (2016-2020).

Our 2021 Annual G20 Scorecard includes a special analysis of the G20 contribution to recent COVID-19 research. This year we focus on the different national responses and the link to each region’s research investment and subject diversity.

As anticipated, regions with more even research bases, especially the United States, Germany and the United Kingdom, tend to support a response across a wider range of COVID-19 topics. Other G20 nations had a more specialized response. For example, Brazil, Mainland China and India have a similar level of evenness in their research portfolio, which is less than the United Kingdom and United States. Nonetheless, Brazil has a relatively high evenness for COVID-19 papers when compared to India and Mainland China. While all three had a substantial output in the core clinical topics, Brazil also published COVID-19 research in areas that were less prominent in Mainland China and India’s COVID-19 portfolios, such as online learning, economics and digital media.

The overall pattern is clear: as in economics, diversity in national portfolios enables a rapid and agile response. Brazil is an exception that ‘proves the rule’ because its response reflects the strengths in its research portfolio, particularly around biosciences.
Understanding the G20 scorecards

The research profile

The research profile of each country is summarised across two pages of data, graphics and tables. Each profile is headed by key statistics for the country and graphs show the pattern of activity and performance by subject area or the distribution or trend in performance across the last ten years.

Data sources

There are several sources of the data used in the headlines and elsewhere. The OECD is an important source of research information, particularly the Main Science and Technology Indicators (MSTI) but not all nations are OECD members and data may be missing where an OECD member has not consistently and recently updated their profile. Interpolation is used to fill these gaps.

<table>
<thead>
<tr>
<th>Data type</th>
<th>Source</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population, GDP</td>
<td>World Bank</td>
<td>GDP (PPP) data are in current international $. Data were retrieved using World Bank’s API, documented at <a href="https://datahelpdesk.worldbank.org/knowledgebase/articles/1886701/sdms-api-queries">https://datahelpdesk.worldbank.org/knowledgebase/articles/1886701/sdms-api-queries</a>.</td>
</tr>
<tr>
<td>Researchers, GERD, BERD</td>
<td>OECD</td>
<td>GERD is Gross national Expenditure on R&amp;D, BERD is Business sector Expenditure on R&amp;D. Most recent data for each item, matched to related data for the corresponding same year from for example the World Bank. For example, if Researcher data are from 2018, population and female researcher data are from 2018 to provide a meaningful comparison. OECD only includes data for OECD members and Argentina, mainland China, Romania, Russia, Singapore, South Africa and Taiwan. Data are therefore absent for Brazil, India, Indonesia or Saudi Arabia, except where obtained from other, validated sources. Data may be missing where an OECD member has not consistently and recently updated their profile. For output by researcher or GERD, data are all from 2011 to 2019, linearly interpolated where not available, and extended with earliest or latest value to cover the start/end of the period. Data were retrieved using OECD’s API, documented at <a href="https://data.oecd.org/api/sdms-ml-documentation/">https://data.oecd.org/api/sdms-ml-documentation/</a>.</td>
</tr>
<tr>
<td>Patents</td>
<td>WIPO</td>
<td>Data are for 2019 and were retrieved from the WIPO IP Statistics Data Centre <a href="https://www3.wipo.int/ipstats/index.htm?tab=patent">https://www3.wipo.int/ipstats/index.htm?tab=patent</a>.</td>
</tr>
<tr>
<td>Publications, citations</td>
<td>Web of Science</td>
<td>Data were taken from Web of Science (2011 to 2020). Data are from the Science Citation Index Expanded™, Social Sciences Citation Index™ and Arts &amp; Humanities Citation Index™, and only cover Articles and Reviews.</td>
</tr>
<tr>
<td>Open Access</td>
<td>DOAJ, Unpaywall</td>
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Data type SOURCES

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Notes

- GDP (PPP) data are in current international $. Data were retrieved using World Bank’s API, documented at https://datahelpdesk.worldbank.org/knowledgebase/articles/1886701/sdms-api-queries.
- GERD is Gross national Expenditure on R&D, BERD is Business sector Expenditure on R&D. Most recent data for each item, matched to related data for the corresponding same year from for example the World Bank. For example, if Researcher data are from 2018, population and female researcher data are from 2018 to provide a meaningful comparison. OECD only includes data for OECD members and Argentina, mainland China, Romania, Russia, Singapore, South Africa and Taiwan. Data are therefore absent for Brazil, India, Indonesia or Saudi Arabia, except where obtained from other, validated sources. Data may be missing where an OECD member has not consistently and recently updated their profile. For output by researcher or GERD, data are all from 2011 to 2019, linearly interpolated where not available, and extended with earliest or latest value to cover the start/end of the period. Data were retrieved using OECD’s API, documented at https://data.oecd.org/api/sdms-ml-documentation/.
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- Data were taken from Web of Science (2011 to 2020).
Benchmarks

A country’s performance is better understood if it is contextualized, ideally against an appropriate reference value. The reference benchmark in the G20 scorecards is either the G20 average or the G20 median, and this is shown in all the graphics and tables. The reason for using median values in some instances is that research data can be very skewed, with many low values and a few high value outliers, so the average does not then reflect the mid-point of the distribution.

There are no direct comparisons between individual countries. The G20 nations vary significantly in size and research maturity so direct comparison would not always be informative. In future reports, we expect to add information that tracks the evolving state of each country, benchmarking its activity against its historical position.

Citation analysis

The significance of a paper (an article or review) in a research journal is measured by the number of times it is subsequently cited in later research. These citation counts grow over time at a rate that varies between research fields, so actual counts are ‘normalized’ for analysis using the global average for field and year of publication. This is called Category Normalized Citation Impact, or CNCI; values greater than 1.0 show a paper is cited more often than world average.

Impact Profiles

Impact Profiles display the distribution of CNCI values for a ten-year sample of journal papers. The profile is much more informative than a single average value for the whole sample. Papers are assigned to categories as either uncited, or cited less often (down to half, less than half to one-quarter and so on), or cited more often (up to 2 times, 2-4 times and so on) than the world average (Adams et al., 2007).

International collaboration

International collaboration in research has been growing and most of the world’s most highly-cited research now has authors from two or more countries. As a result, the specifically domestic part of each country’s research base has been shrinking and is contributing less to overall national impact (Adams, 2013). These graphs show the growth of collaboration and the contribution that it makes to average national citation impact.

Output and collaboration

The citation impact of collaboration is shown by comparing average national impact with the papers that have an international co-author

- Total paper count for the country
- The percentage of annual output that is still domestic
- G20 average percentage of annual output that is still domestic
- Grey blocks is the count of domestic papers, with no international co-author

Impact and collaboration

- Country as a whole
- Papers with an international co-author
- G20 average CNCI

Average citation impact is shown relative to world average

Output trend is tracked over the last ten years

Research productivity

Research productivity is analyzed in terms of both output per unit GERD funding and output per researcher.

- National performance
- G20 average papers per unit activity

Output trend is tracked over the last ten years

<table>
<thead>
<tr>
<th>Papers</th>
<th>CNCI</th>
<th>% world average</th>
<th>% in top 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina total</td>
<td>96,518</td>
<td>0.9%</td>
<td>27.2%</td>
</tr>
<tr>
<td>Argentina domestic</td>
<td>48,872</td>
<td>0.57%</td>
<td>18.3%</td>
</tr>
<tr>
<td>Argentina international</td>
<td>47,646</td>
<td>1.36%</td>
<td>36.1%</td>
</tr>
<tr>
<td>G20 total dataset</td>
<td>15,175,599</td>
<td>0.99%</td>
<td>31.9%</td>
</tr>
</tbody>
</table>

Data are shown as percentage papers in sample

Comparison to the Impact Profile for the complete G20 dataset

Uncited papers shown as a separate block

Eight impact categories of cited papers: far below the world average citation impact and four above

For each dataset, the table shows the count of papers, the average CNCI and the percentages of papers above world average and in the world’s top 10%
Research Footprints

Research Footprints show how a research activity or performance measure varies across disciplines. They show the “footprint” of the country on the global research landscape.

The Research Footprints for publication output and for citation impact use eight major discipline groups (see key) within which there are broadly similar publication and citation patterns.

- Med = medicine
- Life = life sciences
- MPS = maths and physical sciences
- Eng = engineering and technology
- A&D = art and design
- H&L = humanities and languages
- Soc = social sciences
- SAM = subjects allied to medicine

Impact by discipline

The purple shape shows the Research Footprint for the country as its rank among the G20 countries on this indicator.

The dotted line shows the world average citation impact (1.0)

Each axis indicates the range of performance for a specific discipline group (see key)

The dotted line shows the median value for the G20

Output and Open Access

The purple shape shows the Research Footprint for the country as its rank among the G20 countries on this indicator.

Open Access (OA) research publication

Open Access (OA) research publication, where the author or funder pays instead of the reader or a university library paying via journal subscription, is increasing in response to demands from research funders — including governments (see Global Research Report: The Plan S Footprint). The trends and patterns in OA research publication are shown in a graph and a Research Footprint.
Argentina

Population 44,044,811
Researchers 84,284
Female researchers 45,311
Researchers/1000 population 1.91
Women as % researchers 53.8
GDP (PPP US$ billions) 1039.3
GERD (PPP US$ billions) 5.8
GERD/GDP (%) 0.56
Patents 815
BERD (PPP US$ billions) 1.6
Patents/BERD 520.7

Impact profile

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher
### Australia

- **Population**: 25,687,041
- **Researchers**: –
- **Female researchers**: –
- **Researchers/1000 population**: –
- **Women as % researchers**: –

### Impact profile

- **Papers**: 656,467
- **CNCI**: 1.37
- **% > world average**: 41.1%
- **% in top 10%**: 15.6%

#### GDP (PPP US$ billions)
- **Australia**: 1192.8
- **G20 total dataset**: 15,175,599

#### Patents
- **Australia**: 12,611
- **G20 total dataset**: 11.8

#### GerD/GDP (%)
- **Australia**: 1.88
- **G20 total dataset**: 1068.6

### Impact by discipline

#### Output and Open Access

#### Output by discipline

#### Output and collaboration

#### Impact and collaboration

#### Output by GERD

#### Output by researcher
Brazil

Population: 212,559,409

Impact profile

- Brazil total: 475,382, 0.84, 25.5%, 7.3%
- Brazil domestic: 305,725, 0.59, 18.8%, 4.0%
- Brazil international: 169,657, 1.29, 37.7%, 13.4%
- G20 total dataset: 15,175,599, 0.99, 31.9%, 10.7%

Output and collaboration

- Papers per million GERD (PPP$): 2011-2020
- Open Access papers per year: 2011-2020

Impact and collaboration

- Category-normalized citation impact: 2011-2020
- Impact profile: 2011-2020

Output by discipline

- Output and Open Access
- Output by GERD
- Output by researcher
Canada

Population: 38,005,238

Impact profile

World average cites/paper = 1.0

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher

Canada

Researchers

Female researchers

Researchers/1000 population

Women as % researchers

GDP (PPP US$ billions)

GERD (PPP US$ billions)

GERD/GDP (%)

Patents

BERD (PPP US$ billions)

Patents/BERD

Impact profile

Papers | CNCI | % > world average | % in top 10%
---|---|---|---
Canada total | 722,410 | 1.29 | 38.3% | 14.5%
Canada domestic | 322,201 | 0.91 | 30.9% | 9.2%
Canada international | 400,209 | 1.60 | 44.3% | 18.4%
G20 total dataset | 15,175,599 | 0.99 | 31.9% | 10.7%

Canada

GDP (PPP US$ billions)
1904.5

GERD (PPP US$ billions)
29.3

GERD/GDP (%)
1.64

Patents
25,174

BERD (PPP US$ billions)
15.0

Patents/BERD
1673.3

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher

Impact and collaboration

Output and collaboration

Output and Open Access

Output by GERD

Output by researcher
Mainland China

Population: 1,350,695,000

Researchers: 2,069,650

Researchers/1000 population: 1.53

Female researchers: –

Women as % researchers: –

Impact profile

<table>
<thead>
<tr>
<th>Papers</th>
<th>CNCI</th>
<th>% &gt; world average</th>
<th>% in top 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainland China total</td>
<td>3,262,654</td>
<td>1.05</td>
<td>33.4%</td>
</tr>
<tr>
<td>Mainland China domestic</td>
<td>2,408,909</td>
<td>0.90</td>
<td>29.8%</td>
</tr>
<tr>
<td>Mainland China international</td>
<td>853,745</td>
<td>1.46</td>
<td>43.8%</td>
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Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher

GDP (PPP US$ billions): 23442.7

GERD (PPP US$ billions): 526.7

GERD/GDP (%): 2.24

Patents: 1,328,067

BERD (PPP US$ billions): 401.7

Patents/BERD: 3305.9

Impact and collaboration

Output and collaboration

Impact and collaboration
### France

**Population**
- Total: 67,101,930
- Researchers/1000 population: 6.41

**Researchers**
- Total: 429,959
- Researchers as % of population: 6.41

**Female researchers**
- Women as % of researchers: –

### Impact profile

- **World average cites/paper**: 1.0

### Impact by discipline

- **Output and collaboration**
  - **Output by discipline**
    - Health & Life Sciences (H&L)
    - Natural Sciences (N.S.)
    - Social Sciences (Soc)
    - Agriculture & Applied Sciences (A&D)
    - Engineering (Eng)
    - Mathematical, Physical Sciences (MPS)
    - Medical (Med)

- **Impact and collaboration**
  - **Impact profile**
    - Papers CNCI % > world average:
      - France total: 775,189 (1.21)
      - France domestic: 308,863 (0.80)
      - France international: 466,326 (1.48)
    - Papers CNCI % in top 10%:
      - France total: 13.2%
      - France domestic: 7.9%
      - France international: 16.8%

### Output by discipline

- **Output and Open Access**
  - **Open Access papers per day**
    - In 2020, France had 1409.9 Open Access papers per million GERD.

### Output and collaboration

- **Total papers per year**
  - In 2020, France had 775,189 total papers published.

### Output by GERD

- **GERD (PPP US$ billions)**
  - G20 total dataset: 72.8
  - France total: 3320.6

- **Patents**
  - G20 total dataset: 67,390
  - France total: 47.8

- **Patents/GERD**
  - G20 total dataset: 1409.9
  - France total: 2.19
Germany

Researchers: 623,125
Female researchers: 179,700
Researchers/1000 population: 7.54
Women as % researchers: 27.9

Impact profile

Impact by discipline

Output and Open Access

Output by discipline

Impact and collaboration

Output and collaboration

Population: 82,657,002

GDP (PPP US$ billions): 4644.2
GERD (PPP US$ billions): 147.5
GERD/GDP (%): 3.18

Patents: 178,359
BERD (PPP US$ billions): 101.7
Patents/BERD: 1753.0

Impact and collaboration

Output by GERD

Output by researcher
India

Population 1,380,004,385

Impact profile

Output and collaboration

Impact and collaboration

GDP (PPP US$ billions) 8907.0

GERD (PPP US$ billions) –

GERD/GDP (%) –

Patents 34,052

BERD (PPP US$ billions) –

Patents/BERD –

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher
**Indonesia**

- Researchers: 273,523,621
- Female researchers: -
- Researchers/1000 population: -
- Women as % researchers: -

**Impact profile**

- World average cites/paper = 1.0

**Impact by discipline**

**Output by discipline**

**Output and Open Access**

**Output by GERD**

**Output by researcher**

**GDP (PPP US$ billions)**
- 3392.4

**GERD (PPP US$ billions)**
- -

**GERD/GDP (%)**
- -

**Patents**
- 1,141

**GDP (PPP US$ billions)**
- 3392.4

**Patents (PPP US$ billions)**
- -

**Patents/BERD**
- -

**Impact profile**

- Papers
- CNI (%) > world average (%) in top 10%
- Indonesia total: 27,410 (1.09) 31.0% 10.0%
- Indonesia domestic: 6,099 (0.58) 18.2% 4.5%
- Indonesia international: 21,311 (1.24) 34.7% 11.5%
- G20 total dataset: 15,175,599 (0.99) 31.9% 10.7%

**Output and collaboration**

- Total and domestic papers per year
- Category normalised citation impact

**Impact and collaboration**

- Total and domestic papers per year
- Category normalised citation impact

**Output by discipline**

- Med
- MPS
- Eng
- A&D
- H&L
- Soc
- Life
- SAM

**Output and Open Access**

- Med
- MPS
- Eng
- A&D
- H&L
- Soc
- Life
- SAM
Italy

Population: 60,421,760
Researchers: 212,671
Researchers/1000 population: 3.52
Female researchers: 72,177
Women as % researchers: 33.9

Impact profile

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher

Impact and collaboration

Output and collaboration

Impact profile

World average cites/paper = 1.0

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher
Japan

Population

126,264,931

Researchers

942,180

Researchers/1000 population

7.46

Female researchers

158,927

Women as % researchers

16.9

Impact profile

World average
cites/paper = 1.0

Impact by discipline

Output by discipline

Output and Open Access

Output by GERD

Output by researcher
Mexico

Population: 127,575,529
Researchers: 58,013
Female researchers: 19,033
Researchers/1000 population: 0.45
Women as % researchers: 32.8

Impact profile

World average cites/paper = 1.0

- Mexico total: 150,309 (0.84) 23.3% 7.2%
- Mexico domestic: 80,645 (0.50) 14.6% 2.9%
- Mexico international: 69,664 (1.24) 33.5% 12.1%
- G20 total dataset: 15,175,599 (0.99) 31.9% 10.7%

Impact by discipline

Output by discipline

Output and Open Access

Output and Open Access

Output by GERD

Output by researcher

GDP (PPP US$ billions): 2608.6
GERD (PPP US$ billions): 7.4
GERD/GDP (%): 0.28
Patents: 2,535
BERD (PPP US$ billions): 1.6
Patents/BERD: 1569.2
**South Africa**

- **Researchers**: 61,840
- **Female researchers**: 27,774
- **Population**: 57,009,761
- **Researchers/1000 population**: 1.08
- **Women as % researchers**: 44.9

**Impact profile**

- World average cites/paper = 1.0

<table>
<thead>
<tr>
<th>Papers</th>
<th>CNI%</th>
<th>% &gt; world average</th>
<th>% in top 10%</th>
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<tr>
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<td>140,845</td>
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<tr>
<td>South Africa domestic</td>
<td>58,049</td>
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<tr>
<td>South Africa international</td>
<td>82,796</td>
<td>1.48</td>
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<td>G20 total dataset</td>
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<td>31.9%</td>
</tr>
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</table>

**Output and collaboration**

- **Impact and collaboration**

**Impact by discipline**

- **Output by discipline**

**Output by GERD**

- **Output by researcher**

**GDP (PPP US$ billions)**: 724.1

**GERD (PPP US$ billions)**: 6.0

**GERD/GDP (%)**: 0.83

**Patents**: 1,517

**BerD (PPP US$ billions)**: 2.5

**Patents/BerD**: 614.7
South Korea

Population 51,709,098

Researchers 538,136
Female researchers 113,187
Researchers/1000 population 10.41
Women as % researchers 21.0

GDP (PPP US$ billions) 2209.4
GERD (PPP US$ billions) 102.5
GERD/GDP (%) 4.64
Patents 248,551
Patents/GERD 82.3

Impact profile

Impact by discipline

Output and Open Access

Output by discipline

Output and Open Access
Turkey

Population
83,429,607

Researchers
243,773

Female researchers
90,168

Researchers/1000 population
2.92

Women as % researchers
37.0

Impact profile

World average
cites/paper = 1.0

Impact by discipline

Output and collaboration

Impact and collaboration

Output by GERD

Output by researcher
United Kingdom

Population 66,460,344
Researchers 535,477
Researchers/1000 population 8.06
Female researchers 206,687
Women as % researchers 38.6

Impact profile

<table>
<thead>
<tr>
<th>Papers</th>
<th>CNCI</th>
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<td>United Kingdom total</td>
<td>1,263,652</td>
<td>1.39</td>
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<tr>
<td>United Kingdom domestic</td>
<td>497,351</td>
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<tr>
<td>United Kingdom international</td>
<td>766,301</td>
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<tr>
<td>G20 total dataset</td>
<td>15,175,599</td>
<td>0.99</td>
<td>31.9%</td>
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</tbody>
</table>

Impact by discipline

Output and Open Access

Output by discipline

Output and Open Access

Output by GERD

Output by researcher

GDP (PPP US$ billions) 3242.5
GERD (PPP US$ billions) 56.9
GERD/GDP (%) 1.76

Patents 54,794
BERD (PPP US$ billions) 38.7
Patents/BERD 1414.8
United States

Population
329,484,123

Researchers
–

Researchers/1000 population
–

Female researchers
–

Women as % researchers
–

Impact profile

<table>
<thead>
<tr>
<th>Papers</th>
<th>CNCI</th>
<th>% &gt; world average</th>
<th>% in top 10%</th>
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<tbody>
<tr>
<td>United States total</td>
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<td>38.9%</td>
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<tr>
<td>United States domestic</td>
<td>2,581,108</td>
<td>1.12</td>
<td>35.5%</td>
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<tr>
<td>United States international</td>
<td>1,659,946</td>
<td>1.51</td>
<td>44.2%</td>
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<tr>
<td>G20 total dataset</td>
<td>15,175,599</td>
<td>0.99</td>
<td>31.9%</td>
</tr>
</tbody>
</table>

Impact and collaboration

GDP (PPP US$ billions)
2143.2

GERD (PPP US$ billions)
657.5

GERD/GDP (%)
3.07

Patents
521,735

BERD (PPP US$ billions)
485.8

Patents/BERD
1073.9

Impact by discipline

Output by discipline

Output by GERD

Output by researcher

Impact by discipline

Output and Open Access

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