Institute for Scientific Information

The Annual G20 Scorecard – Research Performance 2022

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Clarivate™

Author biographies

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Ivana Rumenić is a Data Analyst. Previously, she worked in EY Serbia, where she performed various data analysis and extraction tasks for the needs of the audit team. Ivana also has experience in marketing data analysis. She's interested in data science, data visualization, and machine learning. ORCiD: 0000-0003-4630-4328.

Foundational past, visionary future

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 while 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 while conducting primary research to sustain, extend and improve the knowledge base.

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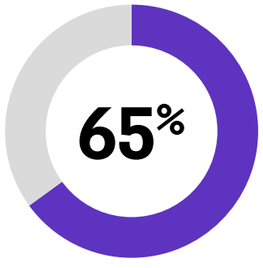
Cover image: Reflections on a curved glass skyscraper in the financial district La Défense, Paris, France.

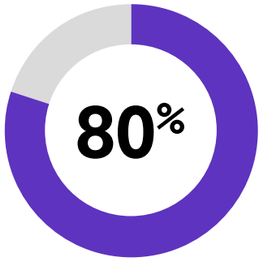
The G20:

Represents



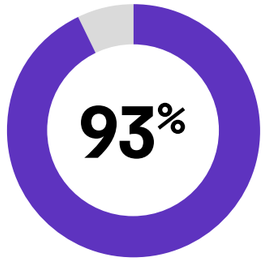
of world population
(World Bank, 2021)

Produces



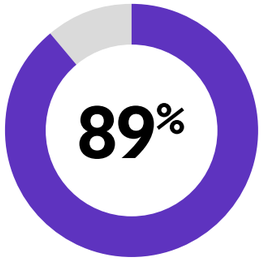
of global GDP
(World Bank, 2021)

Spends



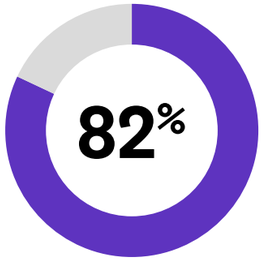
of global R&D
(UNESCO, 2018*)

Employs



of the world's researchers
(UNESCO, 2018*)

Publishes



of global research papers
(Web of Science, 2021)

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

Executive summary

Region	Snapshot of research footprint
Argentina	Indexed output per researcher remains around two-thirds of the G20 average. While Category Normalized Citation Impact (CNCI) is around world average, collaborative impact (Collab-CNCI), which adjusts for different types of collaboration, is lower at 0.73. International collaboration is increasing, but the collaborative impact of this output remains broadly constant. The female share of the research workforce remains high at 53%.
Australia	Impact and collaborative impact remain high, with international impact continuing to be the highest among the G20 at 1.67. Output continues to rise, driven by the mathematical and physical sciences, where output has doubled, and engineering, where output has trebled in the last decade.
Brazil	While open access output remains strong across many disciplines, the overall proportion has dropped below the G20 average in 2021. The largest share of output is in Life Sciences (37%); however, the proportion of open access in this discipline has fallen from 47% to 37% over the decade, primarily due to a fall in domestic OA. Impact and collaborative impact are both below the world average.
Canada	Open access remains below the G20 average in all subjects, but output per both researcher and Gross Expenditure on R&D (GERD) remain well above average. Government investment is relatively low, however; GERD by GDP is only 1.8%. Output is becoming increasingly more international, with 62% of output now internationally collaborative.
Mainland China	Output has trebled in a decade, with more than a third of a million papers published in the mathematical and physical sciences (including chemistry and materials science) in 2021 alone. Impact is above the world and G20 averages. Much of this output, however, is domestic; consistently only a quarter is internationally collaborative. While GDP has increased by 60% between 2012 and 2020, GERD has doubled in the same period leading to an increase by a quarter in GERD by GDP.
France	While impact is well above average, except in the arts and humanities, collaborative impact is below average. Although the number of open access papers published has increased since Plan-S was launched in 2018, the proportion remains below the G20 average. More than half of life sciences papers are now open access, however.
Germany	More than half the output in 2021 is open access (50.8%), the highest level in the G20, and just ahead of Indonesia (50.4%). While GERD as a percentage of GDP is relatively high at 3.2%, expenditure is not leading to papers; output by GERD is well below the G20 average. Collaborative impact is around the world average, including for both domestic and international research.
India	In common with many of the other Asian countries in the G20, international collaboration is well below the group's average. Growth is therefore mostly domestic, with a particular focus on the physical sciences and engineering. Impact has increased in recent years to the world average.
Indonesia	The research base has tended to be internationally collaborative with more than 80% of papers having a foreign author in the early part of the last decade. However, the domestic base has grown significantly in recent years to now comprise a third of the total output. Impact has declined as a result, but still matches the world average. Collaborative impact is lower, however, at around 0.8.
Italy	Government investment remains low, but productivity continues to be unaffected. Output by GERD and researcher are both well above the G20 average. Collaborative impact is around world average for both domestic and international output. Open access output has recently exceeded the G20 trend, driven by the sciences.

Region	Snapshot of research footprint
Japan	Productivity remains low: output by both GERD and researcher remain well below the G20 average, despite a relatively high level of government investment (GERD by GDP at 3.3%). International collaboration remains low, at around a third. Impact is consequently low, and below the world average. Patents per business expenditure on R&D (BERD) remains high.
Mexico	Open access tracks just above the G20 average, and yet OA output is strong in most disciplines except for medicine and life sciences. Research investment (GERD by GDP) remains low, but output by GERD continues to increase.
Russia	Despite government incentives to publish in Russian-language outlets, international collaboration continues to climb and, in 2021, exceeded two-fifths of all output. Domestic output, however, is adversely affected by such incentives with impact well below world average. Share of output in the mathematical and physical sciences has fallen from three-quarters to two-thirds, but still a far higher degree of specialism than for any other G20 country.
Saudi Arabia	More than four-fifths of all output is now internationally collaborative, with the total output having more than doubled between 2018 and 2021. This leads to an impact well above world average. If the collaboration class is considered, however, impact is around the world average. Open Access output is strong in most fields, and generally tracks just above the G20 average.
South Africa	Research expenditure is low (GERD by GDP is 0.62%), but international collaboration has helped ensure productivity remains high - output by researcher and GERD are both well above the G20 average. The country has the second highest level of female researchers (45%) and open access output remains strong in most disciplines.
South Korea	Research expenditure is the highest in the G20 with GERD per GDP at 4.8% and patents per BERD is also high. Productivity, however, remains low. As with many other Asian countries in the G20, international collaboration is below the G20 average, with impact below average as a result.
Turkey	While output per researcher has fallen over most of the last decade, impact has remained unaffected. In fact, impact has climbed from 0.68 in 2012 to 0.96 in 2021. While international collaboration remains low, the impact of these international papers has increased significantly over the period from 1.30 to 1.74.
United Kingdom	Impact is strong, with even domestic impact performing better than the overall G20 average in the Impact Profile. Even so, by 2021, more than two-thirds of output was international. Open Access is above average and strong in most disciplines, except for the Arts.
United States	At 1.18, collaborative impact is highest among the G20, although other countries have a higher CNCI. Like the UK, and in contrast to most other countries, domestic collaborative impact is higher than that for international output. Productivity as indexed output per GERD is well below the G20 average and falling, however, and Open Access is also weak, except in the hard sciences. The largest share of output is in medicine, in contrast to all other G20 countries where the mathematical and physical sciences have the greatest share.

Introduction

International collaboration is an increasingly common trait of academic research and has burgeoned since the 1980s (Adams, 2013). Motivations include knowledge transfer, access to equipment and financial aid. Additionally, such collaboration is increasingly necessary to tackle global scale issues such as pandemics (COVID-19) and climate change, and large-scale technical research projects such as CERN. As some of the leading nations in terms of scientific publishing, the G20, with their established research economies, present favourable partners for other nations to seek collaboration with.

Concurrently with the rise in international collaboration there has been a boom in scientometrics, particularly in quantifying and assessing research output at the national and institutional level. A common yardstick is the number of citations received by papers. Citations can be made for many reasons (e.g., Garfield, 1977; Small, 1982), but they generally acknowledge the usefulness or significance of the work with papers cited more often likely to be influential (Garfield, 1955).

Citations, however, accumulate at different rates in different fields (e.g., Garfield, 1979) making comparisons meaningless. The Category Normalized Citation Index (CNCI) offers an approach that considers field differences, as well as other factors: it normalizes citations by year of publication and document type (e.g., article) in addition to field (i.e., Web of Science subject category). However, the CNCI value of any document would be applied to all participants on a paper. With increasing authorship via international collaboration, it is becoming harder to apportion credit equitably between all contributors.

Numerous counting methods have been devised (see Gauffriau, 2021) - 32 since 1981 – to assign publication credit. The most widespread of these is fractional counting (an entity is assigned a fractional share of paper credit, e.g., Waltman and van Eck, 2015), which itself has many variations (e.g. Sivertsen et al., 2019). However, as author numbers on publications increase, sometimes into the hundreds or even thousands, the assignment of fractional credit becomes illogical.

Given the collaborative nature of research, it appears appropriate to consider the type of collaboration when attempting to apportion credit. Collaborative-CNCI (Collab-CNCI) was formulated (Potter et al., 2020; 2022) with this in mind, and as an approach which does not arbitrarily assign a fractional credit share.

Collab-CNCI follows the standard CNCI method but with an additional normalization by collaboration type. This is one of five types split between domestic and international collaborations: domestic single institution, domestic multi-institution, international bilateral, international trilateral, and international quadrilateral plus. The type is assigned based on available address data within the Web of Science. This extra normalization means that, for example, international bilateral papers are only compared to other international bilateral papers.

Results have demonstrated that Collab-CNCI values are generally lower than standard CNCI and agree well with fractional values (Adams et al., 2022; Potter et al., 2022). Collab-CNCI can also highlight situations where a country's domestic articles outperform its internationally collaborative articles. Additionally, the five collaboration types provide a more in-depth view of an entity's research profile for assessment. Without this additional normalization, crucial aspects of a country's research profile would be overlooked and potentially impact management decision making.

Boxplots and bar graphs illustrating article and Collab-CNCI data for a representative selection of G20 countries, divided by collaboration type are shown in Figure 1. Data cover all article documents published in the Web of Science Core Collection in 2021. Bar graphs show the total number of articles and citations for each collaboration type with the overall percentage adjacent. Boxplots show the distribution of Collab-CNCI values and citations. The total cites axis begins at one; many articles have yet to receive citations. White squares on the boxplots represent the mean value. If no white square or boxplot is present, then these numbers fall below the minimum value plotted. Diamonds represent outliers beyond the interquartile range represented by the box.

There is a notable difference in the relative percentages of articles and citations between the G20 nations. For example, only 9% of Russia's output is international quadrilateral plus, but this group accounts for nearly 35% of all citations to Russian output. This is a greater disparity than Indonesia (8% international quadrilateral plus articles accounting for 28% of citations). In contrast, domestic single articles account for 25% of South Africa's output, but only generate 9% of citations. Mainland China and Turkey (not shown) are the most domestically focused nations (75%). Saudi Arabia is the most international (77% international collaboration), followed by the United Kingdom (68%).

The most common collaborations are either international bilateral (e.g., Australia, Saudi Arabia, United Kingdom) or domestic multi (Mainland China, Russia, USA). Mean Collab-CNCI values generally increase as research becomes more collaborative (i.e., multi-institutional or multi-national). Consequently, some G20 nations are more reliant on highly multi-lateral papers for citations and impact.

Figure 1. Boxplots and bar charts illustrating Collab-CNCI, total articles and total cites for six G20 countries split by collaboration type: domestic single institution (dom:single), domestic multi-institution (dom:multi), international bilateral (int:bilat), international trilateral (int:trilat), and international quadrilateral-plus (int:quad+). The edges of the coloured boxes on the boxplots represent the 25th and 75th percentiles, the 50th percentile (median) is represented by a vertical white line; white squares represent the mean value; diamonds represent outliers.

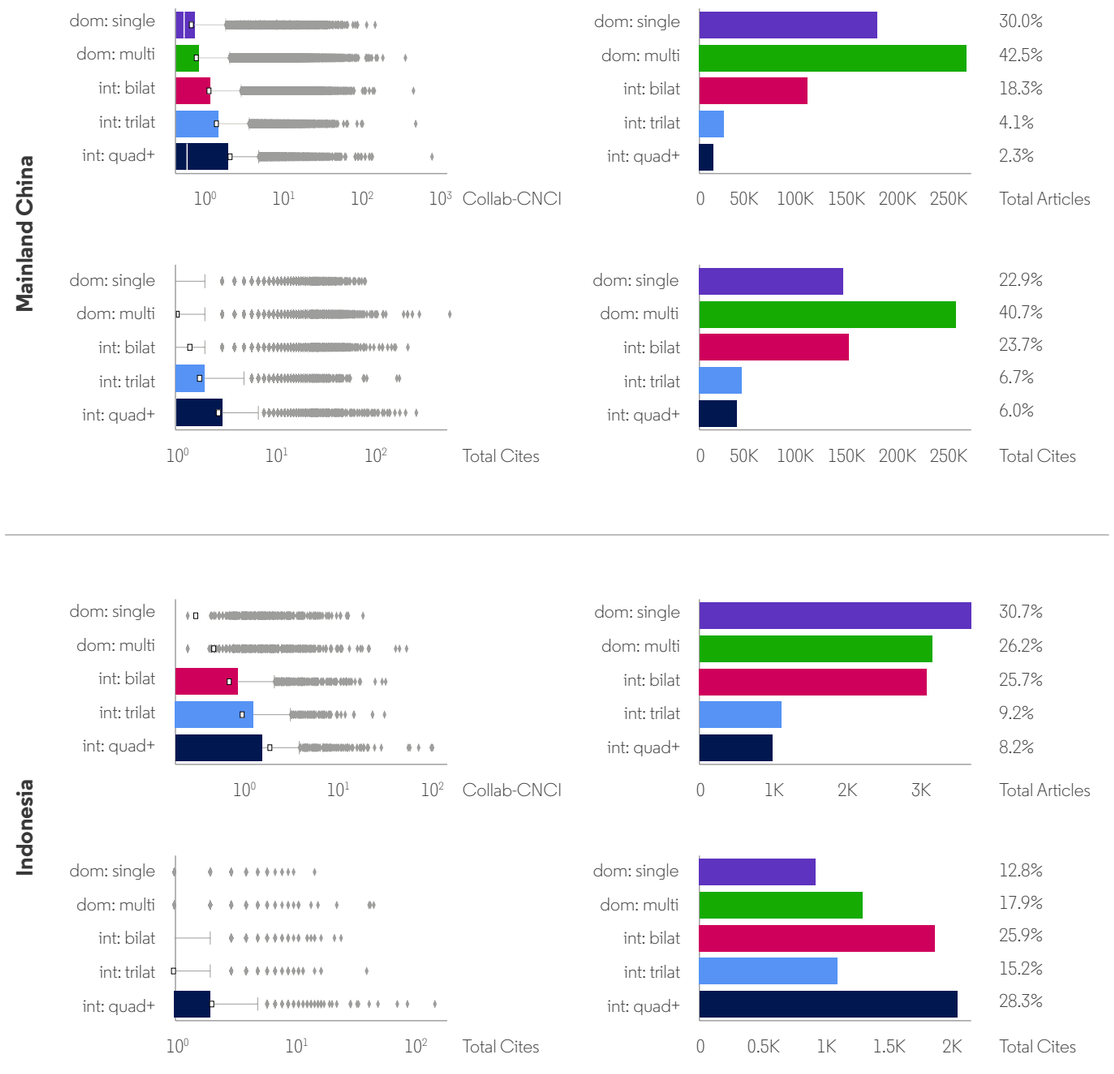
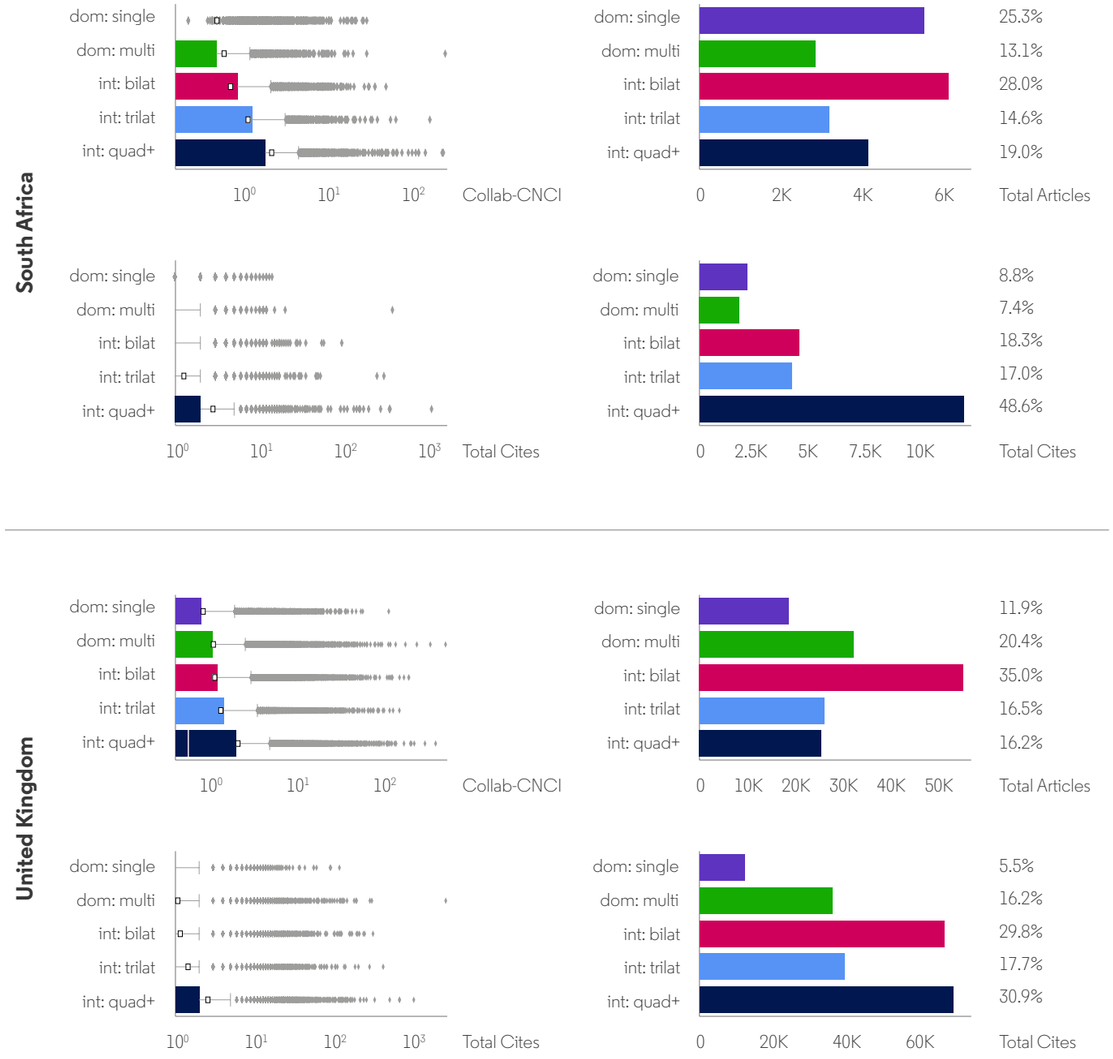


Figure 1 (continued). Boxplots and bar charts illustrating Collab-CNCI, total articles and total cites for six G20 countries split by collaboration type: domestic single institution (dom:single), domestic multi-institution (dom:multi), international bilateral (int:bilat), international trilateral (int:trilat), and international quadrilateral-plus (int:quad+). The edges of the coloured boxes on the boxplots represent the 25th and 75th percentiles, the 50th percentile (median) is represented by a vertical white line; white squares represent the mean value; diamonds represent outliers.



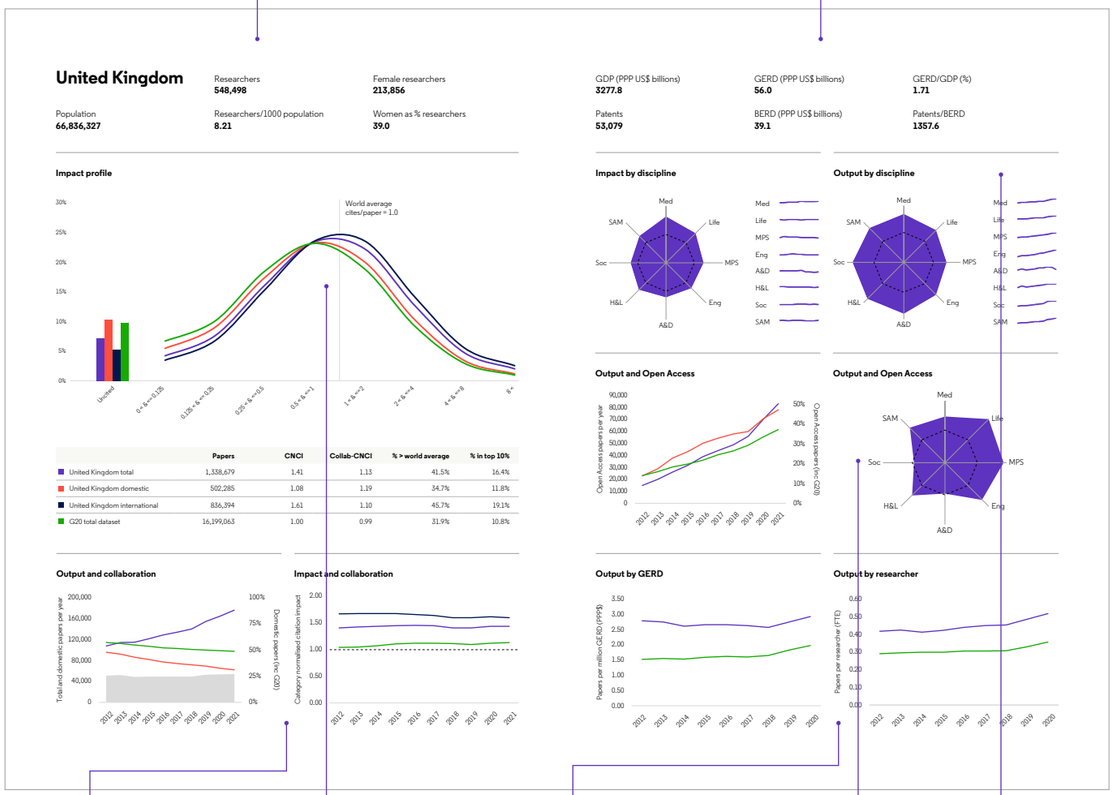
Understanding the G20 scorecards

The research profile

The research profile of each country is summarized 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.

The headlines on the left-hand page are about people: the population, the abundance of researchers in that population and the percentage of those researchers who are female

The headlines on the right-hand page are about money and intellectual property: total GDP, Gross Expenditure on R&D (GERD), Business Expenditure on R&D (BERD) and the ratio of patents to BERD



Growth and impact of international collaboration

An Impact Profile shows the spread of citation impact across a country's research output

Trends in productivity by funding and researcher number

The growth of Open Access and its spread by subject area

Research Footprints show the balance of research impact by main field

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.

Data type	Source	Notes
Population, GDP	World Bank	GDP (PPP) data are in current international $. Data were retrieved using World Bank's API, documented at https://datahelpdesk.worldbank.org/knowledgebase/articles/1886701-sdmx-api-queries.
Researchers, GERD, BERD	OECD	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 2012 to 2020, 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/sdmx-ml-documentation/.
Patents	WIPO	Data are for 2020 and were retrieved from the WIPO IP Statistics Data Centre https://www3.wipo.int/ipstats/index.htm?tab=patent.
Publications, citations	Web of Science	Data were taken from Web of Science (2012 to 2021). Data are from the Science Citation Index Expanded™, Social Sciences Citation Index™ and Arts & Humanities Citation Index™, and only cover Articles and Reviews.
Open Access	DOAJ, Unpaywall	Data were taken from Web of Science (2012 to 2021)

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.

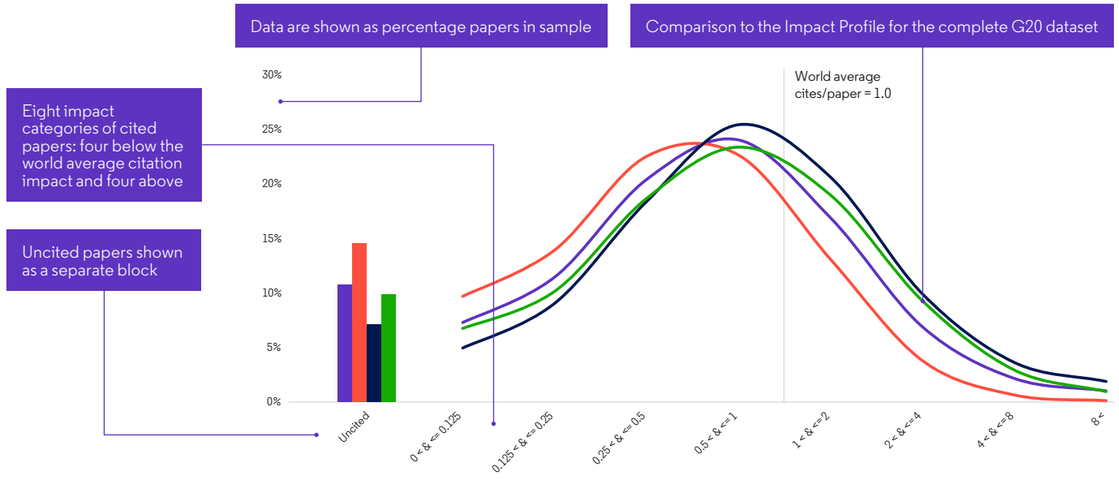
Citation analysis

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).

Impact profile. Three Impact Profile curves track CNCI for total national output, the impact for domestic papers and those with international collaborators



For each dataset, the table shows the count of papers, the average CNCI and Collab-CNCI and the percentages of papers above world average and in the world's top 10%

	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Argentina total	100,781	0.97	0.73	26.8%	8.2%
Argentina domestic	49,719	0.56	0.61	17.6%	3.2%
Argentina international	51,062	1.37	0.84	35.8%	13.1%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

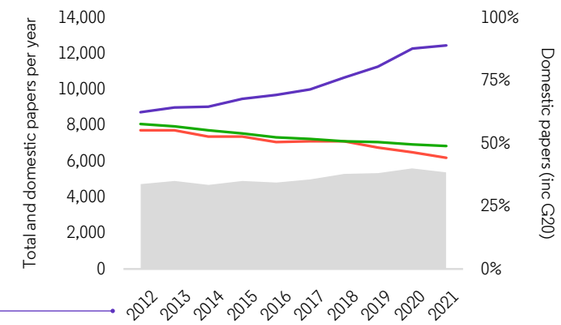
International collaboration

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 block is the count of domestic papers, with no international co-author

Output trend is tracked over the last 10 years

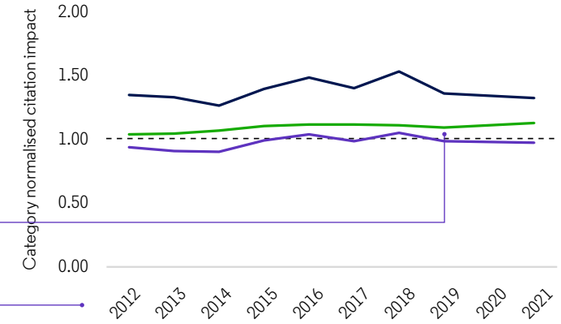


Impact and collaboration

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

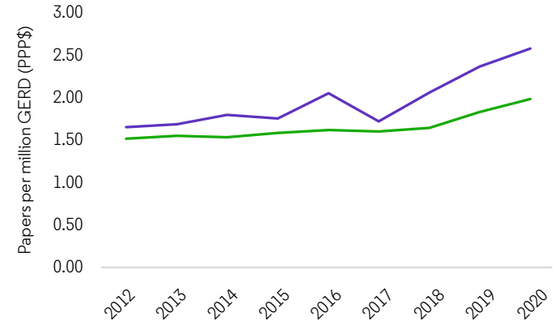
Average citation impact is shown relative to world average

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



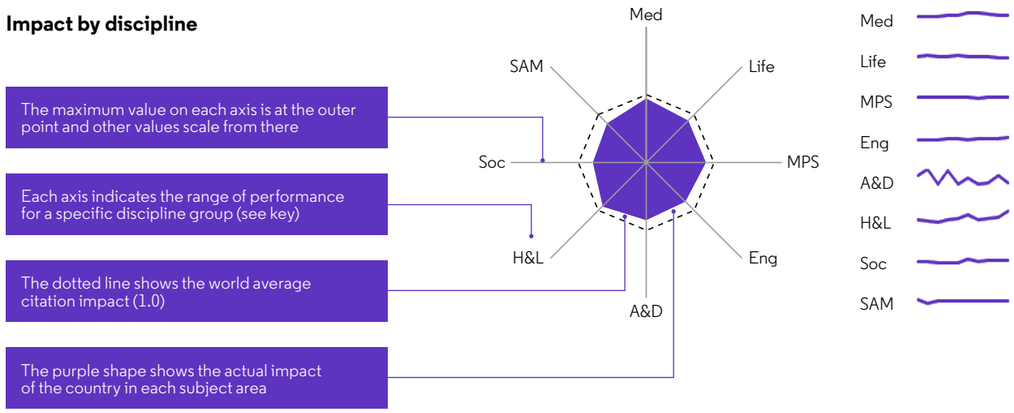
Research Footprints

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.

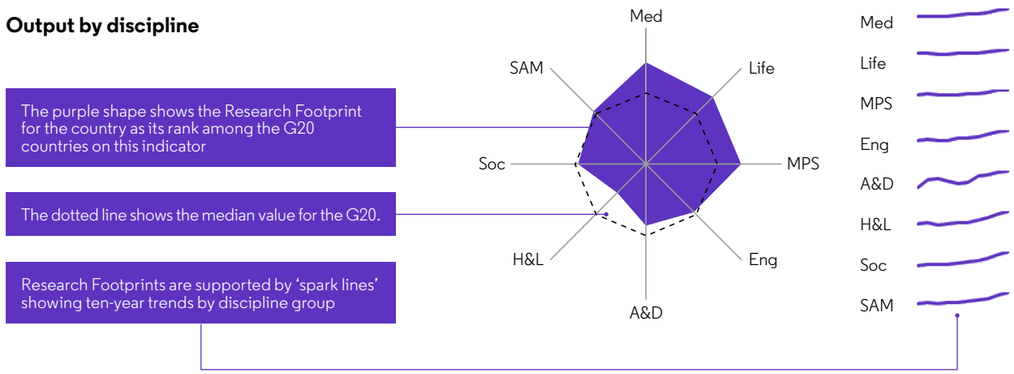
The Research Footprints for publication output and for citation impact use eight major discipline groups (see key) within which there are broadly similar publication and citation patterns.

- **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



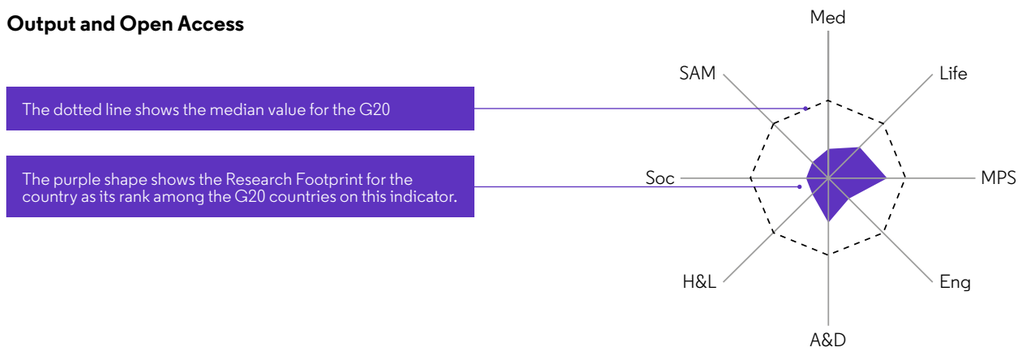
Output by discipline



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.

Output and Open Access



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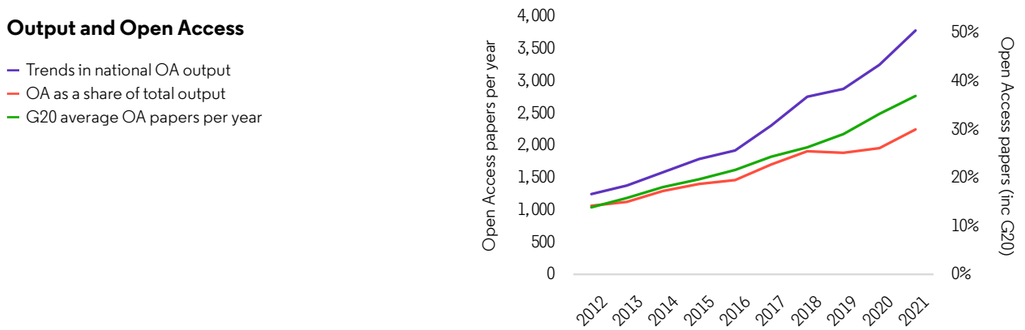


Argentina

Researchers
90,747

Female researchers
48,139

Population
44,938,712

Researchers/1000 population
2.02

Women as % researchers
53.0

GDP (PPP US$ billions)
1033.5

GERD (PPP US$ billions)
4.7

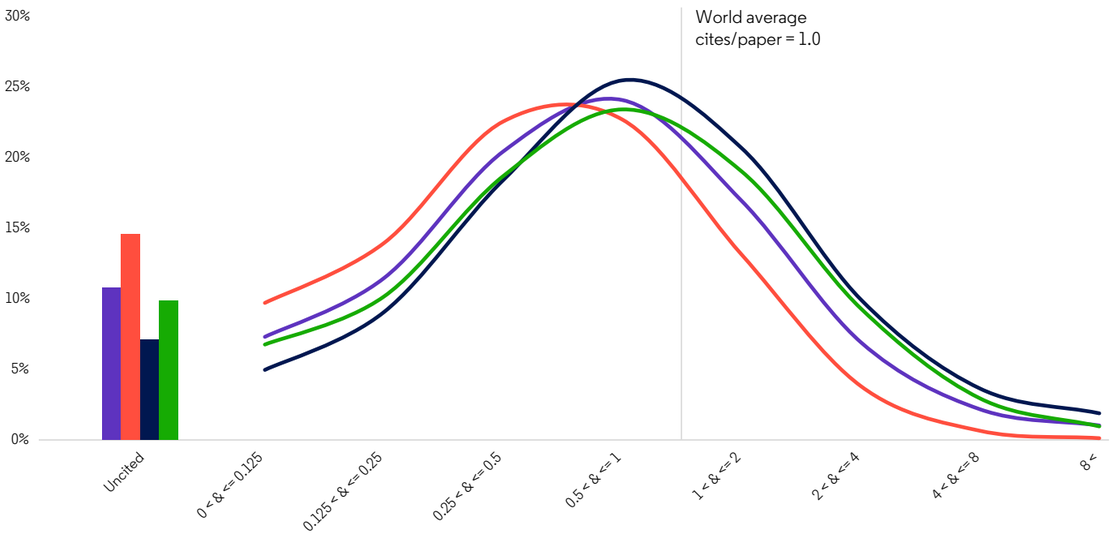
GERD/GDP (%)
0.46

Patents
1,239

BERD (PPP US$ billions)
1.7

Patents/BERD
726.6

Impact profile



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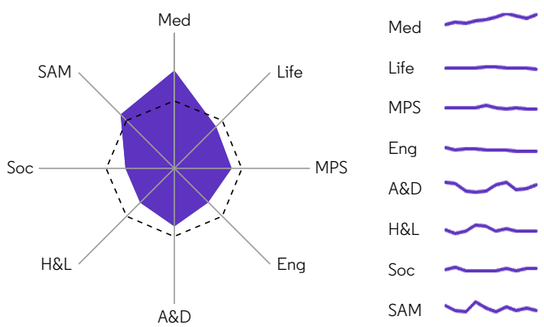
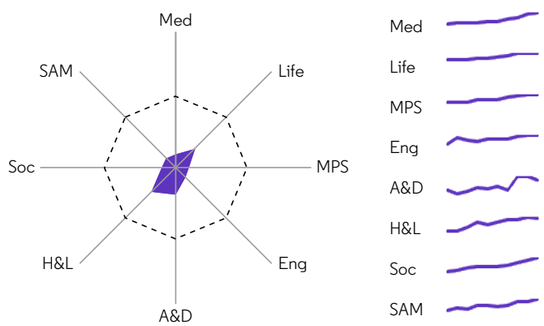
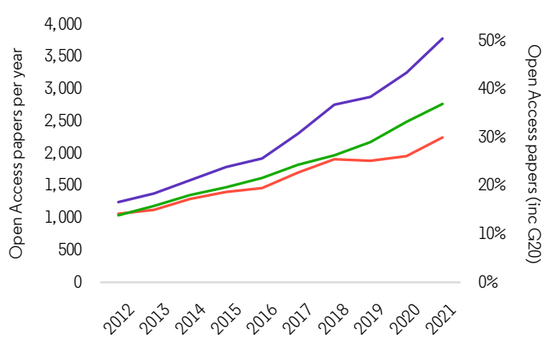
Impact by discipline



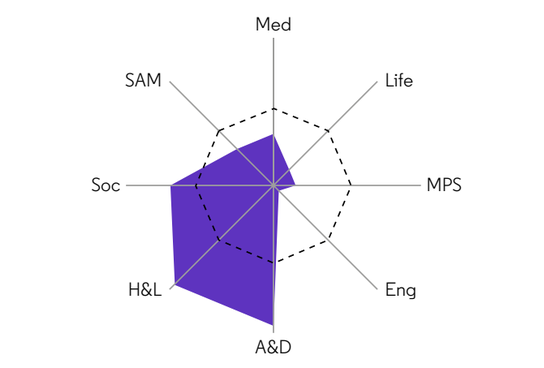
Output by discipline



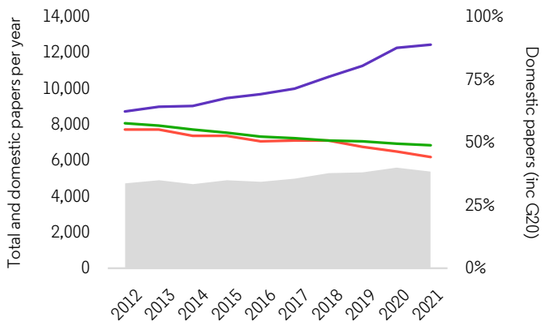
Output and Open Access



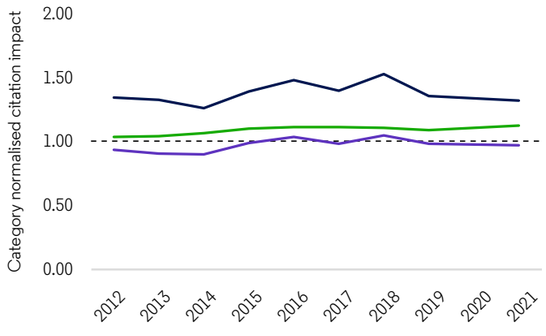
Output and Open Access



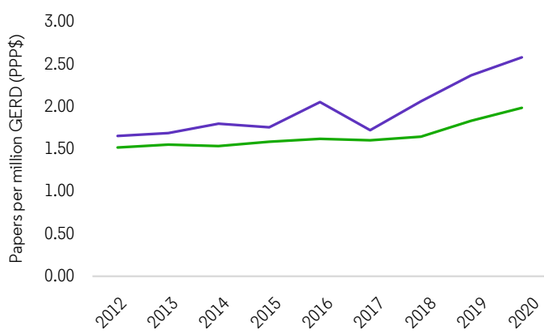
Output and collaboration



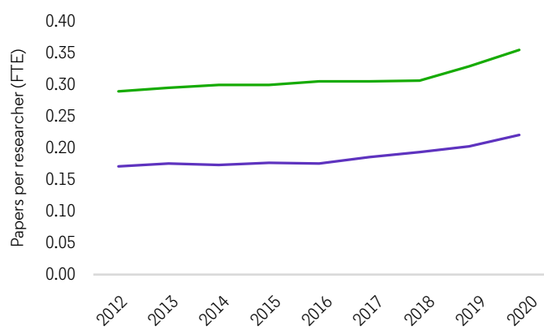
Impact and collaboration



Output by GERD



Output by researcher



Australia

Researchers
–

Female researchers
–

Population
25,739,256

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1312.6

GERD (PPP US$ billions)
24.0

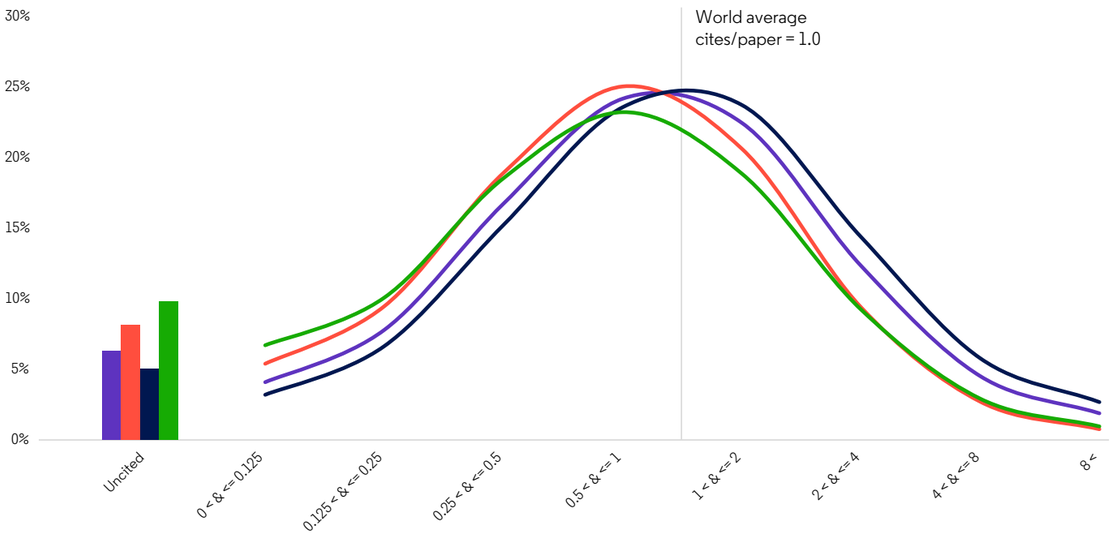
GERD/GDP (%)
1.83

Patents
11,907

BERD (PPP US$ billions)
12.3

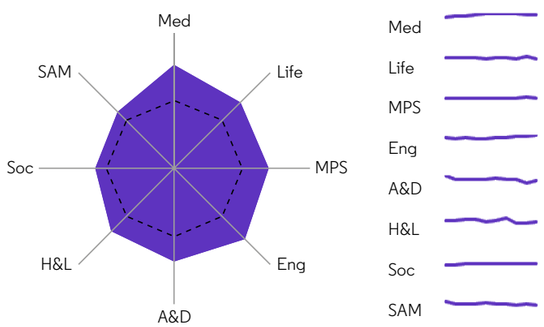
Patents/BERD
971.6

Impact profile

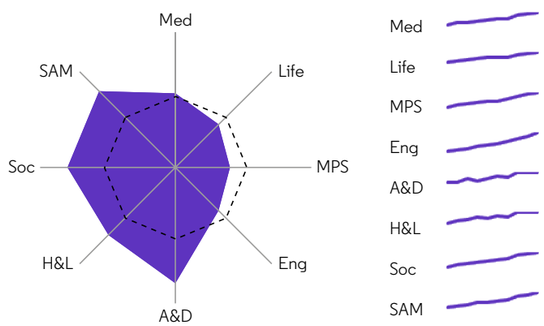


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Australia total	708,512	1.39	1.13	41.1%	15.8%
Australia domestic	289,639	0.98	1.10	33.3%	10.3%
Australia international	418,873	1.67	1.15	46.5%	19.7%
G20 total dataset	16,199,063	1.00	1.00	31.9%	10.8%

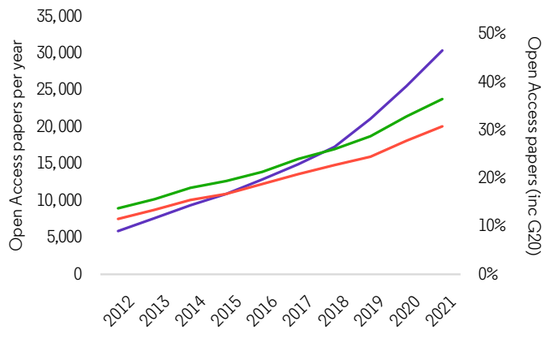
Impact by discipline



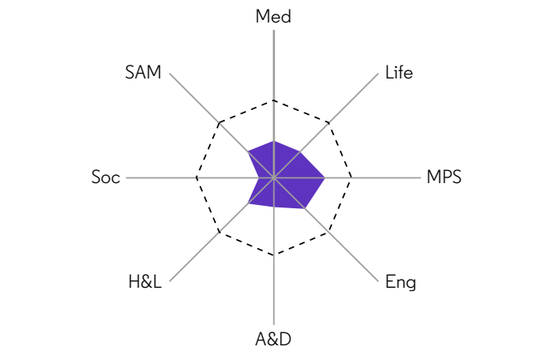
Output by discipline



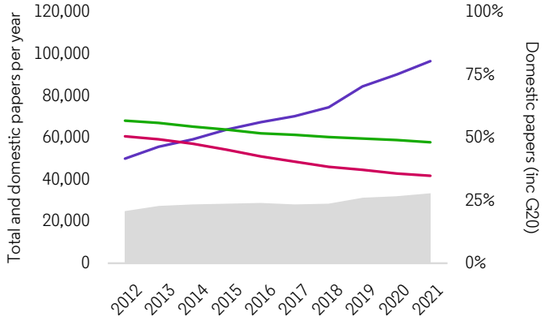
Output and Open Access



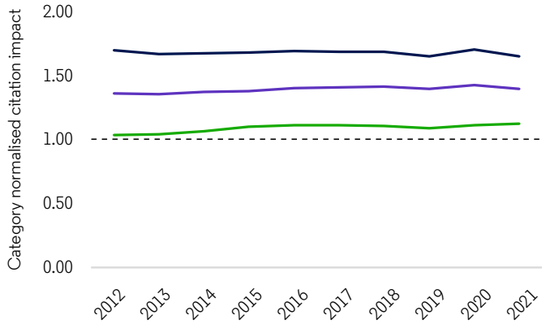
Output and Open Access



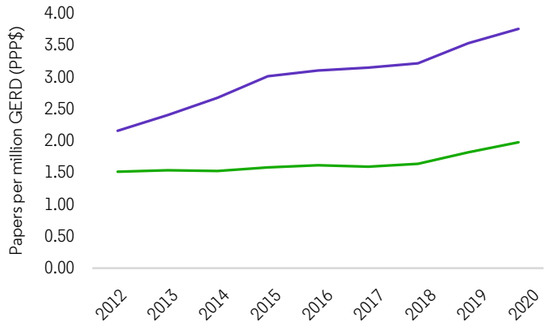
Output and collaboration



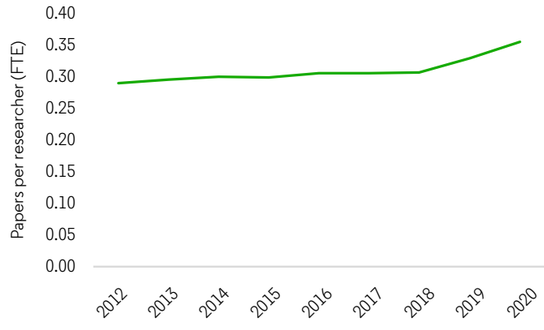
Impact and collaboration



Output by GERD



Output by researcher



Brazil

Researchers
–

Female researchers
–

GDP (PPP US$ billions)
3435.9

GERD (PPP US$ billions)
–

GERD/GDP (%)
–

Population
213,993,441

Researchers/1000 population
–

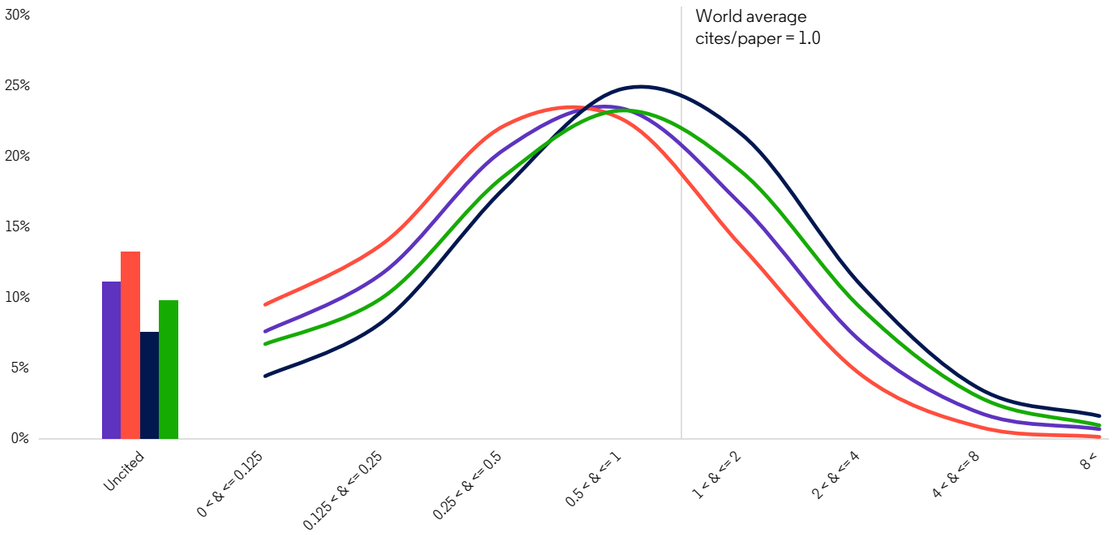
Women as % researchers
–

Patents
7,271

BERD (PPP US$ billions)
–

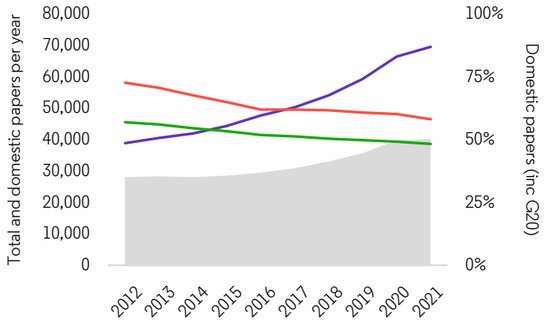
Patents/BERD
–

Impact profile

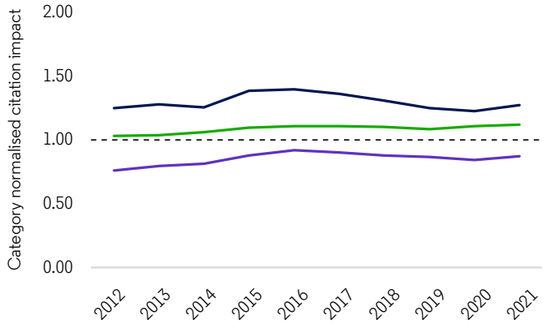


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Brazil total	509,031	0.86	0.74	25.9%	7.6%
Brazil domestic	319,438	0.60	0.66	19.0%	4.1%
Brazil international	189,593	1.29	0.88	37.4%	13.4%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

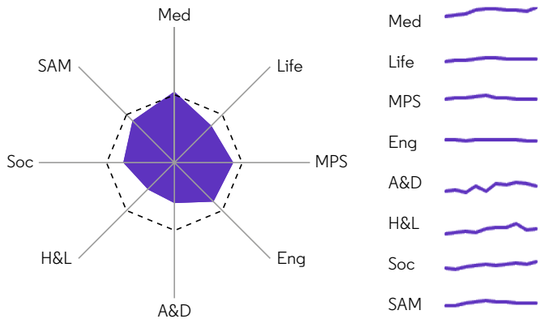
Output and collaboration



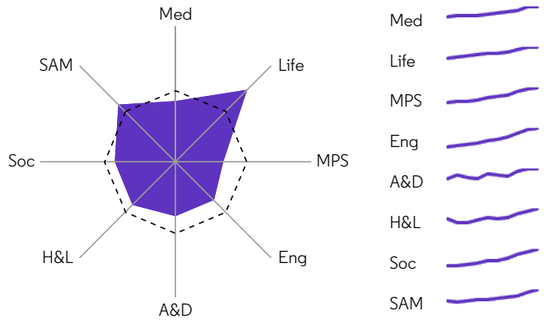
Impact and collaboration



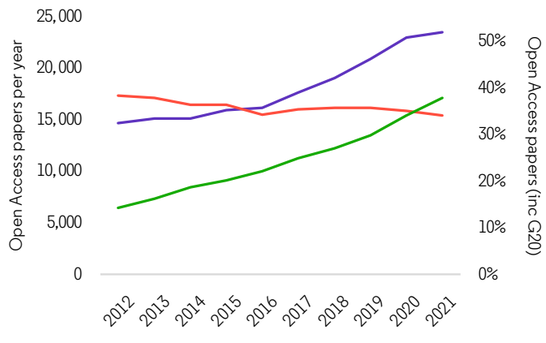
Impact by discipline



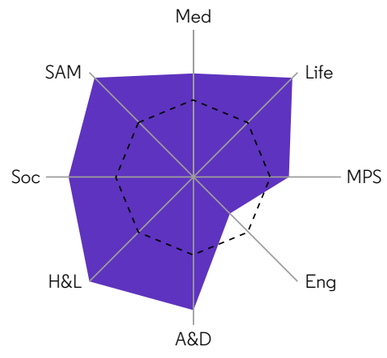
Output by discipline



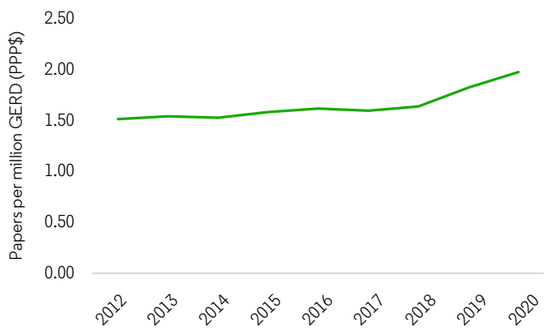
Output and Open Access



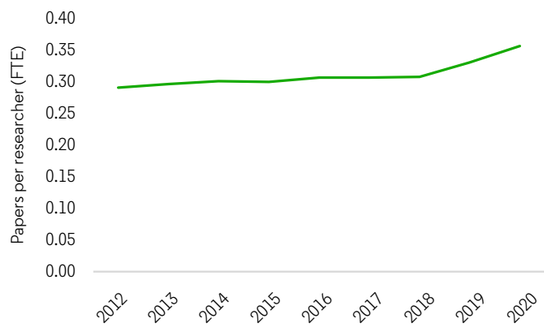
Output and Open Access



Output by GERD



Output by researcher



Canada

Researchers
–

Female researchers
–

Population
38,246,108

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1771.5

GERD (PPP US$ billions)
32.6

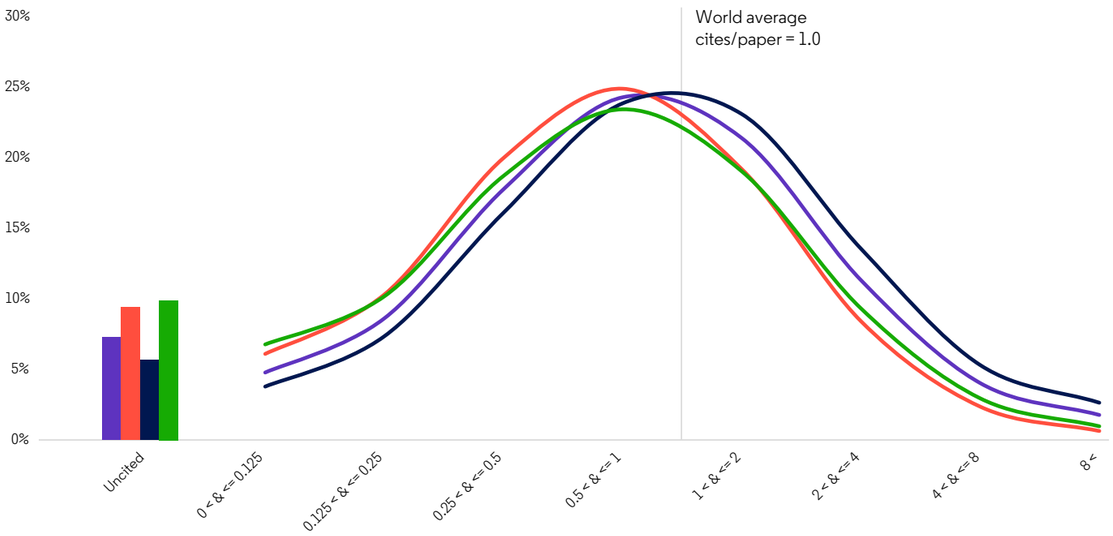
GERD/GDP (%)
1.84

Patents
23,855

BERD (PPP US$ billions)
16.8

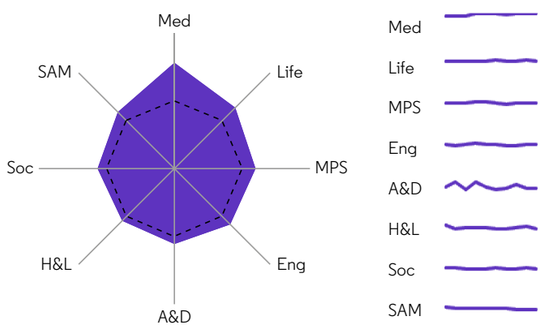
Patents/BERD
1418.0

Impact profile

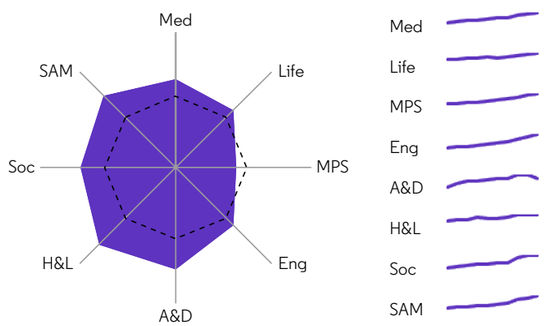


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Canada total	762,317	1.30	1.06	38.0%	14.4%
Canada domestic	329,439	0.90	1.02	30.2%	9.1%
Canada international	432,878	1.61	1.09	44.0%	18.4%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

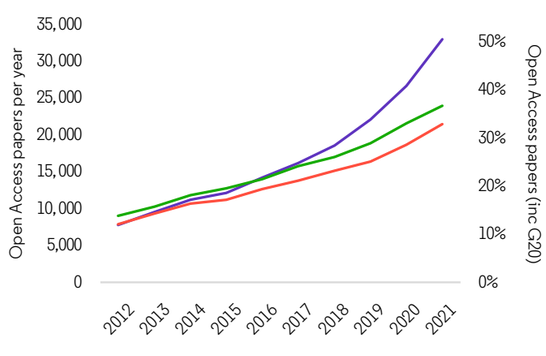
Impact by discipline



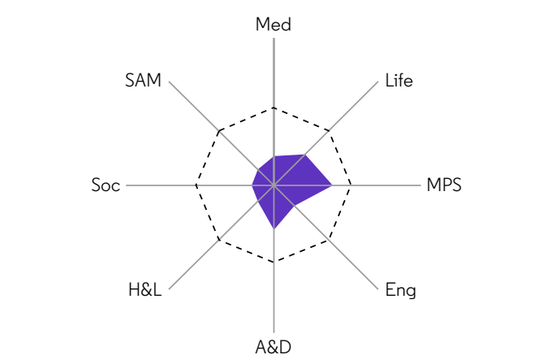
Output by discipline



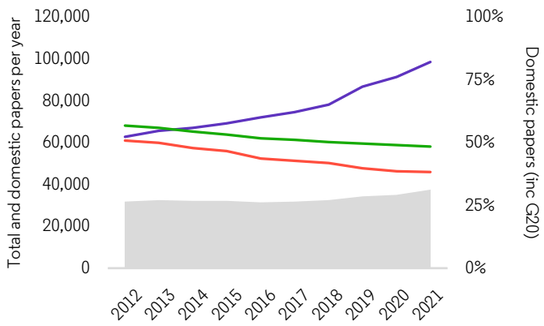
Output and Open Access



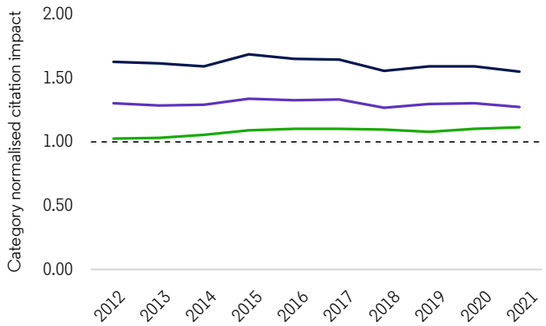
Output and Open Access



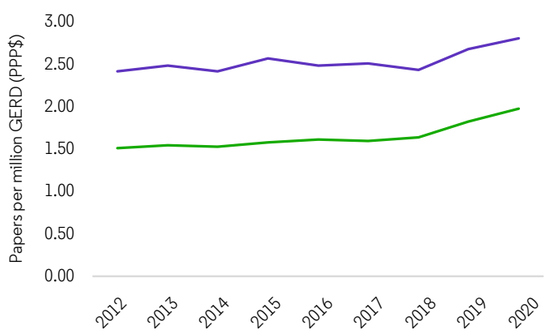
Output and collaboration



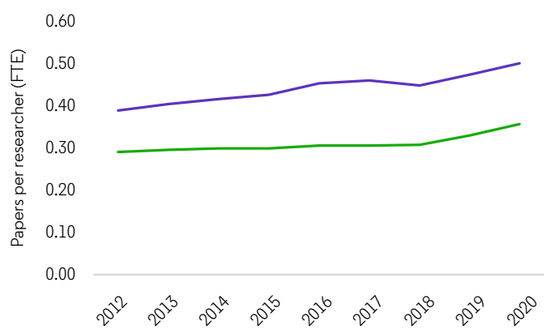
Impact and collaboration



Output by GERD



Output by researcher



Mainland China

Researchers
2,069,650

Female researchers
–

Population
1,354,190,000

Researchers/1000 population
1.53

Women as % researchers
–

GDP (PPP US$ billions)
24255.8

GERD (PPP US$ billions)
583.8

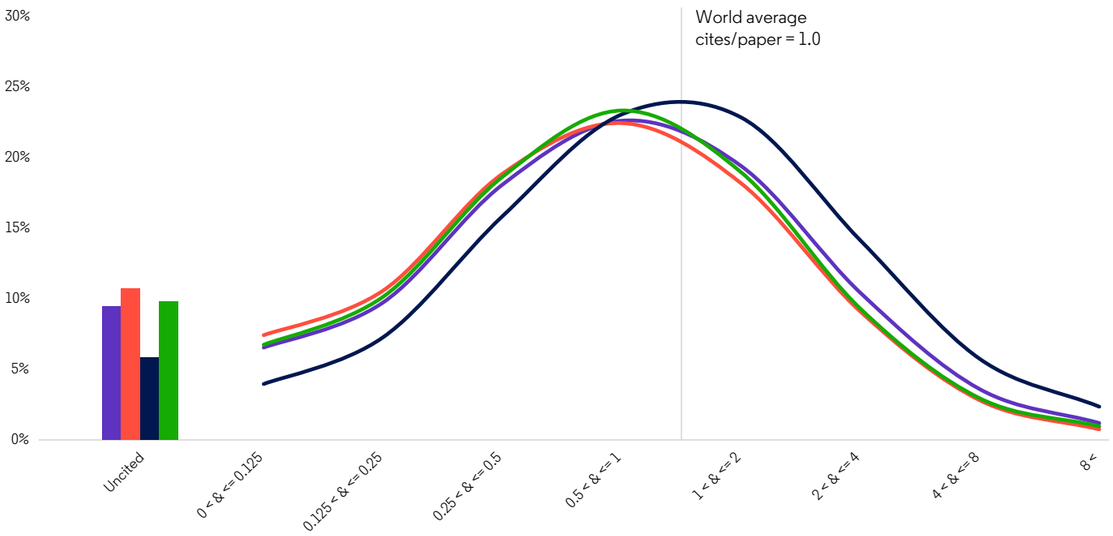
GERD/GDP (%)
2.41

Patents
1,441,086

BERD (PPP US$ billions)
446.9

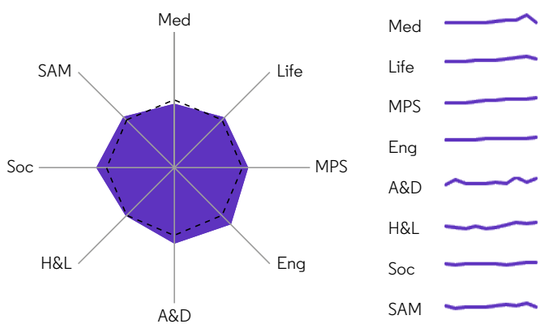
Patents/BERD
3224.7

Impact profile

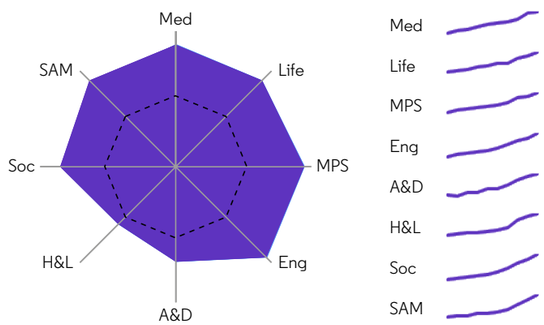


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Mainland China total	3,758,357	1.06	1.06	34.2%	12.4%
Mainland China domestic	2,780,825	0.92	1.03	30.6%	10.2%
Mainland China international	977,532	1.48	1.15	44.6%	18.7%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

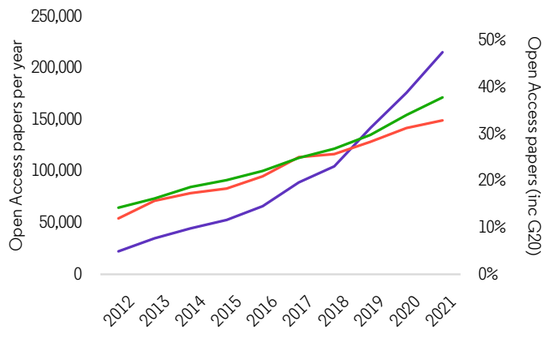
Impact by discipline



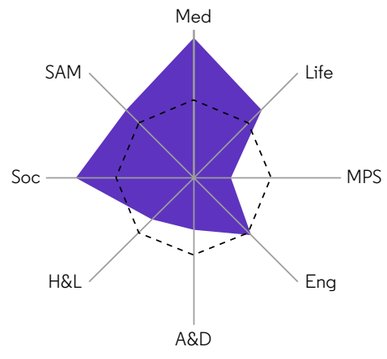
Output by discipline



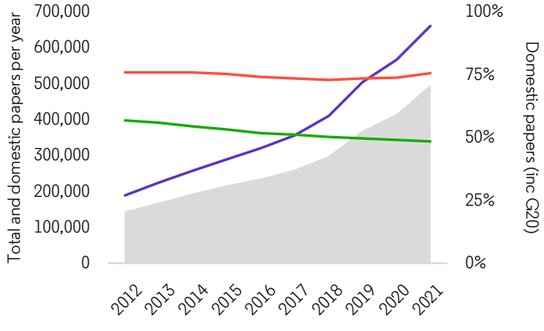
Output and Open Access



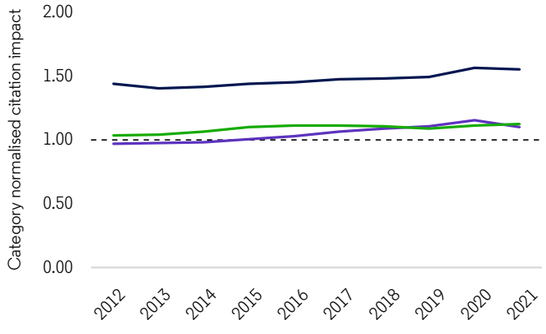
Output and Open Access



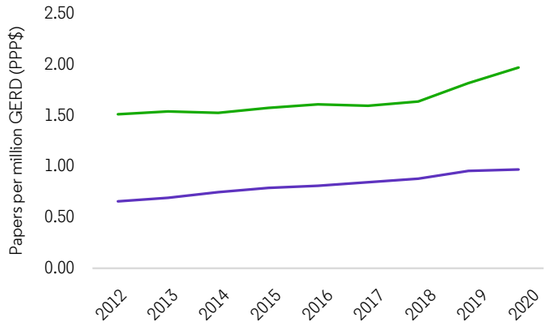
Output and collaboration



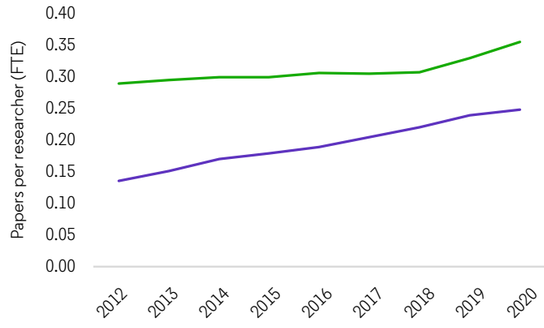
Impact and collaboration



Output by GERD



Output by researcher



France

Researchers
429,959

Female researchers
–

Population
67,101,930

Researchers/1000 population
6.41

Women as % researchers
–

GDP (PPP US$ billions)
3166.3

GERD (PPP US$ billions)
74.6

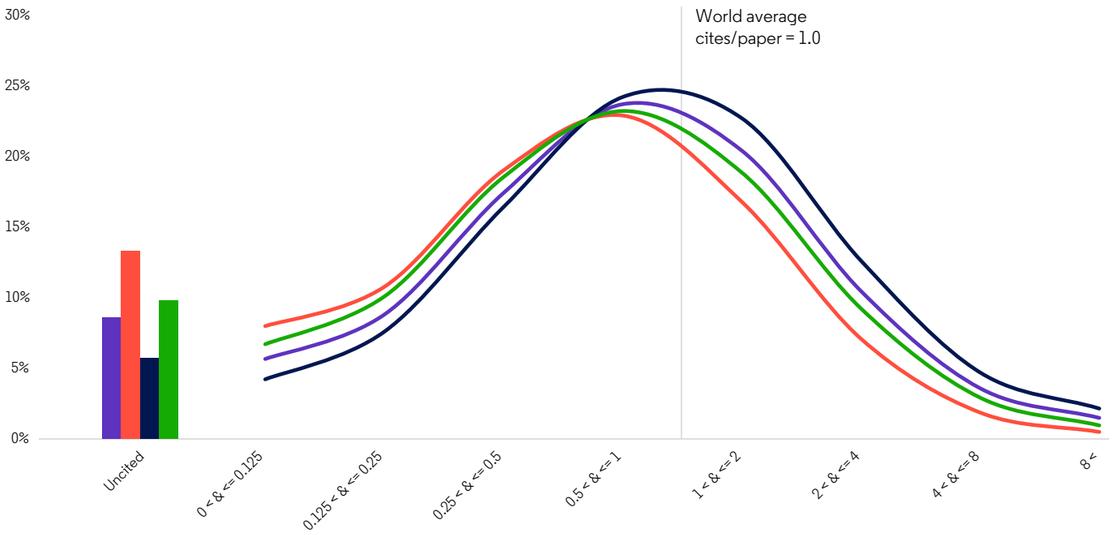
GERD/GDP (%)
2.35

Patents
64,287

BERD (PPP US$ billions)
49.3

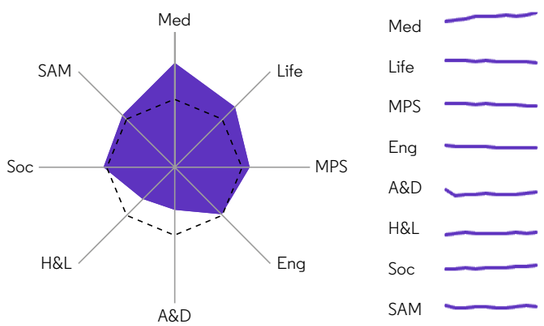
Patents/BERD
1302.8

Impact profile

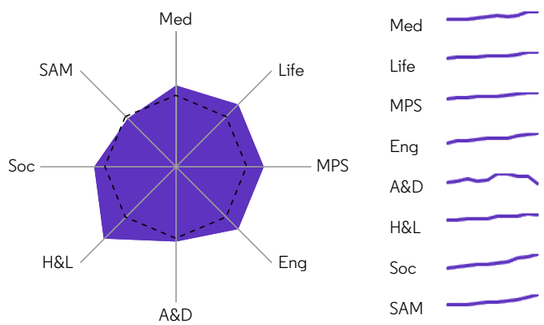


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
France total	802,920	1.22	0.93	35.9%	13.2%
France domestic	310,342	0.79	0.86	26.2%	7.6%
France international	492,578	1.49	0.97	42.1%	16.7%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

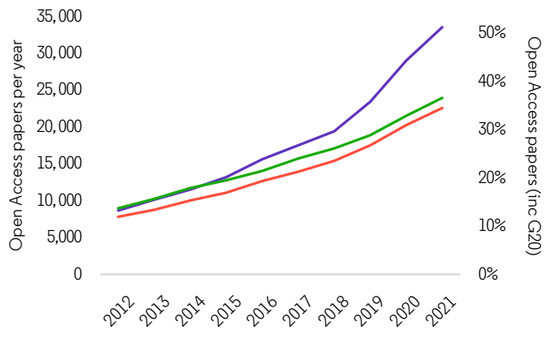
Impact by discipline



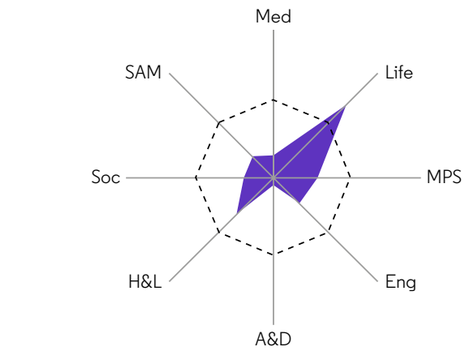
Output by discipline



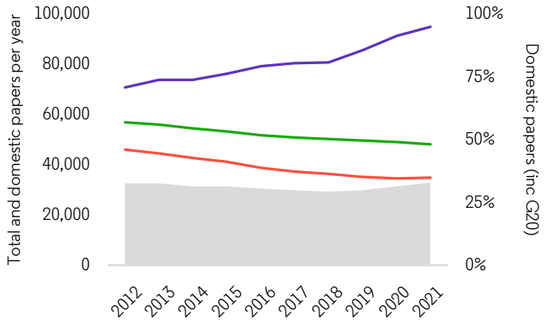
Output and Open Access



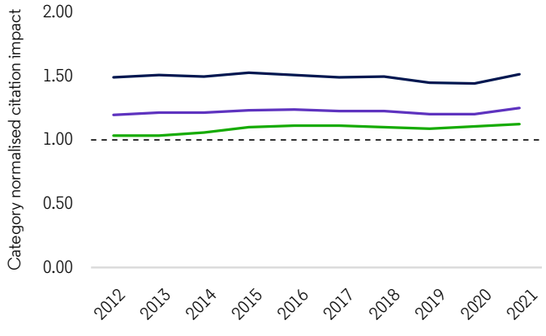
Output and Open Access



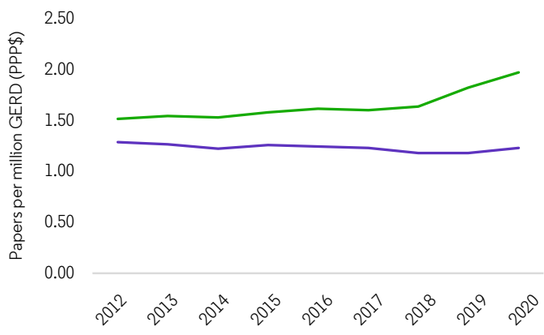
Output and collaboration



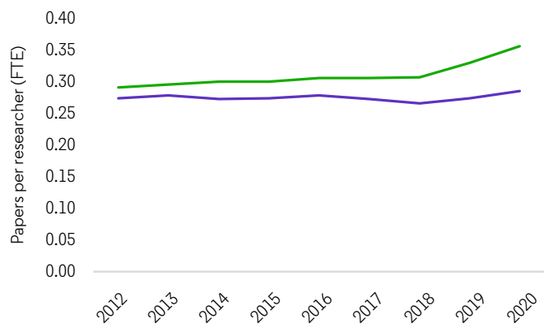
Impact and collaboration



Output by GERD



Output by researcher



Germany

Researchers
667,394

Female researchers
187,231

Population
83,092,962

Researchers/1000 population
8.03

Women as % researchers
28.1

GDP (PPP US$ billions)
4560.9

GERD (PPP US$ billions)
144.4

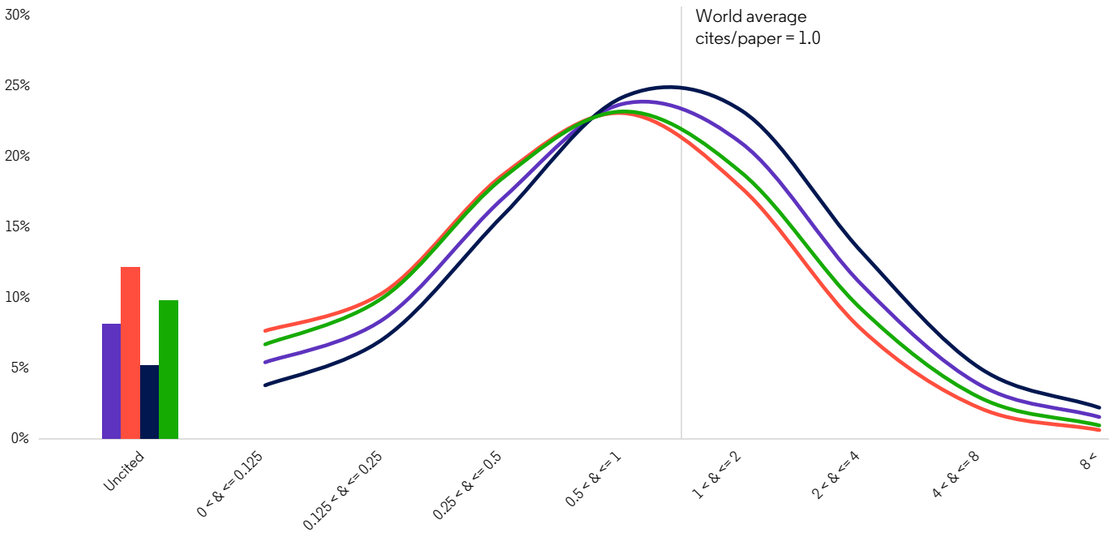
GERD/GDP (%)
3.16

Patents
168,092

BERD (PPP US$ billions)
96.2

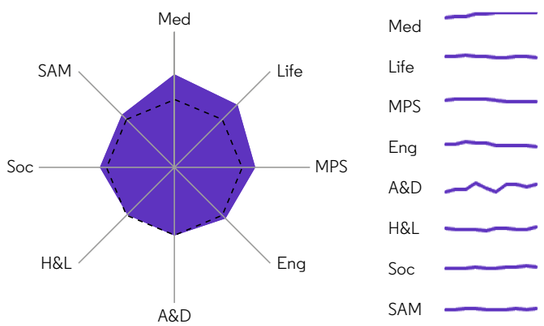
Patents/BERD
1747.3

Impact profile

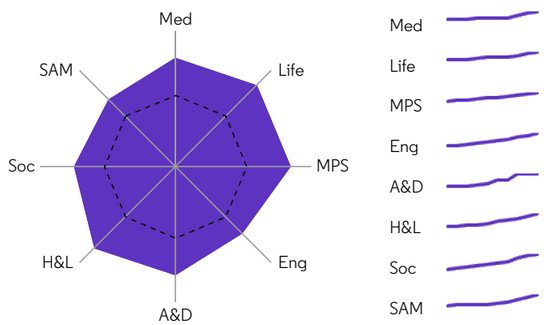


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Germany total	1,192,817	1.24	1.00	37.2%	13.8%
Germany domestic	502,455	0.86	0.97	28.2%	8.5%
Germany international	690,362	1.52	1.02	43.8%	17.6%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

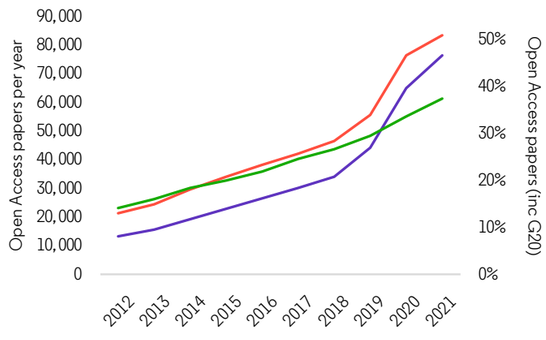
Impact by discipline



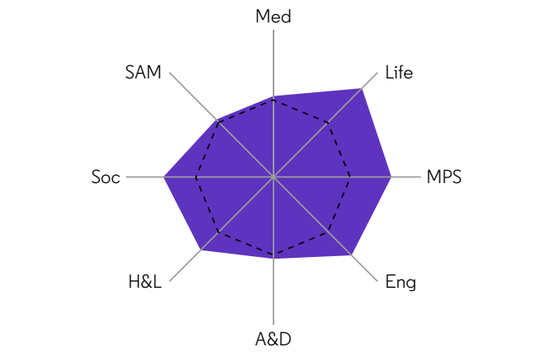
Output by discipline



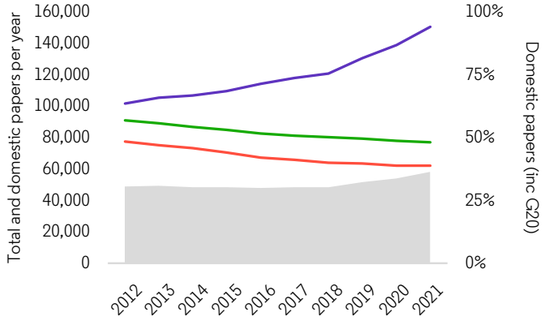
Output and Open Access



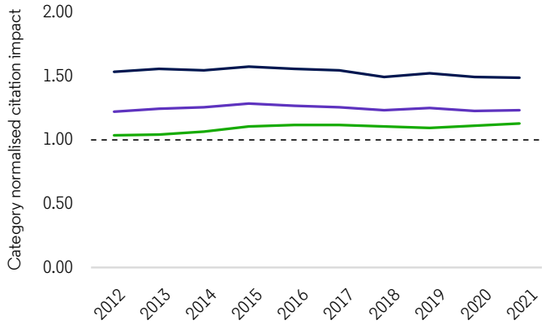
Output and Open Access



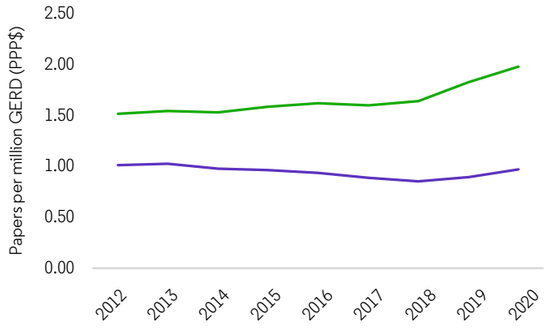
Output and collaboration



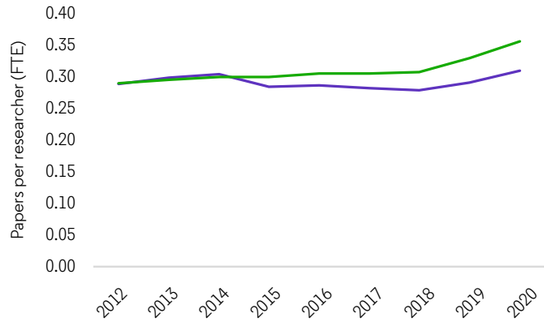
Impact and collaboration



Output by GERD



Output by researcher



India

Researchers
–

Female researchers
–

Population
1,393,409,033

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
10218.6

GERD (PPP US$ billions)
–

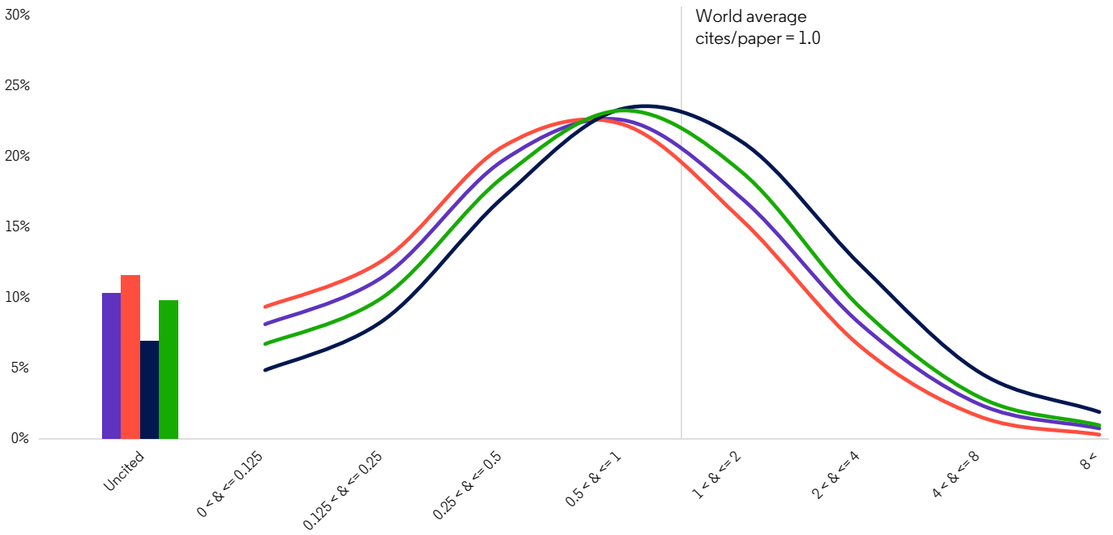
GERD/GDP (%)
–

Patents
37,895

BERD (PPP US$ billions)
–

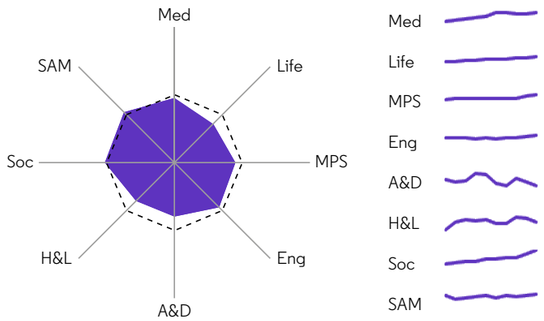
Patents/BERD
–

Impact profile

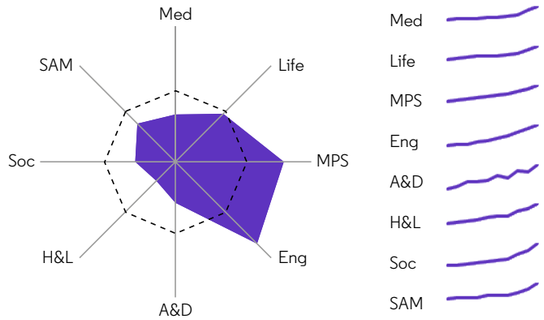


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
India total	747,349	0.89	0.84	28.1%	9.0%
India domestic	541,934	0.71	0.79	23.8%	6.5%
India international	205,415	1.36	0.96	39.6%	15.7%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

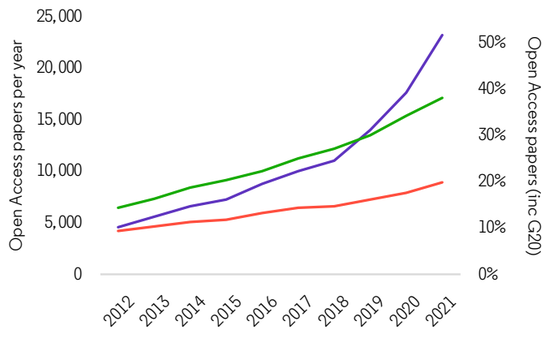
Impact by discipline



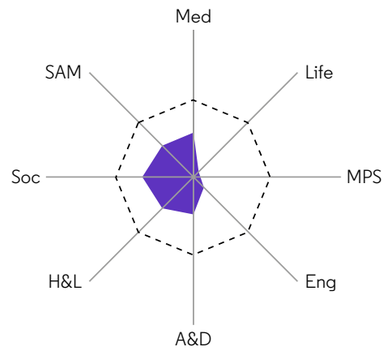
Output by discipline



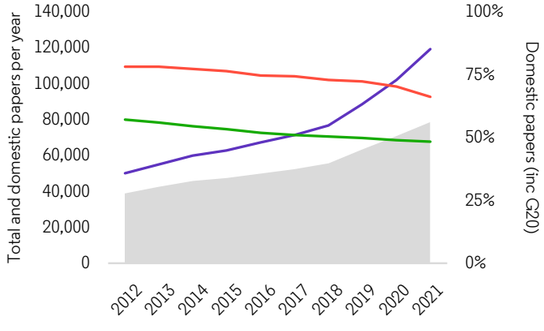
Output and Open Access



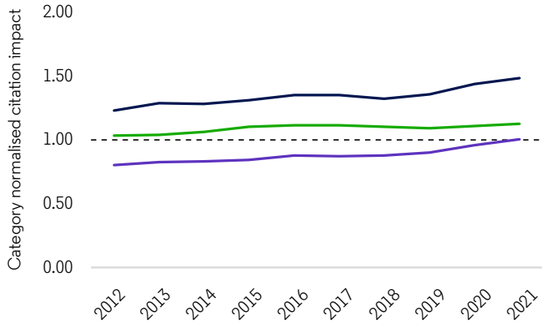
Output and Open Access



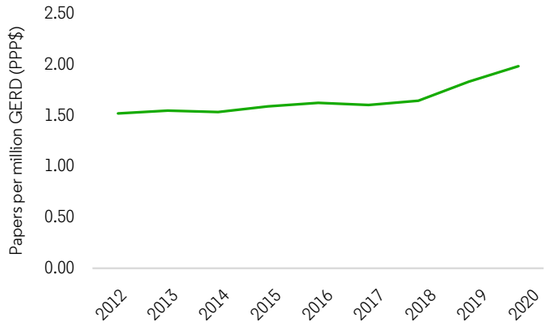
Output and collaboration



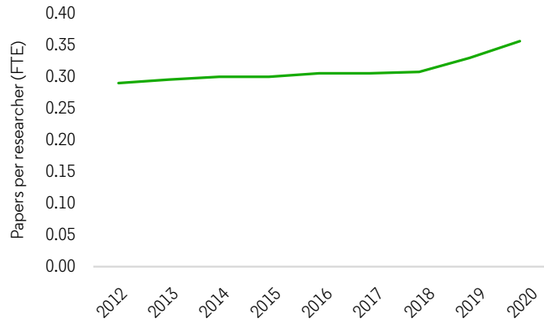
Impact and collaboration



Output by GERD



Output by researcher



Indonesia

Researchers
–

Female researchers
–

GDP (PPP US$ billions)
3566.3

GERD (PPP US$ billions)
–

GERD/GDP (%)
–

Population
276,361,788

Researchers/1000 population
–

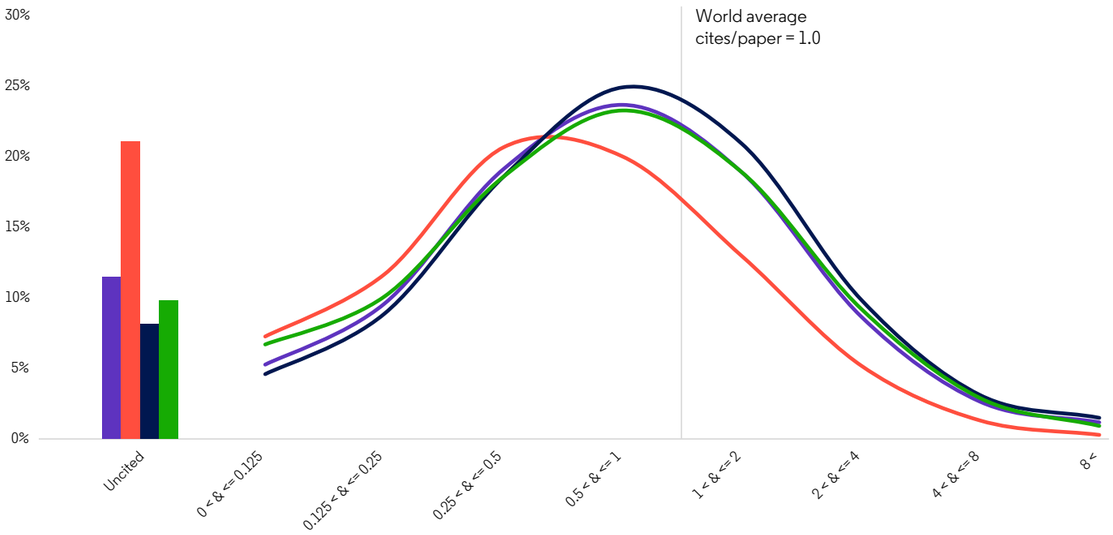
Women as % researchers
–

Patents
1,358

BERD (PPP US$ billions)
–

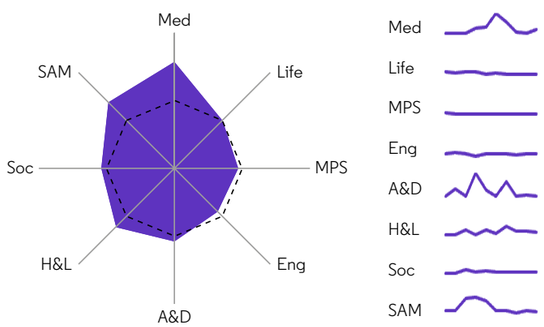
Patents/BERD
–

Impact profile

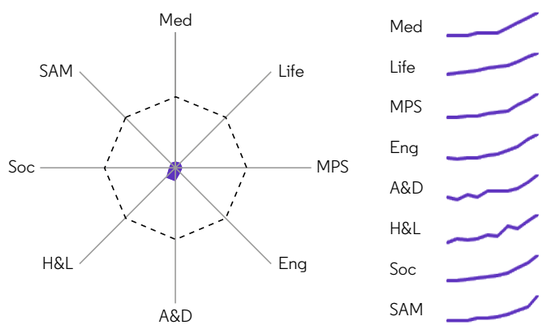


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Indonesia total	34,433	1.10	0.80	31.3%	10.0%
Indonesia domestic	8,798	0.64	0.72	19.8%	4.9%
Indonesia international	25,635	1.26	0.83	35.3%	11.7%
G20 total dataset	16,199,063	1.00	1.00	31.9%	10.8%

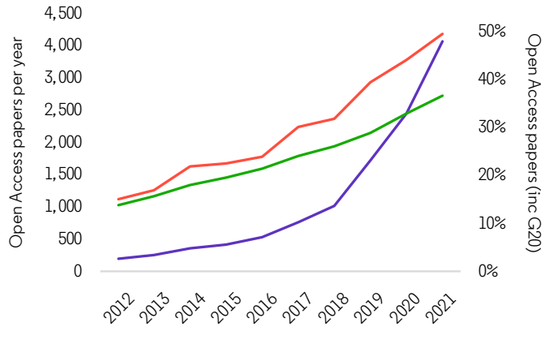
Impact by discipline



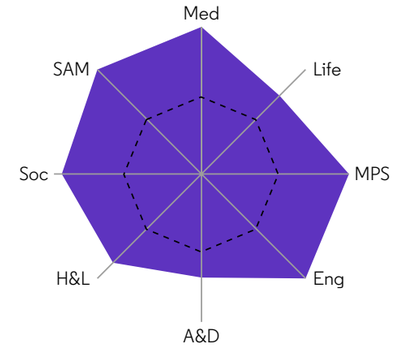
Output by discipline



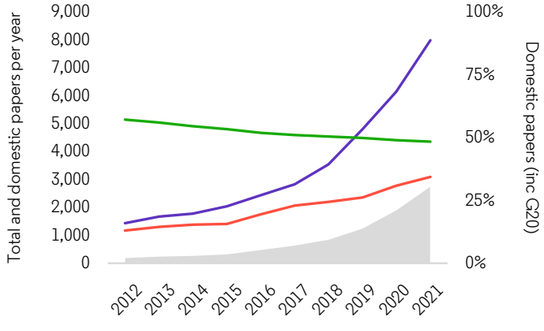
Output and Open Access



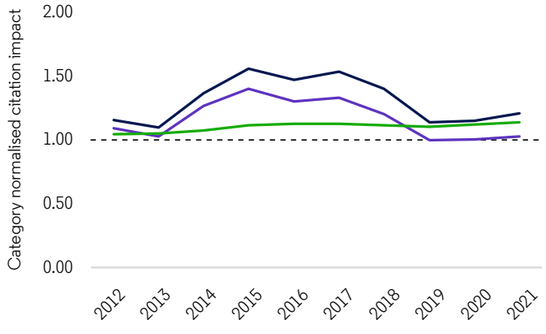
Output and Open Access



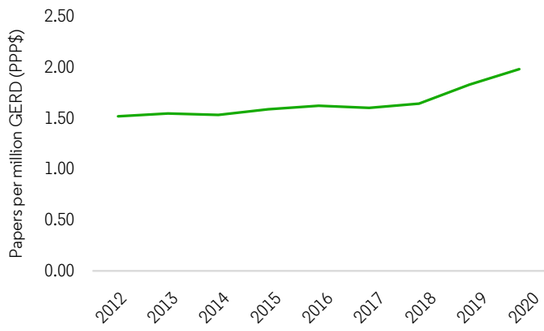
Output and collaboration



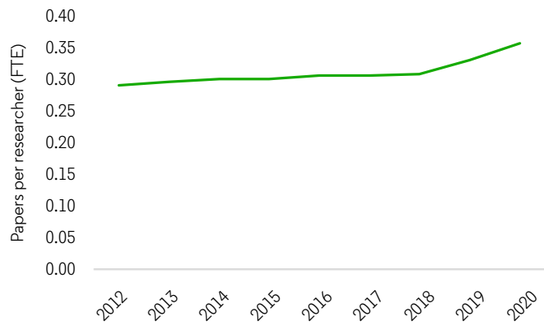
Impact and collaboration



Output by GERD



Output by researcher



Italy

Researchers
217,052

Female researchers
75,762

Population
59,449,527

Researchers/1000 population
3.65

Women as % researchers
34.9

GDP (PPP US$ billions)
2496.2

GERD (PPP US$ billions)
37.7

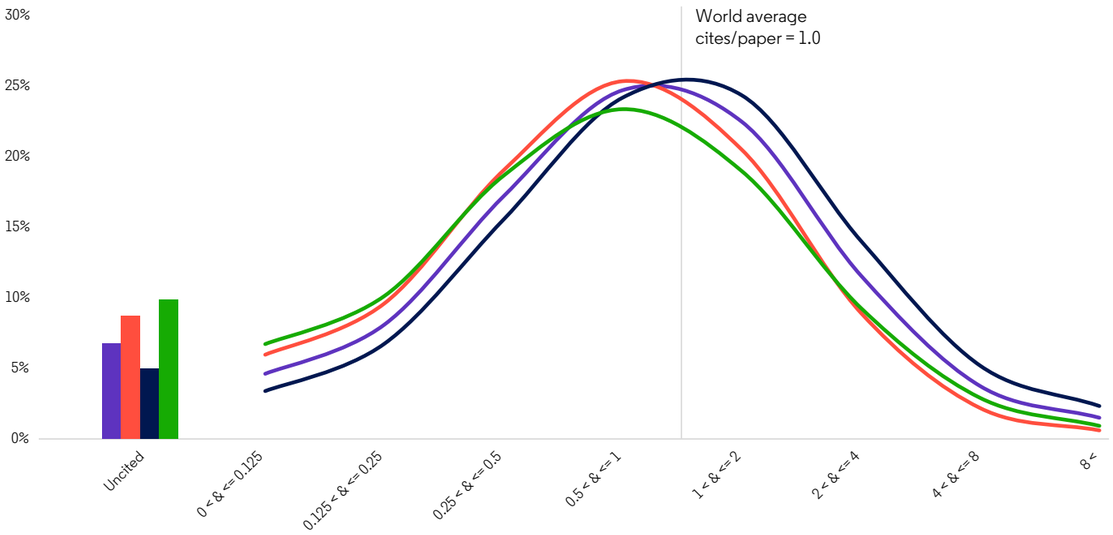
GERD/GDP (%)
1.51

Patents
32,551

BERD (PPP US$ billions)
23.3

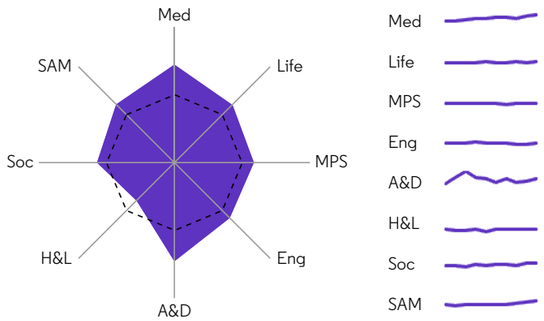
Patents/BERD
1397.0

Impact profile

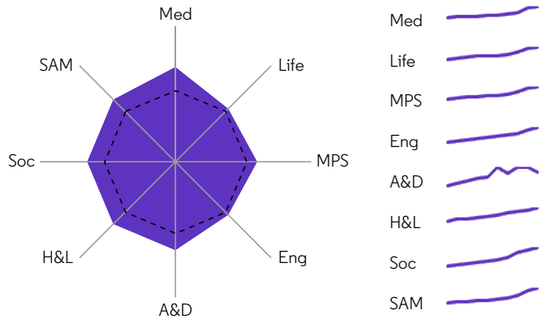


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Italy total	772,134	1.26	1.03	39.1%	14.0%
Italy domestic	369,075	0.92	1.03	32.0%	9.3%
Italy international	403,059	1.58	1.02	45.6%	18.4%
G20 total dataset	16,199,063	1.00	1.00	31.9%	10.8%

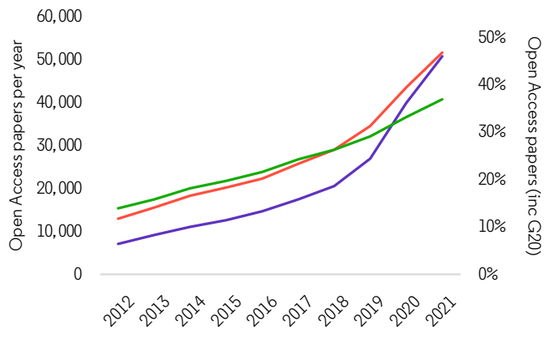
Impact by discipline



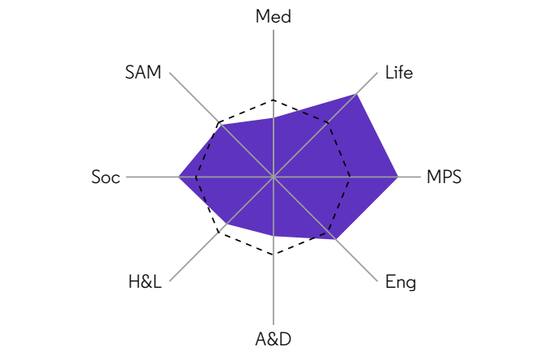
Output by discipline



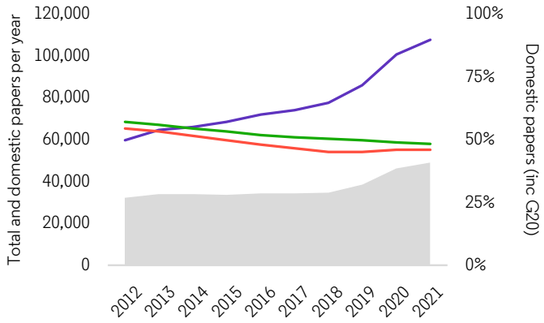
Output and Open Access



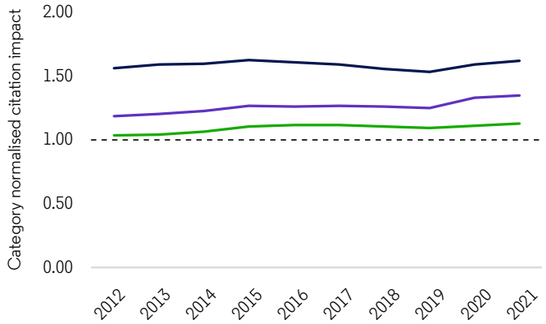
Output and Open Access



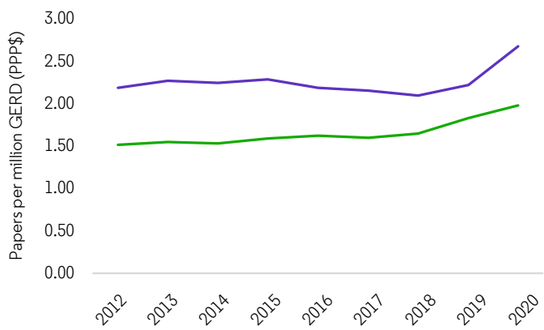
Output and collaboration



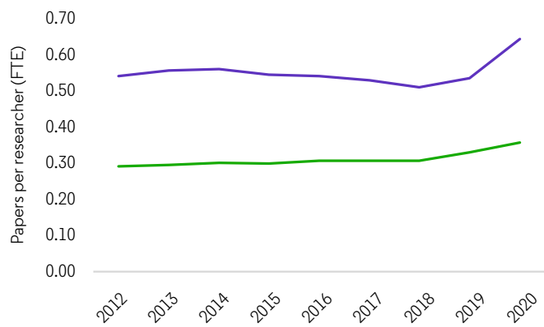
Impact and collaboration



Output by GERD



Output by researcher



Japan

Researchers
951,726

Female researchers
166,304

Population
126,261,000

Researchers/1000 population
7.54

Women as % researchers
17.5

GDP (PPP US$ billions)
5315.6

GERD (PPP US$ billions)
174.1

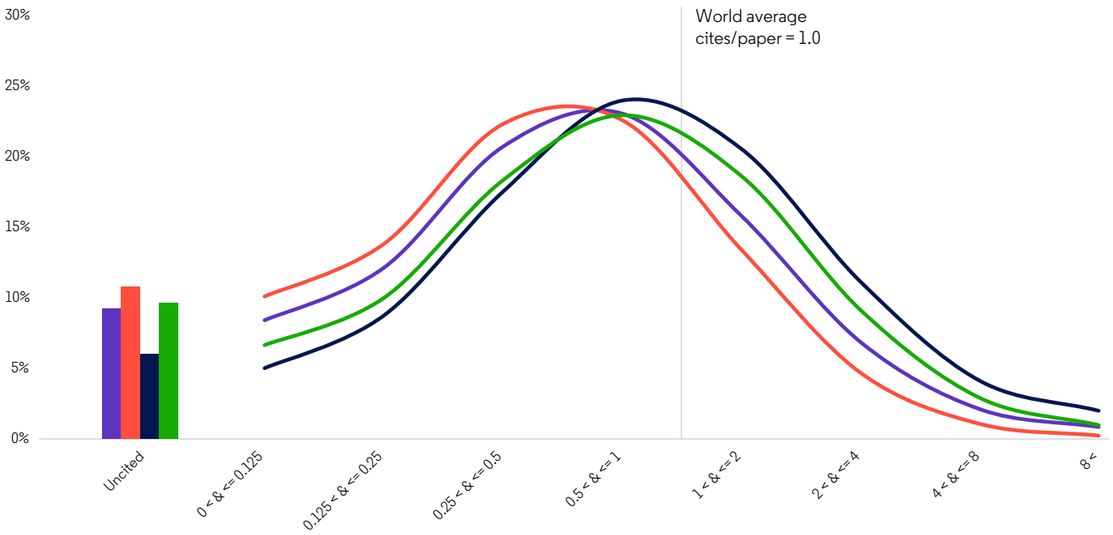
GERD/GDP (%)
3.27

Patents
423,264

BERD (PPP US$ billions)
136.9

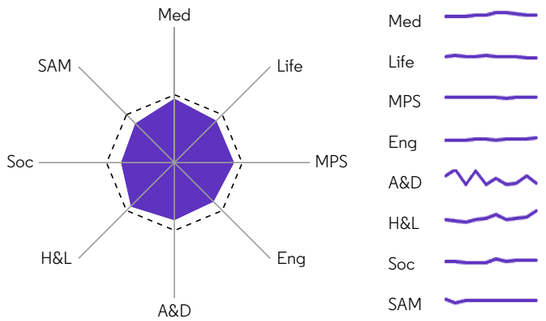
Patents/BERD
3091.5

Impact profile

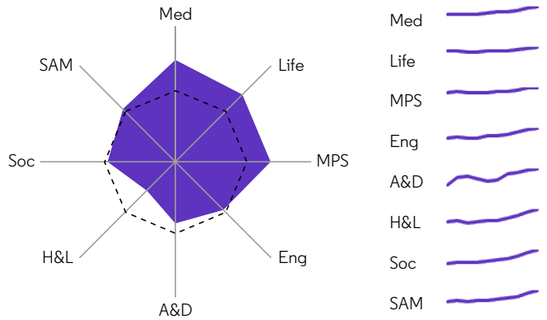


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Japan total	855,237	0.89	0.81	25.9%	8.3%
Japan domestic	568,894	0.64	0.74	19.7%	4.9%
Japan international	286,343	1.38	0.94	38.2%	15.0%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

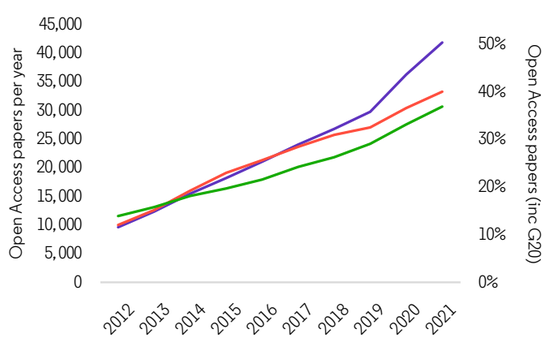
Impact by discipline



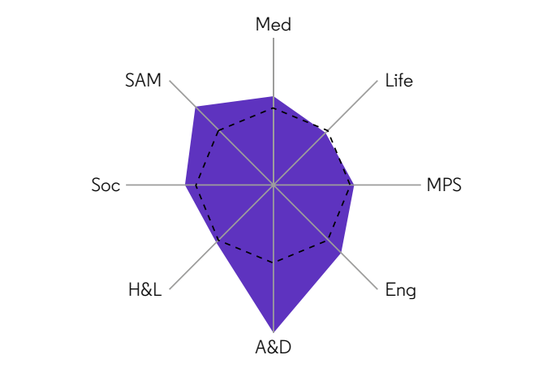
Output by discipline



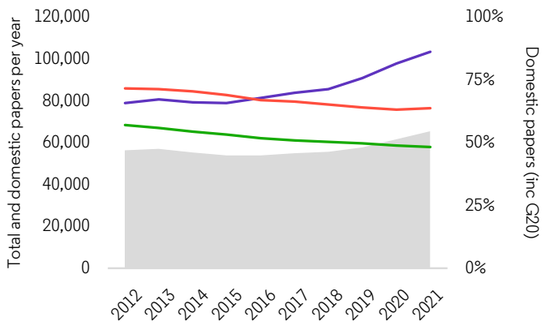
Output and Open Access



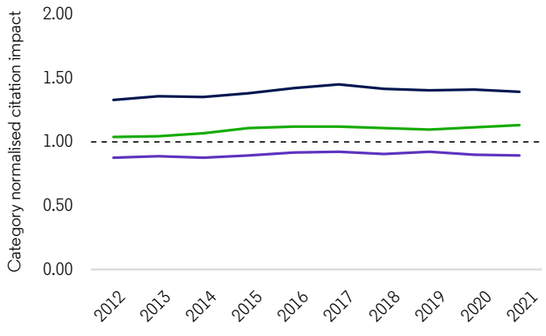
Output and Open Access



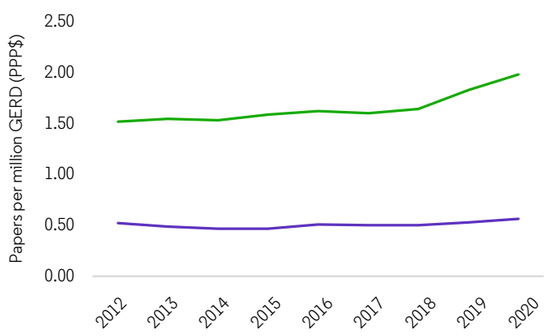
Output and collaboration



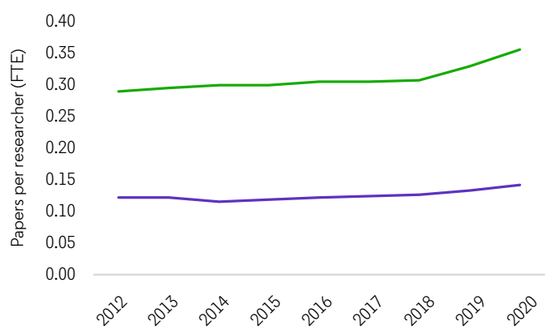
Impact and collaboration



Output by GERD



Output by researcher



Mexico

Researchers
62,356

Female researchers
20,157

GDP (PPP US$ billions)
2407.3

GERD (PPP US$ billions)
7.2

GERD/GDP (%)
0.30

Population
128,932,753

Researchers/1000 population
0.48

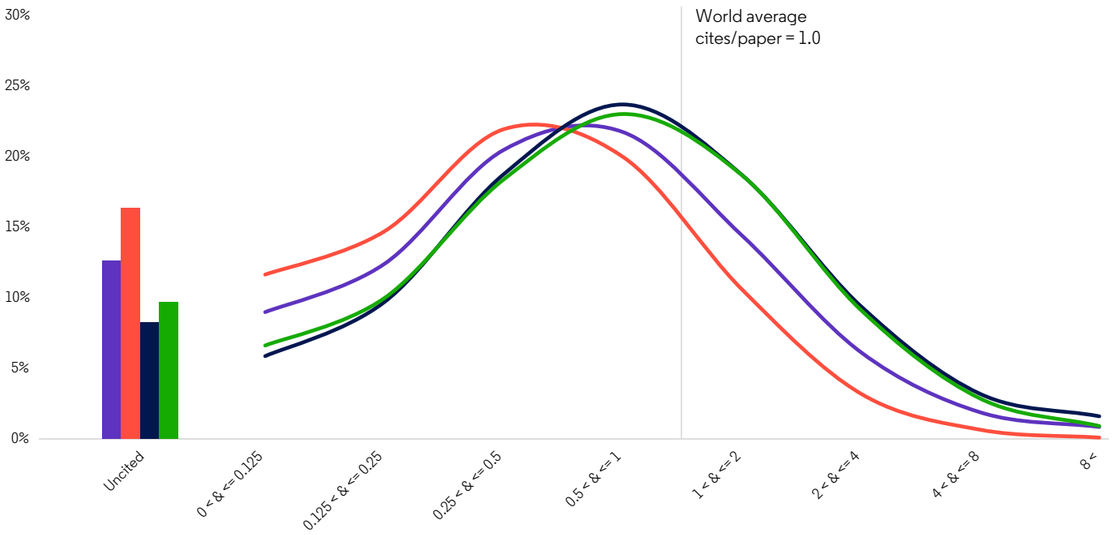
Women as % researchers
32.3

Patents
2,102

BERD (PPP US$ billions)
1.5

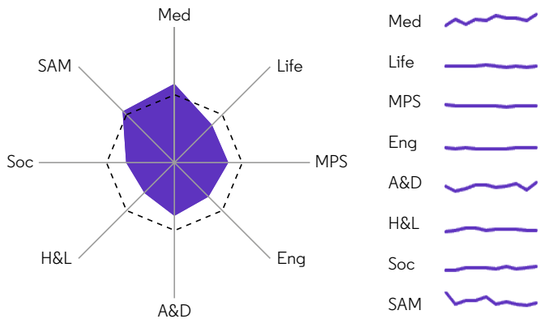
Patents/BERD
1363.0

Impact profile

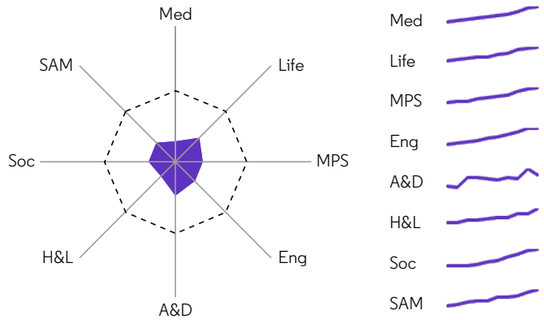


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Mexico total	163,065	0.86	0.68	23.4%	7.3%
Mexico domestic	86,902	0.51	0.57	14.8%	3.1%
Mexico international	76,163	1.26	0.81	33.3%	12.1%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

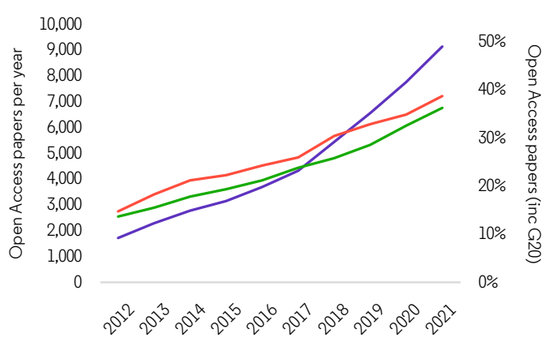
Impact by discipline



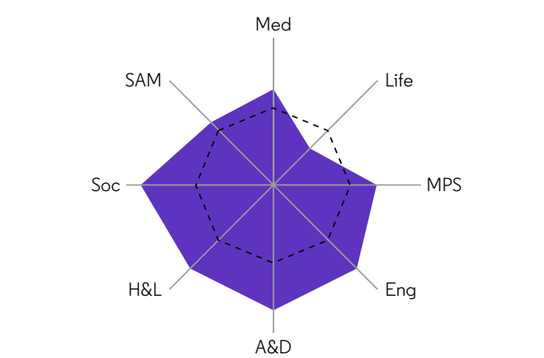
Output by discipline



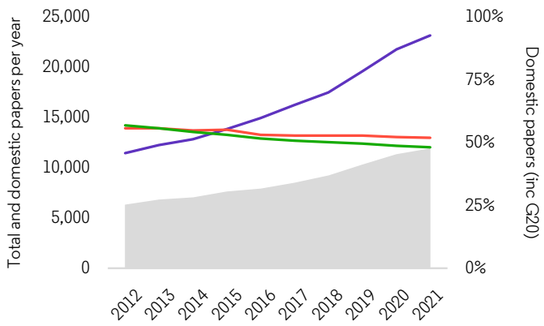
Output and Open Access



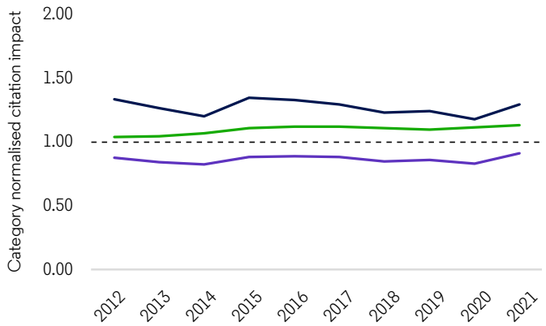
Output and Open Access



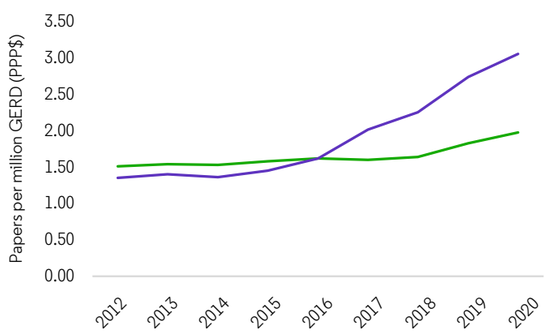
Output and collaboration



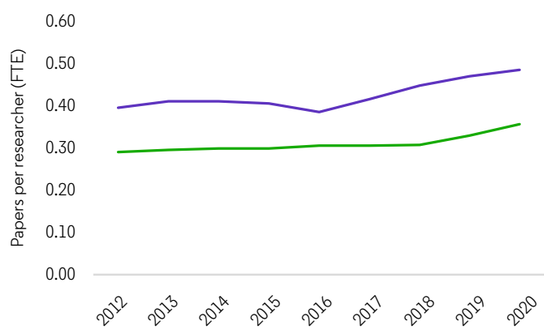
Impact and collaboration



Output by GERD



Output by researcher



Russia

Researchers
346,497

Female researchers
134,389

Population
144,073,139

Researchers/1000 population
2.41

Women as % researchers
38.8

GDP (PPP US$ billions)
4381.5

GERD (PPP US$ billions)
48.0

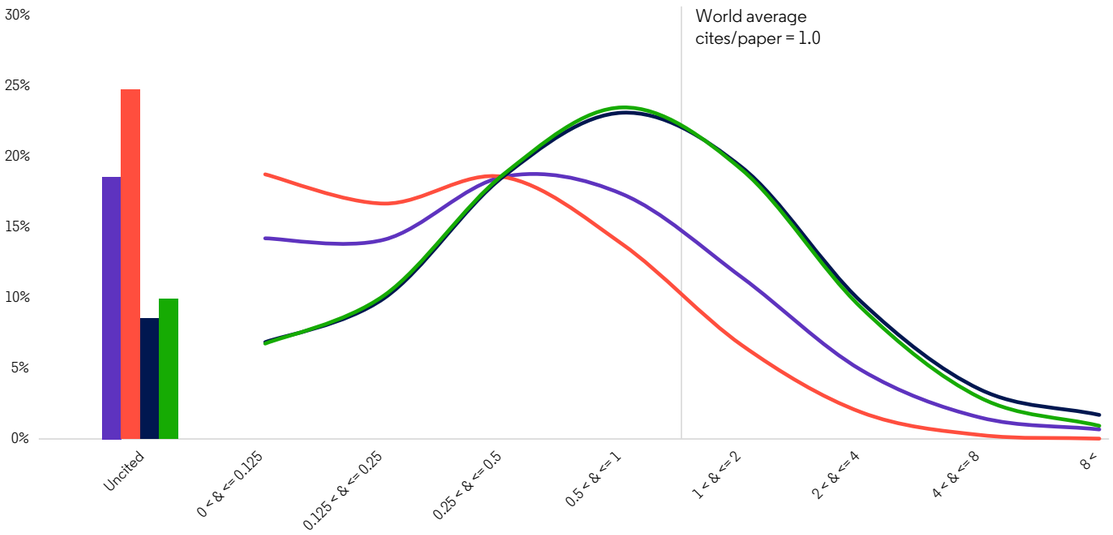
GERD/GDP (%)
1.09

Patents
30,283

BERD (PPP US$ billions)
27.1

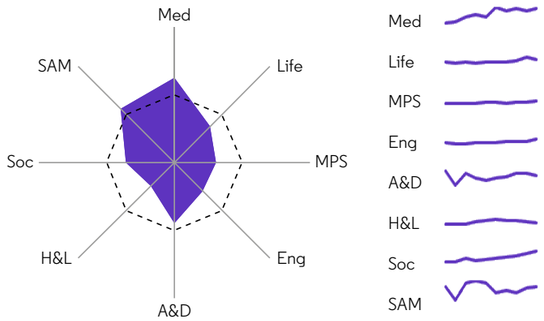
Patents/BERD
1115.7

Impact profile

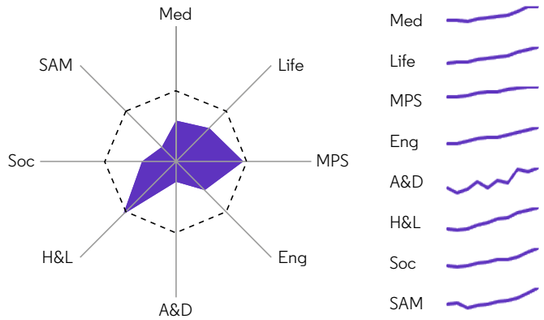


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Russia total	386,268	0.69	0.54	18.4%	5.6%
Russia domestic	239,338	0.34	0.38	8.9%	1.6%
Russia international	146,930	1.25	0.80	33.8%	12.2%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

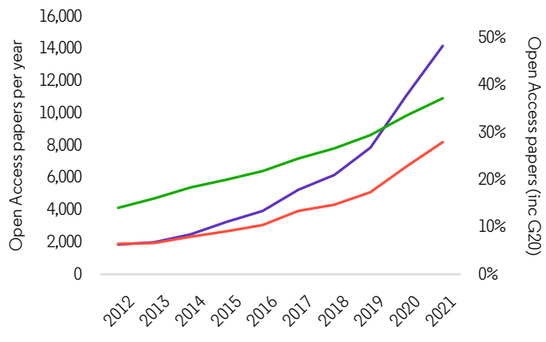
Impact by discipline



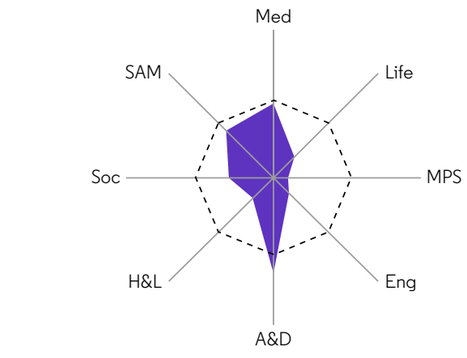
Output by discipline



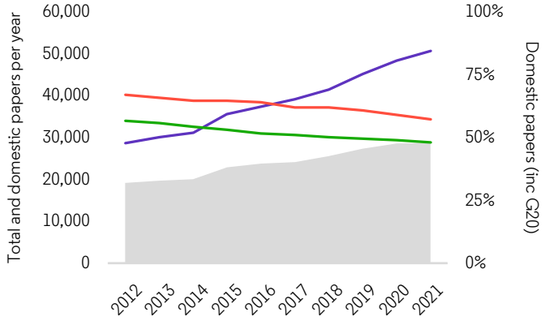
Output and Open Access



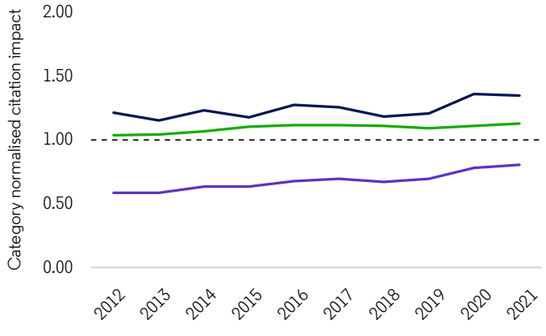
Output and Open Access



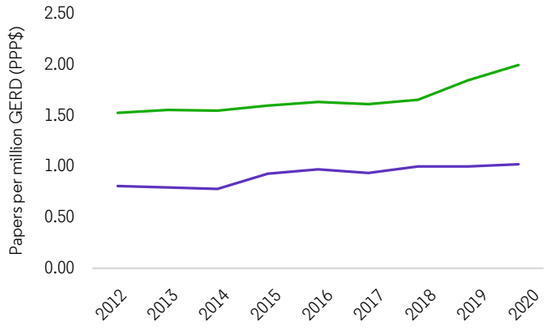
Output and collaboration



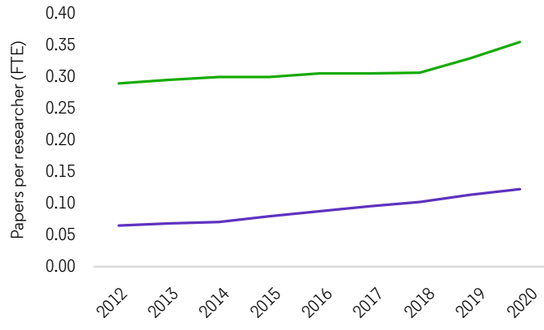
Impact and collaboration



Output by GERD



Output by researcher



Saudi Arabia

Researchers
–

Female researchers
–

Population
35,340,680

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1751.2

GERD (PPP US$ billions)
–

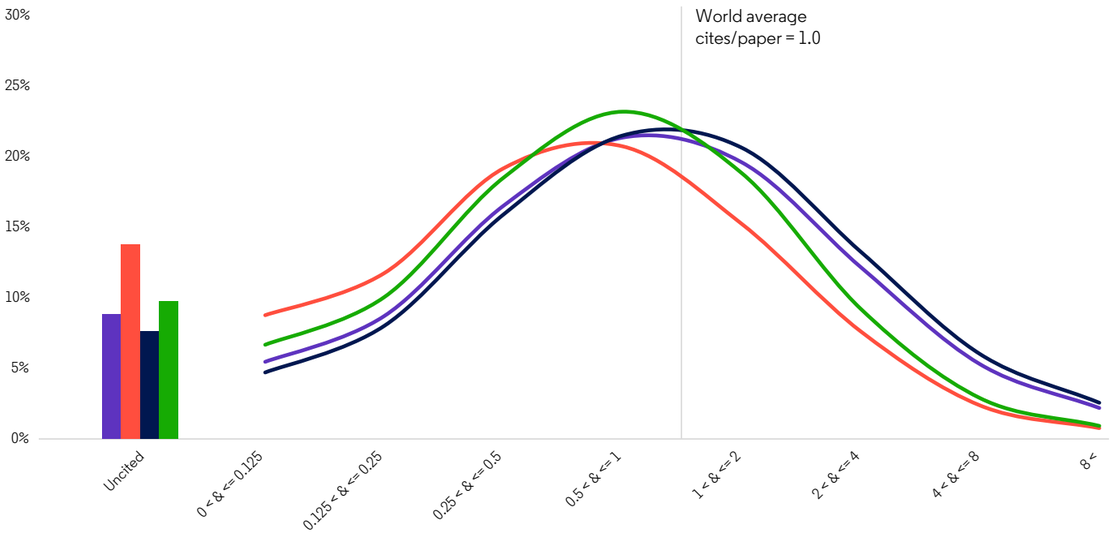
GERD/GDP (%)
–

Patents
9,782

BERD (PPP US$ billions)
–

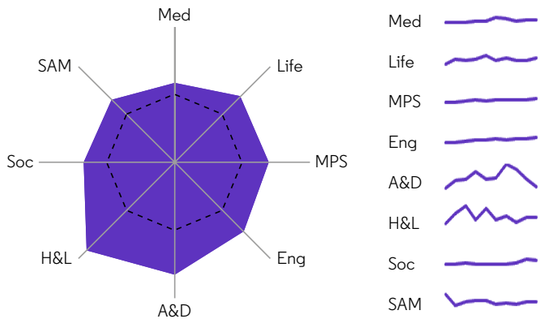
Patents/BERD
–

Impact profile

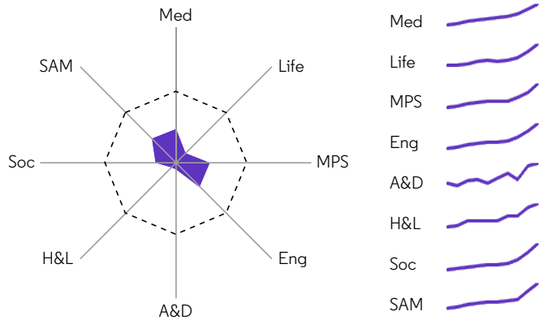


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Saudi Arabia total	176,900	1.38	1.03	39.2%	16.6%
Saudi Arabia domestic	33,820	0.82	0.96	26.0%	8.6%
Saudi Arabia international	143,080	1.51	1.05	42.4%	18.4%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

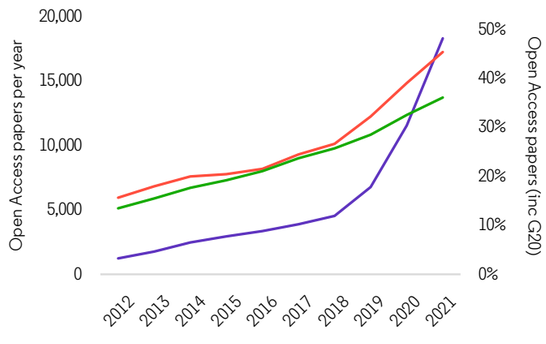
Impact by discipline



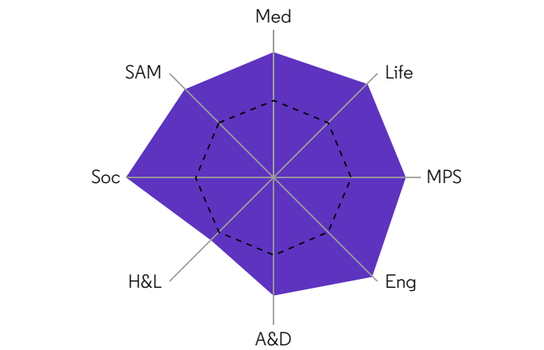
Output by discipline



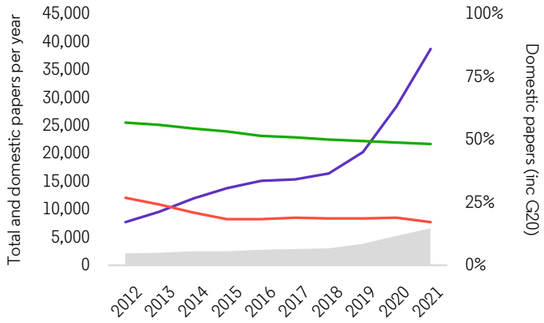
Output and Open Access



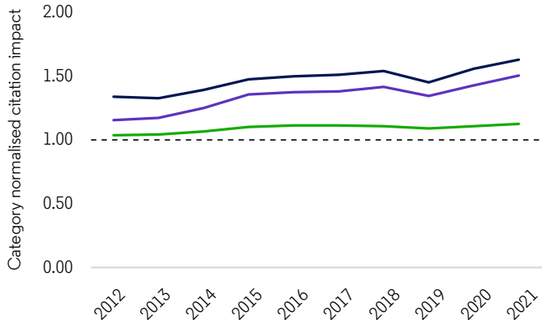
Output and Open Access



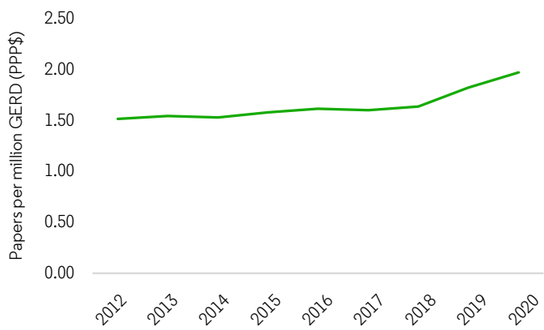
Output and collaboration



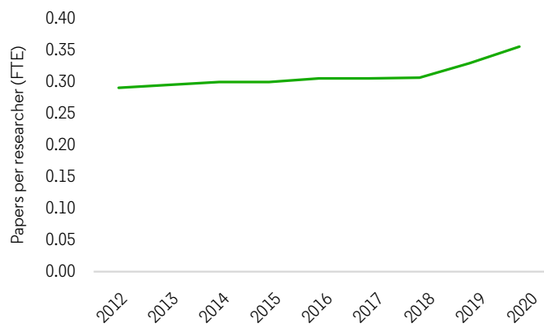
Impact and collaboration



Output by GERD



Output by researcher



South Africa

Researchers
62,002

Female researchers
28,623

GDP (PPP US$ billions)
836.7

GERD (PPP US$ billions)
5.1

GERD/GDP (%)
0.62

Population
58,558,267

Researchers/1000 population
1.06

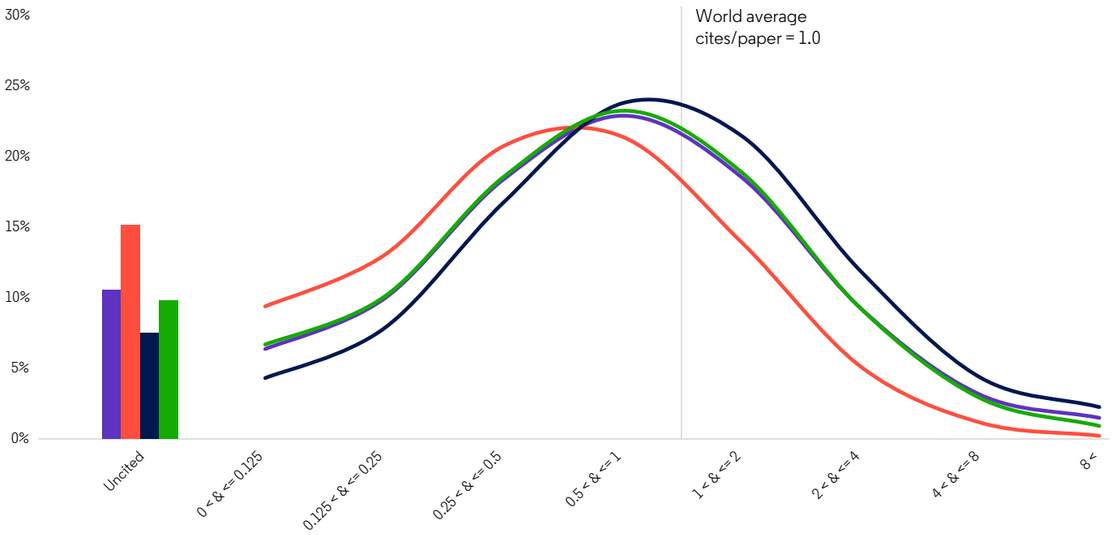
Women as % researchers
46.2

Patents
1,457

BERD (PPP US$ billions)
1.6

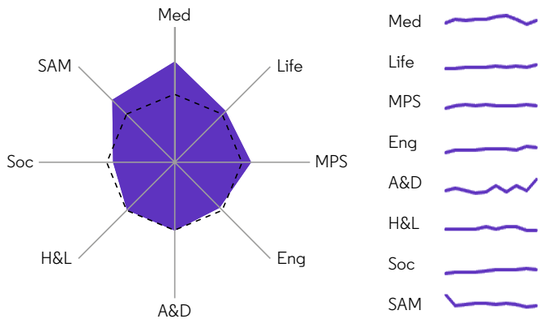
Patents/BERD
911.8

Impact profile

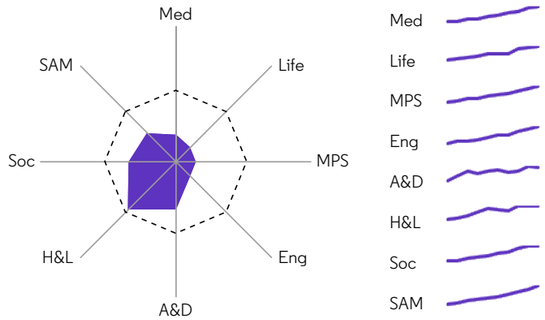


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
South Africa total	153,469	1.16	0.87	32.2%	11.4%
South Africa domestic	60,763	0.64	0.73	20.5%	4.7%
South Africa international	92,706	1.50	0.95	39.9%	15.7%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

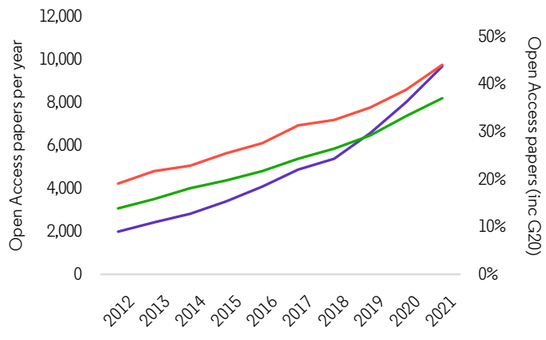
Impact by discipline



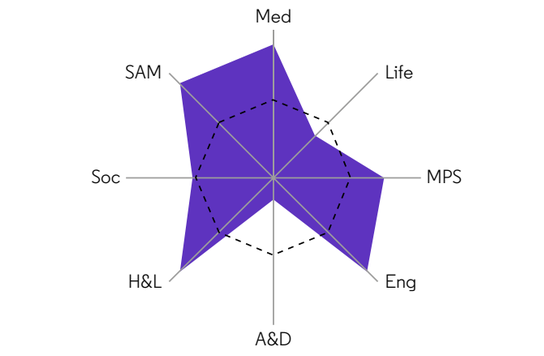
Output by discipline



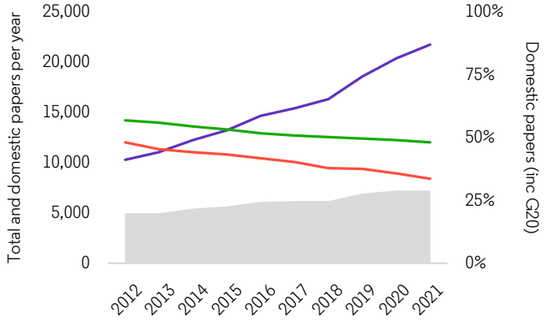
Output and Open Access



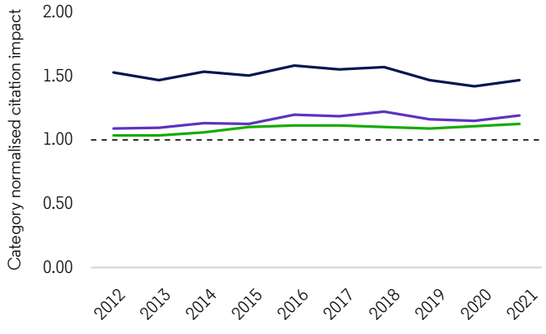
Output and Open Access



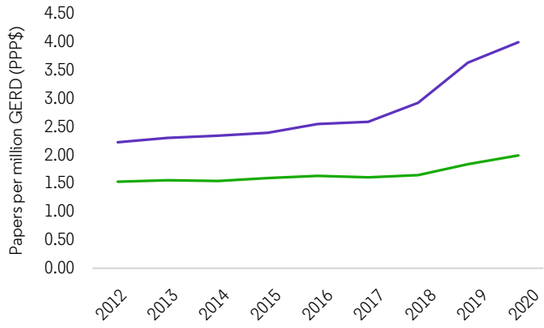
Output and collaboration



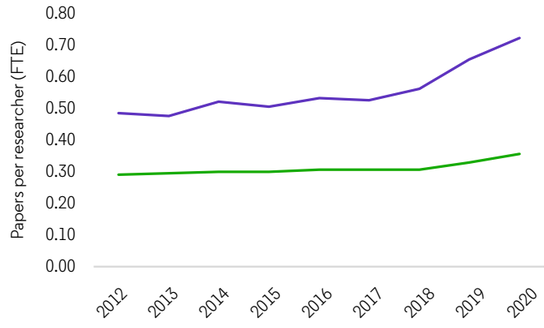
Impact and collaboration



Output by GERD



Output by researcher



South Korea

Researchers
558,045

Female researchers
119,551

GDP (PPP US$ billions)
2344.3

GERD (PPP US$ billions)
112.9

GERD/GDP (%)
4.81

Population
51,836,239

Researchers/1000 population
10.77

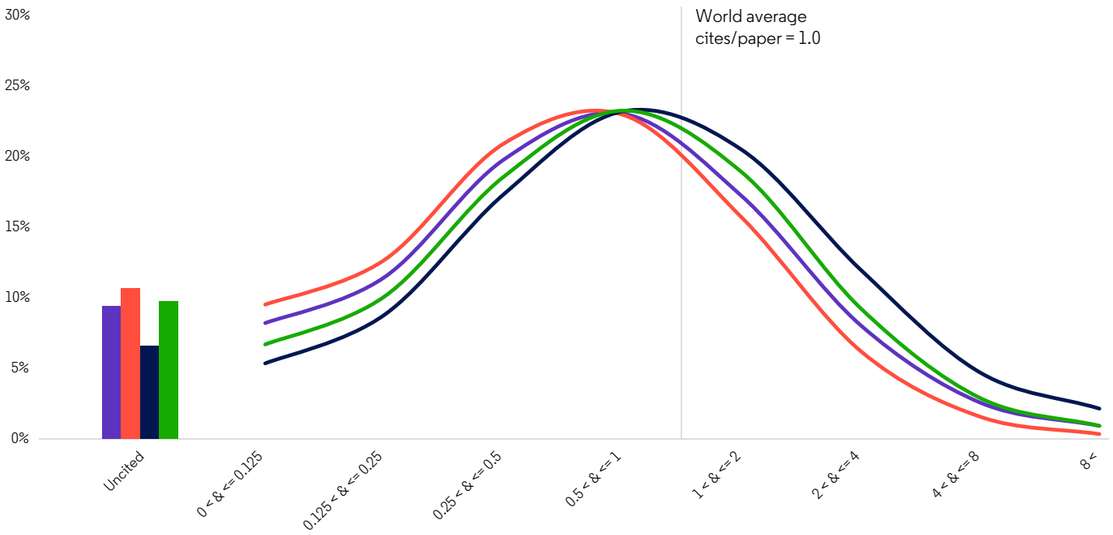
Women as % researchers
21.4

Patents
260,614

BERD (PPP US$ billions)
89.3

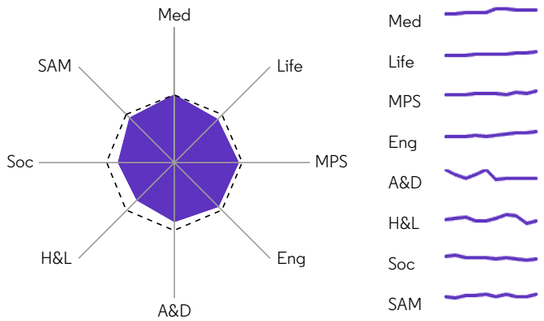
Patents/BERD
2919.9

Impact profile

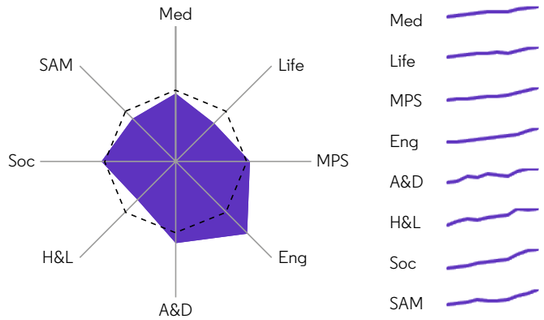


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
South Korea total	631,630	0.94	0.86	28.6%	9.5%
South Korea domestic	432,061	0.72	0.81	23.7%	6.5%
South Korea international	199,569	1.40	0.98	39.1%	16.0%
G20 total dataset	16,199,063	1.00	1.00	31.9%	10.8%

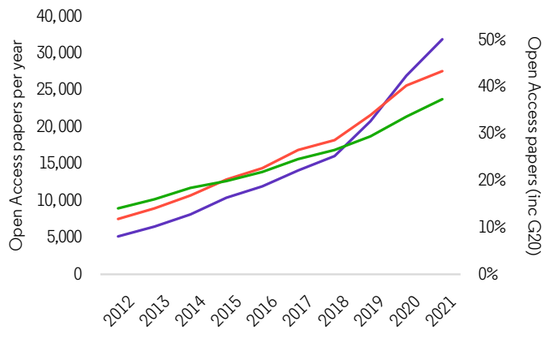
Impact by discipline



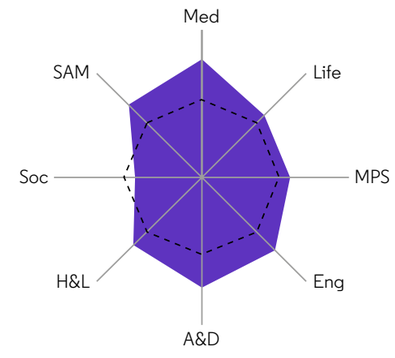
Output by discipline



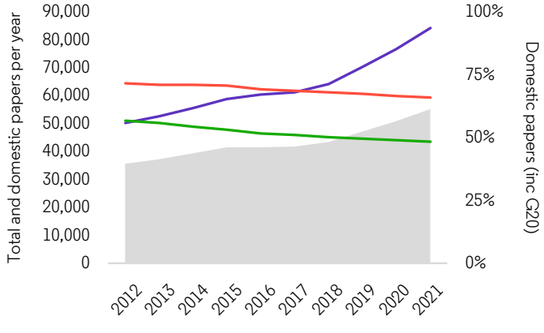
Output and Open Access



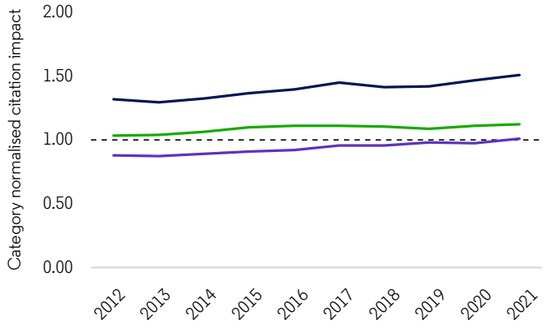
Output and Open Access



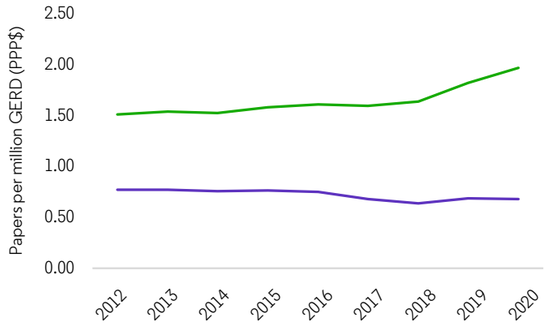
Output and collaboration



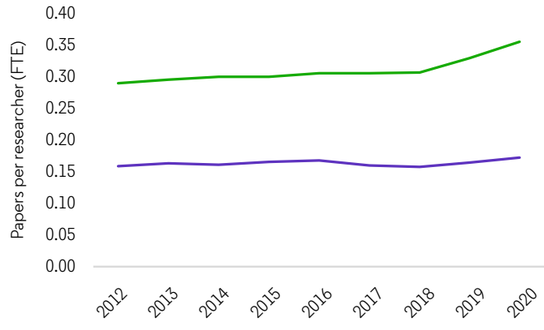
Impact and collaboration



Output by GERD



Output by researcher



Turkey

Researchers
257,930

Female researchers
94,682

Population
84,339,067

Researchers/1000 population
3.06

Women as % researchers
36.7

GDP (PPP US$ billions)
2297.0

GERD (PPP US$ billions)
25.0

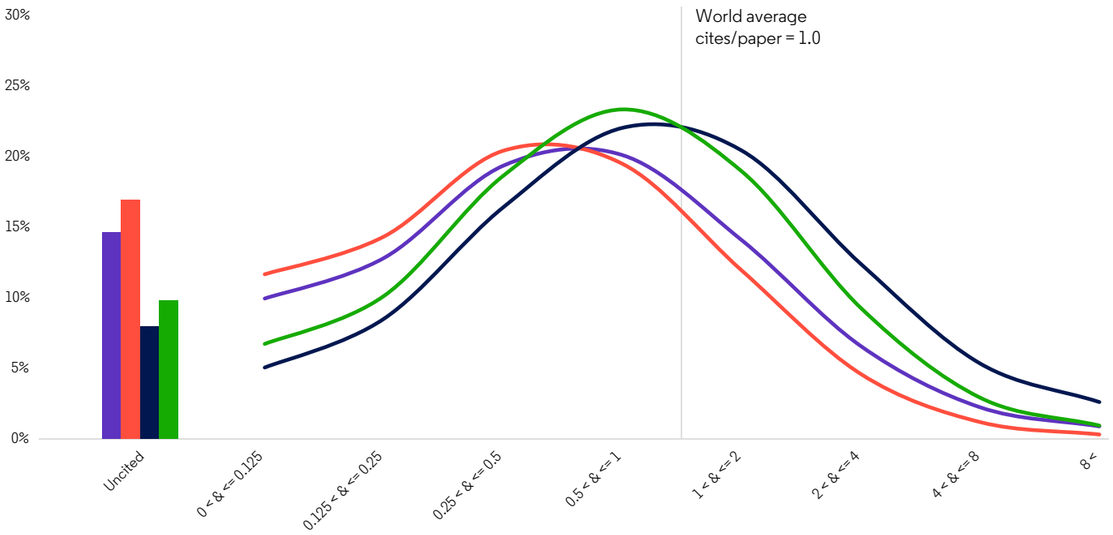
GERD/GDP (%)
1.09

Patents
10,110

BERD (PPP US$ billions)
16.2

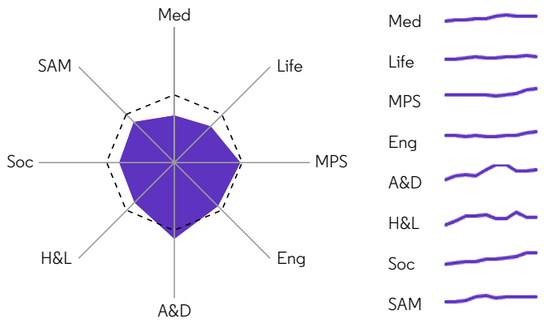
Patents/BERD
623.6

Impact profile

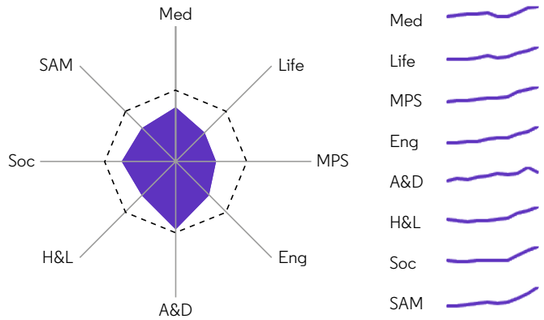


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
Turkey total	330,532	0.82	0.74	23.7%	7.8%
Turkey domestic	245,730	0.58	0.66	17.9%	4.6%
Turkey international	84,802	1.52	0.97	40.5%	17.1%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

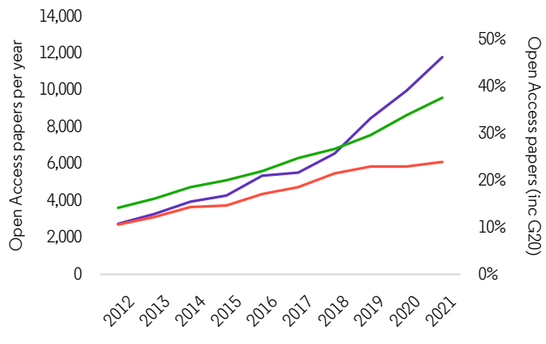
Impact by discipline



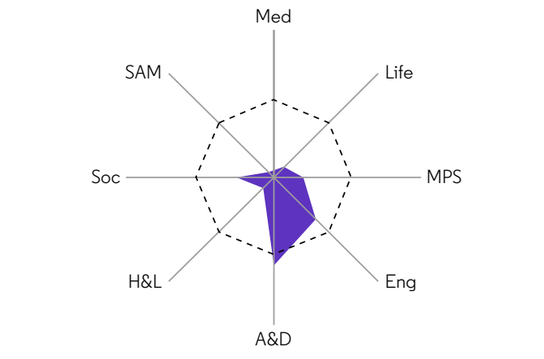
Output by discipline



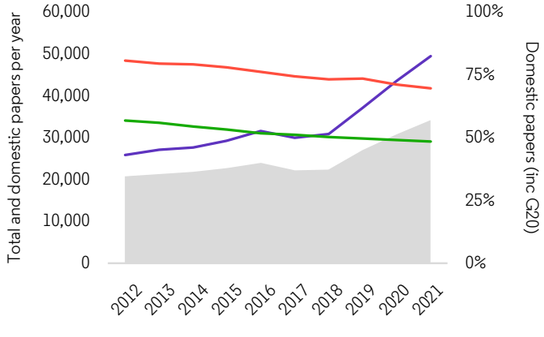
Output and Open Access



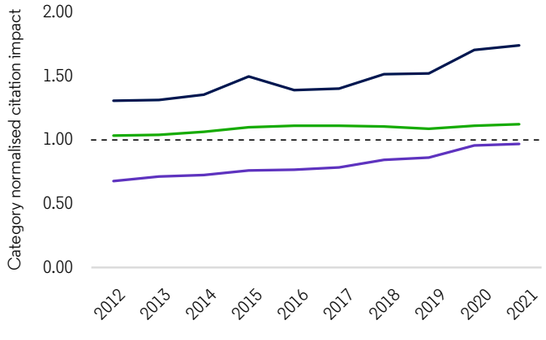
Output and Open Access



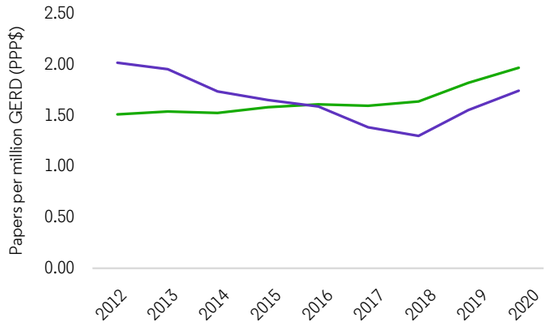
Output and collaboration



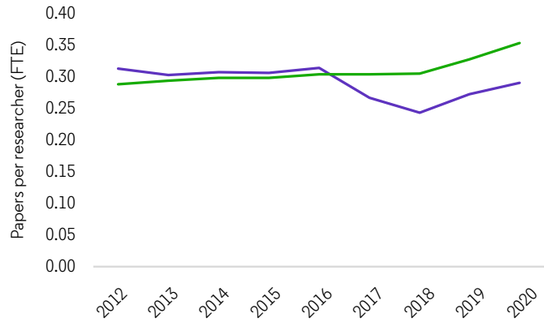
Impact and collaboration



Output by GERD



Output by researcher



United Kingdom

Researchers
548,498

Female researchers
213,856

GDP (PPP US$ billions)
3277.8

GERD (PPP US$ billions)
56.0

GERD/GDP (%)
1.71

Population
66,836,327

Researchers/1000 population
8.21

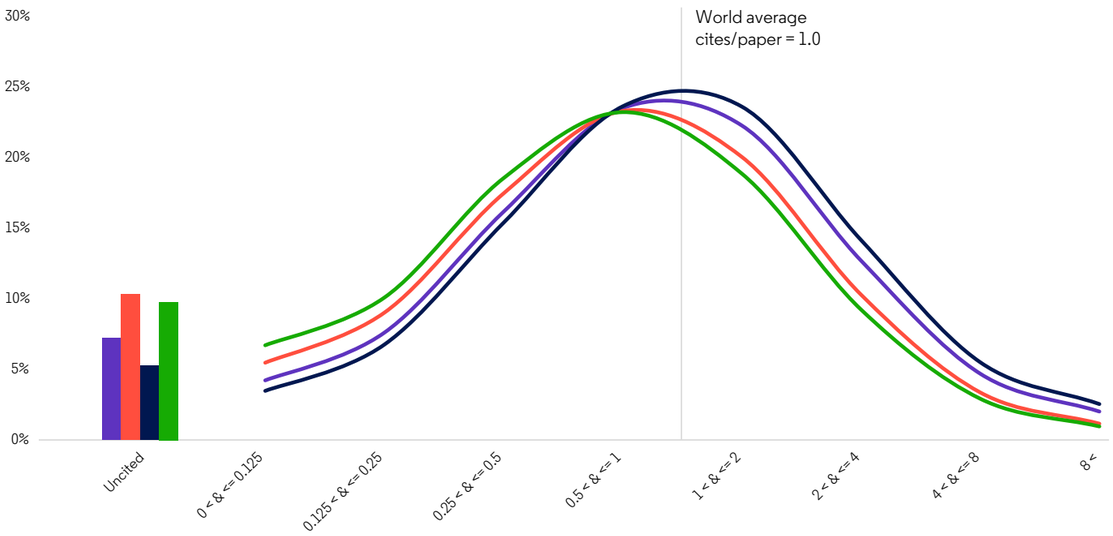
Women as % researchers
39.0

Patents
53,079

BERD (PPP US$ billions)
39.1

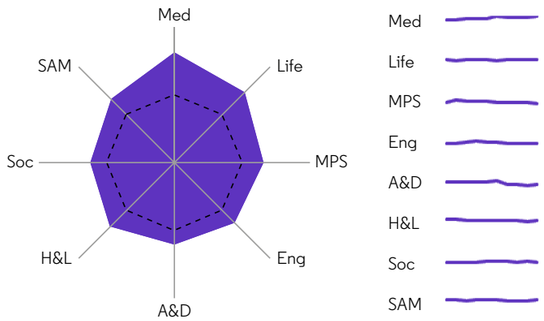
Patents/BERD
1357.6

Impact profile

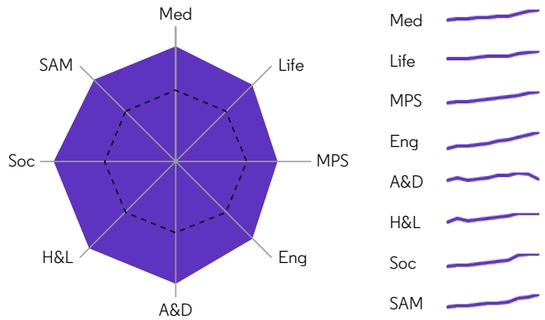


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
United Kingdom total	1,338,679	1.41	1.13	41.5%	16.4%
United Kingdom domestic	502,285	1.08	1.19	34.7%	11.8%
United Kingdom international	836,394	1.61	1.10	45.7%	19.1%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

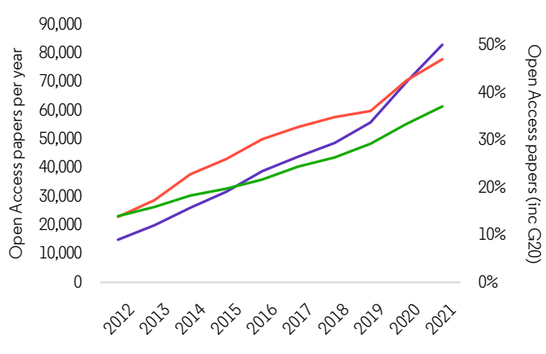
Impact by discipline



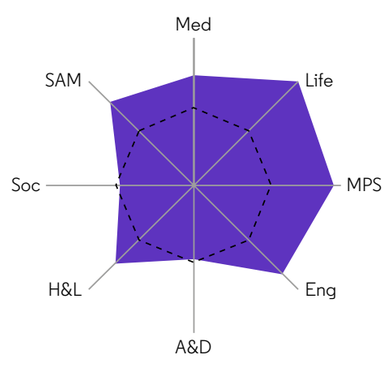
Output by discipline



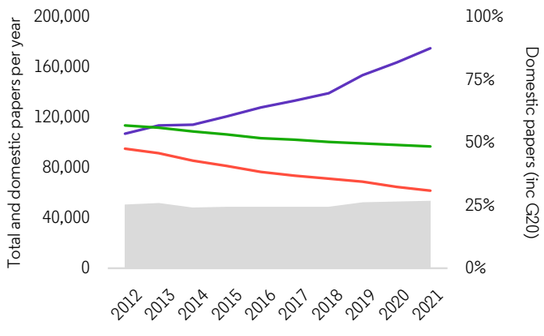
Output and Open Access



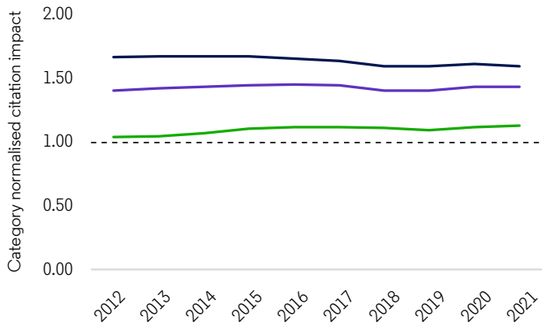
Output and Open Access



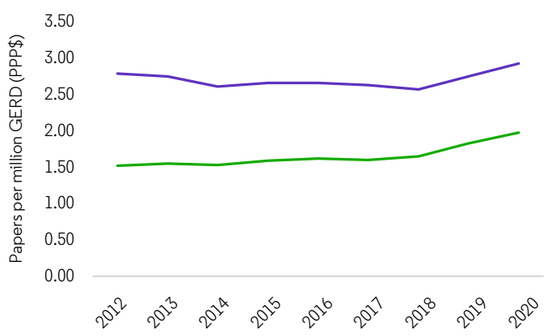
Output and collaboration



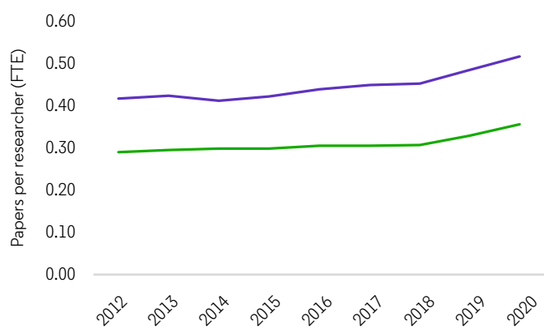
Impact and collaboration



Output by GERD



Output by researcher



United States

Researchers
–

Female researchers
–

Population
331,893,745

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
20893.7

GERD (PPP US$ billions)
720.9

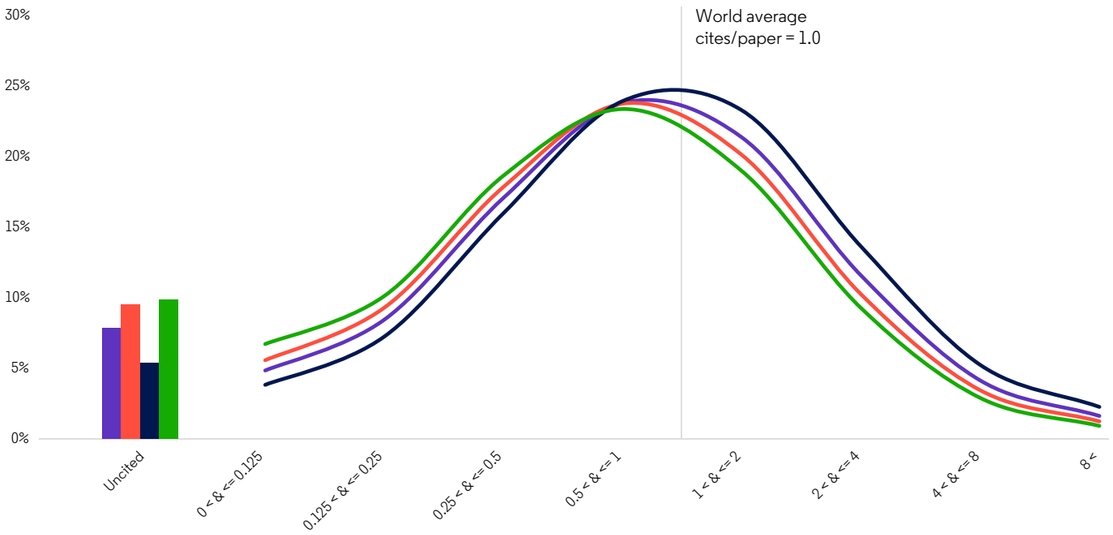
GERD/GDP (%)
3.45

Patents
496,123

BERD (PPP US$ billions)
542.9

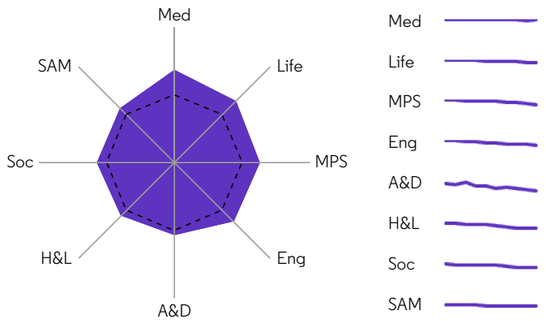
Patents/BERD
913.8

Impact profile

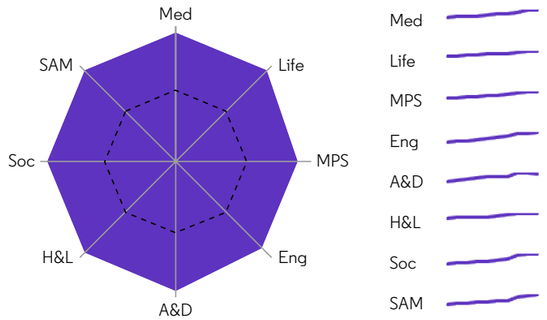


	Papers	CNCI	Collab-CNCI	% > world average	% in top 10%
United States total	4,402,041	1.27	1.18	38.5%	14.8%
United States domestic	2,631,420	1.11	1.22	34.7%	12.4%
United States international	1,770,621	1.52	1.12	44.1%	18.3%
G20 total dataset	16,199,063	1.00	0.99	31.9%	10.8%

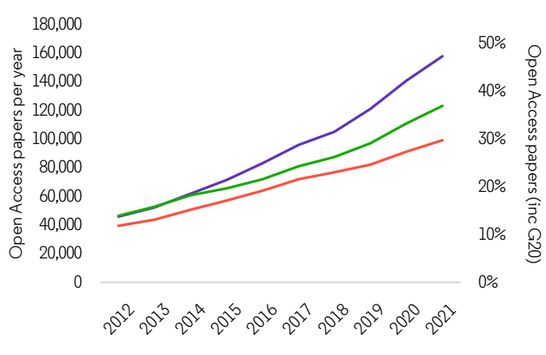
Impact by discipline



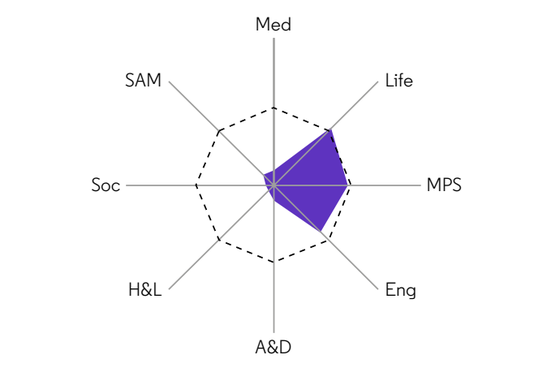
Output by discipline



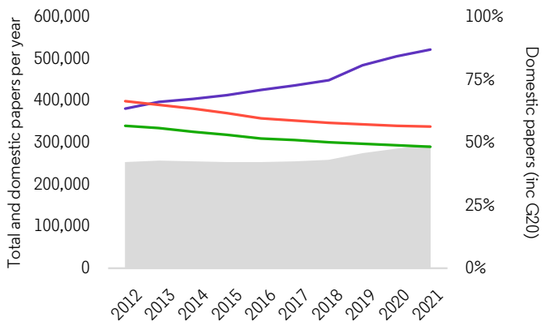
Output and Open Access



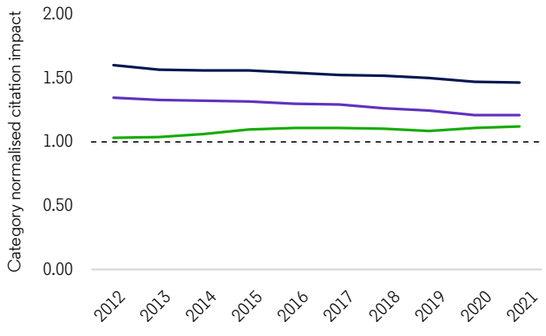
Output and Open Access



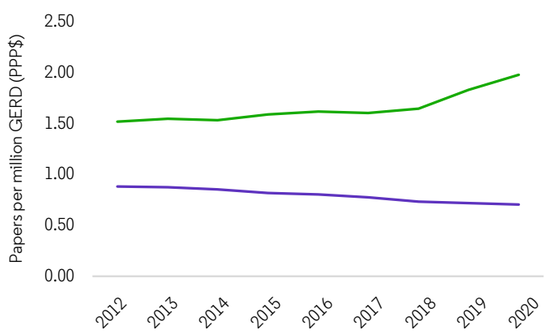
Output and collaboration



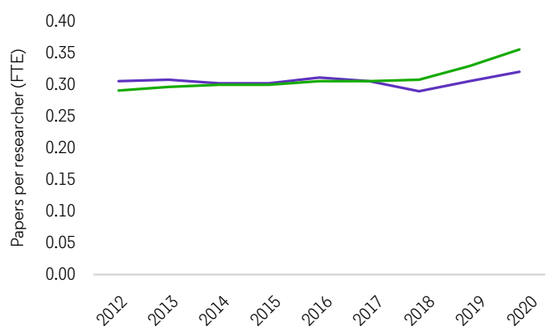
Impact and collaboration



Output by GERD



Output by researcher



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