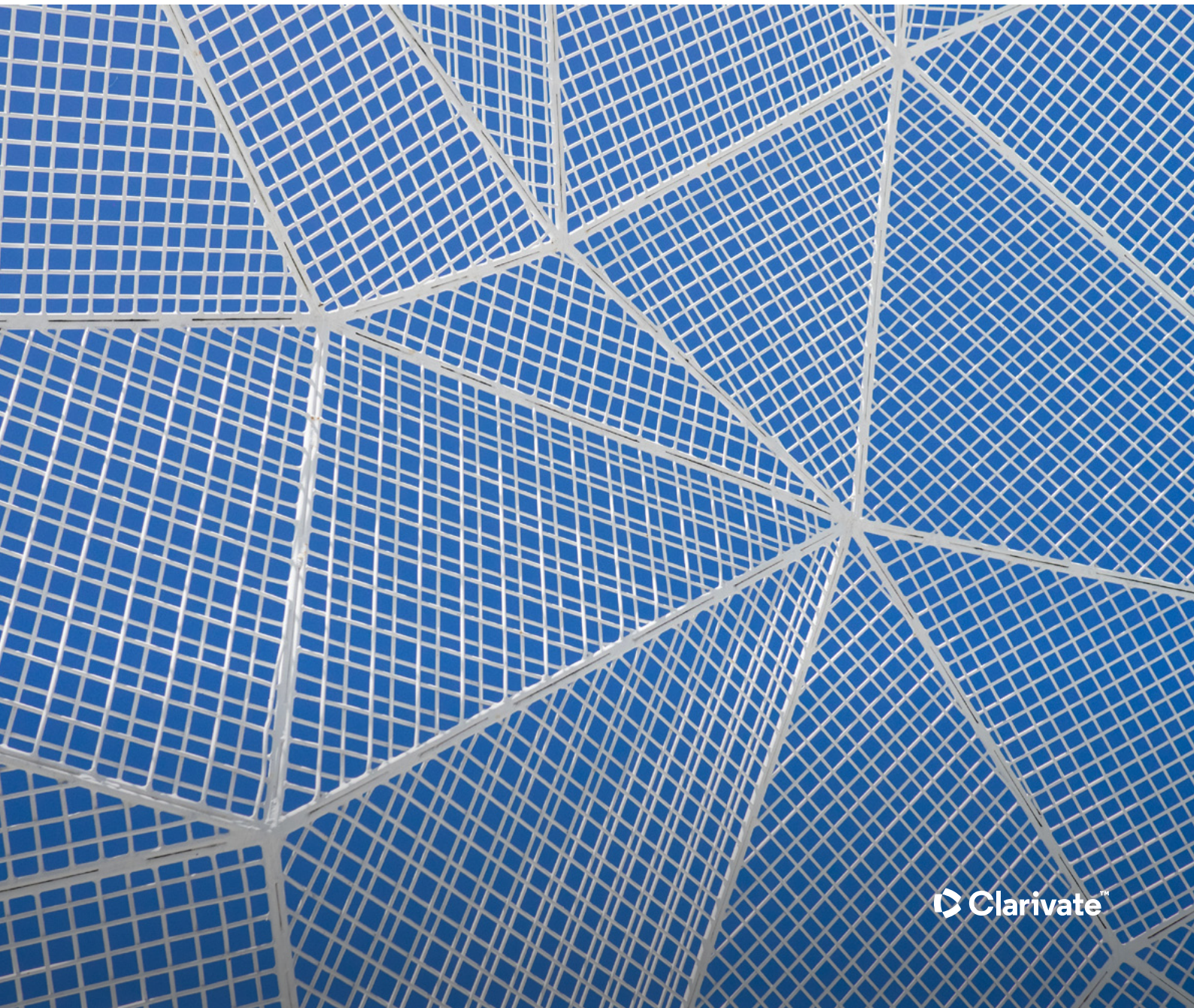
Institute for Scientific Information

The Annual G20 Scorecard – Research Performance 2020

Professor Jonathan Adams, Gordon Rogers, Ross Potter and Dr Martin Szomszor



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Author biographies

Jonathan Adams is Chief Scientist at the Institute for Scientific Information (ISI). He is also a Visiting Professor at King's College London, Policy Institute. In 2017 he was awarded an Honorary D.Sc. by the University of Exeter, for his work in higher education and research policy.

Gordon Rogers is a Senior Data Scientist at the Institute for Scientific Information. He has worked in the fields of bibliometrics and data analysis for the past 10 years, supporting clients around the world in evaluating their research portfolio and strategy.

Ross Potter is a Data Scientist at the Institute for Scientific Information. He has extensive research experience within academia, including NASA-related postdoctoral positions at the Lunar and Planetary Institute, Houston, Texas, and Brown University, Providence, Rhode Island.

Dr Martin Szomszor is Director at the Institute for Scientific Information and has also held the role of Head of Research Analytics at ISI. He was named a 2015 top-50 UK Information Age data leader for his work in creating the REF2014 impact case studies database for the Higher Education Funding Council for England (HEFCE).

Foundational past, visionary future

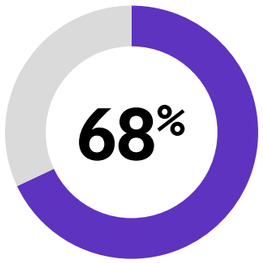
About the Institute for Scientific Information

The Institute for Scientific Information (ISI)™ 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 www.clarivate.com/webofsciencegroup/solutions/isi-institute-for-scientific-information/.

ISBN 978-1-8382799-0-5

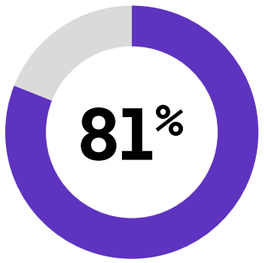
The G20:

Represents



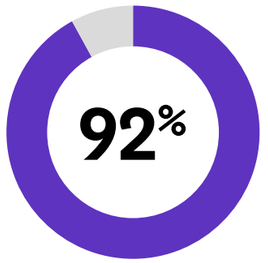
of world population
(World Bank, 2019)

Produces



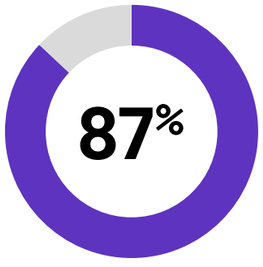
of global GDP
(World Bank, 2019)

Spends



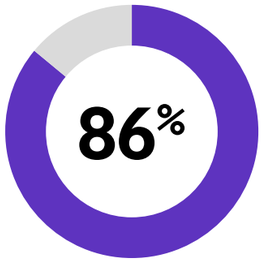
of global R&D
(OECD, 2015*)

Employs



of the world's researchers
(OECD, 2015*)

Publishes



of global research papers
(Web of Science, 2019)

*OECD statistics exclude Brazil, India, Indonesia and Saudi Arabia

Executive Summary

Country	Snapshot of research footprint
Argentina	Research spend (GERD) is rising but remains low at 0.56% GDP. The research workforce balance (53% female) has been sustained. Output per researcher is half G20 average and while Open Access is relatively high this is mainly in social sciences and humanities. The citation impact of publications is around world average and international collaboration trends are typical of the G20. However, citation impact seems to be waning and patents/BERD is among the lowest in the G20.
Australia	Output has doubled in a decade and continues to rise despite being relatively high per researcher and per GERD. This is driven by exceptional international collaboration, so purely domestic output is consequently low. This international collaboration boosts citation impact and share of highly-cited papers (above G20 average in all areas, and the highest overall) but average impact is unchanged.
Brazil	Open Access output is very strong across all disciplines. However, the citation impact of these papers, particularly for domestic output, is below the relevant G20 averages. On average, that impact has fallen slightly over the last few years although output growth, including domestic activity, remains steady.
Canada	Output per researcher continues to rise and overall output has risen by one-third in a decade. It is notably strong in health and social sciences where citation and social impact is very good. Citation impact is well above G20 averages with 39% of publications above world average citation impact compared to 32% for the G20 as a whole. However, Open Access is relatively low.
China	There is an enormous research workforce and a large volume of investment (over two million researchers, GERD over 2% GDP) and patents/BERD is twice that of any other G20 country. The domestic research base continues to diversify. It has been strong in science and technology but growth in all areas including social sciences is notable. However, although average citation impact meets the G20 average, impact in expanding life science areas is weaker.
France	Output per researcher and per GERD funding has been below G20 average and continues to fall. Citation impact is relatively good in life sciences, boosted by a high 60% international collaboration, but domestic output has been in decline and domestic impact is below the G20 average. The female share of the research workforce is low (28%) and increasing very slowly while Open Access is well below G20 average in most fields.
Germany	Investment is higher than EU neighbours, with GERD over 3% of GDP. Output per researcher is around G20 average. The citation impact of this research is relatively good, especially in life sciences, though it secures a 14% share of the world's top 10% of papers, but shows signs of plateauing. However, only 28% of researchers are female and Open Access is below G20 average.
India	Volume output appears to be relatively low (similar paper count to Australia) for such a large economy but we cannot index productivity as there are no recent data on GERD or researchers. International collaboration also remains relatively low (half G20 average) and Open Access has been adopted only in bio-medicine. These factors contribute to a relatively weak Impact Profile and low citation impact in all areas.
Indonesia	Research output is small and domestic output is only 20% of the total, but volume has trebled since 2010, in all disciplines. Average citation impact (peaking above world average in 2012 to 17) is driven by the internationally collaborative output, so that also shapes the Impact Profile. Average citation impact is relatively good in medicine, where collaboration is substantial, and in social science and humanities but over 25% of domestic papers are uncited. Open Access is generally good, driven particularly by very high OA in medicine.
Italy	Citation impact is relatively good in all areas although output is only just above G20 median (surprising for a G7 economy). The impact of domestic research is rising and the Impact Profile shows that average performance is further boosted by international collaboration, accounting for 55% of total output. Productivity per GERD is well above G20 average, so output has not been constrained by consistently low government investment.

Country	Snapshot of research footprint
Japan	Low citation impact is a surprise for a well-established G7 research economy with a high level of GERD/GDP (3.3%) and is likely a result of sparse international collaboration. The Impact Profile shows that performance is lifted above the G20 average through that collaboration, although this is only 30% of a total output that is growing more slowly than similar economies. Productivity is well below average and women represent just 17% of the researcher population.
Mexico	Research investment is low and has fallen (GERD/GDP is 0.31%) but rising output is boosted by rising researcher productivity. Citation impact has been sustained over the decade despite fluctuations. The Impact Profile shows that the performance of the domestic base remains below world average though overall impact is above that benchmark. Impact is good considering the small volume but only in medicine and health does impact match the world average.
Russia	The citation impact and output volume of Russia's research recovered slowly from post-Soviet disruption. It is close to the G20 median in physical sciences but low in engineering. International collaboration (36% of total) is low as is share of global top 10% papers (5.1%). Russia's Impact Profile just matches the G20 average when that collaboration is included but domestic research is cited rather less than world average. Productivity indices appear weak but this may be influenced by choice of publishing venues.
Saudi Arabia	Only 20% of papers are domestic and the Impact Profile reflects a policy orientation towards international collaboration, or affiliation, that has grown steeply while the domestic research base has not yet seen the benefit of investment (domestic researcher numbers are not disclosed). Impact by discipline consequently appears relatively high in all areas, compared both to G20 average and to the country's substantive activity.
South Africa	International collaboration is typical of the G20 (60% of output) and the overall Impact Profile is close to G20 average, boosted by a strong performance in medicine and health research. Productivity is high and output has been rising, although it remains relatively low in the G20. There is consistently high Open Access across disciplines and the country has the second highest frequency of female researchers (45%).
South Korea	The highest GERD/GDP (4.5%) in the G20 has not yet been translated into output, where productivity is well below G20 averages (although output is strong in engineering), or citation impact, which may partly be due to lower international collaboration than the G20 average. The research workforce is relatively large but female researchers are a relatively small part (20%). Open Access is rising and is already above G20 benchmarks.
Turkey	The recent decline in output has been offset but international collaboration remains rather low. Productivity by GERD and by researcher continues to fall markedly. Citation impact remains below world average in all areas, and the Impact Profile is only lifted just above the G20 average by international collaboration. Output is in fact relatively low across all areas, given the size of the economy, and Open Access is declining, unlike G20 generally.
United Kingdom	The share of papers in the global top 10% (16.3%) is the highest in the G20 and the Impact Profile shows that the domestic research base performs well above group average. By discipline, average citation impact is strongest in life sciences, and relatively high (above 1.2) in all areas. International collaboration is exceptionally high, and rising, for such a large economy. The number of female researchers (39%) is above G20 average.
United States	Output is highest in all areas among the G20 and citation impact is consistently good, though less than the UK. The performance of the domestic research base is boosted less by international collaboration than for other countries, as the Impact Profile shows. However, although investment is high (GERD/GDP = 2.8%), output is declining and output/researcher has fallen below the G20 average.

Introduction

This year's G20 Summit was scheduled for Riyadh, Saudi Arabia on November 21st and 22nd 2020 – an event that has been affected by a unique situation created by the coronavirus pandemic. The G20 group is undoubtedly a driver in the global research system, so our 2020 annual G20 scorecard includes a special analysis of the G20 contribution to recent coronavirus research.

The coronavirus disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has caused the most significant global health crisis since the Spanish Flu epidemic a century ago.

The G20 is a group of 19 leading economies, spread regionally around the globe, with the European Union (EU) as an additional member. 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 countries of the G20 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. That is over 70% of the global total.

The world's most prosperous economies are also among the most innovative and that innovation is driven first and foremost by research. The G20 meeting is one of the world's few forums for international co-operation this year and expectations are rightly high that the expertise and resources of its members should play a champion's role in addressing the pandemic challenge – to release the benefits of cutting-edge research to the largest possible number of people as rapidly as is feasible within sound research and clinical practice. This should produce a rapid understanding of the biological issues, the health impacts and responses, the social outcomes and the economic and societal implications of a pandemic.

The coronavirus disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has caused the most significant global health crisis since the Spanish Flu epidemic a century ago. Researchers across the globe have been engaged in basic, experimental and clinical studies to understand the virus and, ultimately, produce a vaccine and/or cure. Consequently, the published literature on this previously unknown virus has rapidly increased at an unprecedented scale. Due to their relatively developed research bases, G20 nations have been the most active participants in COVID-19 research and it has been particularly relevant for countries – including USA, India, Brazil and Russia – that, due to their populations, have the highest absolute number of reported cases.

ISI developed a selective search string for COVID-19 and SARS-CoV-2 and examined the text in the titles, abstracts and keywords of 18,183 articles and reviews indexed since January 2020 and retrieved from the Web of Science. A standard methodology was used to group words together into topics based on the frequency with which disease/treatment specific terms appeared together.

This created a 'family tree' that links 30 topics into eight major topic clusters (Figure 1). Each G20 nation's contribution to the publications in those topic clusters was analyzed (Figure 2) and the topical spread of activity for China, the USA and for the EU-27 as a regional group was compared (Figure 3).

ISI's key findings are:

- The EU-27 region is the biggest contributor to five clusters, followed by USA (two) and China (one). To some extent, regional focus on a topic may reflect the progress of the pandemic and the priorities that emerged as it unfolded.
- China's lead and main focus has been on cluster 4 (Diagnosis and statistics).
- The EU-27 has a balanced set of strong leads spread across clusters 7 (Neurology), 6 (Cardiovascular and diabetes), 2 (Crisis management, modelling and economics), 3 (Vaccines and therapeutics) and 8 (Health implications).
- The USA has its greatest focus in cluster 1 (Safety and clinical practice), although this is also an important EU area, and cluster 5 (Transplantation and immune response)
- The contributions of the EU-27, USA and China are broadly each one third (~28-37%) of the total papers for each cluster. Both the EU-27 and USA account for at least 25% of papers within each topic cluster, which is expected given their size and long-term biomedical orientation.
- Although China's biggest contribution is to cluster 4 (Diagnosis and statistics), it also contributes at least 20% of the papers in clusters 3 (Vaccines and therapeutics) and 5 (Transplantation and immune response).
- Within the EU-27, it is notable that Italy, the first European country to experience significant effects, has contributed >15% of papers in clusters 6 (Cardiovascular and diabetes) and 7 (Neurology); 14% to cluster 1 (Safety and clinical Practice), and 12% to cluster 8 (Health implications).
- The UK, which has the highest number of COVID-19 related deaths in Europe but is not part of the EU-27 modeling has contributed to 14% of papers to cluster 1 (Safety and Clinical Practice), 13% to cluster 2 (Crisis management, modeling and economics) and 12% to cluster 6 (Cardiovascular & Diabetes). Of the other G20 nations, only India has contributed to more than 10% of papers in any topic cluster (Vaccines & Therapeutics)
- Russia is the only G20 member that has not contributed to all the topic clusters – there is no research related to topic cluster 5 (Transplantation and immune response).

Figure 1. A family tree of 30 research topics detected among 18,183 papers indexed in Web of Science during 2020 and related to coronavirus via searches for COVID-19 or SARS-CoV-2. Topics are signposted with a name-tag derived from the most frequent terms in that set of documents and shown alongside the number of papers in each set (n). Groups of similar topics are clustered together and denoted using different colors on the tree.

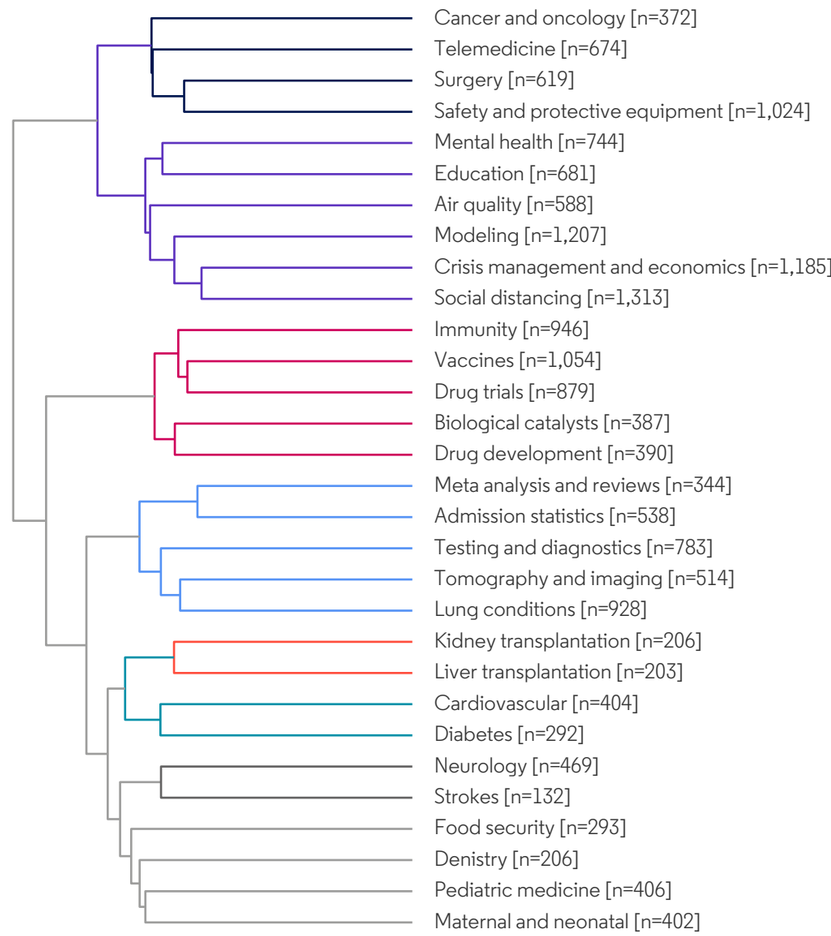


Figure 2. The percentage contribution of total research output made by each G20 nation to each of the topic clusters described in Figure 1.

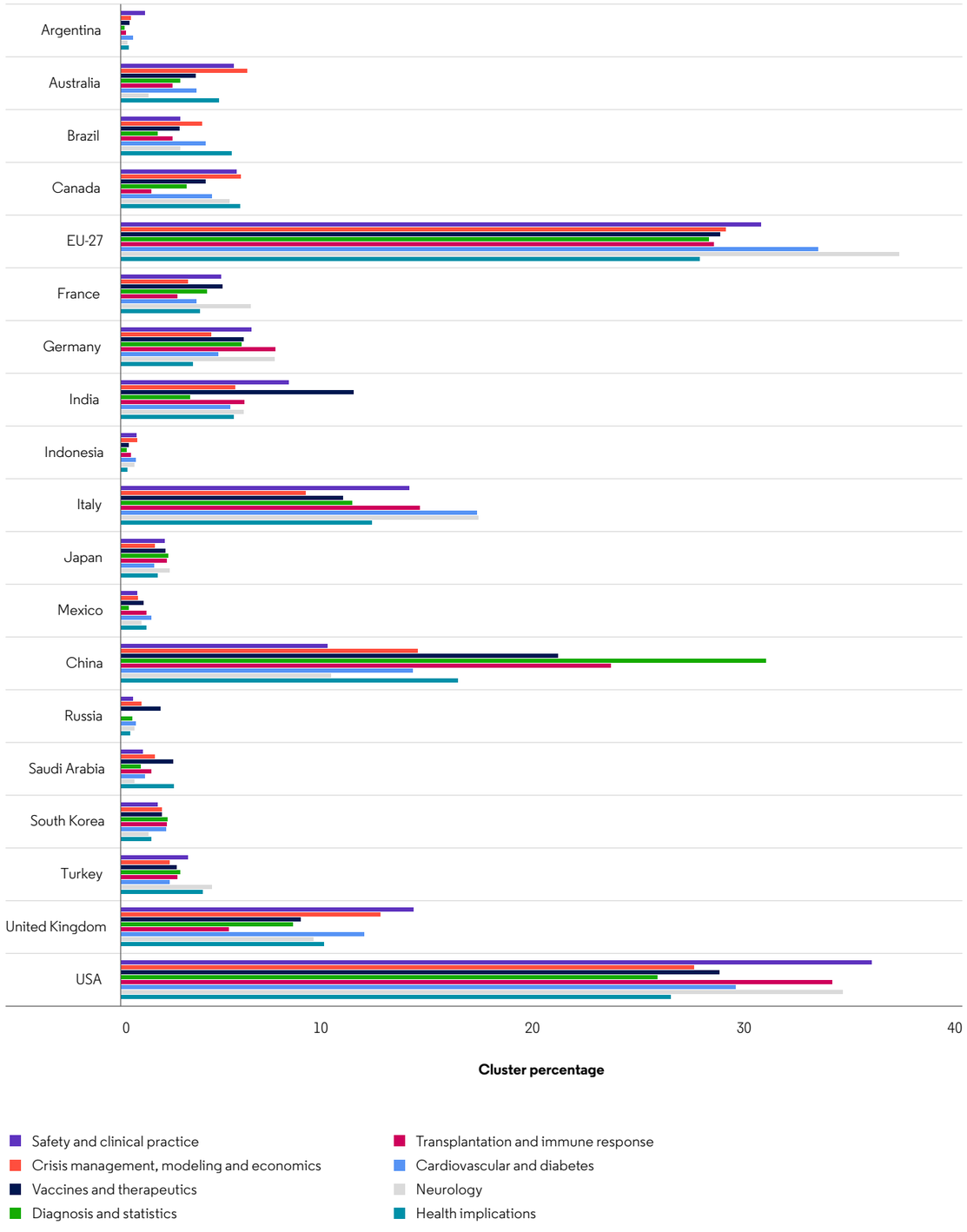
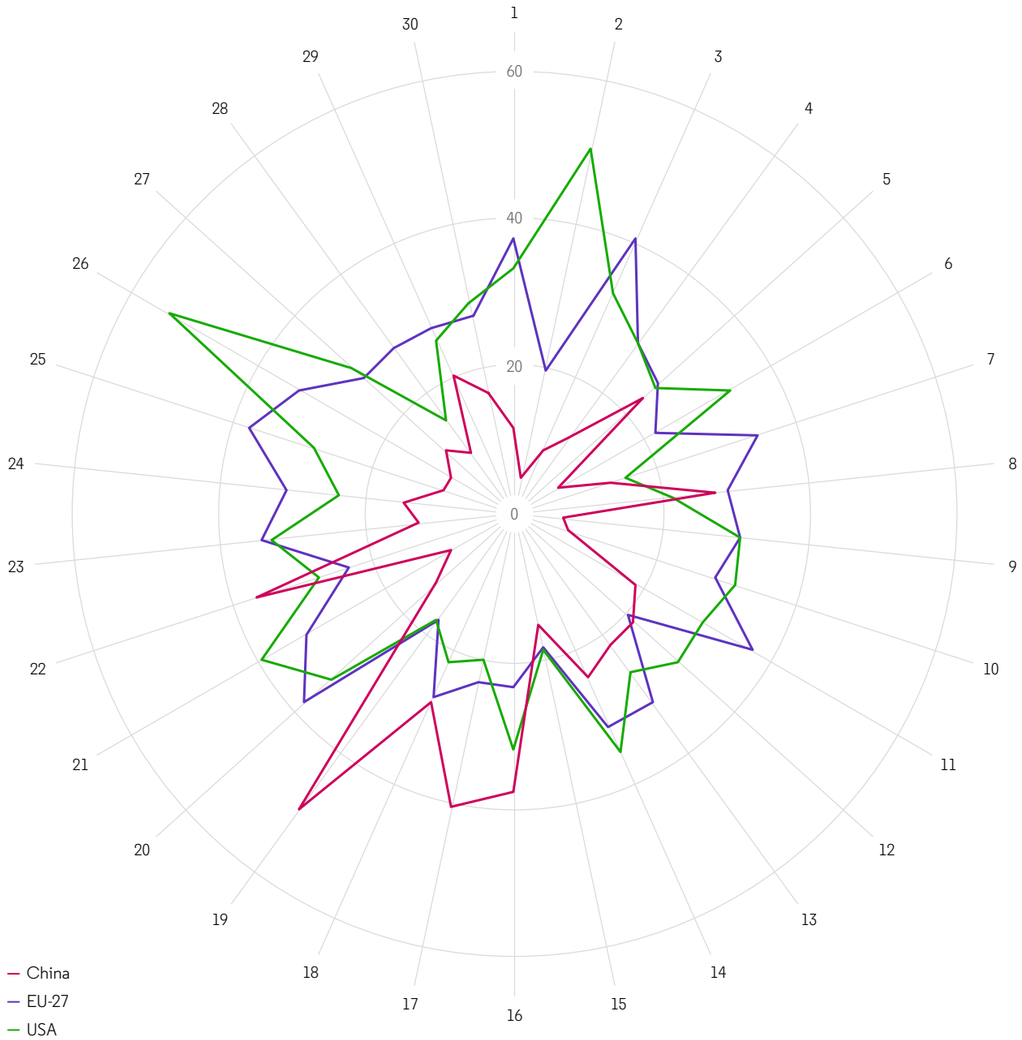


Figure 3. Research Footprint of the three largest research blocs in the G20, showing their contribution to the total research publications in the 30 topic areas described in Figure 1. Topics are arranged in the same hierarchical sequence as presented in Figure 1 (clockwise).



1. Cancer and oncology
2. Telemedicine
3. Surgery
4. Safety and protective equipment
5. Mental health
6. Education
7. Air quality
8. Modeling
9. Crisis management and economics
10. Social distancing
11. Immunity
12. Vaccines
13. Drug trials
14. Biological catalysts
15. Drug development
16. Meta analysis and reviews
17. Admission statistics
18. Testing and diagnostics
19. Tomography and imaging
20. Lung conditions
21. Kidney transplantation
22. Liver transplantation
23. Cardiovascular
24. Diabetes
25. Neurology
26. Strokes
27. Food security
28. Denistry
29. Pediatric medicine
30. Maternal and neonatal

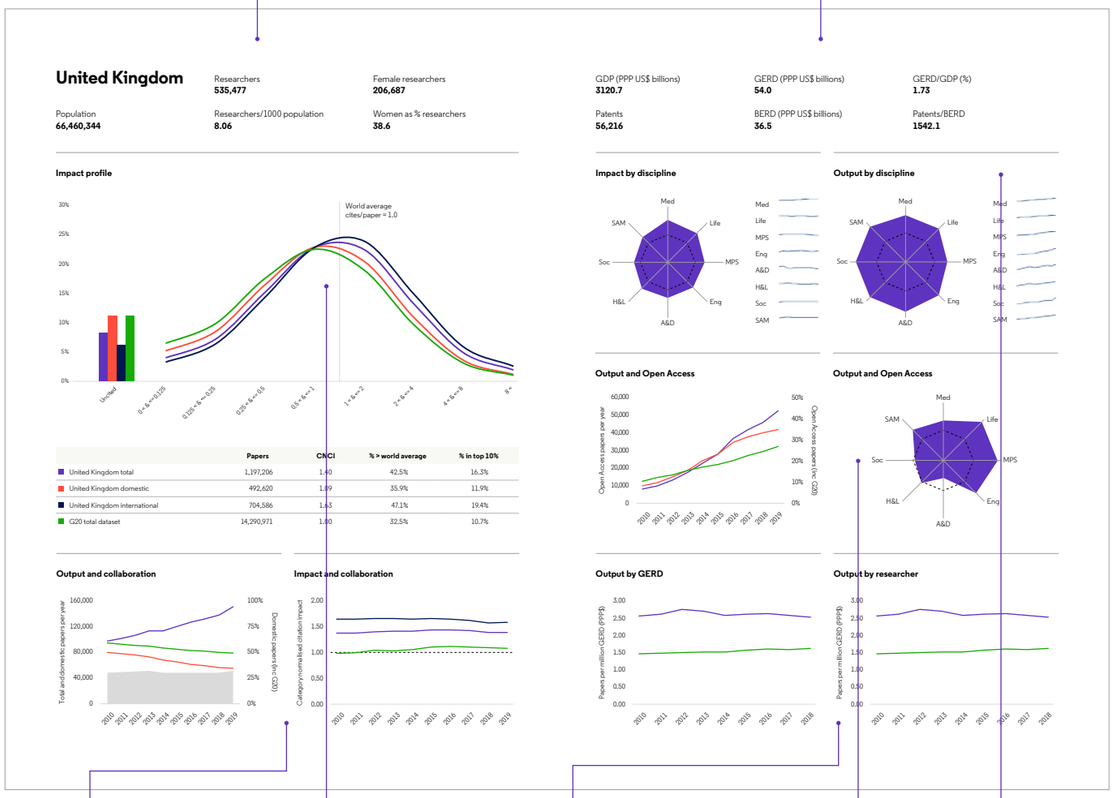
Understanding the G20 scorecards

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 2017, population and female researcher data are from 2017 to provide a meaningful comparison. OECD only includes data for OECD members and Argentina, 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 2010 to 2018, 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 2018 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 (2010 to 2019). Data are from the Science Citation Index Expand™, 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 (2010 to 2019)

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.

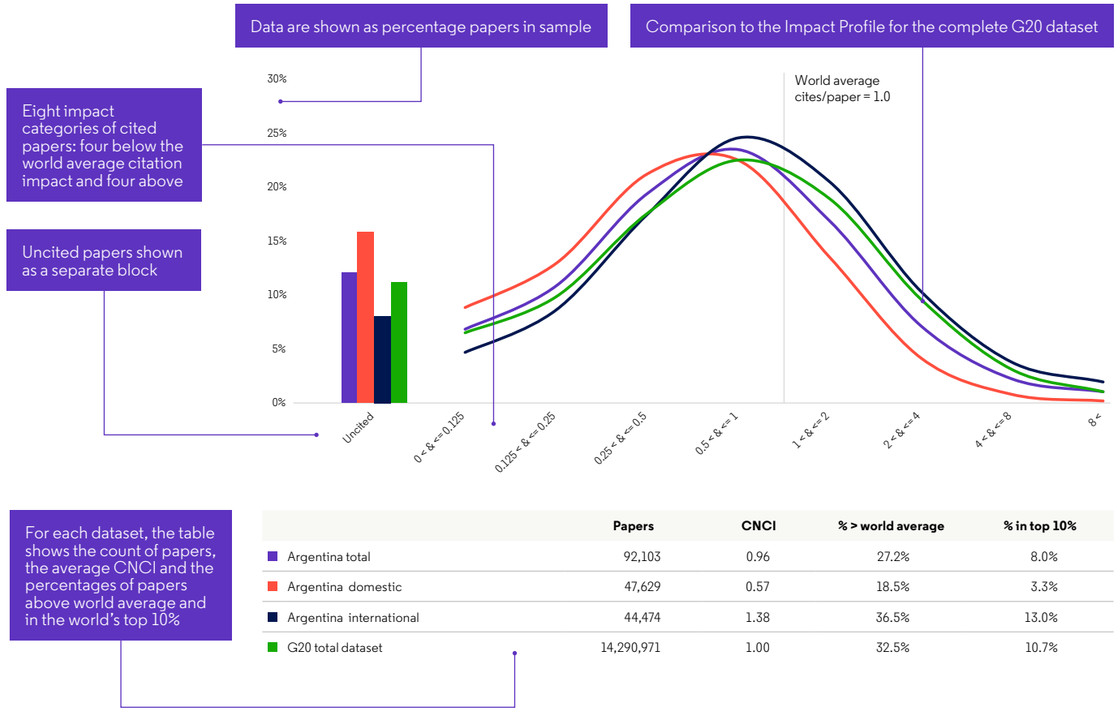
Citation analysis

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



	Papers	CNCI	% > world average	% in top 10%
Argentina total	92,103	0.96	27.2%	8.0%
Argentina domestic	47,629	0.57	18.5%	3.3%
Argentina international	44,474	1.38	36.5%	13.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

International collaboration

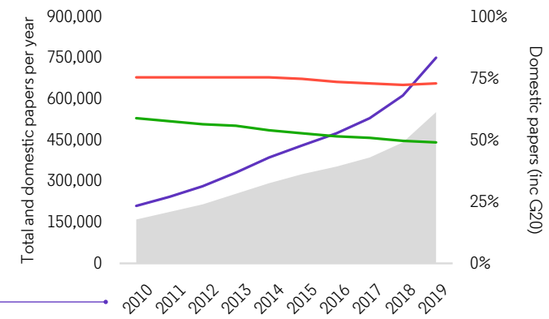
International collaboration in research has been growing and most of the world's most highly-cited research now has authors from two or more countries. As a result, the specifically domestic part of each country's research base has been shrinking and is contributing less to overall national impact (Adams, 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 ten years

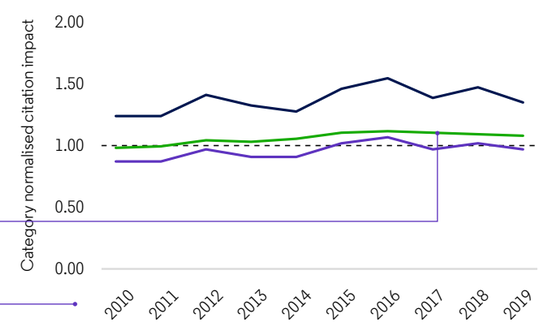


Impact and collaboration

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

Average citation impact is shown relative to world average

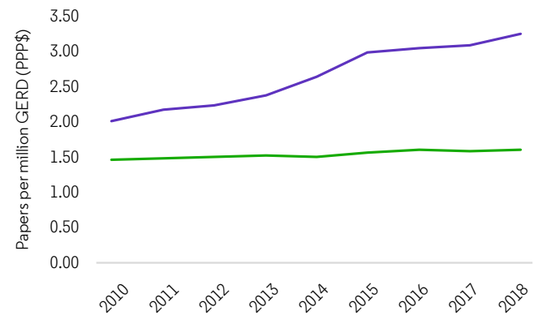
Output trend is tracked over the last ten years



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



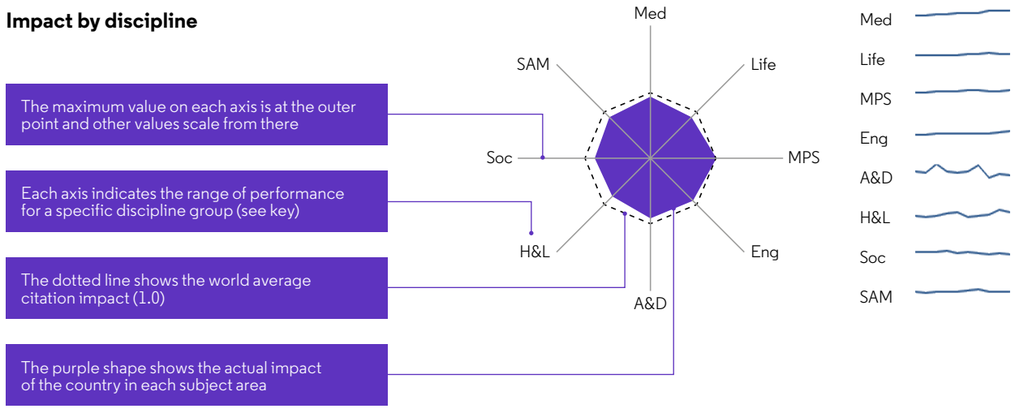
Research Footprints

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.

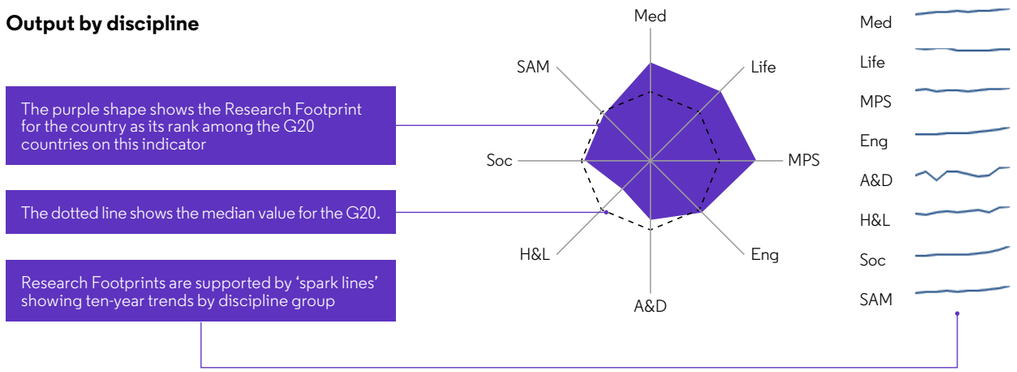
The Research Footprints for publication output and for citation impact use eight major discipline groups (see key) within which there are broadly similar publication and citation patterns.

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

Impact by discipline



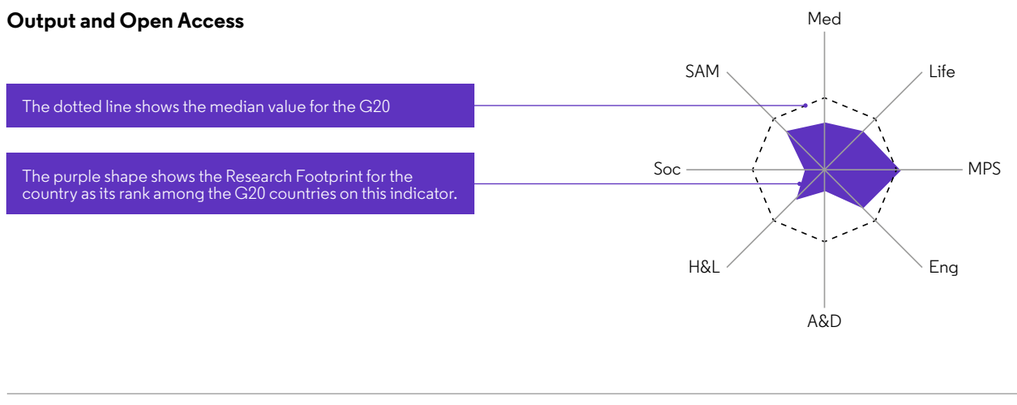
Output by discipline



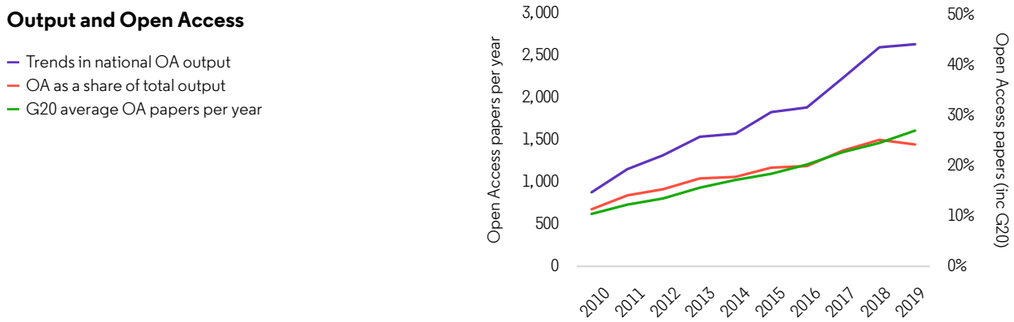
'Open Access' (OA) research publication

'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 2: 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



Output and Open Access



Argentina

Researchers
84,284

Female researchers
45,311

Population
44,044,811

Researchers/1000 population
1.91

Women as % researchers
53.8

GDP (PPP US$ billions)
1037.8

GERD (PPP US$ billions)
5.8

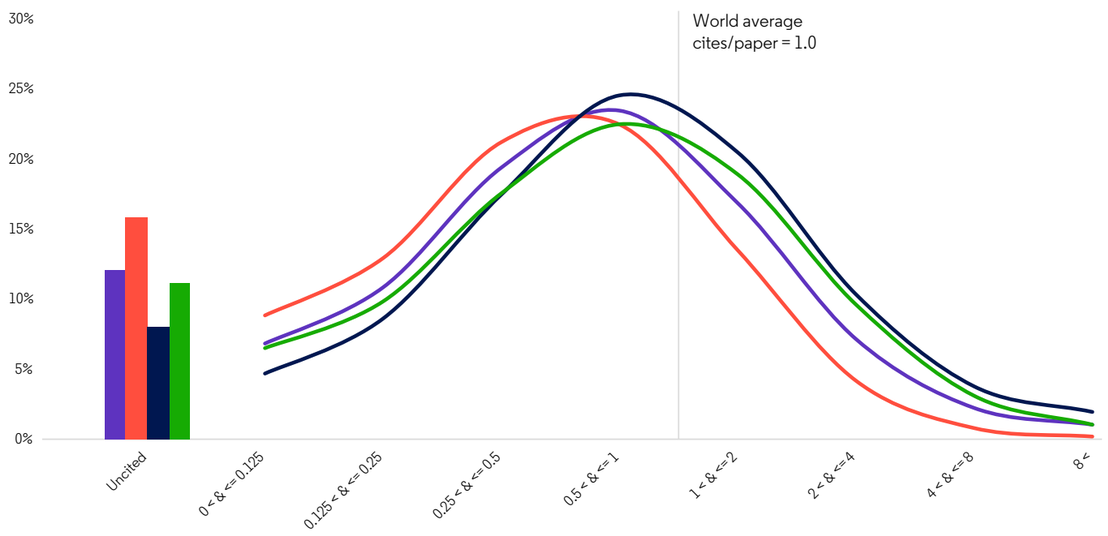
GERD/GDP (%)
0.56

Patents
755

BERD (PPP US$ billions)
1.6

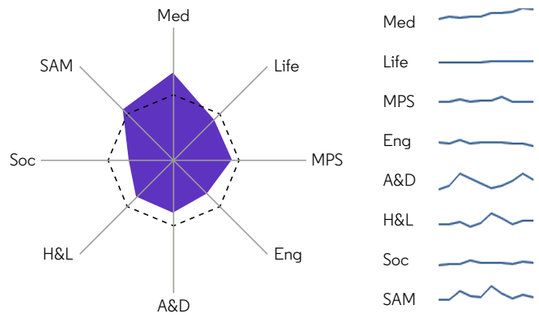
Patents/BERD
482.4

Impact profile

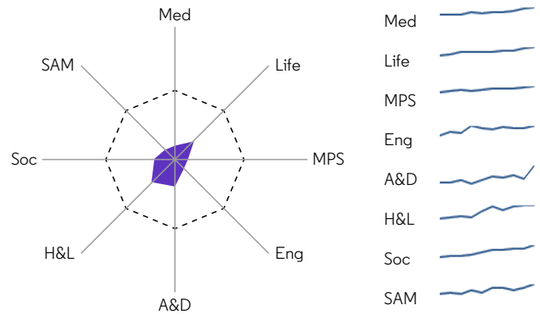


	Papers	CNCI	% > world average	% in top 10%
Argentina total	92,103	0.96	27.2%	8.0%
Argentina domestic	47,629	0.57	18.5%	3.3%
Argentina international	44,474	1.38	36.5%	13.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

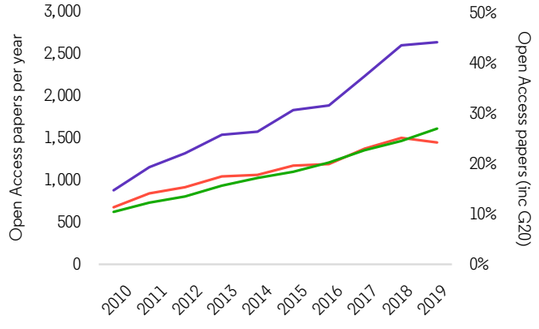
Impact by discipline



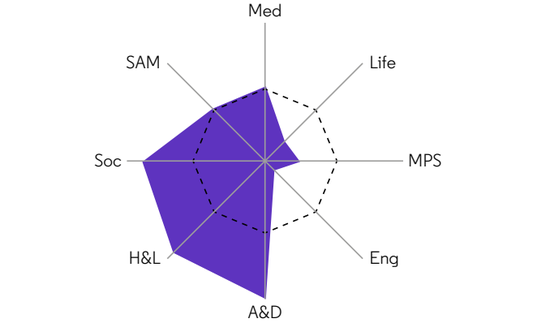
Output by discipline



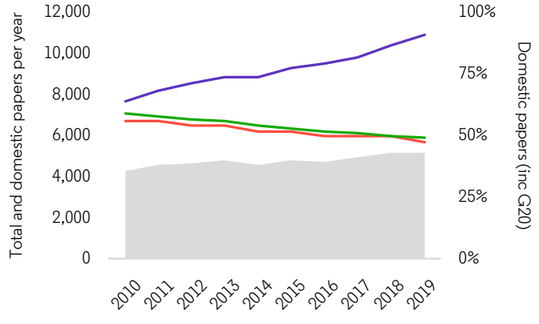
Output and Open Access



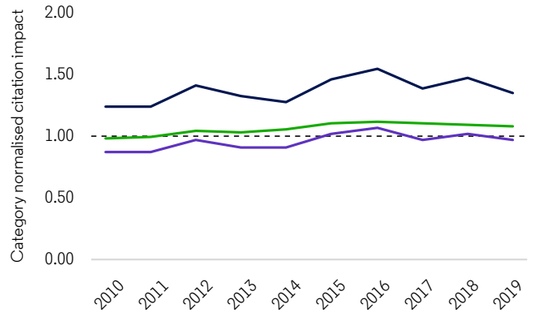
Output and Open Access



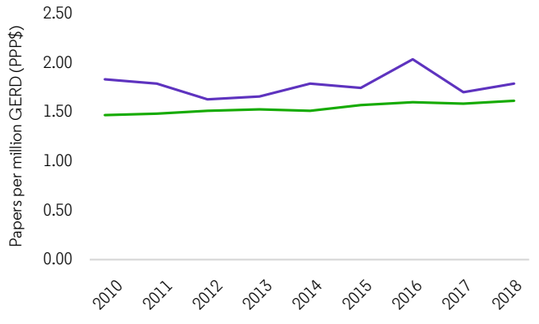
Output and collaboration



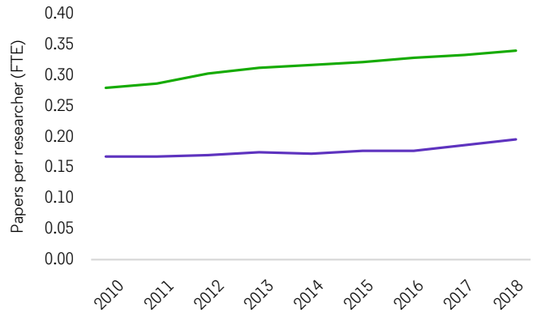
Impact and collaboration



Output by GERD



Output by researcher



Australia

Researchers
–

Female researchers
–

Population
25,364,307

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1203.2

GERD (PPP US$ billions)
22.6

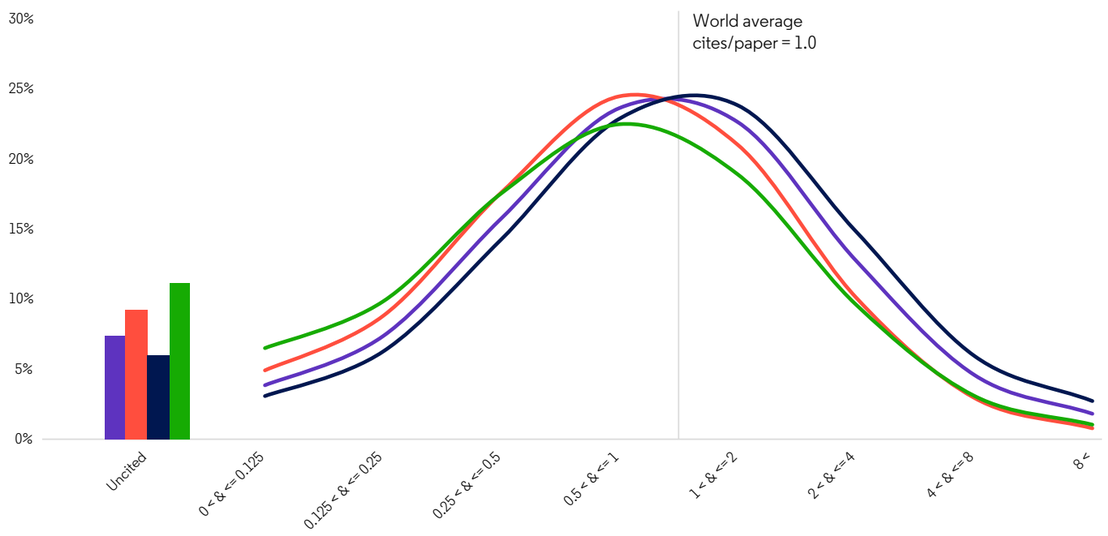
GERD/GDP (%)
1.87

Patents
12,261

BERD (PPP US$ billions)
11.9

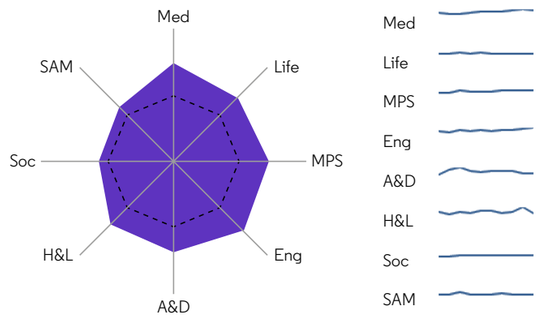
Patents/BERD
1030.7

Impact profile

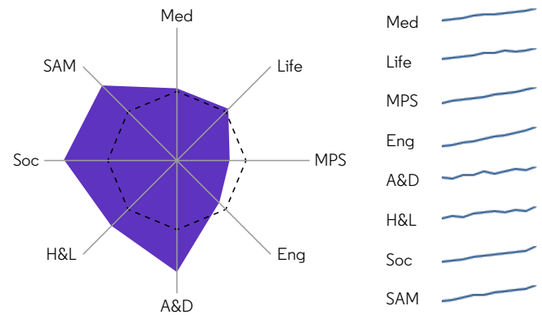


	Papers	CNCI	% > world average	% in top 10%
Australia total	607,984	1.37	41.9%	15.5%
Australia domestic	269,429	1.01	34.9%	10.6%
Australia international	338,555	1.67	47.4%	19.5%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

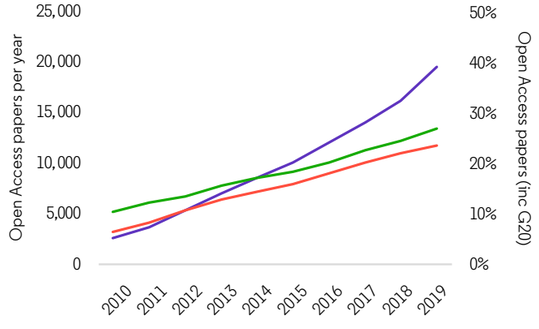
Impact by discipline



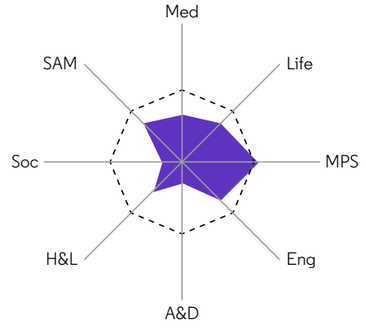
Output by discipline



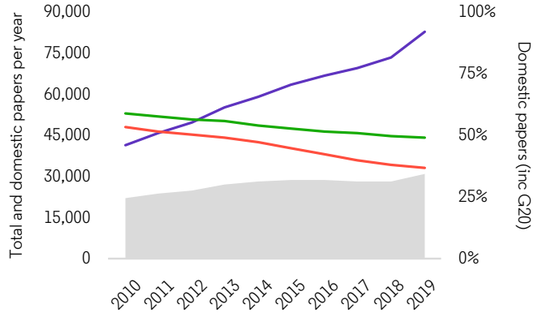
Output and Open Access



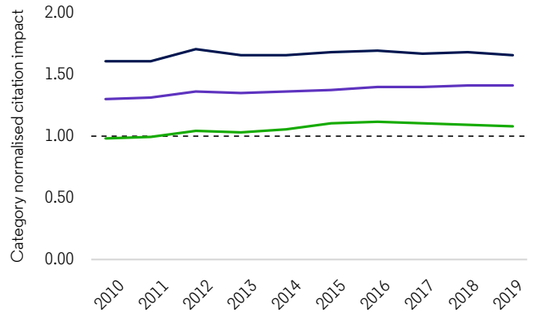
Output and Open Access



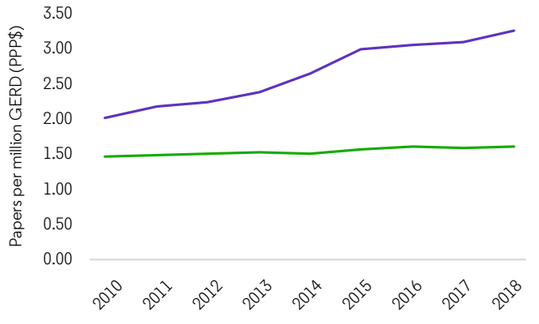
Output and collaboration



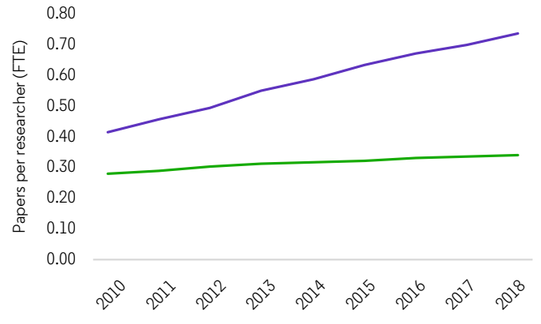
Impact and collaboration



Output by GERD



Output by researcher



Brazil

Researchers
–

Female researchers
–

GDP (PPP US$ billions)
3220.4

GERD (PPP US$ billions)
–

GERD/GDP (%)
–

Population
211,049,527

Researchers/1000 population
–

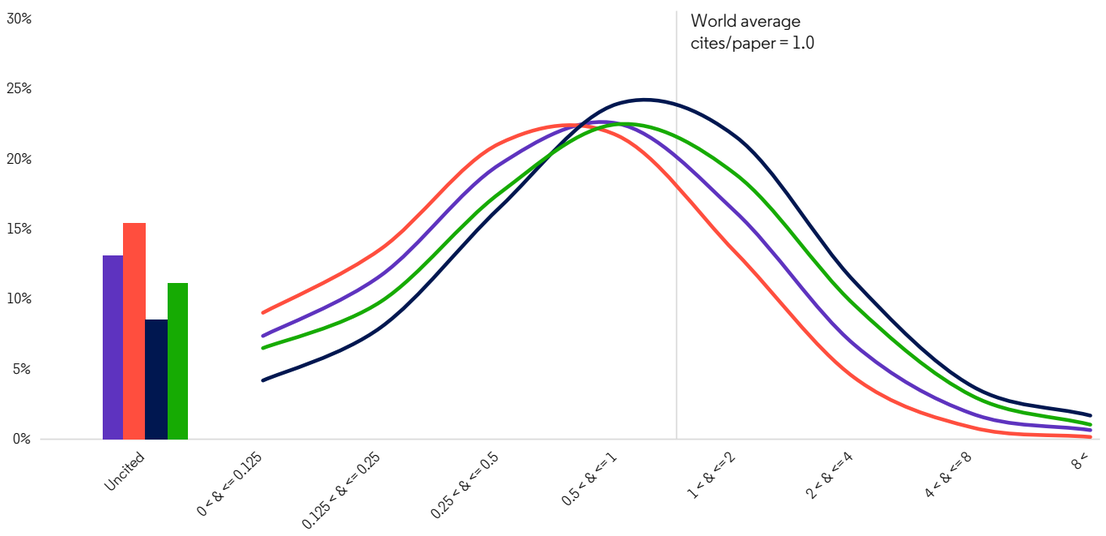
Women as % researchers
–

Patents
6,859

BERD (PPP US$ billions)
–

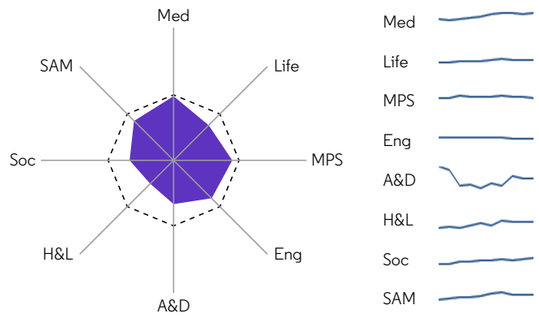
Patents/BERD
–

Impact profile

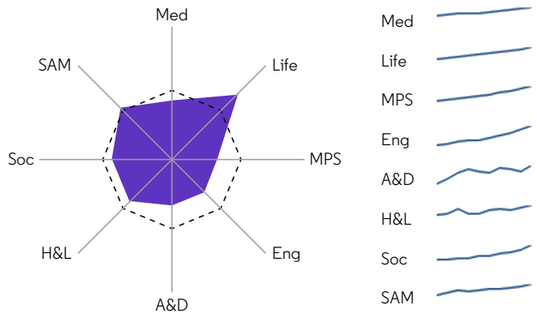


	Papers	CNCI	% > world average	% in top 10%
Brazil total	442,657	0.83	25.5%	7.1%
Brazil domestic	290,868	0.58	18.7%	3.7%
Brazil international	151,789	1.31	38.5%	13.5%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

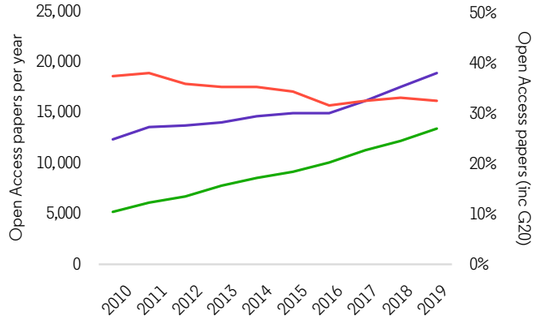
Impact by discipline



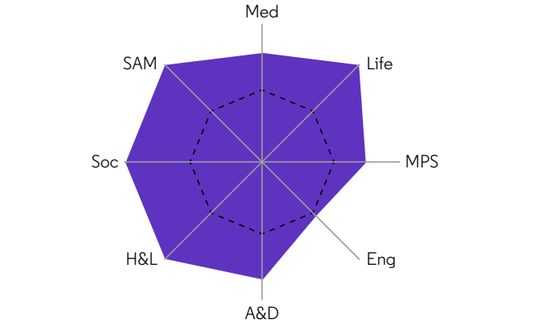
Output by discipline



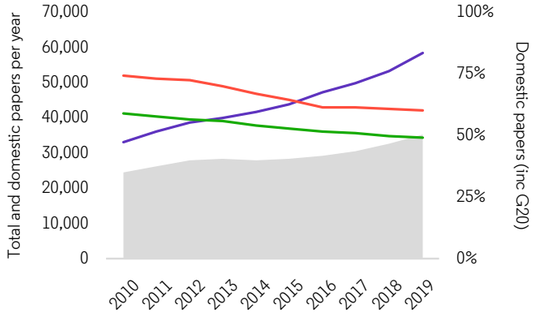
Output and Open Access



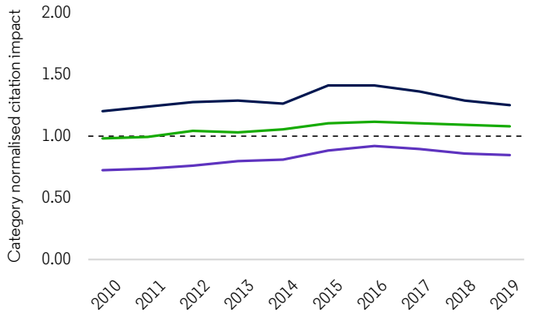
Output and Open Access



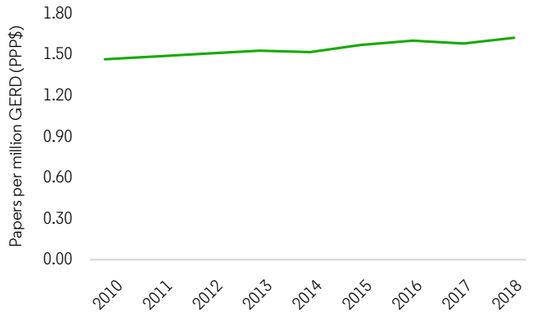
Output and collaboration



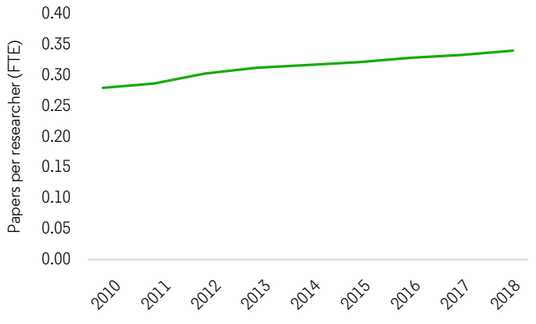
Impact and collaboration



Output by GERD



Output by researcher



Canada

Researchers
–

Female researchers
–

Population
37,589,262

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1855.8

GERD (PPP US$ billions)
29.0

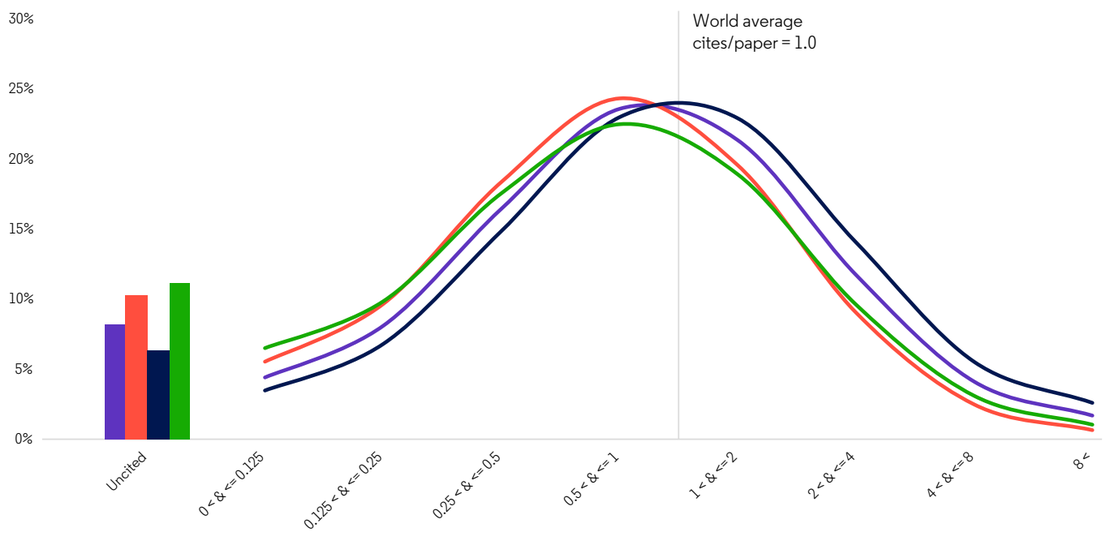
GERD/GDP (%)
1.56

Patents
24,483

BERD (PPP US$ billions)
14.8

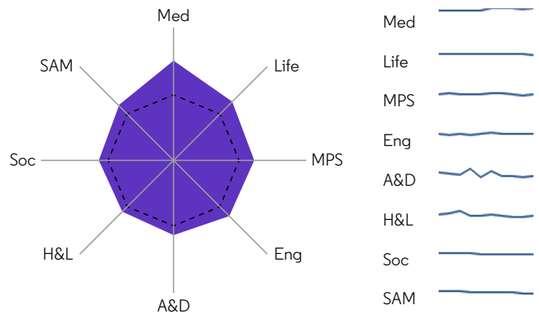
Patents/BERD
1658.3

Impact profile

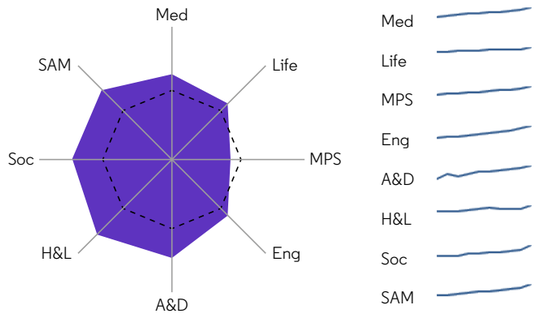


	Papers	CNCI	% > world average	% in top 10%
Canada total	688,067	1.30	39.1%	14.3%
Canada domestic	317,201	0.93	31.8%	9.4%
Canada international	370,866	1.63	45.3%	18.6%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

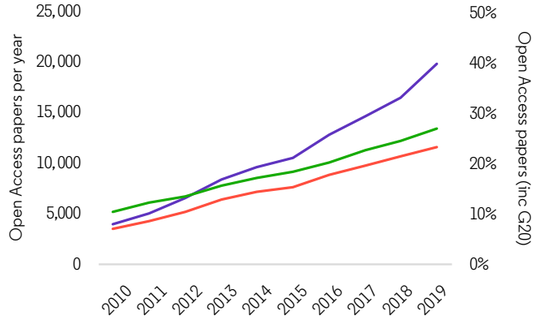
Impact by discipline



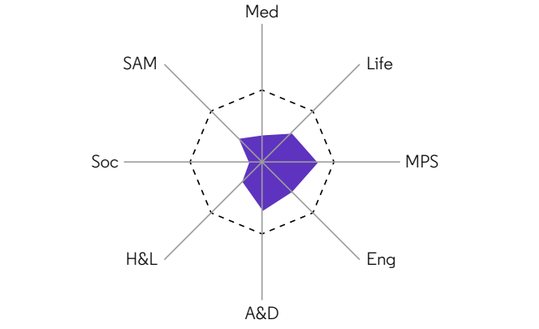
Output by discipline



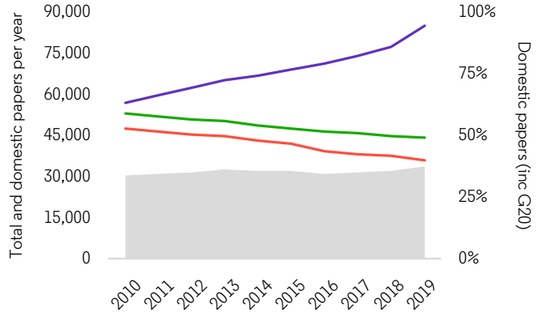
Output and Open Access



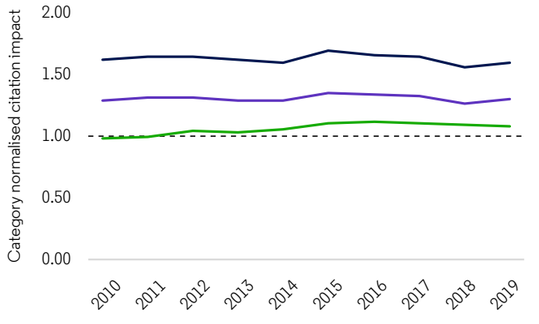
Output and Open Access



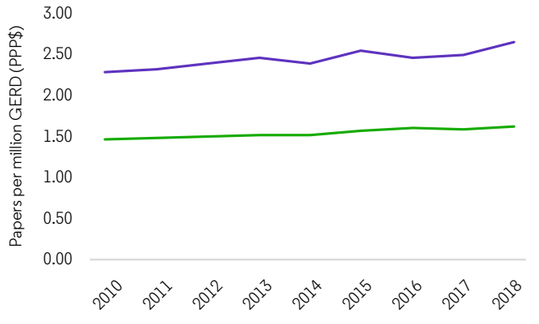
Output and collaboration



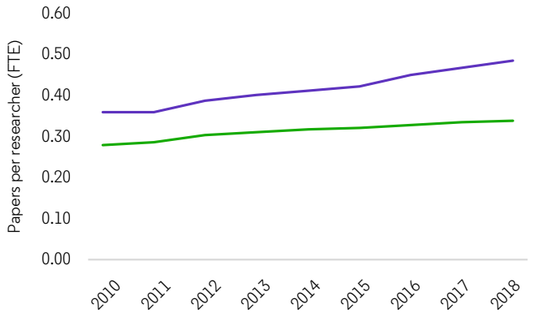
Impact and collaboration



Output by GERD



Output by researcher



China

Researchers
2,069,650

Female researchers
–

Population
1,350,695,000

Researchers/1000 population
1.53

Women as % researchers
–

GDP (PPP US$ billions)
21730.7

GERD (PPP US$ billions)
468.1

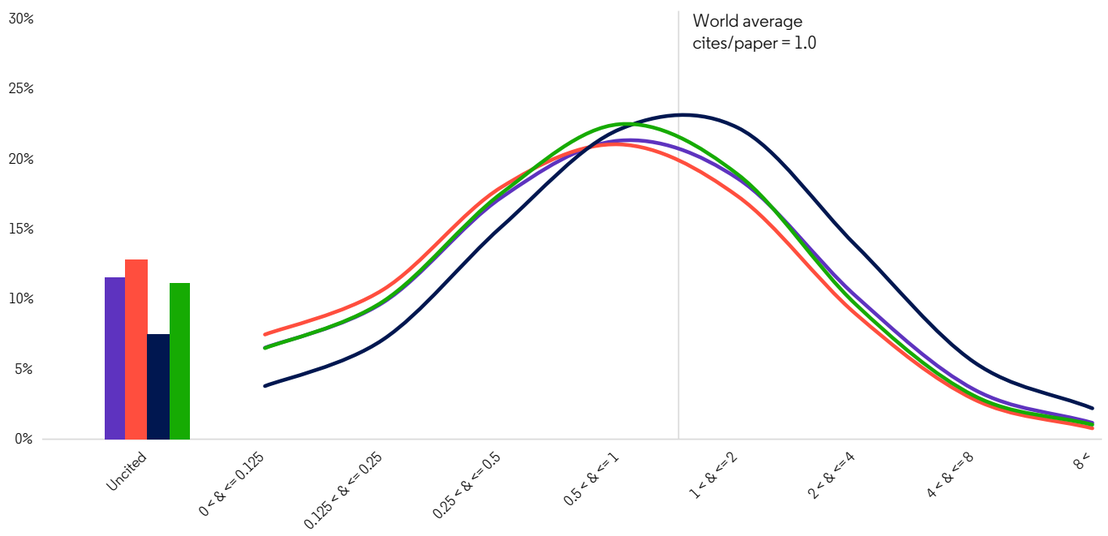
GERD/GDP (%)
2.15

Patents
1,460,244

BERD (PPP US$ billions)
362.4

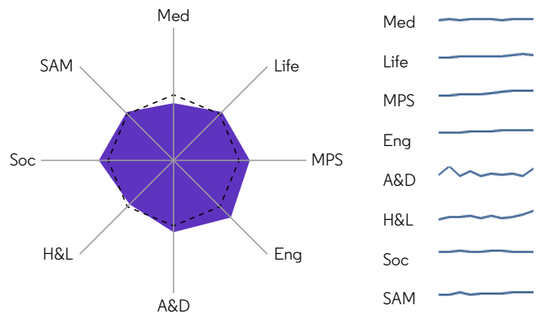
Patents/BERD
4029.9

Impact profile

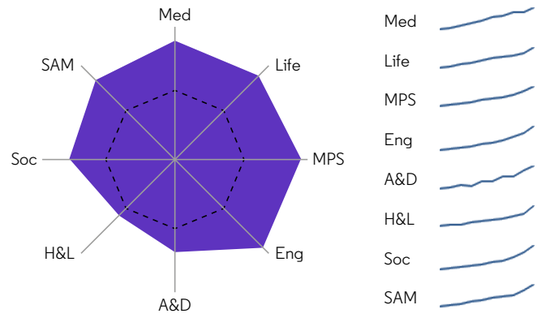


	Papers	CNCI	% > world average	% in top 10%
China total	2,840,988	1.03	33.5%	11.8%
China domestic	2,103,701	0.89	29.8%	9.7%
China international	737,287	1.44	44.0%	17.7%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

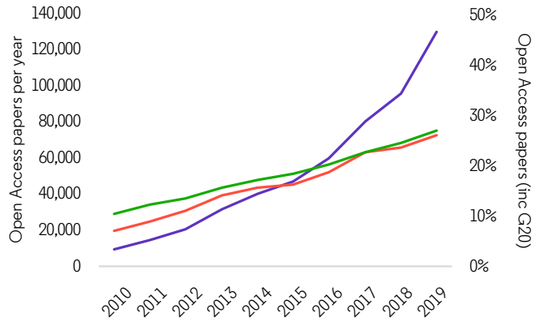
Impact by discipline



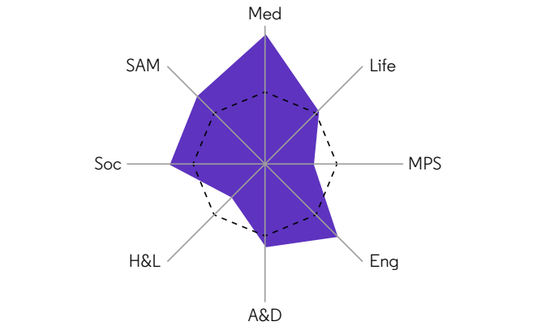
Output by discipline



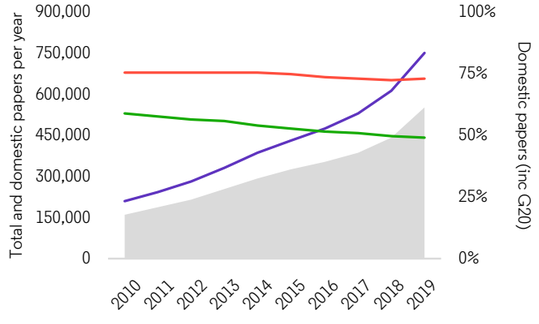
Output and Open Access



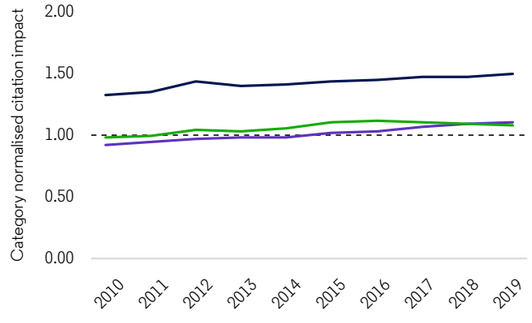
Output and Open Access



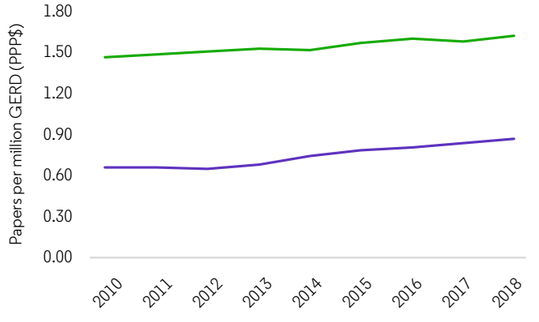
Output and collaboration



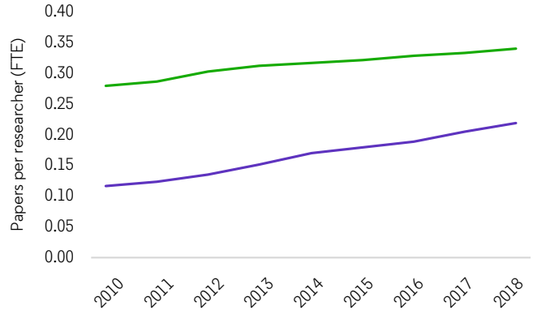
Impact and collaboration



Output by GERD



Output by researcher



France

Researchers
416,217

Female researchers
117,754

Population
66,864,379

Researchers/1000 population
6.22

Women as % researchers
28.3

GDP (PPP US$ billions)
3121.0

GERD (PPP US$ billions)
68.4

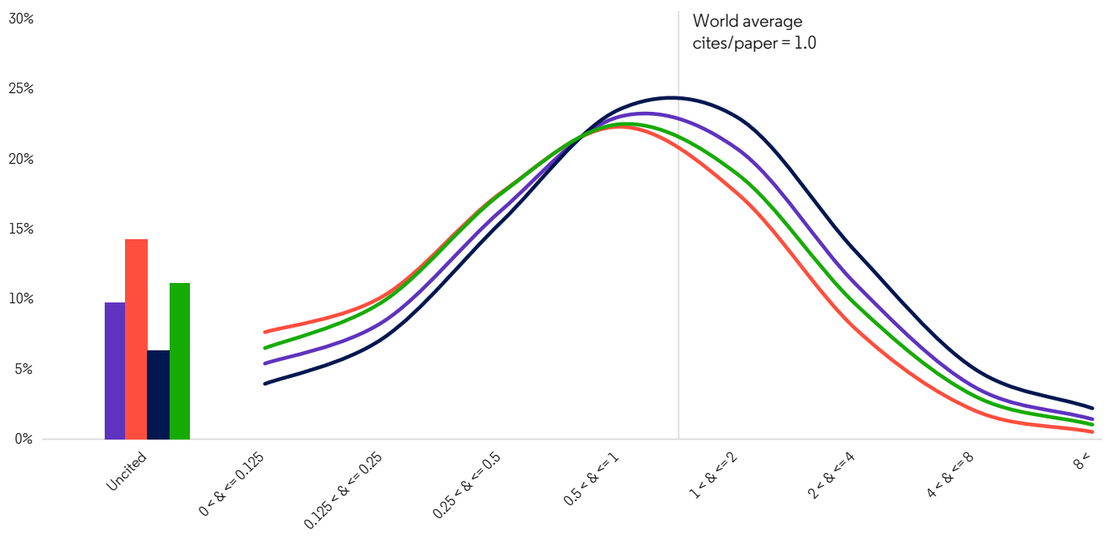
GERD/GDP (%)
2.19

Patents
69,120

BERD (PPP US$ billions)
44.8

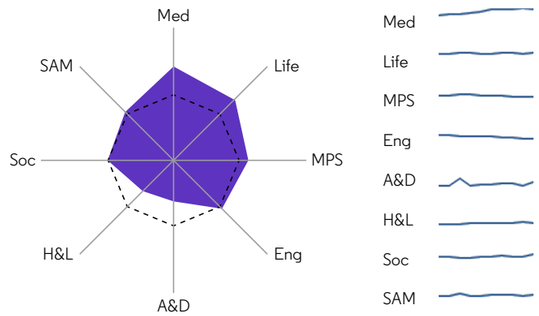
Patents/BERD
1544.1

Impact profile

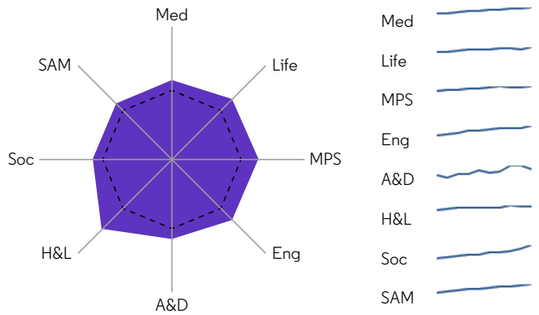


	Papers	CNCI	% > world average	% in top 10%
France total	749,810	1.21	37.0%	13.3%
France domestic	309,014	0.81	27.9%	8.0%
France international	440,796	1.50	43.5%	17.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

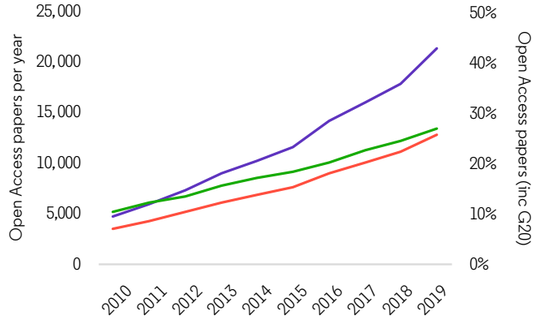
Impact by discipline



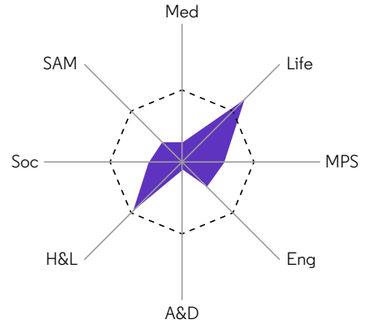
Output by discipline



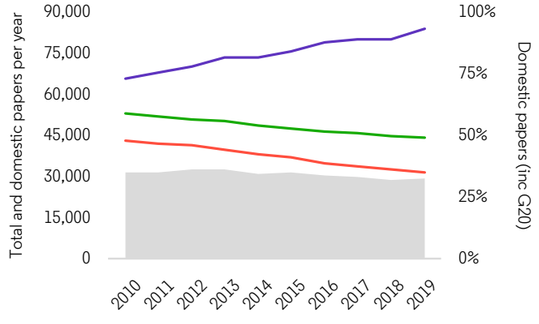
Output and Open Access



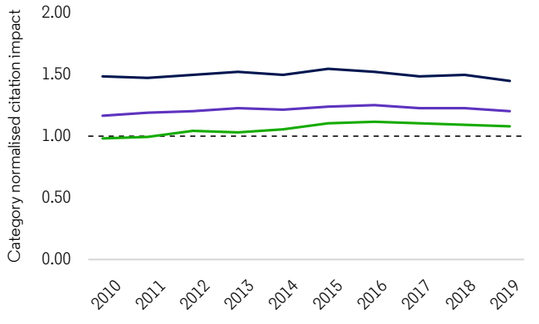
Output and Open Access



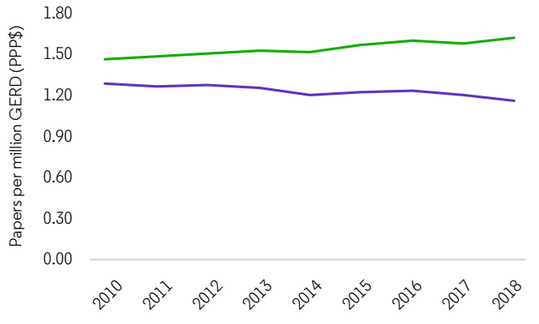
Output and collaboration



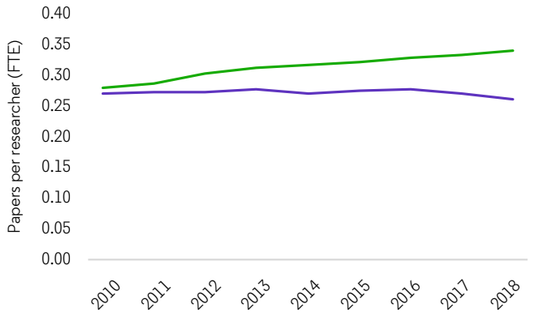
Impact and collaboration



Output by GERD



Output by researcher



Germany

Researchers
623,125

Female researchers
173,700

Population
82,657,002

Researchers/1000 population
7.54

Women as % researchers
27.9

GDP (PPP US$ billions)
4514.8

GERD (PPP US$ billions)
141.3

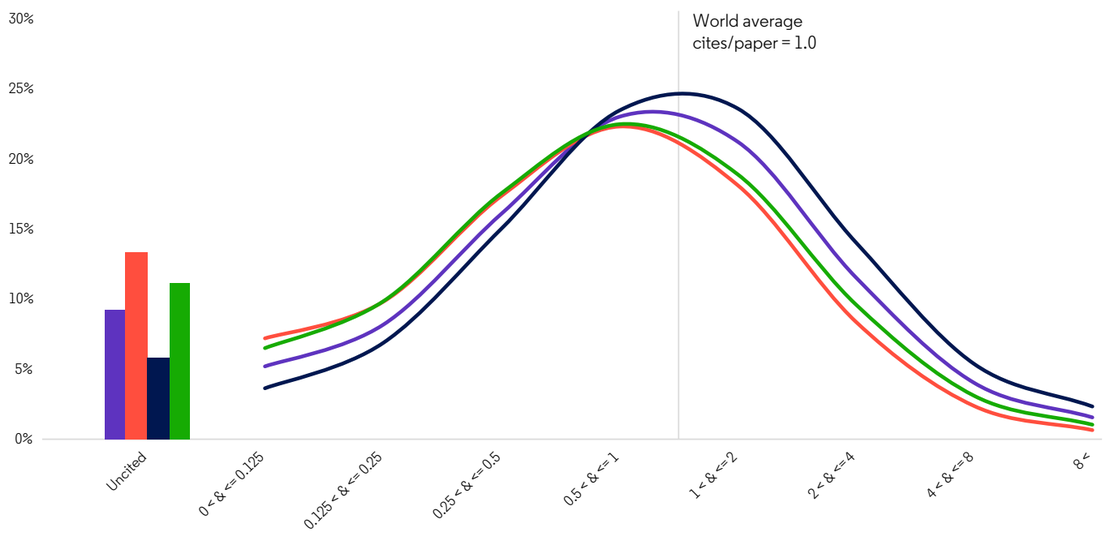
GERD/GDP (%)
3.13

Patents
180,086

BERD (PPP US$ billions)
97.3

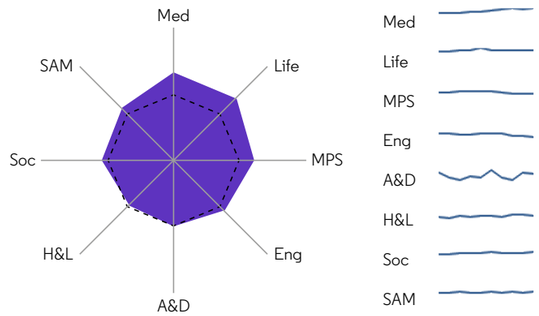
Patents/BERD
1850.2

Impact profile

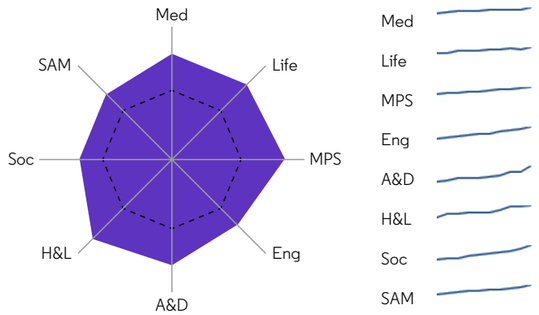


	Papers	CNCI	% > world average	% in top 10%
Germany total	1,090,333	1.24	38.3%	14.0%
Germany domestic	482,146	0.88	29.6%	8.8%
Germany international	608,187	1.53	45.3%	18.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

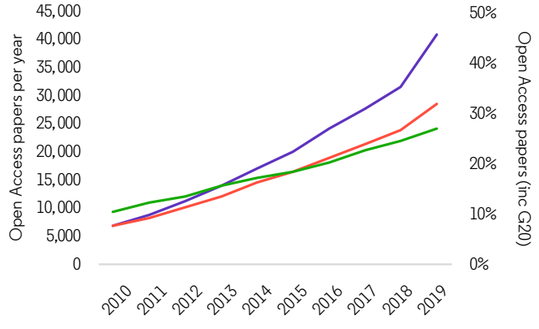
Impact by discipline



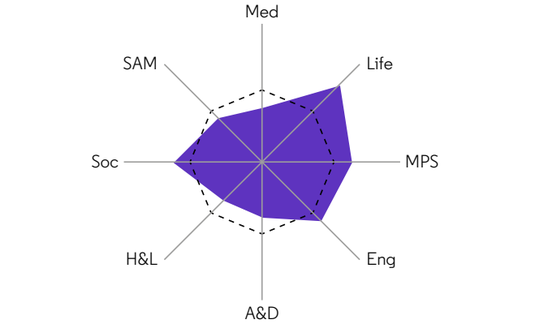
Output by discipline



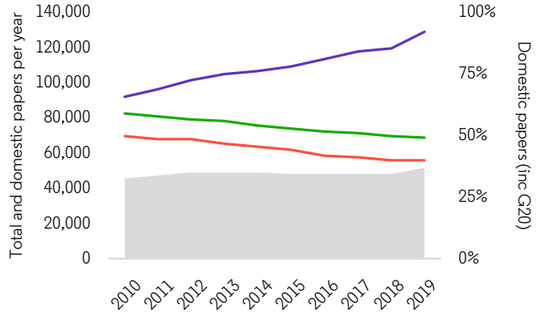
Output and Open Access



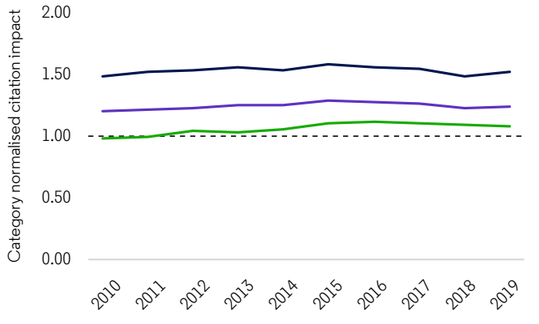
Output and Open Access



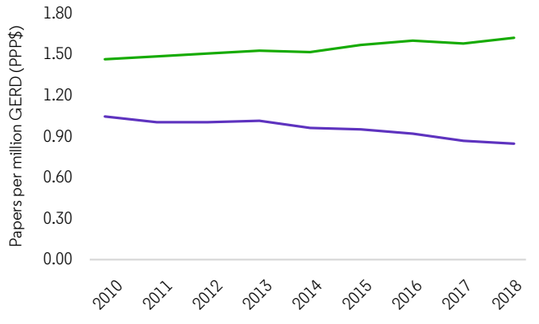
Output and collaboration



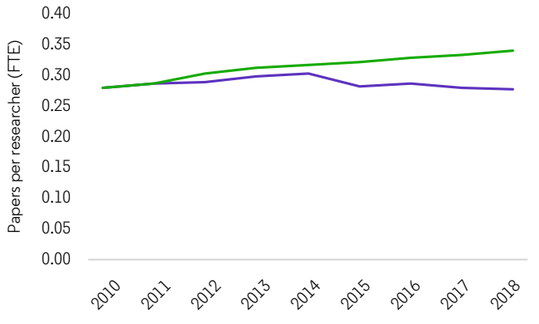
Impact and collaboration



Output by GERD



Output by researcher



India

Researchers
–

Female researchers
–

Population
1,366,417,754

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
9611.7

GERD (PPP US$ billions)
–

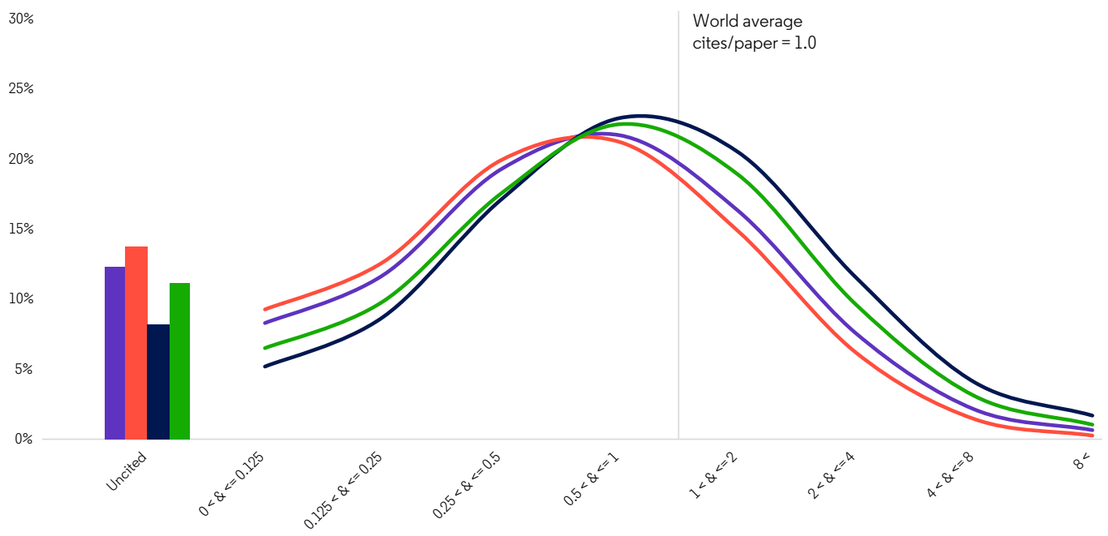
GERD/GDP (%)
–

Patents
30,036

BERD (PPP US$ billions)
–

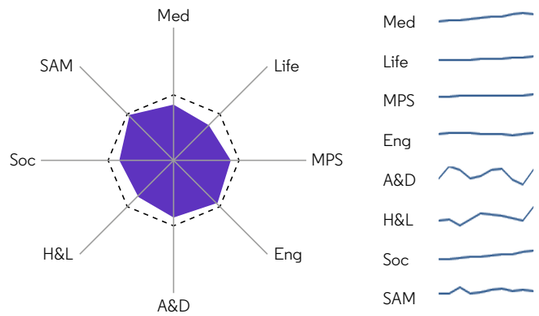
Patents/BERD
–

Impact profile

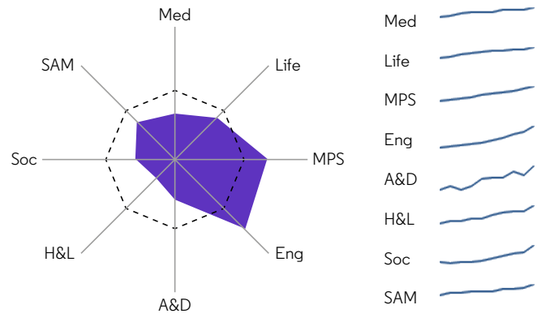


	Papers	CNCI	% > world average	% in top 10%
India total	615,780	0.83	26.6%	7.9%
India domestic	462,231	0.67	22.8%	5.9%
India international	153,549	1.29	37.8%	14.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

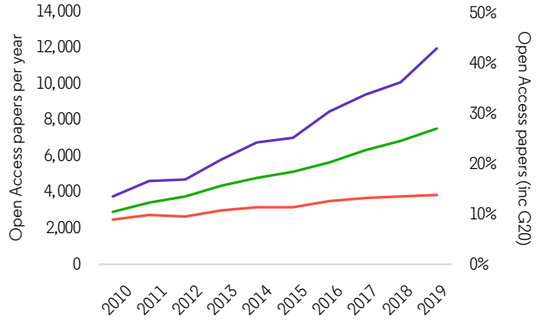
Impact by discipline



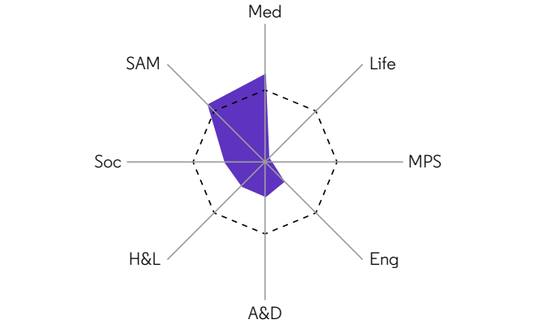
Output by discipline



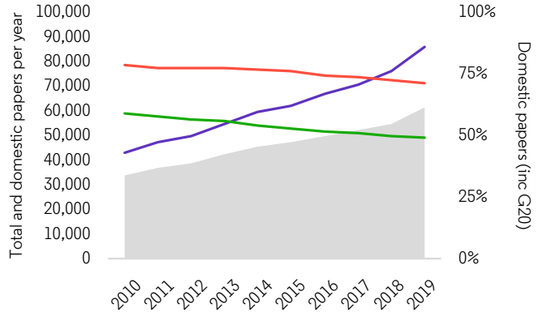
Output and Open Access



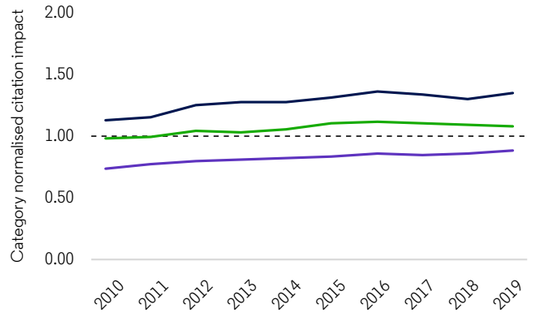
Output and Open Access



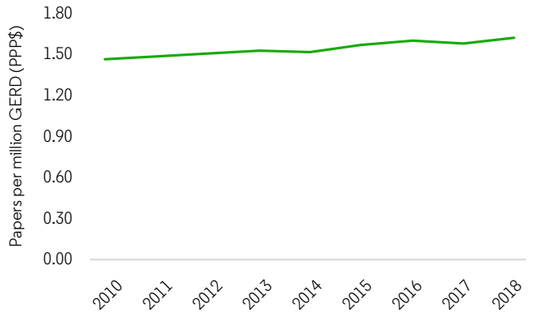
Output and collaboration



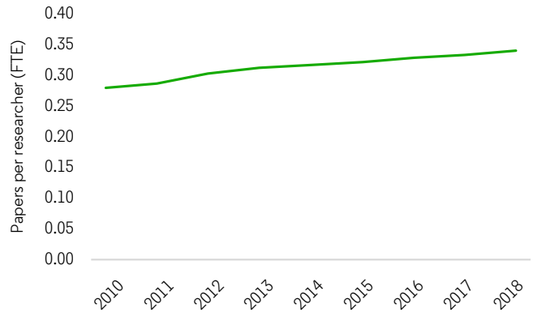
Impact and collaboration



Output by GERD



Output by researcher



Indonesia

Researchers
–

Female researchers
–

GDP (PPP US$ billions)
3329.2

GERD (PPP US$ billions)
–

GERD/GDP (%)
–

Population
270,625,568

Researchers/1000 population
–

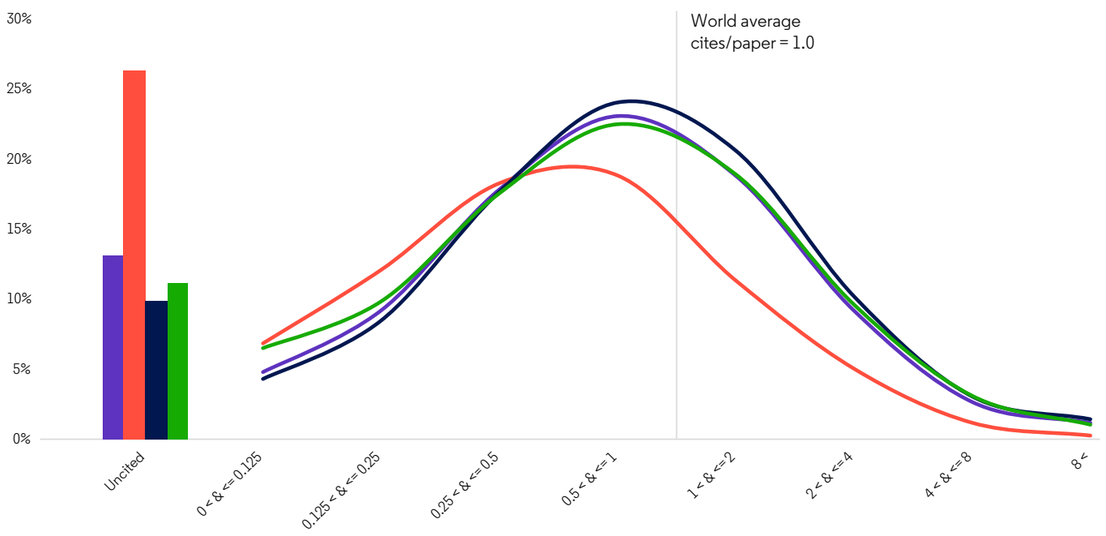
Women as % researchers
–

Patents
1,451

BERD (PPP US$ billions)
–

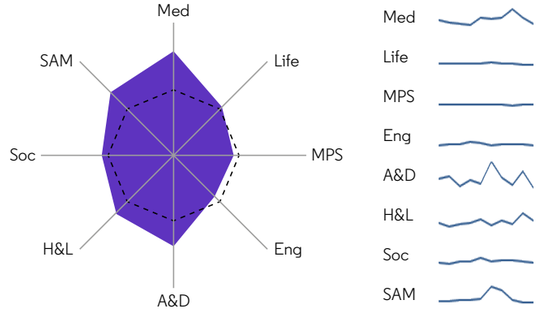
Patents/BERD
–

Impact profile

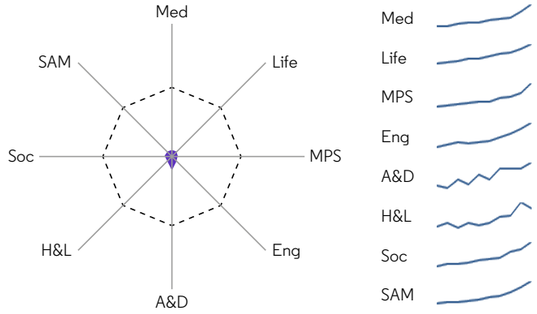


	Papers	CNCI	% > world average	% in top 10%
Indonesia total	22,475	1.13	31.9%	9.9%
Indonesia domestic	4,455	0.54	17.6%	4.1%
Indonesia international	18,020	1.28	35.4%	11.3%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

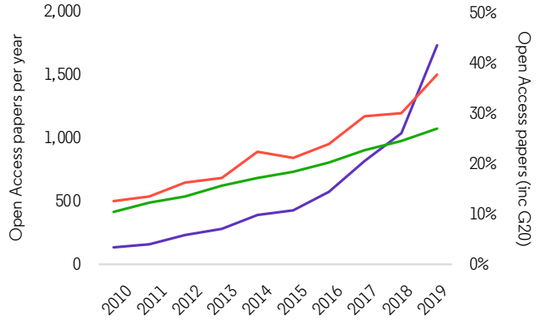
Impact by discipline



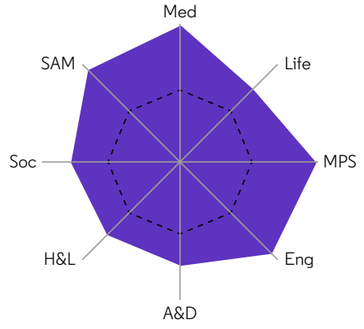
Output by discipline



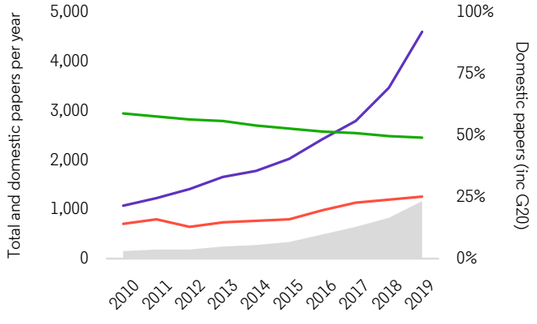
Output and Open Access



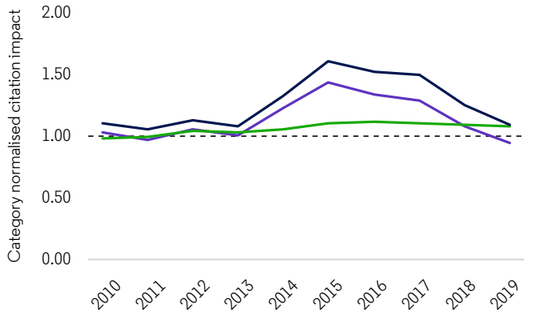
Output and Open Access



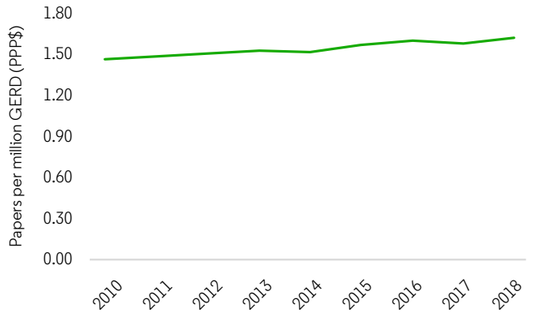
Output and collaboration



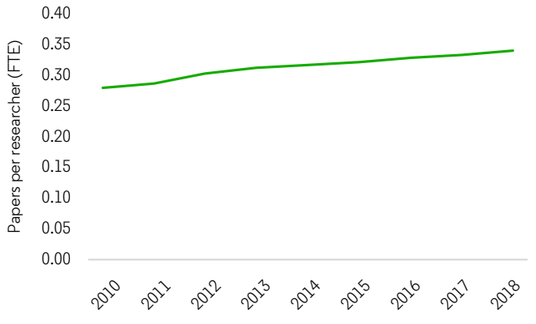
Impact and collaboration



Output by GERD



Output by researcher



Italy

Researchers
212,671

Female researchers
72,177

Population
60,421,760

Researchers/1000 population
3.52

Women as % researchers
33.9

GDP (PPP US$ billions)
2587.0

GERD (PPP US$ billions)
36.9

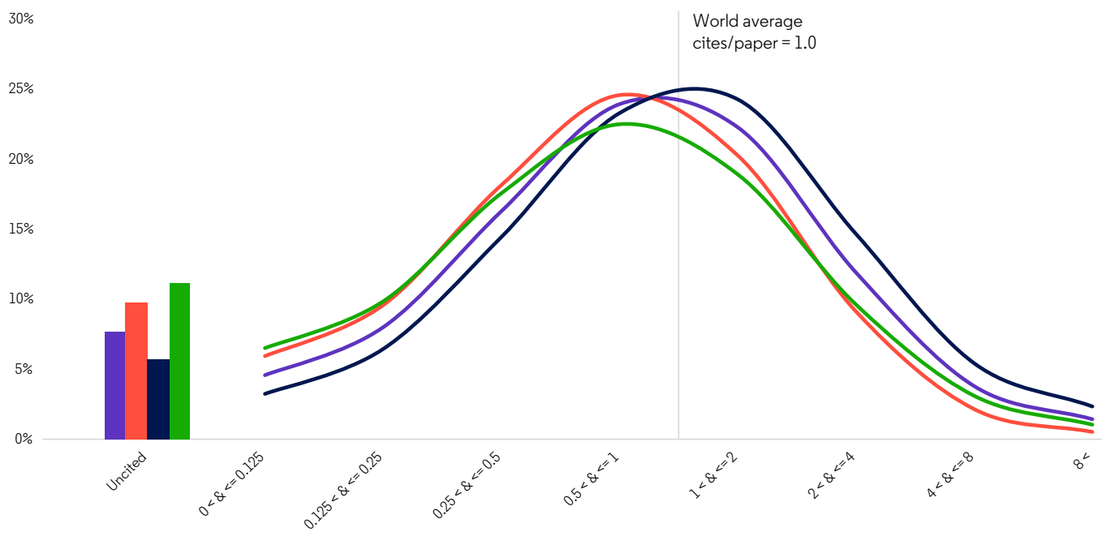
GERD/GDP (%)
1.43

Patents
32,286

BERD (PPP US$ billions)
23.3

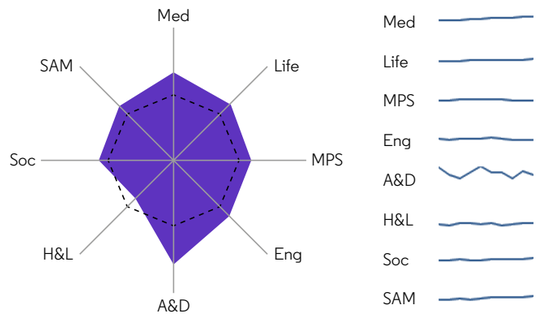
Patents/BERD
1383.3

Impact profile

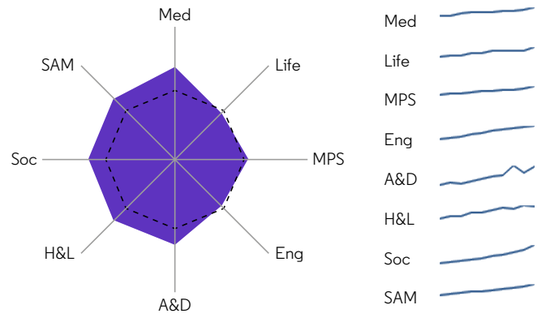


	Papers	CNCI	% > world average	% in top 10%
Italy total	671,859	1.24	39.5%	13.8%
Italy domestic	333,472	0.89	32.0%	8.8%
Italy international	338,387	1.59	46.8%	18.6%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

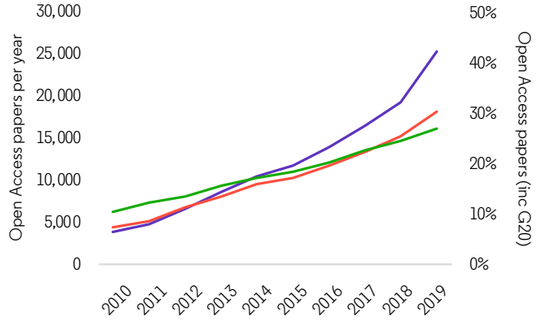
Impact by discipline



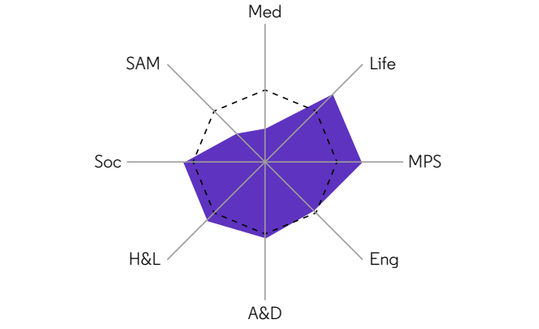
Output by discipline



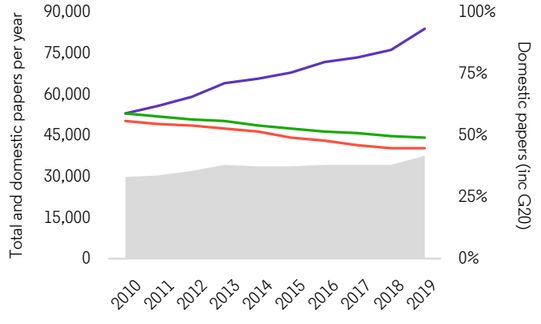
Output and Open Access



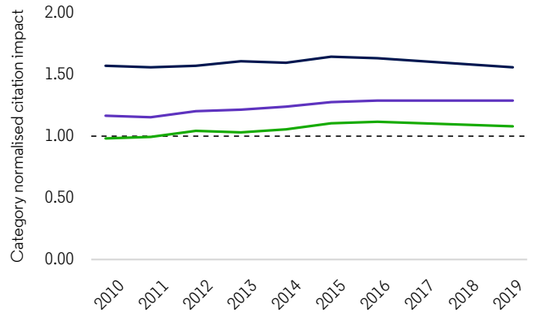
Output and Open Access



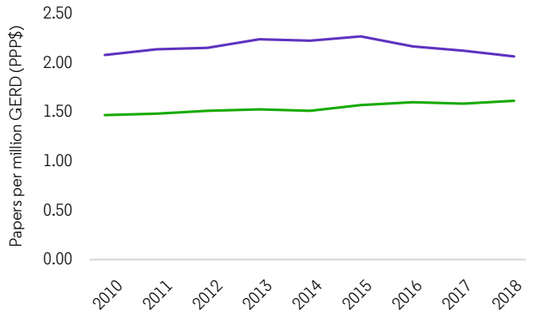
Output and collaboration



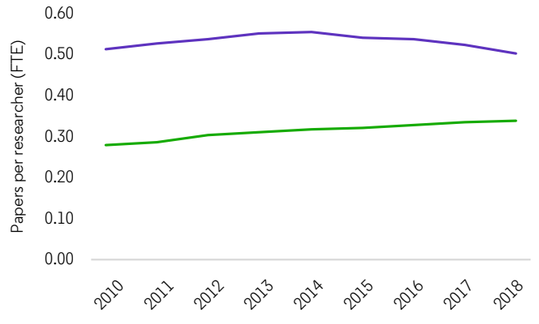
Impact and collaboration



Output by GERD



Output by researcher



Japan

Researchers
935,658

Female researchers
154,964

Population
126,529,100

Researchers/1000 population
7.39

Women as % researchers
16.6

GDP (PPP US$ billions)
5230.1

GERD (PPP US$ billions)
171.3

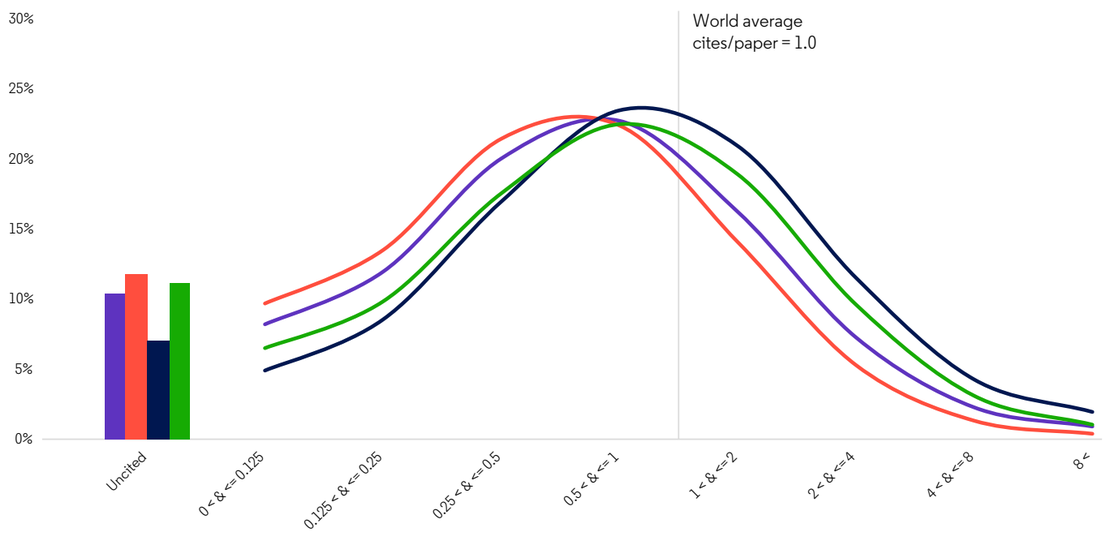
GERD/GDP (%)
3.28

Patents
460,369

BERD (PPP US$ billions)
136.0

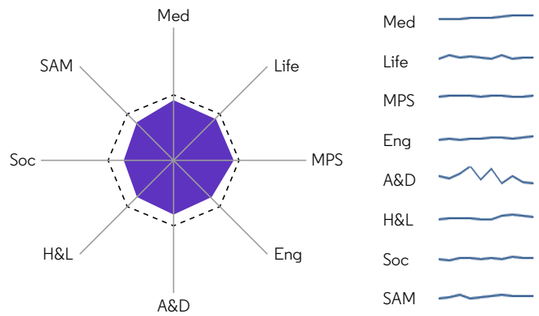
Patents/BERD
3384.0

Impact profile

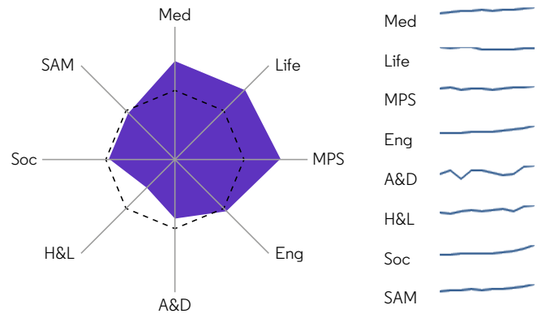


	Papers	CNCI	% > world average	% in top 10%
Japan total	807,221	0.89	26.5%	8.2%
Japan domestic	553,210	0.66	20.9%	5.2%
Japan international	254,011	1.37	38.8%	14.8%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

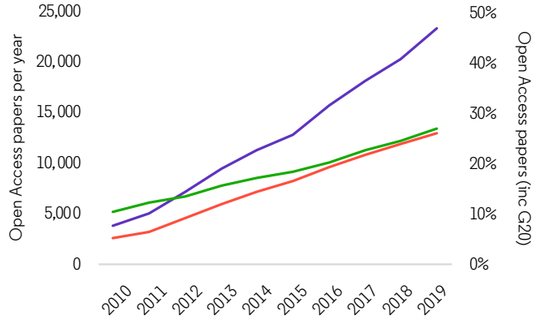
Impact by discipline



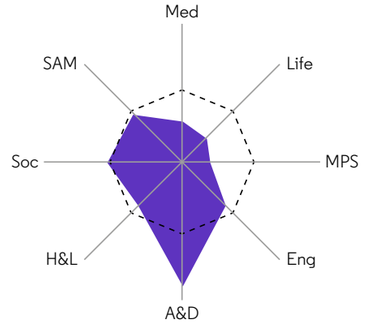
Output by discipline



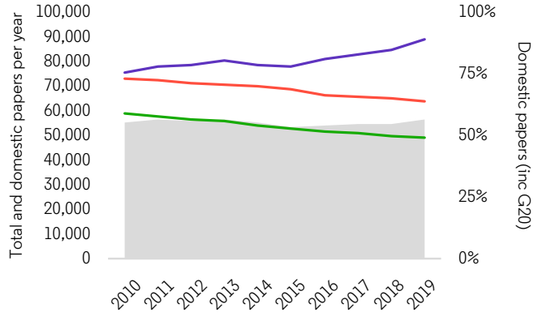
Output and Open Access



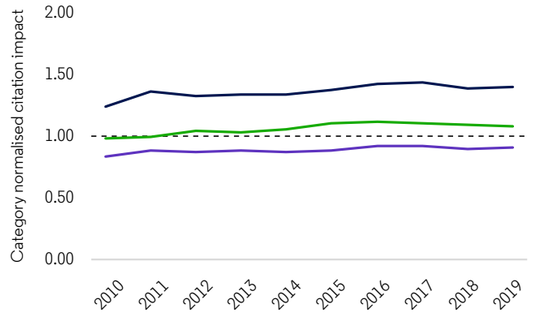
Output and Open Access



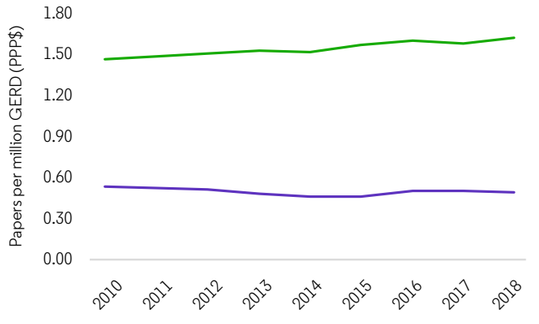
Output and collaboration



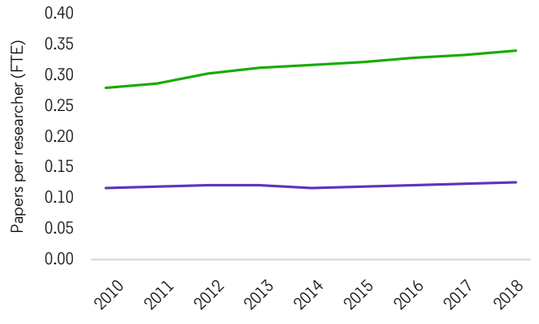
Impact and collaboration



Output by GERD



Output by researcher



Mexico

Researchers
54,354

Female researchers
18,308

GDP (PPP US$ billions)
2573.8

GERD (PPP US$ billions)
8.1

GERD/GDP (%)
0.31

Population
123,333,376

Researchers/1000 population
0.44

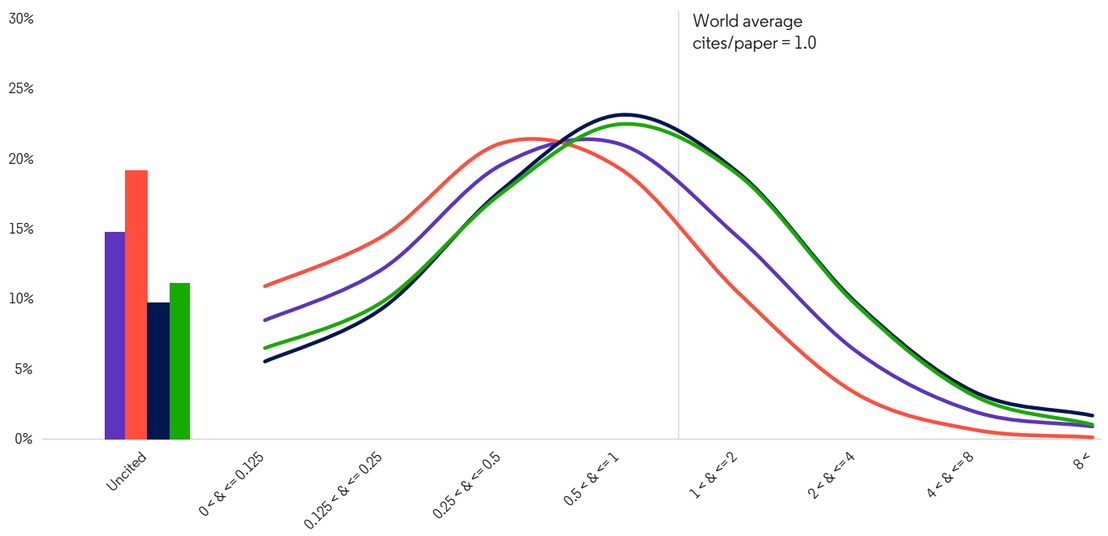
Women as % researchers
33.7

Patents
2,695

BERD (PPP US$ billions)
1.8

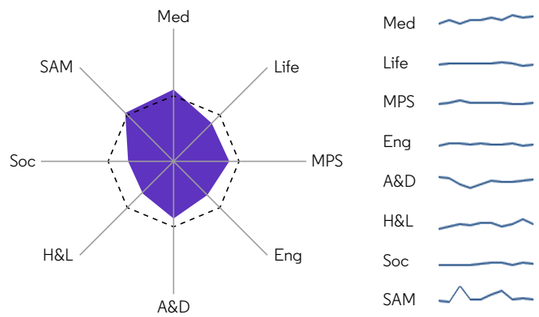
Patents/BERD
1513.4

Impact profile

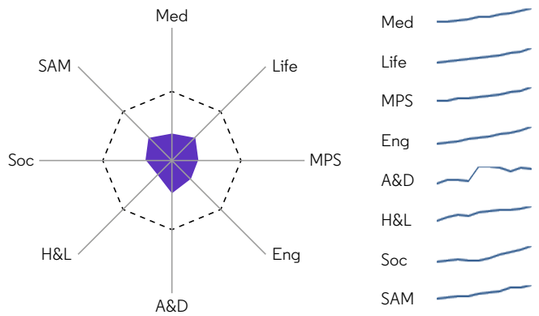


	Papers	CNCI	% > world average	% in top 10%
Mexico total	138,286	0.85	23.5%	7.0%
Mexico domestic	74,733	0.49	14.6%	2.7%
Mexico international	63,553	1.27	34.1%	12.1%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

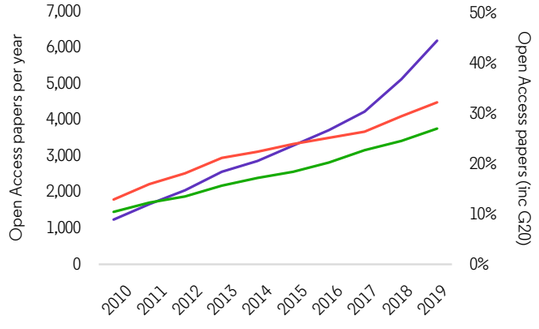
Impact by discipline



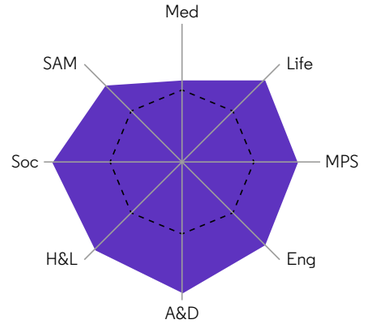
Output by discipline



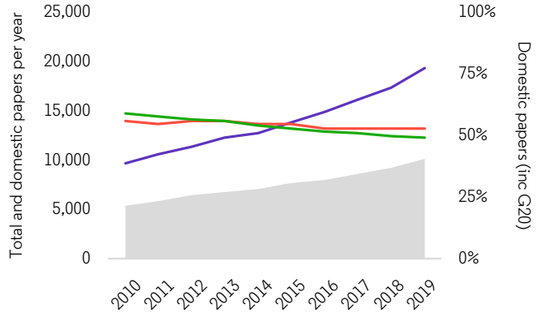
Output and Open Access



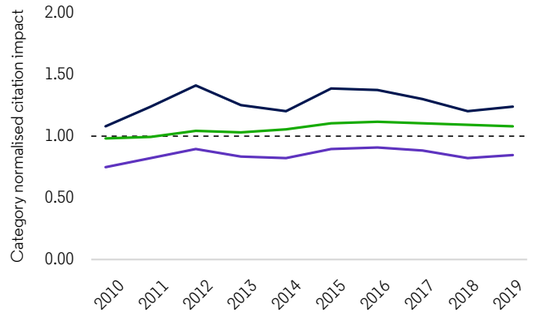
Output and Open Access



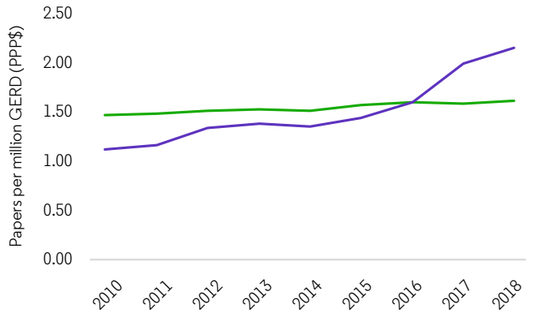
Output and collaboration



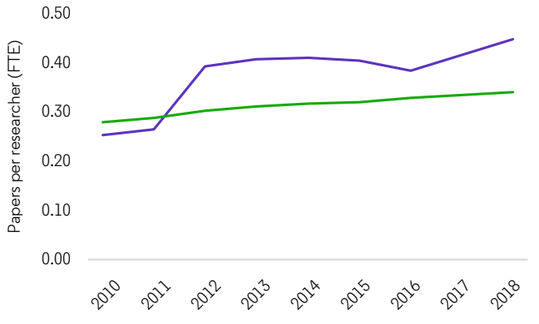
Impact and collaboration



Output by GERD



Output by researcher



Russia

Researchers
347,854

Female researchers
136,431

Population
144,477,860

Researchers/1000 population
2.41

Women as % researchers
39.2

GDP (PPP US$ billions)
4223.4

GERD (PPP US$ billions)
41.5

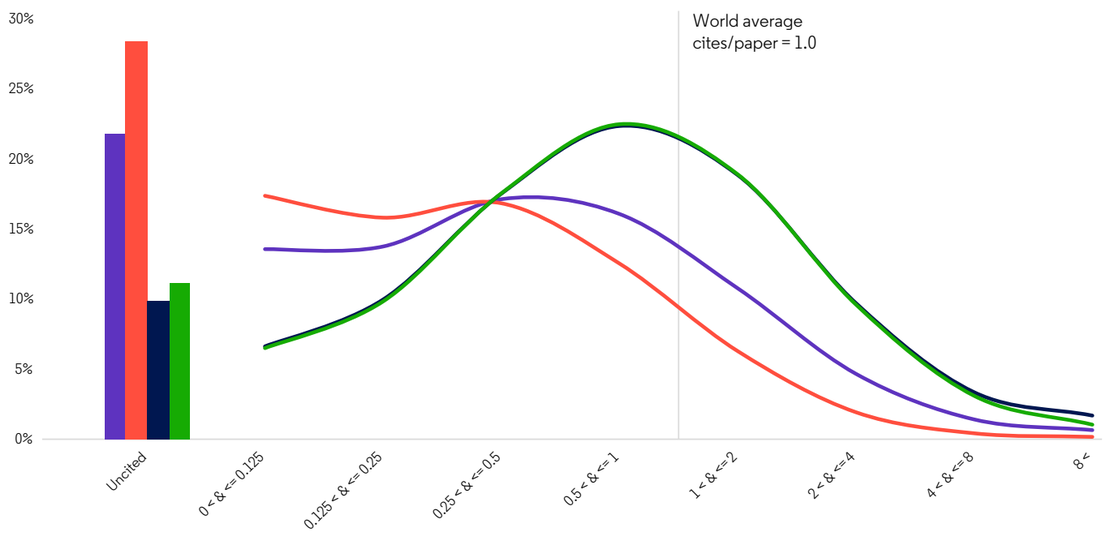
GERD/GDP (%)
0.98

Patents
30,696

BERD (PPP US$ billions)
23.1

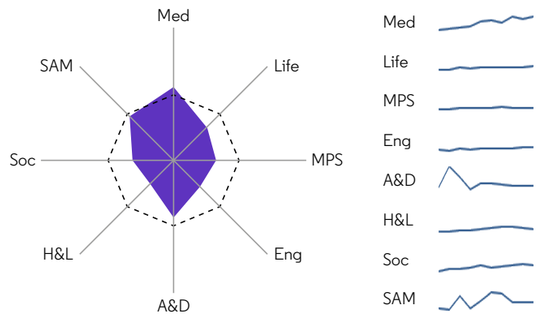
Patents/BERD
1330.3

Impact profile

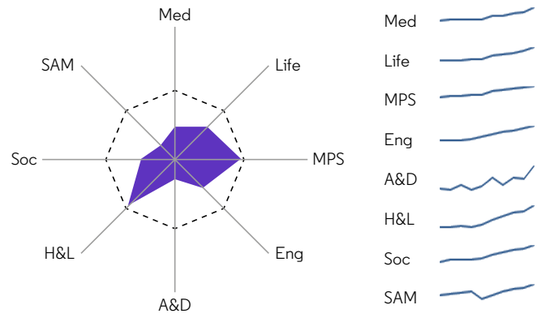


	Papers	CNCI	% > world average	% in top 10%
Russia total	343,974	0.64	17.5%	5.1%
Russia domestic	220,849	0.32	8.5%	1.5%
Russia international	123,125	1.21	33.5%	11.7%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

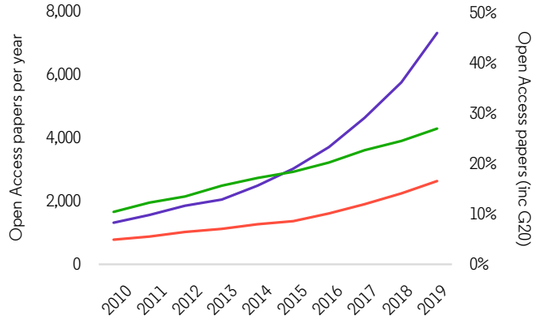
Impact by discipline



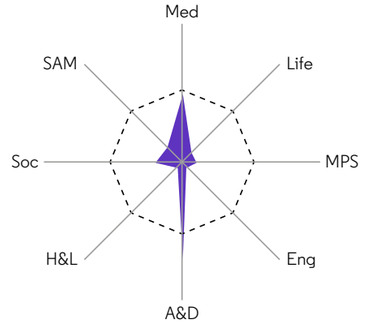
Output by discipline



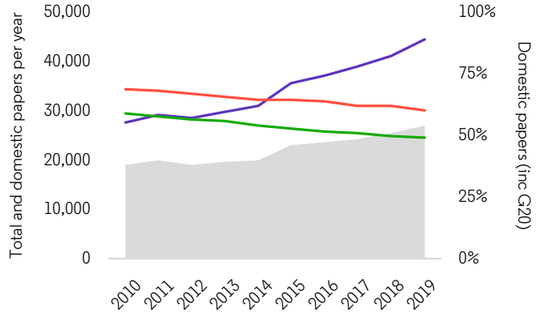
Output and Open Access



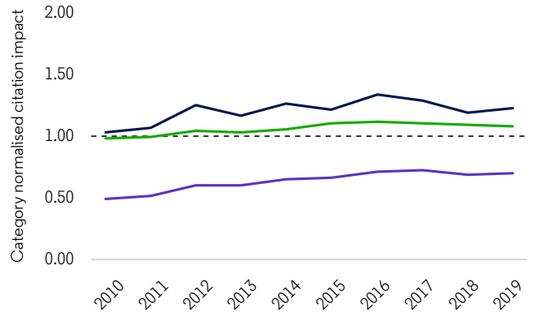
Output and Open Access



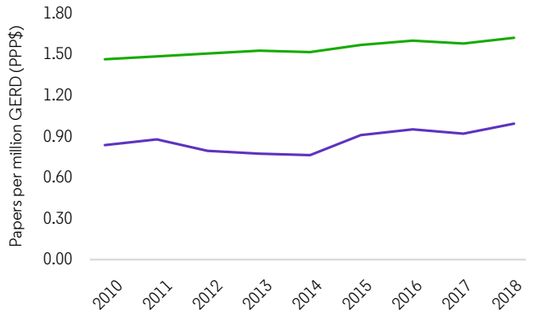
Output and collaboration



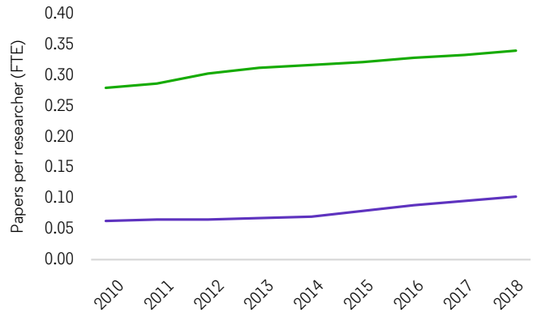
Impact and collaboration



Output by GERD



Output by researcher



Saudi Arabia

Researchers
–

Female researchers
–

Population
34,268,528

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
1676.0

GERD (PPP US$ billions)
–

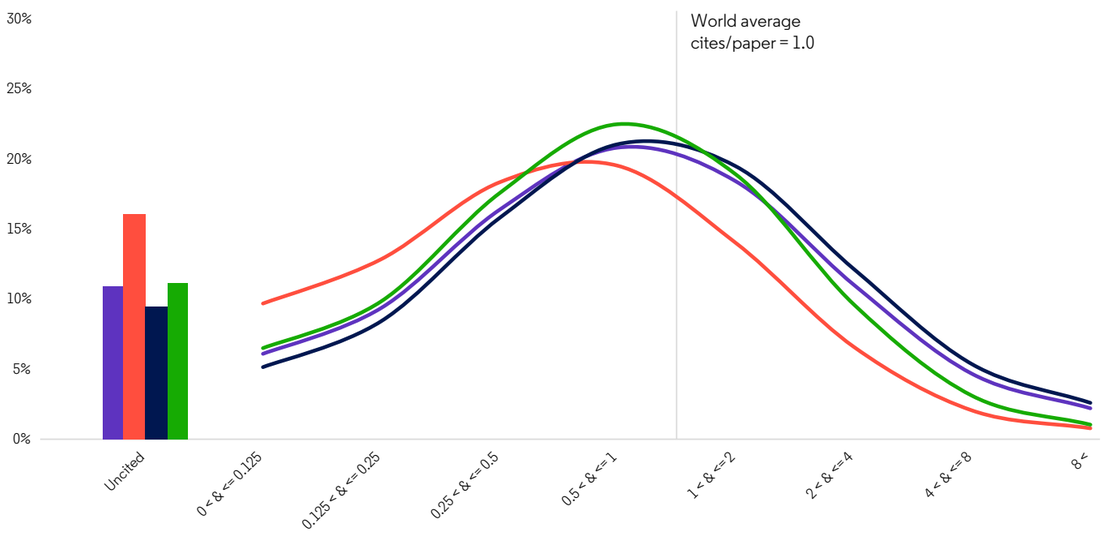
GERD/GDP (%)
–

Patents
6,910

BERD (PPP US$ billions)
–

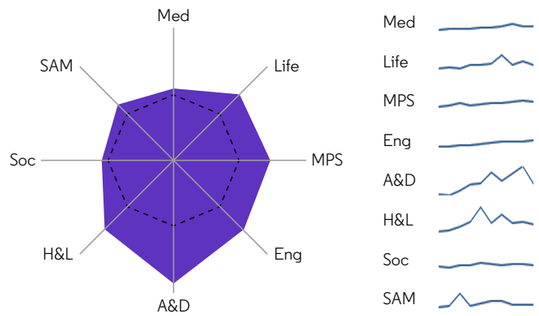
Patents/BERD
–

Impact profile

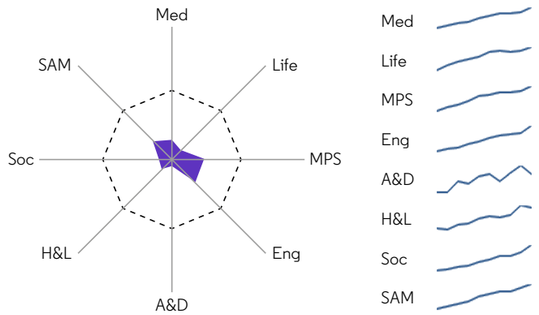


	Papers	CNCI	% > world average	% in top 10%
Saudi Arabia total	119,184	1.31	36.4%	14.8%
Saudi Arabia domestic	24,723	0.74	23.3%	7.1%
Saudi Arabia international	94,461	1.46	39.8%	16.8%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

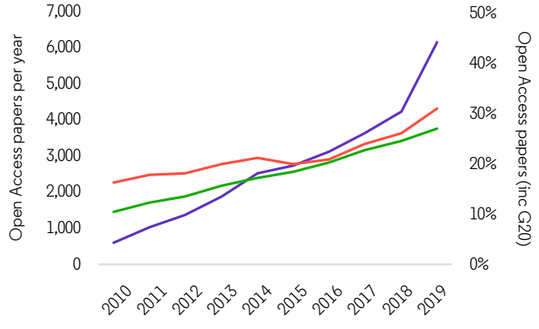
Impact by discipline



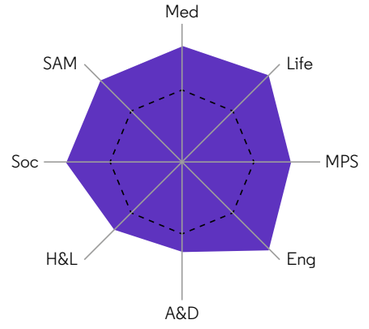
Output by discipline



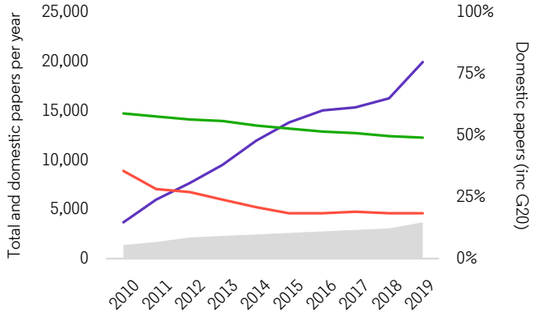
Output and Open Access



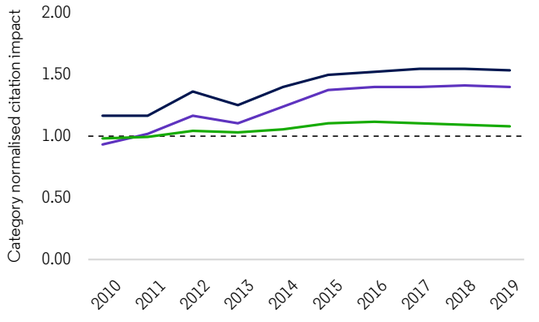
Output and Open Access



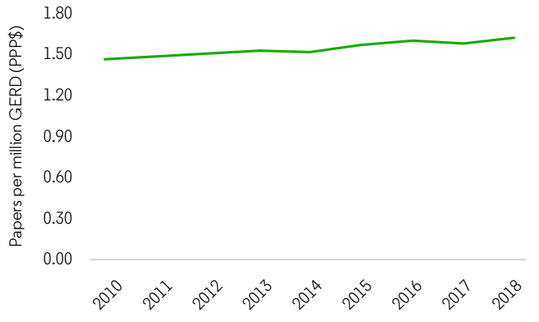
Output and collaboration



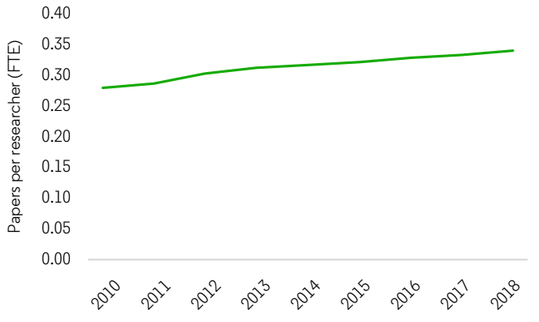
Impact and collaboration



Output by GERD



Output by researcher



South Africa

Researchers
56,761

Female researchers
25,591

Population
56,203,654

Researchers/1000 population
1.01

Women as % researchers
45.1

GDP (PPP US$ billions)
707.7

GERD (PPP US$ billions)
5.8

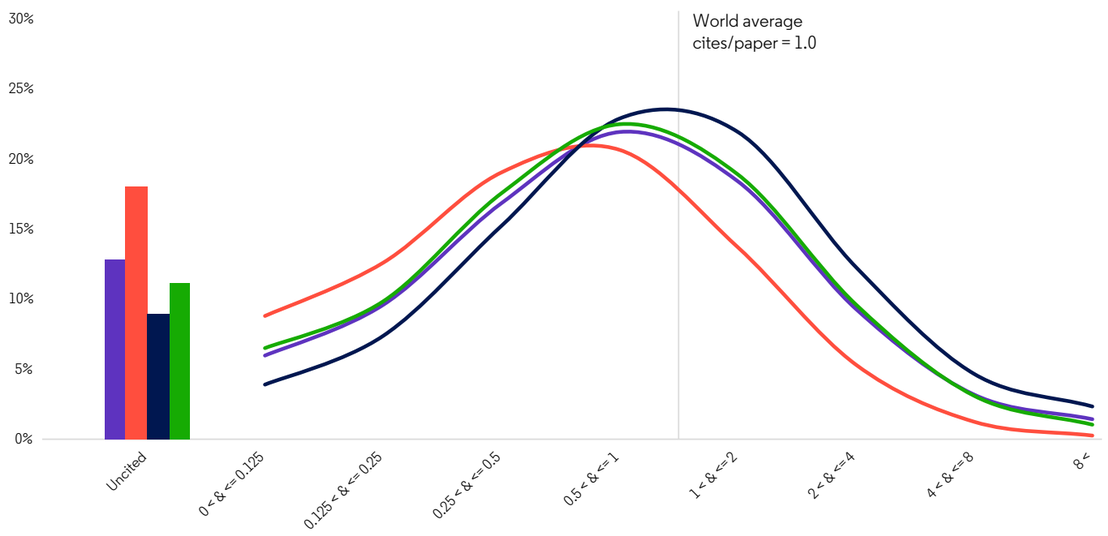
GERD/GDP (%)
0.82

Patents
1,861

BERD (PPP US$ billions)
2.4

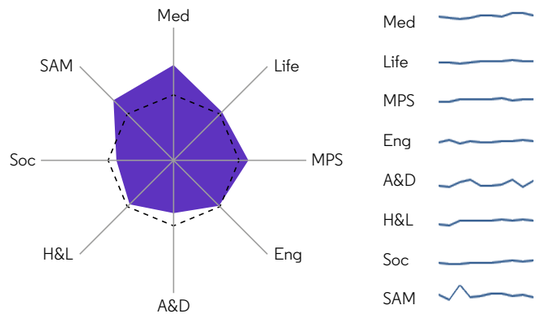
Patents/BERD
775.7

Impact profile

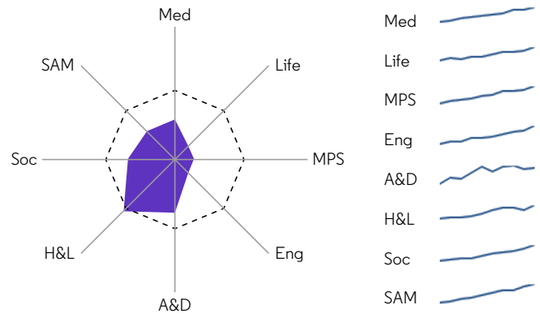


	Papers	CNCI	% > world average	% in top 10%
South Africa total	128,710	1.14	32.5%	10.9%
South Africa domestic	54,909	0.62	20.5%	4.5%
South Africa international	73,801	1.52	41.4%	15.7%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

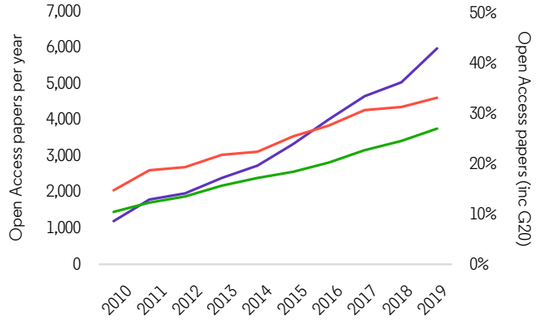
Impact by discipline



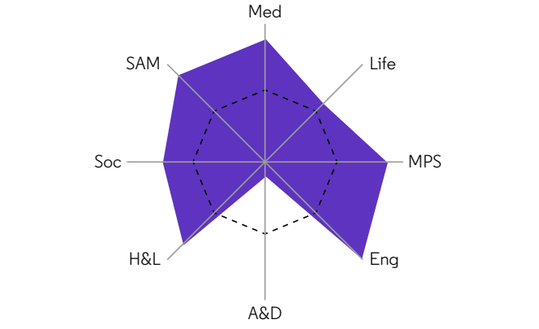
Output by discipline



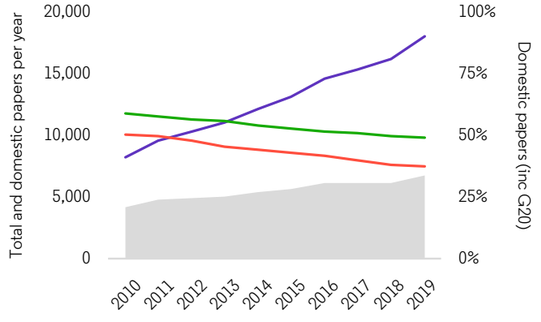
Output and Open Access



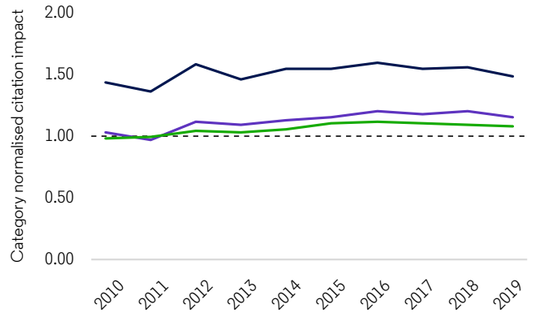
Output and Open Access



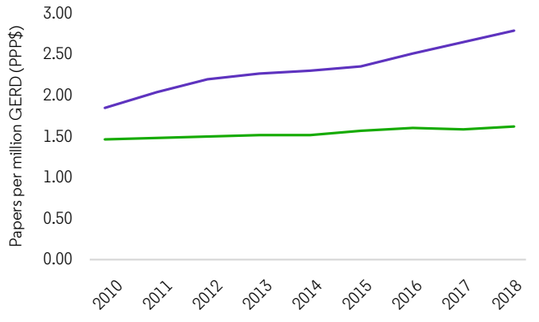
Output and collaboration



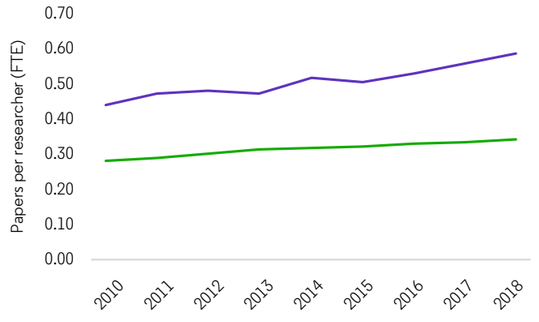
Impact and collaboration



Output by GERD



Output by researcher



South Korea

Researchers
514,170

Female researchers
104,728

Population
51,606,633

Researchers/1000 population
9.96

Women as % researchers
20.4

GDP (PPP US$ billions)
2174.5

GERD (PPP US$ billions)
98.5

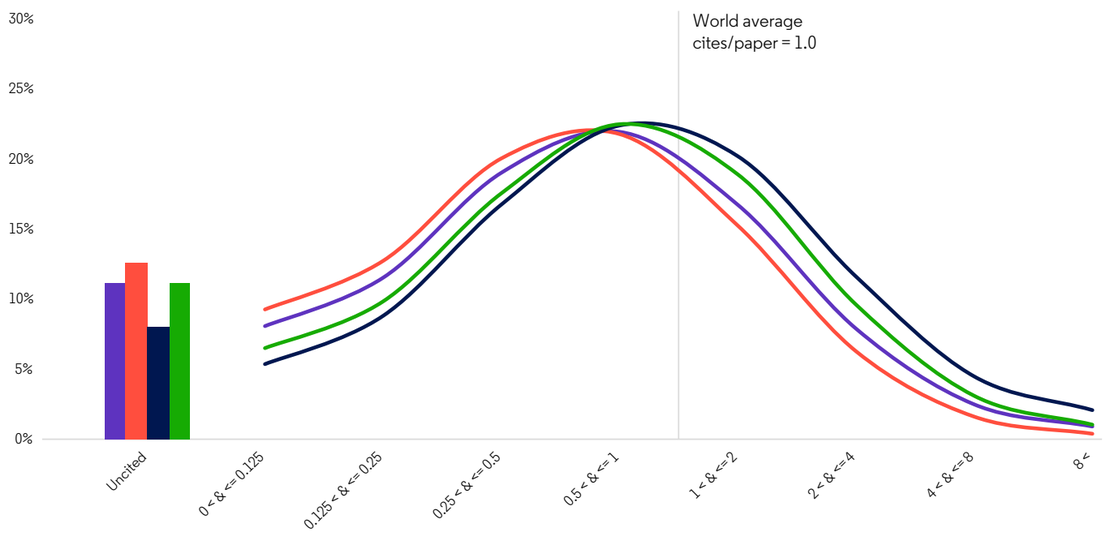
GERD/GDP (%)
4.53

Patents
232,020

BERD (PPP US$ billions)
79.0

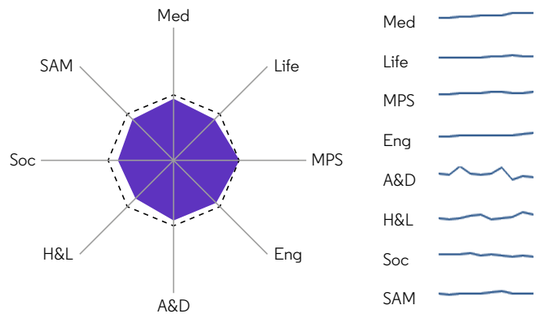
Patents/BERD
2935.1

Impact profile

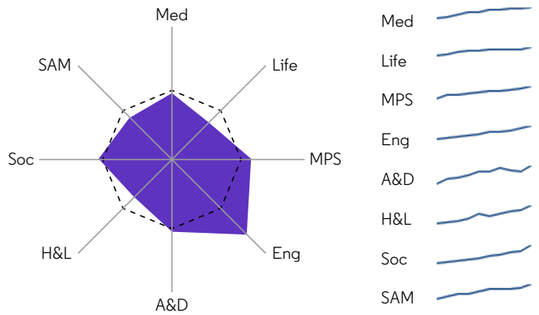


	Papers	CNCI	% > world average	% in top 10%
South Korea total	557,635	0.91	28.0%	8.9%
South Korea domestic	388,698	0.71	23.5%	6.2%
South Korea international	168,937	1.36	38.5%	15.0%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

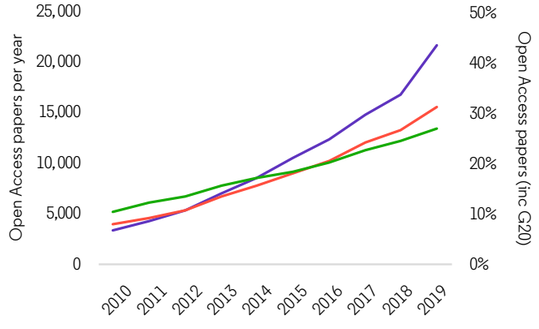
Impact by discipline



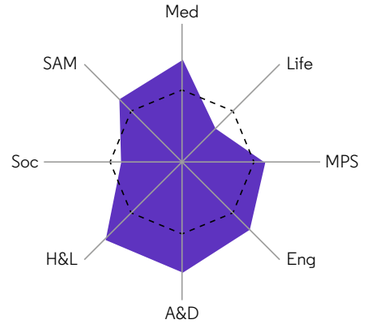
Output by discipline



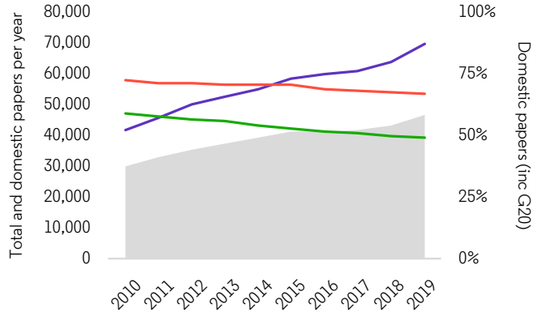
Output and Open Access



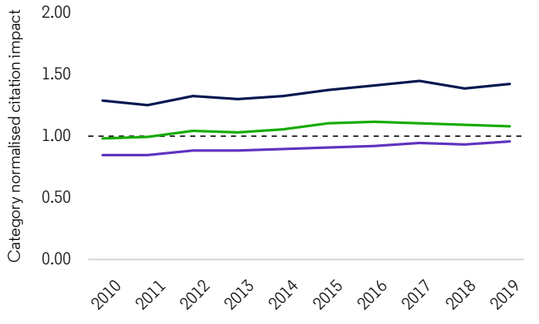
Output and Open Access



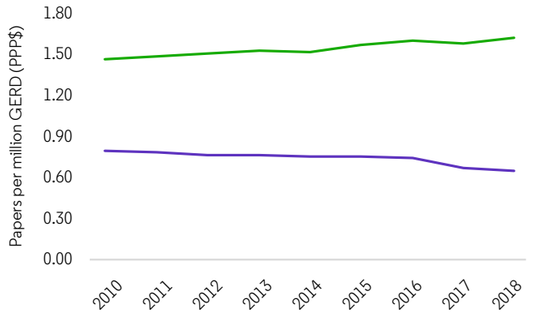
Output and collaboration



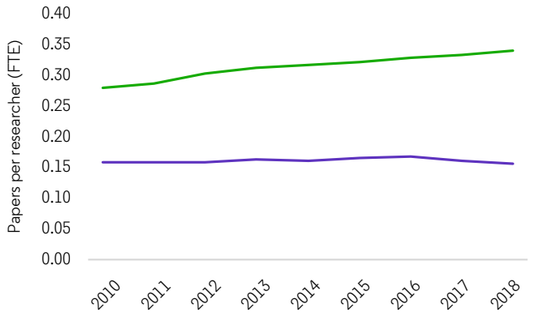
Impact and collaboration



Output by GERD



Output by researcher



Turkey

Researchers
230,030

Female researchers
84,701

Population
82,319,724

Researchers/1000 population
2.79

Women as % researchers
36.8

GDP (PPP US$ billions)
2316.4

GERD (PPP US$ billions)
24.0

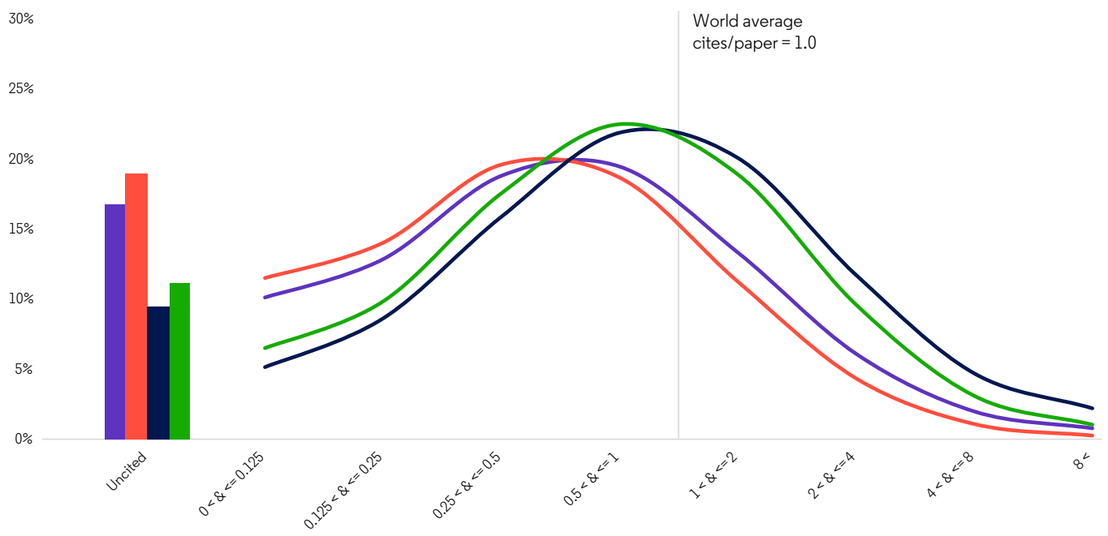
GERD/GDP (%)
1.03

Patents
9,360

BERD (PPP US$ billions)
14.5

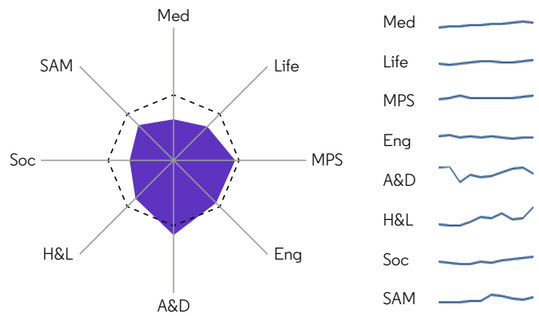
Patents/BERD
646.2

Impact profile

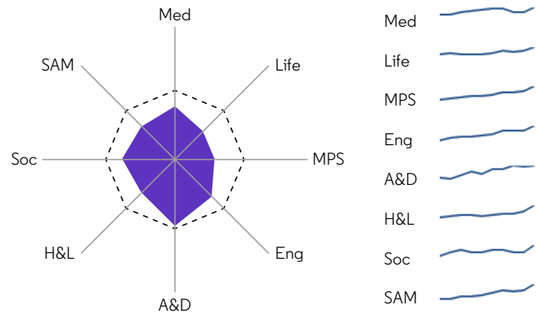


	Papers	CNCI	% > world average	% in top 10%
Turkey total	284,805	0.75	22.0%	6.6%
Turkey domestic	219,627	0.55	17.0%	4.0%
Turkey international	65,178	1.41	38.8%	15.1%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

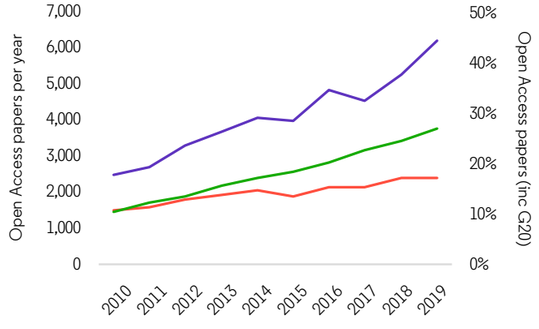
Impact by discipline



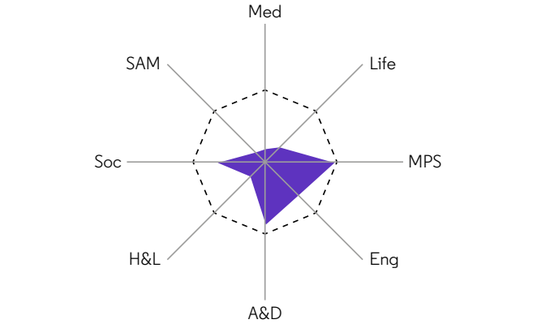
Output by discipline



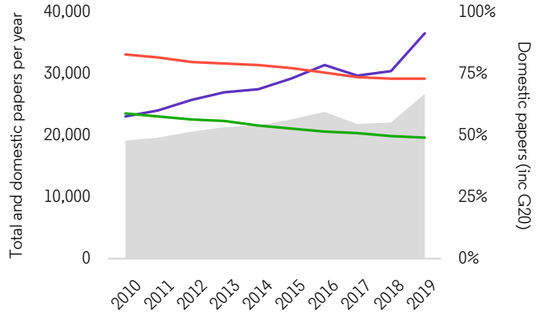
Output and Open Access



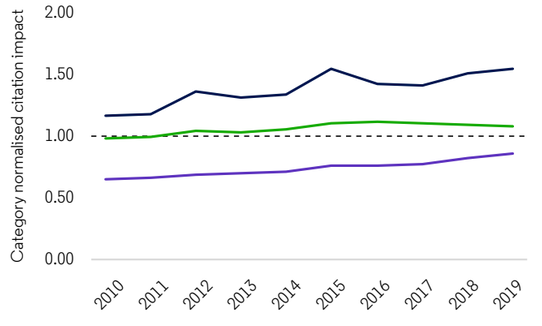
Output and Open Access



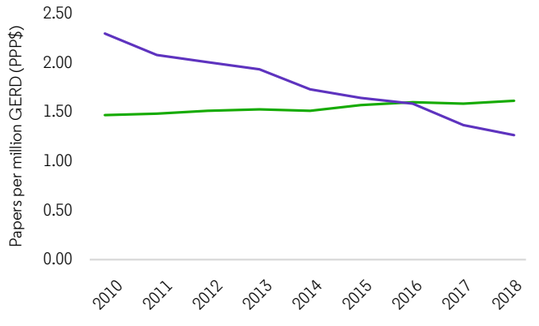
Output and collaboration



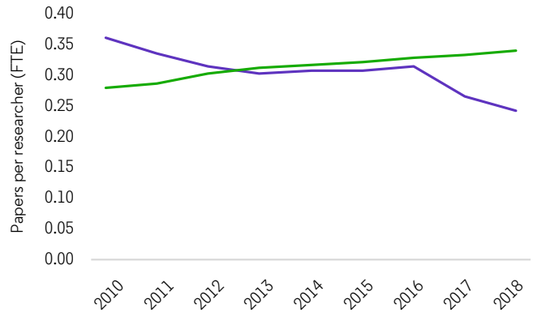
Impact and collaboration



Output by GERD



Output by researcher



United Kingdom

Researchers
535,477

Female researchers
206,687

GDP (PPP US$ billions)
3120.7

GERD (PPP US$ billions)
54.0

GERD/GDP (%)
1.73

Population
66,460,344

Researchers/1000 population
8.06

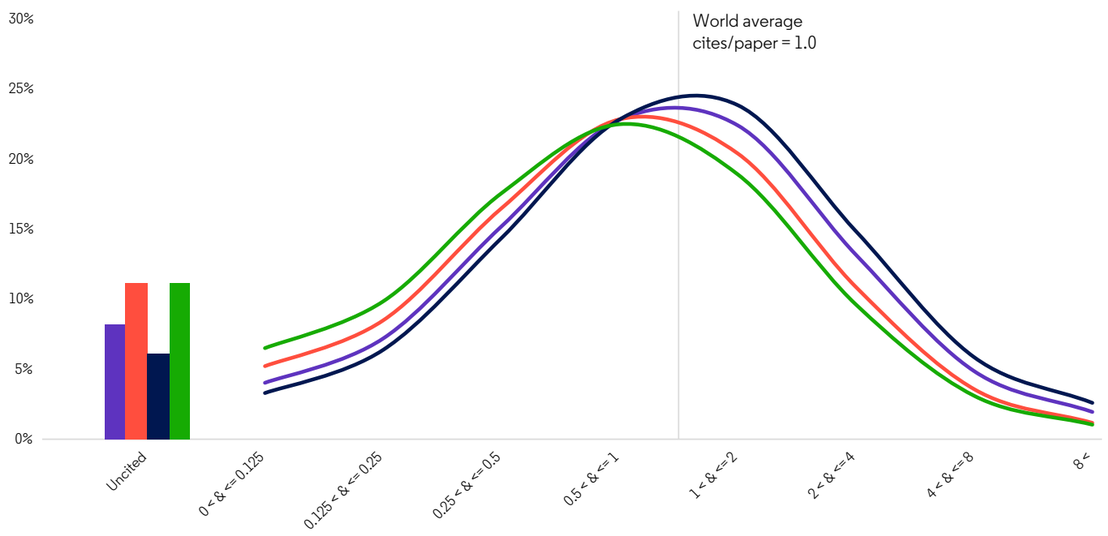
Women as % researchers
38.6

Patents
56,216

BERD (PPP US$ billions)
36.5

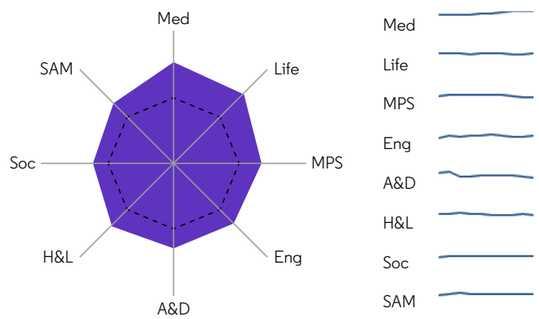
Patents/BERD
1542.1

Impact profile

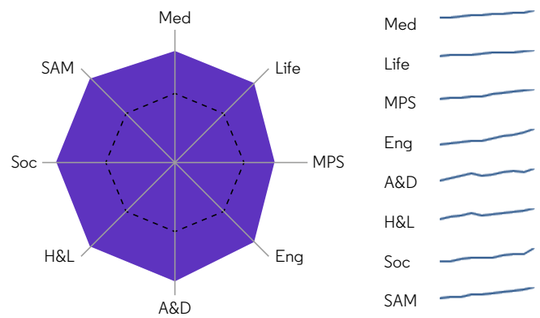


	Papers	CNCI	% > world average	% in top 10%
United Kingdom total	1,197,206	1.40	42.5%	16.3%
United Kingdom domestic	492,620	1.09	35.9%	11.9%
United Kingdom international	704,586	1.63	47.1%	19.4%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

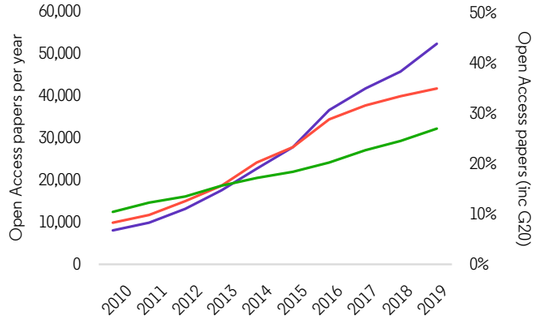
Impact by discipline



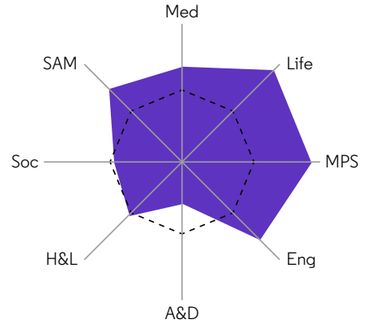
Output by discipline



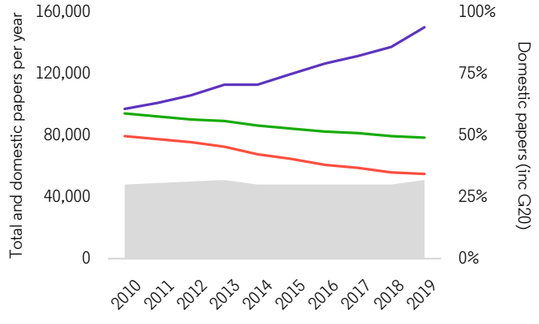
Output and Open Access



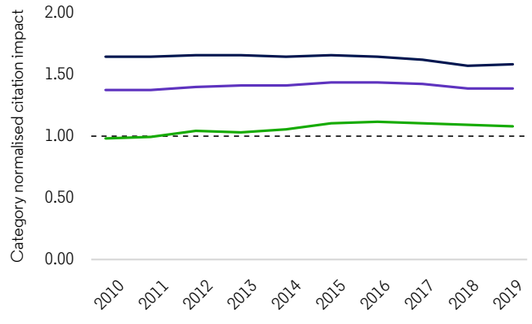
Output and Open Access



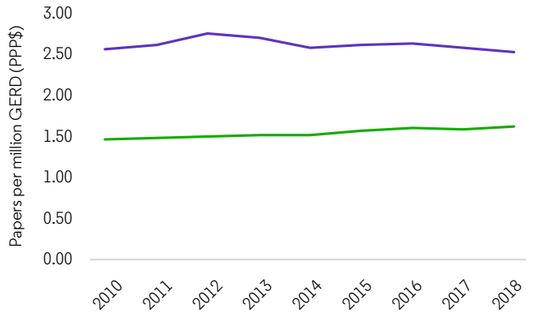
Output and collaboration



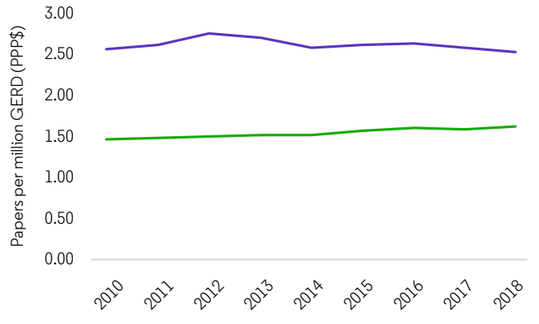
Impact and collaboration



Output by GERD



Output by researcher



United States

Researchers
–

Female researchers
–

Population
328,239,523

Researchers/1000 population
–

Women as % researchers
–

GDP (PPP US$ billions)
20529.0

GERD (PPP US$ billions)
581.6

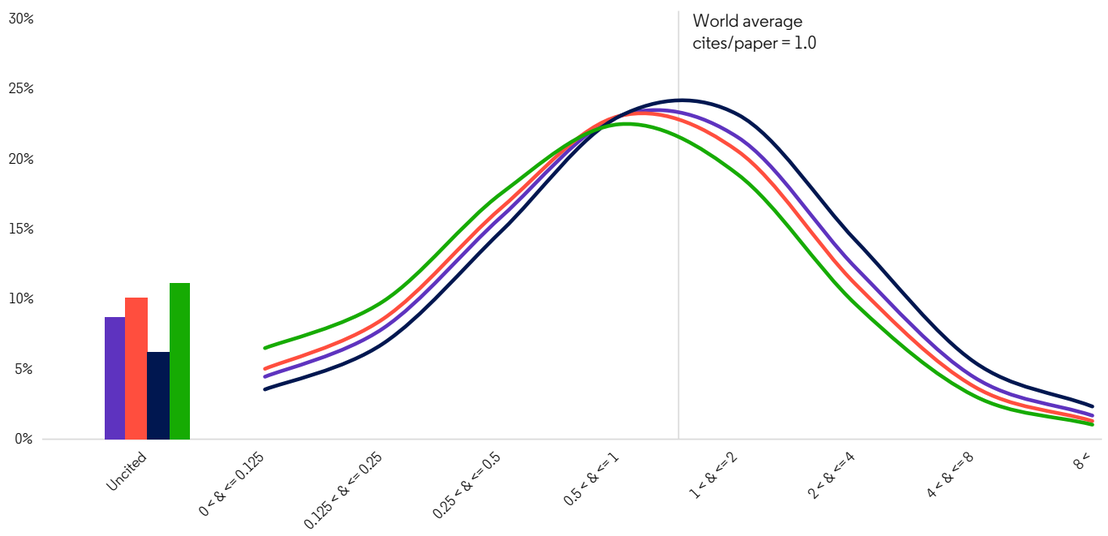
GERD/GDP (%)
2.83

Patents
515,180

BERD (PPP US$ billions)
422.1

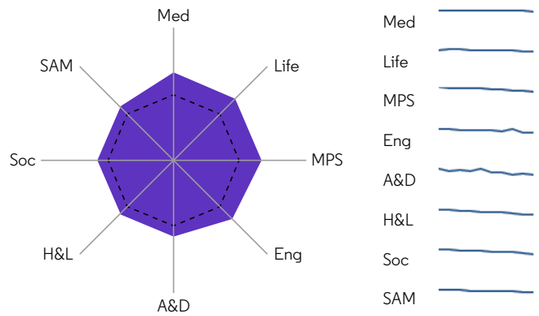
Patents/BERD
1220.6

Impact profile

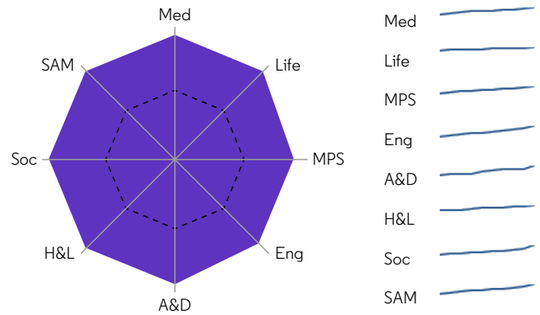


	Papers	CNCI	% > world average	% in top 10%
United States total	4,085,645	1.29	39.9%	15.1%
United States domestic	2,535,359	1.15	36.6%	13.0%
United States international	1,550,286	1.54	45.3%	18.5%
G20 total dataset	14,290,971	1.00	32.5%	10.7%

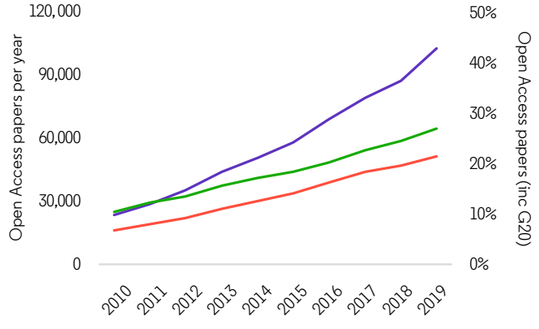
Impact by discipline



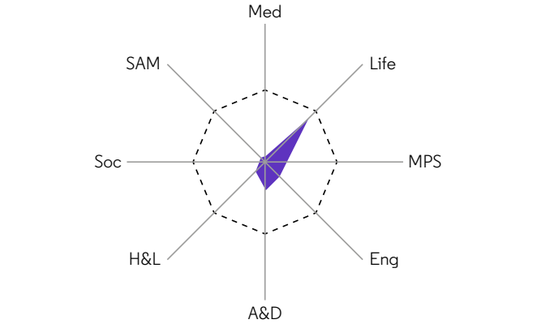
Output by discipline



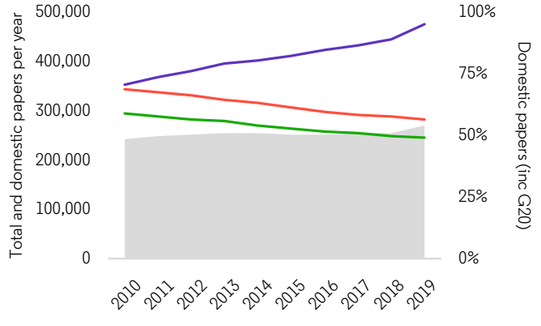
Output and Open Access



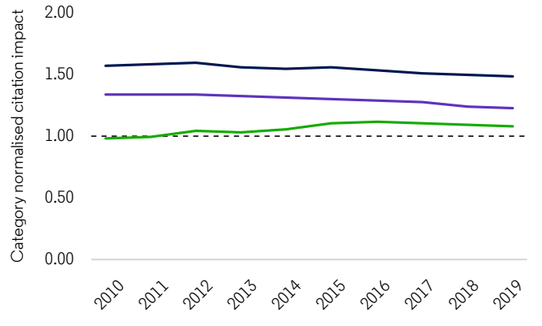
Output and Open Access



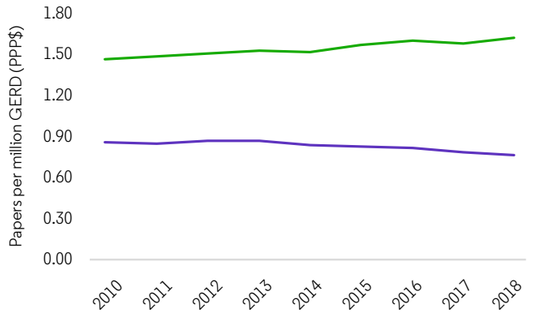
Output and collaboration



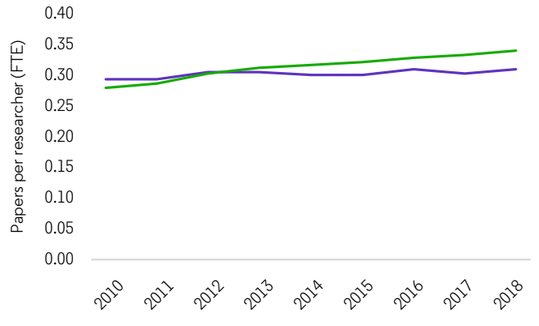
Impact and collaboration



Output by GERD



Output by researcher



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