



Italy as a Science Nation

Current Status





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Italy as a Science Nation – Current Status

Summary

• How well is Italian science performing?

The landscape of Italian research has undergone a remarkable transformation since the turn of the millennium. At that time, Italy trailed behind nations like Japan, France, and Canada in scholarly output. However, Italy has now surpassed all three, solidifying its position as the world's 6th most productive research nation (3rd in Europe and 2nd within the EU). Only China, the US, UK, India, and Germany publish more research. Notably, Italy boasts higher citation levels than all but one of these leading nations – the UK. This competitive impact is a recent development as well. At the beginning of the 21st century, the US, Germany, and France held the edge over Italy in terms of citation impact.

- **What is the impact on policy?** Italian science demonstrably extends its influence beyond the realm of global research, shaping policy decisions as well. Italian research is frequently cited in government policy documents, with a higher impact on these documents compared to the EU average. Notably, research produced by the University of Milan and the University of Turin demonstrates a particularly strong presence within policy citations.

• What is the impact on sustainability?

- Italian research demonstrably contributes to achieving the United Nations' Sustainable Development Goals (SDGs). Italy is particularly active in areas like Good Health and Well-being, and Sustainable Cities and Communities. Importantly, Italian research boasts a high scientific impact across all SDGs, with particularly strong contributions in health, climate change, and industry innovation. Additionally, research on biodiversity demonstrates both higher citation rates and a stronger emphasis on international collaboration compared to the average.

• Which disciplines contribute the most to research impact?

Clinical & Health is by far the subject area with the largest number of publications, followed by Physical Sciences. Clinical & Health is also the field with highest citation levels (along with Business & Economics) and therefore contributes the most to the overall success of Italian Research. Topics related to sustainable energy, AI and key technology constitutes a modest contribution from Italy in terms of scale but have high citation impact.

- **Which Italian universities perform the best?** All Italian universities perform much better than the world average on scientific impact. The University of Rome La Sapienza is by far the most productive, while Milan and Napoli Federico II lead in scientific impact.

Key Data

- Italy is the 6th most prolific science nation in the world, second only to Germany in the EU.
- Italy scores 40% above the world average in scientific impact, above US, China and EU average
- 47% of all Italian articles involve international collaborations.
 - This is higher than the world average (20%) or the EU27 (42%).
 - These international articles have more than twice the world average impact, while national articles from Italy are only 20% above the world average.
- Italian research is making a tangible difference by influencing government policy: 7% of Italian articles published since 2013 are cited in policy documents. This is above the EU average and above France and Germany.
- Italian scientific research is a strong contributor to the issues of sustainability we face today. Italy is particularly prolific in research within the UN Sustainable Development Goal 3: Good Health and Well-being; and Goal 11: Sustainable Cities and Communities. Italian research in topics of sustainability is particularly well cited (above its national average)
- Italy is particularly strong in research related to Clinical and Health, both in term of volume of research and in term of impact (citations levels)

Introduction

How well is Italy performing in the realm of science? While a simple question, assessing Italy's standing in science can be complex. Analyzing the impact of Italian research publications on global scientific progress, innovation, policy, and sustainability offers valuable insights. This examination reveals a landscape of strengths in Italian science, and we'll explore the factors behind this success.

Chapter 1 covers the position of Italy in the global scientific landscape. In Chapter 2, we explore the success factors of Italian science in the global scale. Chapter 3 describes the impact of Italian research beyond science: on policy, sustainability, innovation and key technologies. Chapter 4 examines the scientific disciplines and universities that contribute the most to the success of Italian science. We conclude with summaries (Chapter 5) and definitions (Chapter 6).

This report is part of a series of reports that Elsevier has released over the years, including the international reports on [Artificial Intelligence](#), on [Net Zero](#), on [Gender Gap in Science](#) and many more.

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1 How Well Does Italy Perform Compared to Other Countries?

To answer the question of how Italy is performing in the field of science, we examine publication output and citations levels of selected research-intensive regions.

The number of publications serves as a good measure of productivity (or output). These publications are cited by other scientists, which is a good indication of scientific impact. For this purpose, we use the Field Weighted Citation Impact (FWCI), which is normalized to 1.0 for the world average. An FWCI of 1.2 is 20% better than the world average, while an FWCI of 3.0 is three times better, and so forth.

In terms of productivity, we can examine the share of all publications worldwide. Larger countries such as China and the US contribute around 20% and the EU as a block of 27 countries 24%. Refer to the Definitions section (Chapter 6) for more information on publications, citations, FWCI, productivity, etc.

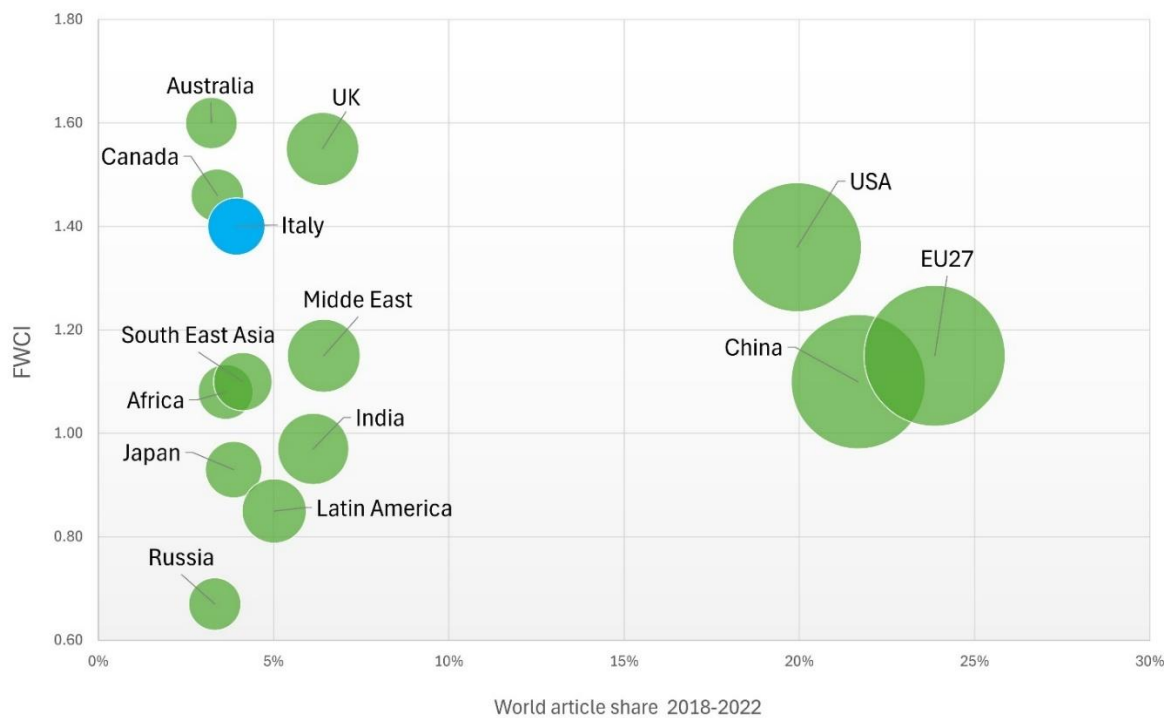


Figure 1: FWCI vs. Relative share of different world regions. Also included some selected countries for context.

As depicted in Figure 1, Italy appears among the top in terms of citation impact, measured by the FWCI, well above the EU average and US. (FWCI: Italy 1.40; US 1.35; EU average 1.45)

In terms of the number of publications we find Italy Scholarly Output to be a little larger than Japan, and 14% larger than Canada and Australia.

Italy has become the 6th most prolific science nation in the world, second only to Germany in the EU. At the start of the millennium, Japan, France and Canada were all ahead of Italy.

Position	Country	Scholarly Output	FWCI	Publications per author average #	Scholarly Output (growth %)
1	China	4,067,299	1.11	0.9	69.8
2	USA	3,728,387	1.36	1.3	0.5
3	UK	1,195,287	1.55	1.7	4.4
4	India	1,143,519	0.97	1.1	57.8
5	Germany	1,013,358	1.33	1.5	8.8
6	Italy	733,979	1.40	1.7	24.5
7	Japan	718,766	0.93	1.1	4.0
8	France	648,471	1.29	1.5	1.2
9	Canada	634,759	1.46	1.6	13.3
10	Russia	622,401	0.67	1.4	8.1

Italian research output has been growing faster than most and is continuing to grow at speed also in recent years (as shown in the last column of this table, since 2018 only China and India have grown faster than Italy). This suggests that the influence of our country in the scientific podium is likely to continue to increase particularly considering that US, UK and Germany are showing significant challenges in keeping up with the growing pace of emerging regions.

Although a rough indicator, the average number of publications per author does show us how intense is the publication activity of the researchers in our country compared to other regions, and we can see that Italian researchers are performing at the highest levels in term of getting published.

Figure 2: The above table shows data on academic research published in the 5 years between 2018 and 2022 by the 10 most prolific countries in the world.

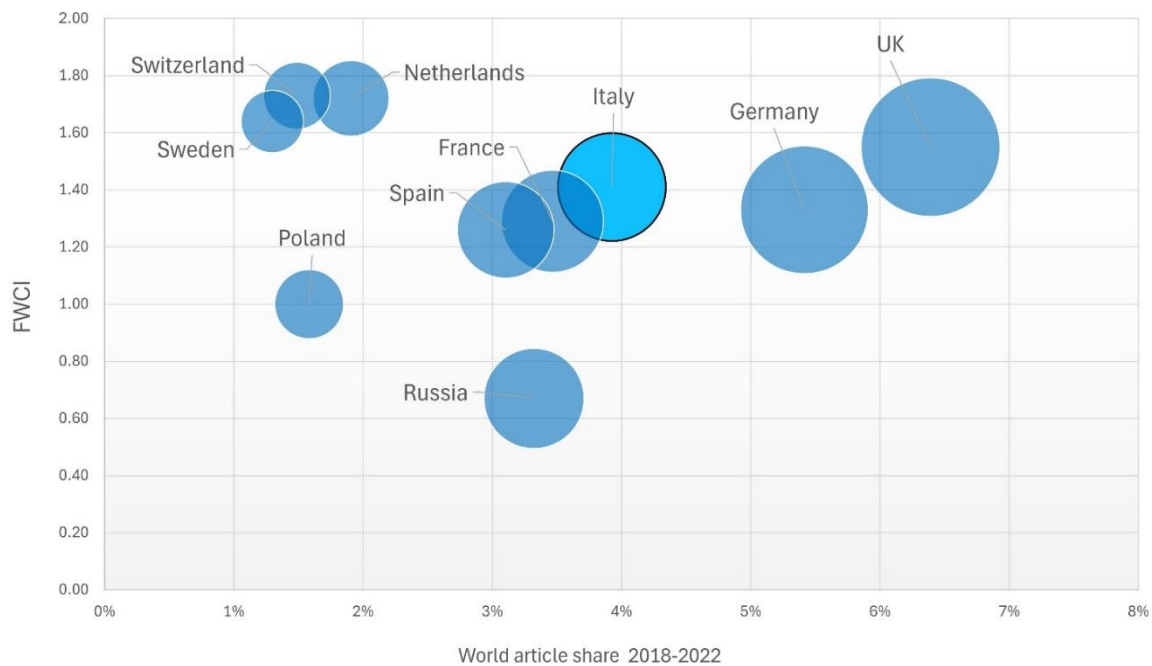


Figure 3: Scientific Impact Measured in FWCI vs. Relative Contribution of 10 most prolific European Countries

As observed in Figure 3, which shows the most research-intensive countries in Europe, we can see how Italy perform very well in terms of scientific impact, outperforming not only France and Spain, but also Germany.

Italy is the 6th most productive research nations worldwide (3rd in Europe; 2nd in the EU). Of the more research intensive than Italy, only the UK has higher citation impact than Italy.

2 Success Factors of Italian Science in the global scale

Two factors stand out immediately for Italian science: both volume and impact have significantly increased in the last 2 decades: in term of citation levels Italy overtook France in 2004 and Germany in 2012; in term of Research Volume it surpassed France in 2020.

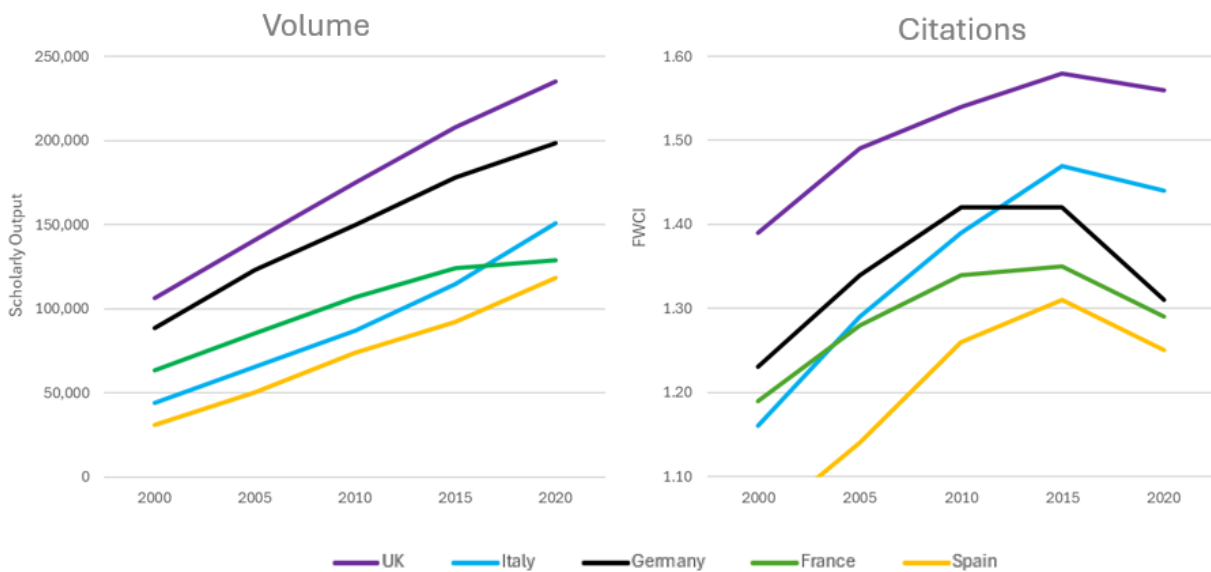


Figure 4: Italy Scholarly Output surpassed France in 2020, and its FWCI overtook France in 2004 and Germany in 2012.

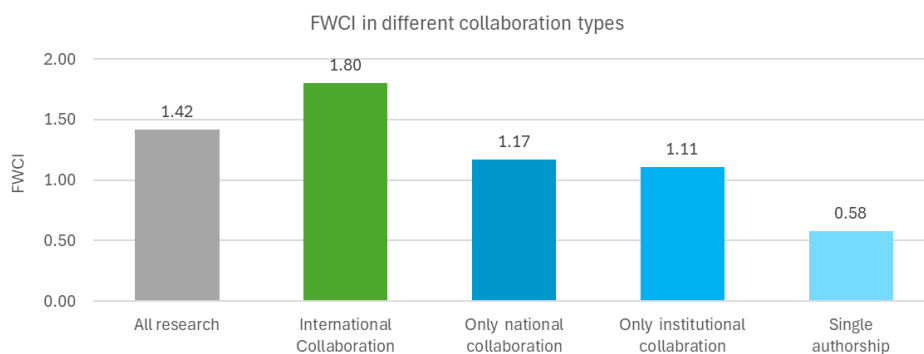


Figure 5: The Research Impact Measured as FWCI for all Italian Research (1.40), for International Research (1.80) Compared to National Research (1.17).

As shown in Figure 5, international research has significantly more impact than national research: 1.80 vs. 1.17: this means that international articles have 80% more citations than the

world average while Italian national articles are only 17% above the world average.

Given the impactful international scientific collaboration involving Italy, the question arises: how international is Italian research?

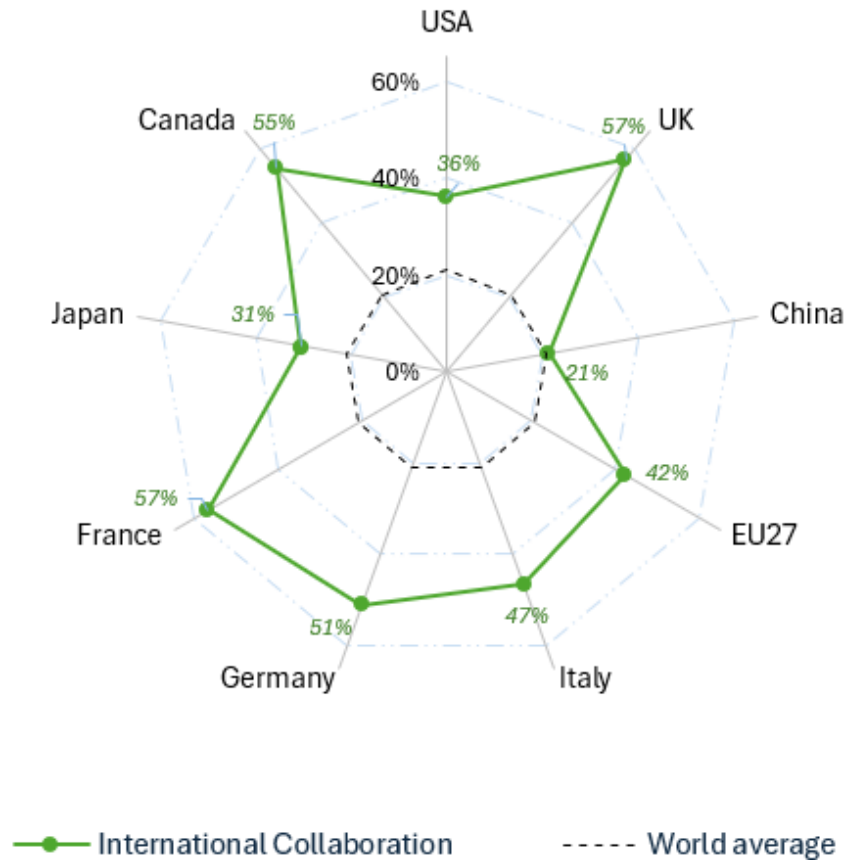


Figure 6: Internationalization of Scientific Research in G7, EU and China. The world average is 20% (publications 2018-2022)

In Figure 6, we observe the degree of internationalization in research in G7 countries, China and EU average. Research is considered international scientific collaboration when at least one author from one country collaborates with at least one

author from another country. The world average is 20% indicated by the black dotted line. We see that Italy is more internationally collaborative than average in the EU, and well above the US.

Given the levels and impact of international scientific collaboration, we wanted to look at the countries with which Italy engages with the most.

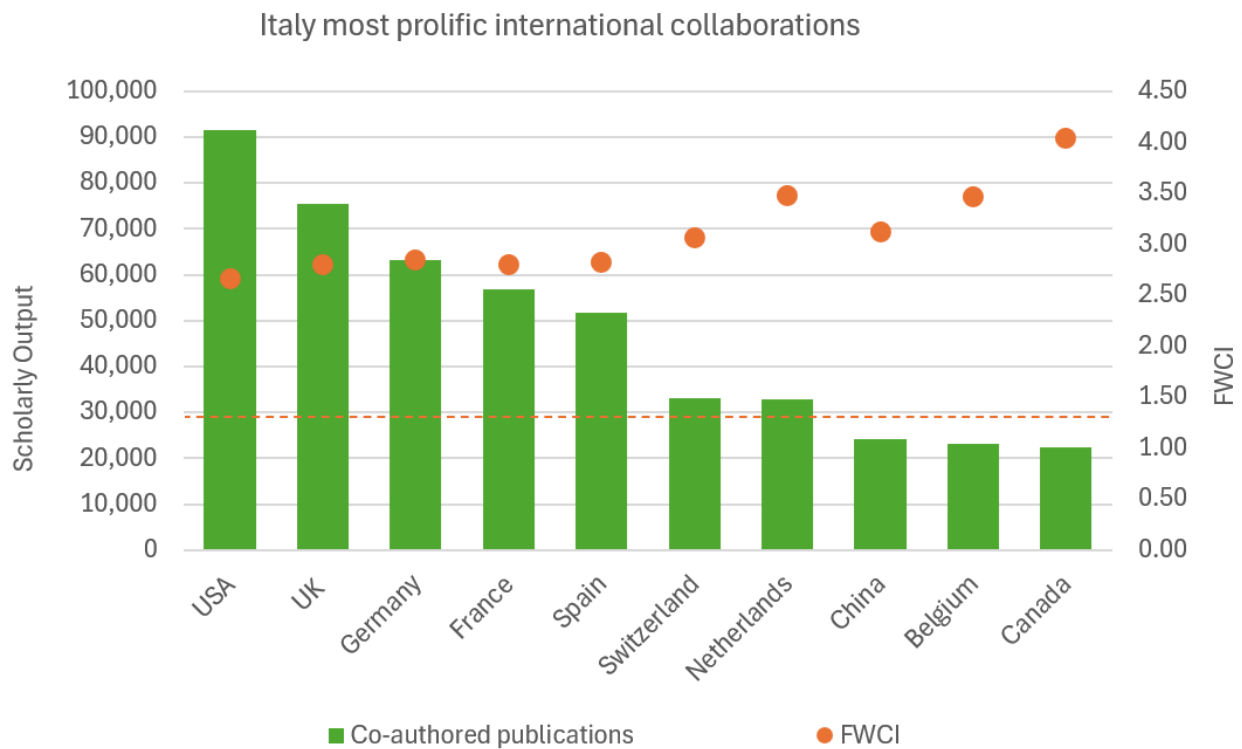


Figure 7: Most prolific countries Collaborating with Italy (shown as a percentage of Total Italy Scholarly Output)

Figure 7 illustrates that more than a quarter of international collaborations involves the US. Collaboration with the UK is above 20%, while with Germany, France and Spain is around the 15% mark. Only 7% of collaborations involve China.

Later, we will see that Italian universities typically collaborate more intensively with academic leaders in Europe (such as Paris-Saclay and Paris Cite, Paris-Saclay in France, UCL and Imperial in the UK), while in the US the spread appears wider involving a

larger number of institutions each with smaller number of co-authorships. It is interesting to note that these most prolific international collaborations also produce higher than average citation levels. In fact, the average FWCI for International publications is 1.80, but when collaborating with the US we get FWCI 2.66; with the UK 2.80. We are also reminded of the overall Italian FWCI 1.40 indicated by the dotted line.

3 Impact of Science on Policy and Sustainability and key technologies

Beyond its scientific merit, Italian research is making a tangible difference by influencing policy and contributing to real-world progress on global sustainability issues.

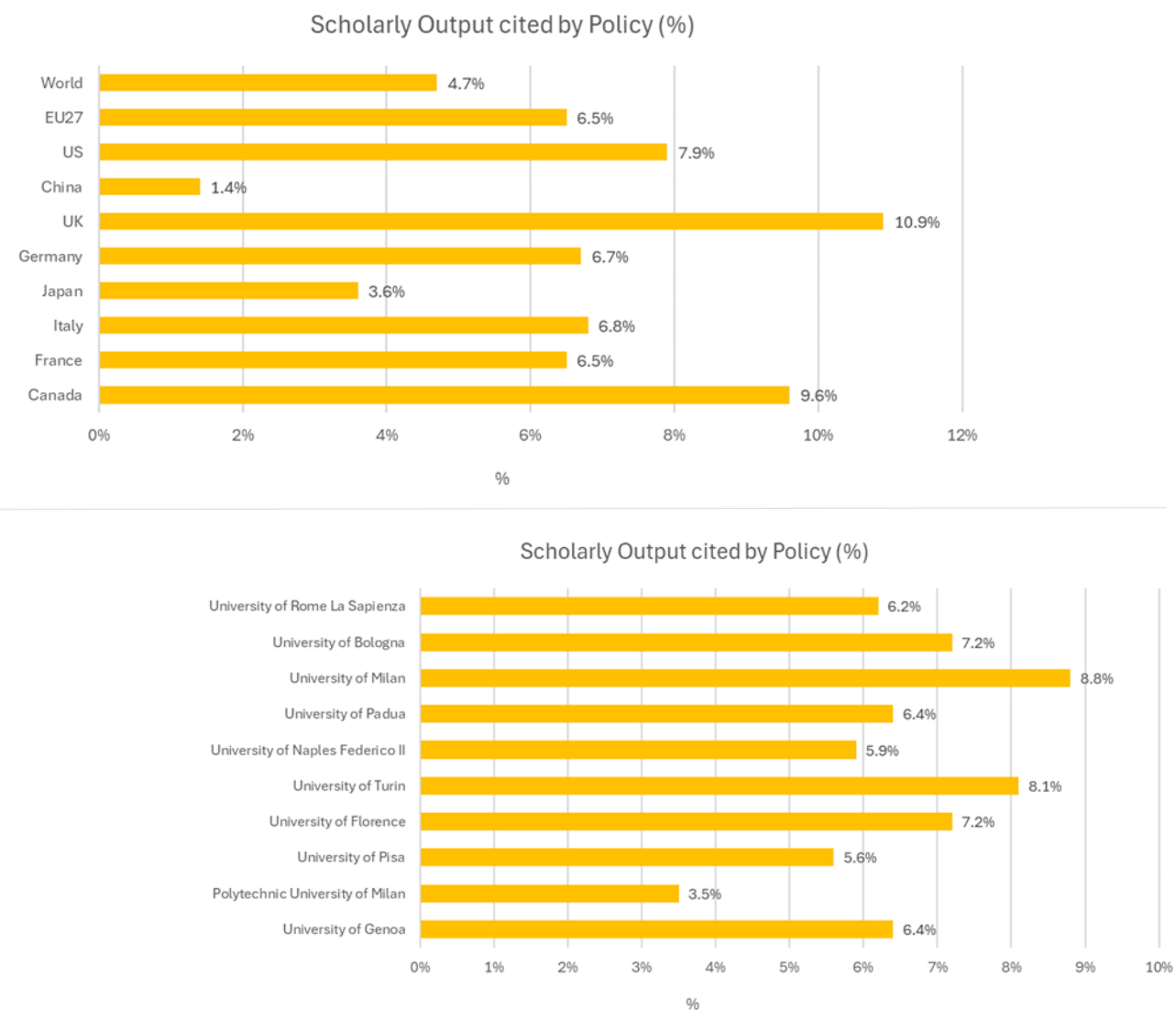


Figure 8: Scientific Articles Cited in Policy Documents (as a Percentage of All Articles from the Country, Region, or Institution). Publications 2013-2022

We can also examine the impact of Italian research on government policy worldwide. This is done by looking at how many scientific articles are cited in policy documents worldwide. We observe interesting results: 6.8% of Italian articles (published 2013-2022) are cited in policy documents: this is higher than the

EU average, higher than France and higher than Germany. The University of Milan stands out positively with 8.8% of its articles cited in policy documents, followed by the University of Turin with 8.1%.

Sustainability

The Sustainable Development Goals are a set of global goals adopted by all United Nations member states in 2015. They represent a collective effort to achieve a better and more sustainable future for all by addressing critical issues facing our planet and its people. The SDGs address a wide range of interconnected issues, recognizing that solutions to one problem can contribute to solving others. They are designed to be a universal call to action for all countries, developed and developing alike, to work together in a global partnership. In the chart below we have mapped Italian research to the SDGs and presented the data normalized so that it can be compared with the average for the EU and also in a global context.

RAI (Relative Activity Index)

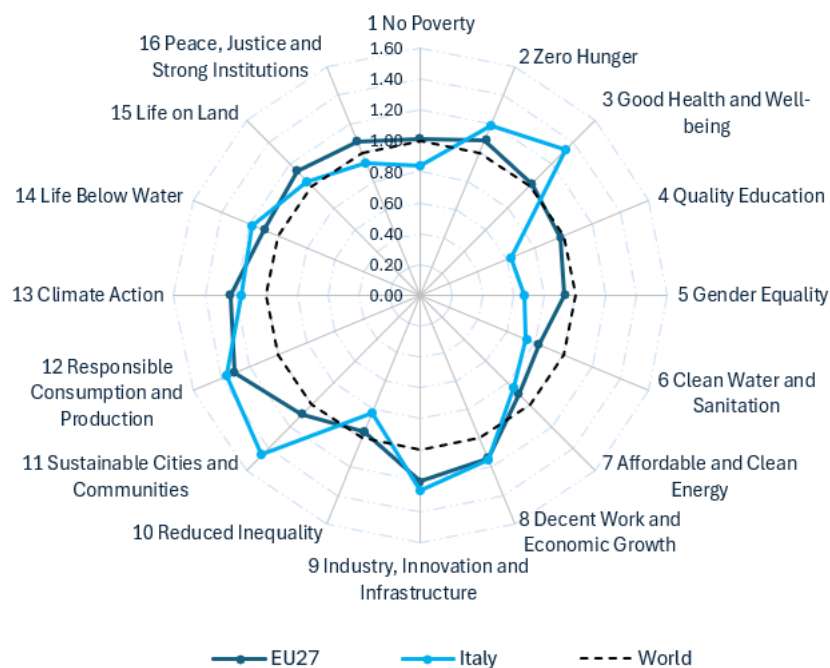


Figure 9: How Active is Italy in Research Related to the 16 SDGs, compared to the World (Normalized to 1.0) and the EU27. Italy is exceptionally active in the areas of SDG 3 and 13.

We can further analyse the distribution of Italian research focused on the Sustainable Development Goals (SDGs). To enable a fair comparison between regions of varying sizes, research output is normalized. As illustrated in Figure 9, Italy demonstrates a higher research productivity (publishing more

articles) in most SDGs compared to the global average (normalized to 1.0) and in seven out of the sixteen SDGs compared to EU average. Notably, Italy excels in areas related to SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities).

How impactful is Italian research related to the Sustainable Development Goals (SDGs)? Significantly, Italian research focused on these UN-defined goals attracts citations at a rate exceeding the national average. This focus on sustainability not only positions Italy at the forefront of tackling global challenges, but also elevates the nation's scientific research to a position of high impact on the world stage.

FWCI (Field-Weighted Citation Impact)

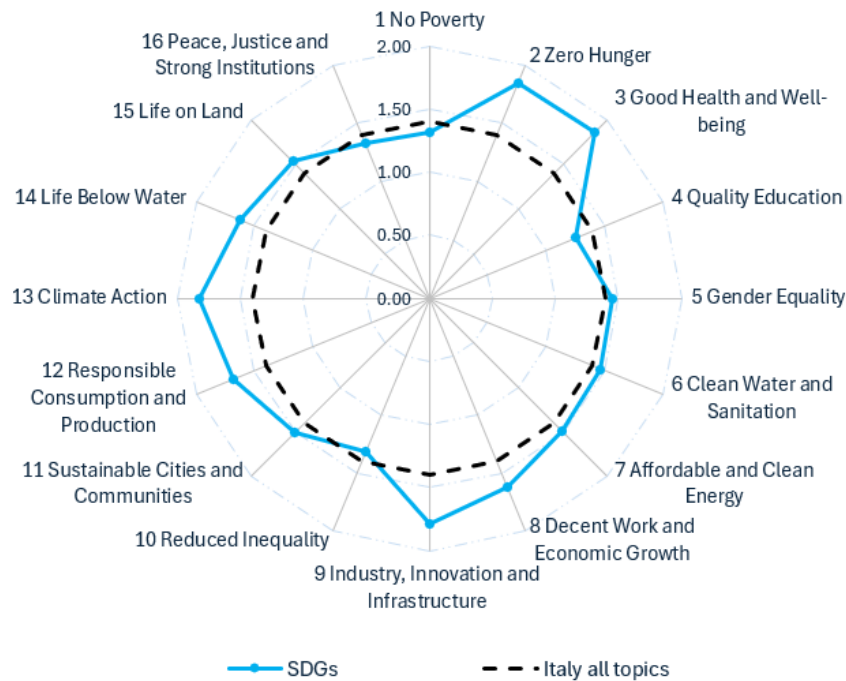


Figure 10: The black dotted line represents the average citation level of Italian Research. In light blue we show the FWCI of Italian research specifically related to the 16 SDGs.

Italian research demonstrably contributes to achieving the United Nations' Sustainable Development Goals (SDGs). Across most SDGs, research conducted in Italy exhibits a significantly higher Field-Weighted Citation Impact (FWCI) compared to the

national average. This is particularly true for SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 9: Industry, Innovation and Infrastructure, and SDG 13: Climate Action.

Biodiversity

Concerns over loss of biodiversity have been increasing in recent years. A recent Elsevier report from 2023 demonstrates that Italian biodiversity research has high impact (over 70% time the world average) and it is highly international (60% of all Italian research is conducted in collaboration with foreign institutions). Italian Biodiversity research is also cited in policy documents 2.5 times more than the average for all Italian research. When we looked at the trend in recent years, we also noticed a steep increase in Italian research in this area since 2019 (50% increase in 2 years).

Sustainable Energy – Net Zero

When we examine SDG 7 (energy) and SDG 13 (climate) and focus on sustainable energy, as per the Elsevier Net Zero report published few years ago, an interesting picture emerges. China heavily dominates research in this area with EU and USA failing to keep the pace. In relative term we notice strong presence from South Korea, and India fast growing contribution. The Middle East and Africa are also particularly prolific in this area in relative terms. Relative to other countries, Italy is very much on par with EU27 average, coming second only to Germany in term of volume; while globally it ranks 7th. Germany is also Italy most frequent partner in international collaborative research in this field, followed by US and UK. Collaboration with China sits at 4.3%, higher than the 3.3% average for all Italian research.

Artificial Intelligence

Examining the landscape of AI research, we see a similar pattern as for Net Zero research: China dominates, India is very present, South Korea very strong in relative terms. The US and EU each with about roughly half the Scholarly Output of China in this area.

Italy is in 9th place worldwide in term of volume of publications, but citations are high (FWCI 1.97). Within the EU only Germany is more prolific, but the distance is significant (Italy publishes approx two third of the level of Germany). US and UK have the most frequent international co-authorships with us.

Semiconductors

Research in this key technology has seen a big shift in the last ten years; in 2012 Scholarly Output in Europe was twice the amount of research output of China, and the US was also ahead of China. Ten years later the outlook is completely reversed, and China now dominates and publishes twice more than Europe and 3 times as much as the US. In term of relative activity (RAI) Taiwan is the country showing the highest activity in the field of semiconductors, followed by South Korea, India, China, and Japan. Regarding collaborative research we find the highest levels of **international collaboration** in European countries (around 60%), the US sits at around 45%. In East Asia, we find lower levels of international collaboration: Taiwan, Japan and South Korea are at around 35%, and China is the lowest with 22%.

In conclusion:

- We observe that Italian science not only has an impact on research worldwide but also on sustainability and on policy.
- Italian research contributes significantly to the SDGs with high scientific impact for all 16 SDGs.
- Despite a modest scale of research activity in key technology fields compared to, particularly, Asian regions, Italian research demonstrates high scientific quality. This is further bolstered by a rise in international collaborations.

4 Which disciplines and universities contribute the most to Italian success?

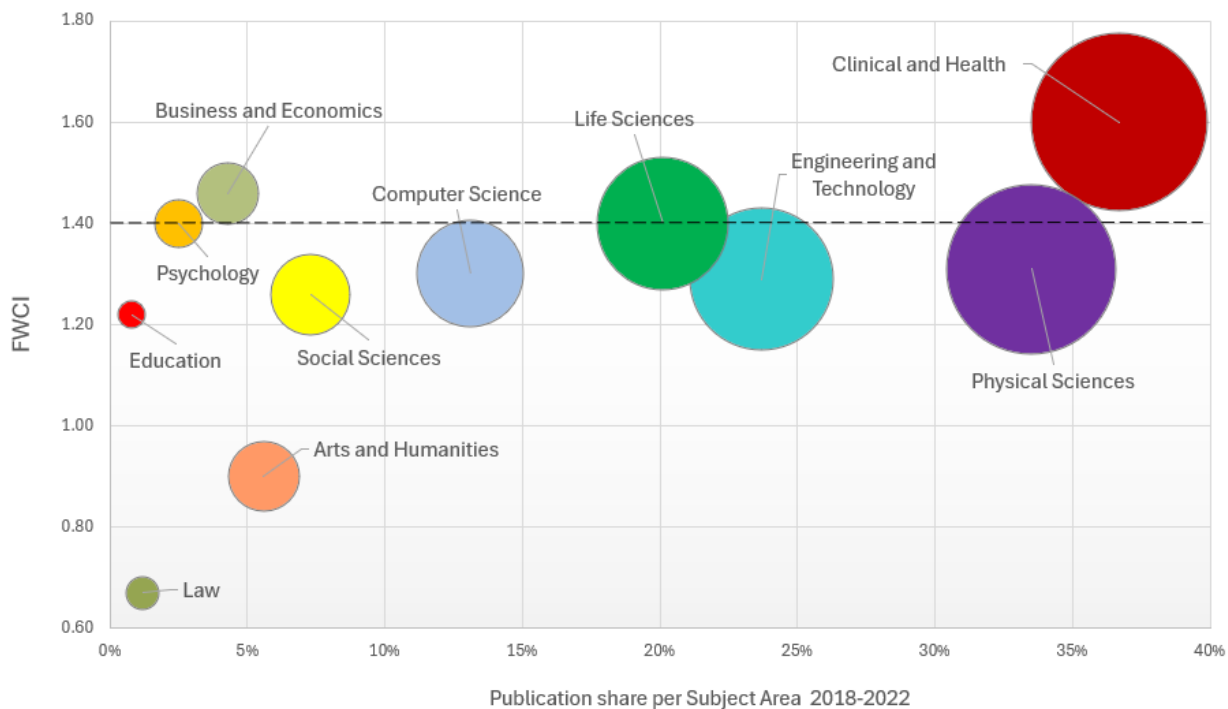


Figure 10: Relative contribution per discipline to Italian Science, in term of volume, share and FWCI.

The overall research impact measured as Field-Weighted Citation Impact (FWCI) for Italian research published in the five years period 2018-2022 is 1.40, represented by the horizontal dotted line in the above chart. FWCI 1.40 signifies 40% more citations compared to the global benchmark.

When we examine fields of study, we observe that in Italy Clinical and Health, is both the largest research areas and the most impactful (FWCI 1.60). This emphasizes the significant contribution of medical research to Italy's overall scientific performance.

The global landscape paints a different picture. While Psychology and Computer Science lead in FWCI, their publication volume remains comparatively modest. In stark

contrast, Physical Sciences and Engineering account for the vast majority of publications globally. In the EU, the fields with the highest citation levels are Business & Economics and Psychology, but again they represent a very small share of the total output of the European Union (less than 7%). The largest number of published research in the EU is within the Physical Sciences (FWCI 1.12) followed by Clinical and Health (FWCI 1.22). The picture in Germany and also in France is similar, with the largest number of publications coming from the Physical Sciences with an FWCI below the national average, and higher citation levels come from smaller fields.

The UK mirrors Italy's pattern, with Clinical and Health research ranking as the largest and most cited subject area.

Prolific universities in Italy

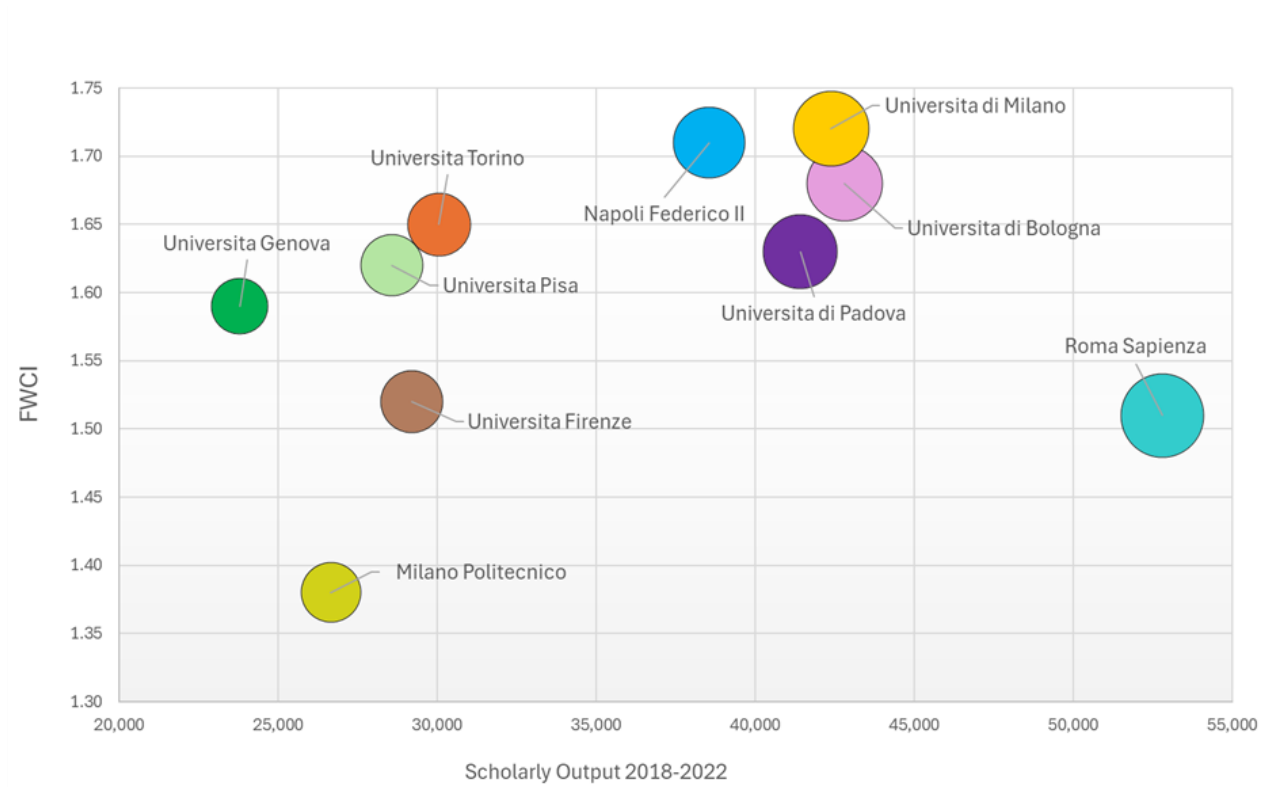


Figure 11: For Italian universities, the output (in thousand articles) and the scientific impact (in FWCI).

Among Italian universities, Sapienza University of Rome takes the crown for productivity, boasting over 50,000 research articles published between 2018 and 2022. The Universities of Bologna, Milan, and Padua follow closely behind, each contributing around 42,000 publications during the five-year period. The University of Naples Federico II rounds out the top five with a respectable 38,000 publications.

However, the University of Milan shines in terms of scientific impact, achieving a Field-Weighted Citation Impact (FWCI) of 1.72. Naples Federico II follows closely with an FWCI of 1.71. Notably, all ten universities listed

in the chart (representing Italy's most prolific institutions) consistently outperform the global (of 1.00).

Beyond these top institutions, other Italian universities worth mentioning are: Cattolica del Sacro Cuore (FWCI 1.80); Torre Vergata Roma (FWCI 1.55); Torino Politecnico (FWCI 1.40); University of Pavia (FWCI 1.72); Milano Bicocca (FWCI 1.99); University of Bari (FWCI 1.63). Other smaller academic institutions with notable citation levels include Vita-Salute San Raffaele (FWCI 2.27); University of Brescia (FWCI 1.94) and University of Insubria (FWCI 1.81).

Top **Academic International Collaborators** of the five most research-intensive universities in Italy

With Roma Sapienza		Co-authored publications	FWCI
FRA	Paris-Saclay	2,131	9.05
FRA	Paris Cité	1,784	7.82
FRA	Sorbonne	1,389	8.11
GRC	Athens	1,362	12.51
RUS	Lomonosov Moscow	1,308	13.03
USA	Ohio State	1,231	14.25
GBR	Imperial	1,216	11.05
CZE	Charles University	1,213	13.18
ESP	Autónoma de Madrid	1,206	14.25
GBR	UCL	1,164	10.24

With Bologna		Co-authored publications	FWCI
FRA	Paris-Saclay	1,876	3.9
FRA	Paris Cité	1,639	4.5
GRC	Athens	1,304	5.34
CZE	Charles University	1,273	4.99
GBR	Imperial	1,262	6.44
RUS	Lomonosov Moscow	1,220	3.85
FRA	Sorbonne	1,171	4.46
ESP	Autónoma de Madrid	1,151	6.35
DEU	Heidelberg	1,144	7.85
CHN	Tsinghua University	1,138	5.69

With Milan		Co-authored publications	FWCI
FRA	Paris-Saclay	1,571	4.91
FRA	Paris Cité	1,415	4.77
FRA	Sorbonne	1,408	5.14
GBR	UCL	1,292	6.7
GBR	Oxford	1,187	7.58
GBR	Cambridge	1,176	6.86
USA	Harvard	1,166	8.52
GBR	Manchester	1,099	6.21
DEU	Heidelberg	1,017	8.31
GBR	Edinburgh	996	6.34

With Padova		Co-authored publications	FWCI
FRA	Paris-Saclay	1,696	4.45
FRA	Paris Cité	1,398	4.95
GBR	Imperial	1,330	4.93
CHE	Zurich	1,264	4.55
USA	MIT	1,174	4.22
USA	Maryland, College Park	1,109	4.31
FRA	Sorbonne	1,043	5.17
DEU	RWTH Aachen	1,031	4.39
BEL	Ghent University	984	4.17
CHE	ETH Zurich	956	3.69

With Napoli Federico II		Co-authored publications	FWCI
FRA	Paris-Saclay	1,866	3.88
FRA	Paris Cité	1,455	3.96
CZE	Charles University	1,268	4.78
GRC	Athens	1,201	3.59
ESP	Autónoma de Madrid	1,177	4.9
GBR	Imperial	1,170	4.95
RUS	Lomonosov Moscow	1,107	4.05
RUS	Moscow Engineering Physics	1,102	3.22
CHN	CAS - High Energy Physics	1,100	3.41
DEU	Hamburg	1,051	3.97

Figure 12: The 5 tables show the most prolific international academic collaborators with the 5 research-intensive Italian universities measured.

When we then look at the 10 most productive international collaborations of the top five universities in Italy (Figure 12), several important points immediately stand out:

All five universities have the most prolific collaborations with Paris-Saclay and with Paris-Cité': 4 out of 5 with Sorbonne and Imperial in the UK.

We note that most foreign academic institutions are in Europe. The US's best institutions are barely on the list, and only once we see a Chinese institution. 3 out of 5 show Russian institutions within their top collaborators.

Top **Corporate Collaborators** of the five most research-intensive universities in Italy

With Roma Sapienza		Co-authored publications	FWCI
CHN	China Nuclear Corp	177	2.36
ITA	Ceinge Biotechnologie	52	1.33
FRA	Thales	46	0.99
ITA	Leonardo	43	1.97
DEU	Fresenius	40	4.15
GBR	GlaxoSmithKline	36	19.68
NLD	Airbus	33	2.4
ITA	Terma SpA	33	1.29
USA	Alphabet Inc	31	1.65
ITA	GVM SpA	28	2.72

With Bologna		Co-authored publications	FWCI
ITA	GVM SpA	86	1.58
CHN	China Nuclear Corp	67	2.45
DEU	Fresenius	53	4.81
CHE	STMicroelectronics	50	1.04
KOR	Samsung	43	14.19
USA	Johnson & Johnson	41	10.83
GBR	GlaxoSmithKline	40	22.51
USA	IBM	39	2.42
DEU	von Hoerner & Sulger	38	1.91
USA	Mars Inc	34	1.76

With Milan		Co-authored publications	FWCI
CHE	Novartis	69	5.25
ITA	Ceinge Biotechnologie	68	4.31
GBR	GlaxoSmithKline	57	18.3
CHE	F. Hoffmann-La Roche	53	3.79
ITA	GVM SpA	51	3.05
DEU	Fresenius	49	7.33
GBR	AstraZeneca	48	17.24
ARE	Etisalat EBTIC	43	1.51
USA	Genentech Inc	43	11.49
KOR	Samsung	40	13.44

With Padova		Co-authored publications	FWCI
ITA	GVM Spa	61	3.93
USA	AbbVie	60	4.19
ITA	EURAC Research	58	5.02
DEU	Infineon Technologies	55	2.11
KOR	Samsung	48	6.54
USA	Leidos Inc	44	4.44
ITA	Ceinge Biotechnologie	40	5.75
DNK	Novo Nordisk	40	6.64
CHN	China Nuclear Corp	39	1.36
USA	IBM	37	1.79

With Napoli Federico II		Co-authored publications	FWCI
ITA	Ceinge Biotechnologie	808	1.49
ITA	CIRA	149	1.43
ITA	Biogen	83	1.97
ITA	Leonardo	45	1.75
USA	General Atomics	44	1.22
DEU	von Hoerner & Sulger GmbH	36	1.99
ITA	GVM SpA	29	3.92
GBR	GlaxoSmithKline	28	27.2
CHE	Novartis	27	3.72
USA	AbbVie	23	6.45

Figure 13: The 5 tables show the most prolific corporate collaborators with the 5 research-intensive Italian universities measured.

Research collaborations between academic institutions and corporations tend to produce highly cited publications. This global trend holds true for Italy as well, where scholarly output co-authored by academics and corporate professionals boasts a remarkable Field-Weighted Citation Impact (FWCI) of 2.89. The most frequent corporate collaborators with Italian academics include EURAC Research, Ceinge Biotechnologie, STMicroelectronics, GVM, and GlaxoSmithKline.

Further analysis of Italy's top five research-intensive universities reveals a pattern of collaboration. All five universities list the Italian company GVM Spa among their top corporate partners. Four out of five also collaborate extensively with Ceinge Biotechnologie (Italy) and GlaxoSmithKline (UK). Additionally, three universities partner with Fresenius (Germany), Samsung (South Korea), and China National Nuclear Corporation.

5 Conclusions

Italy has witnessed a remarkable surge in scientific research productivity in recent years. It now stands as the world's sixth-most productive scientific nation, solidifying its position as the second-highest producer within the EU, trailing only Germany. This impressive rise can be ascribed to two key factors: a flourishing output of publications in the field of health research and a strong commitment to addressing global sustainability challenges through scientific inquiry. Furthermore, Italian researchers are increasingly engaging in international collaborations, further amplifying their impact on the global scientific landscape.

The past two decades have witnessed a dramatic transformation in the landscape of scientific research. On a global scale, a significant shift has been marked by the meteoric rise of China, whose share of global scholarly output has skyrocketed from 4% to a staggering 26%. Similarly, developing nations, most notably India, have made increasingly significant contributions. Conversely, the dominance of the US and Europe has waned, with the US share dropping from 28% to 18% and the EU27 declining from 26% to 23%. Italy, however, stands out as an anomaly. In stark contrast to the diminishing contributions of other established research powerhouses, Italy's footprint in global research has actually grown. In 2000, Italy accounted for 3.4% of the world's published scientific research. By 2022, this share had climbed to 4%. This achievement becomes even more impressive when compared to the declining shares of traditionally research-intensive nations like the UK (falling from 8% to 6%), Germany (from 6.7% to 5.1%), and Japan (from 8% to a concerning low 3.5%).

The field of Clinical and Health research stands out prominently within the Italian scientific landscape. It holds the undisputed top spot in terms of both research volume and impact. This dominance is evident not only when examining Clinical and Health as a distinct area, but also when considering research conducted under the umbrella of Sustainable Development Goal 3: Good Health and Well-being.

Italian science has witnessed a surge in international collaborations. These partnerships across borders demonstrably lead to scientific research with a significantly

greater impact than studies conducted solely within Italy. Notably, Italian researchers collaborate most frequently with high-performing countries like the US, UK, and Germany. This trend is further exemplified by the strong relationships between top Italian universities and prestigious European institutions. These include French universities like Paris-Saclay, Paris Cité, and Sorbonne; Imperial College London, University College London, and Cambridge University in the UK; Charles University in the Czech Republic; Autónoma University of Madrid in Spain; University of Athens in Greece; and Heidelberg University in Germany.

The influence of Italian researchers extends beyond global science. Their work also demonstrably shapes policymaking, both nationally and internationally. This is evidenced by the higher-than-average citation rate of Italian research in policy documents across the European Union.

Italian research demonstrates impressive contributions to achieving the Sustainable Development Goals (SDGs). Italy is highly active in half of the SDGs, particularly in Good Health and in Sustainable Cities. Furthermore, Italian research in critical areas like Health, Industry, Innovation, and Climate Action receives a high number of citations, signifying its significant impact. We have also observed high research impact in the fields of AI, Net Zero, and key technologies, although the scale of research activity in these areas is modest and lags behind in the global landscape.

6 Definitions

This report is based on Scopus data. Scopus is a large citation database launched in 2004 by Elsevier. It's one of the most prominent tools for researchers to find relevant academic publications, track citations, and analyse research trends. It covers 36,377 titles from 11,678 publishers. For more information see scopus.com

Subject Area classification

The subject area classification used in this report is that of the THE World University Rankings. It covers 11 subject areas mapped to the Journal Classification (ASJC) used in scopus database. Scopus uses a hierarchical structure with 27 main subject areas. Each of the 11 THE subject area is mapped to one or more ASJC's.

International collaboration

International collaboration in this report is indicated by papers with at least two different countries listed in the authorship byline.

Academic-corporate collaboration

In Scopus, institutions are classified into one of four main sectors (Corporate, Academic, Government, and medical sectors). In this report, academic–corporate collaboration is indicated when there is at least one author from an Academic institution and one author from a Corporate.

Citation

A citation is a formal reference to earlier work made in a paper or patent, frequently to other papers. A citation is used to credit the originator of an idea or finding and is typically used to indicate that the earlier work supports the claims of the work citing it. The number of citations received by a paper from subsequently published papers can be used as a proxy of the quality or importance of the reported research.

FWCI (Field-weighted citation impact)

Field-weighted citation impact (FWCI) is an indicator of mean citation impact and compares the actual number of citations received by a paper with the expected number of citations for papers of the same document type (article, review, or conference proceeding), publication year, and subject area. When the paper is classified in two or more subject areas, the harmonic mean of the actual and expected citation rates is used. The indicator is therefore always defined with reference to a global baseline of 1.0 and intrinsically accounts for differences in citation accrual over time, differences in citation rates for different document types (e.g., reviews typically attract more citations than research articles), as well as subject specific differences in citation frequencies overall and over time and document types. It is one of the most sophisticated indicators in the modern bibliometric toolkit.

RAI (Relative Activity Index)

Relative Activity Index is defined as the share of an entity's publications in a subject relative to the global share of publications in the same subject. A value of 1.0 indicates that an entity's research activity in a field corresponds exactly with the global activity in that field; higher than 1.0 implies a greater emphasis while lower than 1.0 suggests a lesser focus.