

Cluster ranking

The GII reveals the world's top 100 science and technology (S&T) clusters and identifies the most S&T-intensive top global clusters.

The GII 2022 top 100 science and technology clusters

Recognizing that innovation output at the local level is as important as output at the national level, the Global Innovation Index (GII) continues to present the world's largest top 100 science and technology (S&T) clusters (see Map 1) – that is, the geographical areas around the world with the highest density of inventors and scientific authors (see Appendix IV, which details the methodological adjustment employed).

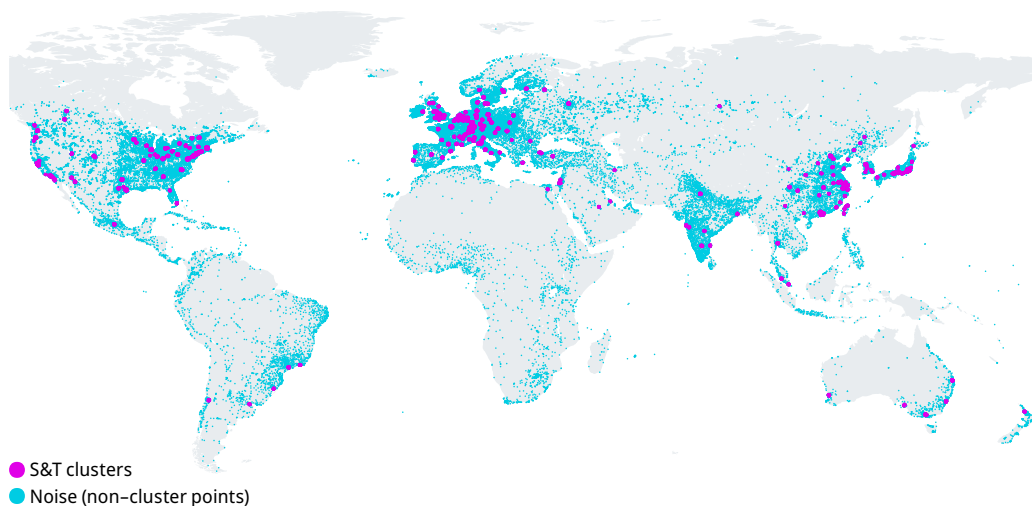
For the first time, this year the GII also presents S&T clusters beyond the top 100, shedding light on those clusters not normally highlighted in the section.

Tokyo–Yokohama continues to lead the top 100 S&T clusters

Among the top 100, Tokyo–Yokohama (Japan) is the top-performing cluster, followed by Shenzhen–Hong Kong–Guangzhou (China and Hong Kong, China), Beijing (China), Seoul (Republic of Korea) and San Jose–San Francisco (United States) (see Appendix Table 3).

The top 10 clusters remain the same as last year, with one difference: Shanghai and Suzhou have now merged into one cluster.

Map 1 Top 100 clusters worldwide, 2022



Source: WIPO Statistics Database, April 2022.

Note: Noise refers to all inventor/author locations not classified in a cluster.

The largest increases in the ranking came from three Chinese clusters – Zhengzhou (+15 positions), Qingdao (+12) and Xiamen (+12). Berlin (+4) in Germany, Istanbul (+4) in Türkiye, Kanazawa (+4) in Japan, Ankara (+3) in Türkiye, Daegu (+3) in the Republic of Korea and Mumbai (+3) in India also advanced strongly this year.

Chinese clusters experienced the largest increases in S&T output too, with the median increase equating to +13.9 percent and with China hosting the fastest growing clusters – Qingdao (+25.2 percent) and Wuhan (+21.9 percent).¹ Other clusters in middle-income economies, besides those in China, also experienced strong growth, including Istanbul (Türkiye, +7.3 percent), Chennai (India, +7.1 percent) and Delhi (India, +5.2 percent).

High-income economy clusters generally grew at a slower pace than clusters in middle-income economies. However, there were some notable exceptions among the high-income economy clusters, namely Basel (+10.5 percent), a new top 100 entrant this year from the French, German and Swiss border region, Munich (+8.6 percent) in Germany – closing the gap between it and Cologne – and Kanazawa (+8.1 percent) in Japan.

The top S&T clusters of each economy or cross-border region are shown in Table 6.

Table 6 Top S&T cluster of each economy or cross-border region, rank among the top 100, 2022

| Rank | Cluster name | Economy | Rank change since 2021 |
|------|------------------------------|----------|------------------------|
| 1 | Tokyo-Yokohama | JP | 0 |
| 2 | Shenzhen-Hong Kong-Guangzhou | CN/HK | 0 |
| 3 | Beijing | CN | 0 |
| 4 | Seoul | KR | 0 |
| 5 | San Jose-San Francisco, CA | US | 0 |
| 10 | Paris | FR | 0 |
| 19 | London | GB | 0 |
| 23 | Cologne | DE | -2 |
| 25 | Amsterdam-Rotterdam | NL | -2 |
| 26 | Taipei-Hsinchu | TW* | 0 |
| 30 | Tel Aviv-Jerusalem | IL | -2 |
| 31 | Moscow | RU | -1 |
| 32 | Tehran | IR | 0 |
| 33 | Singapore | SG | -2 |
| 35 | Stockholm | SE | 0 |
| 36 | Eindhoven | NL/BE | -2 |
| 39 | Melbourne | AU | -2 |
| 46 | Istanbul | TR | 4 |
| 47 | Brussels | BE | -4 |
| 48 | Madrid | ES | -1 |
| 51 | Zürich | CH/DE | 1 |
| 53 | Milan | IT | 0 |
| 54 | Toronto, ON | CA | -5 |
| 59 | Copenhagen | DK | -4 |
| 60 | Bengaluru | IN | 0 |
| 71 | São Paulo | BR | 0 |
| 73 | Helsinki | FI | -1 |
| 76 | Vienna | AT | -1 |
| 92 | Warsaw | PL | 0 |
| 93 | Lausanne | CH/FR | -3 |
| 99 | Basel | CH/DE/FR | 7 |

Source: WIPO Statistics Database, April 2022.

Notes: The codes given in the tables in this section are the ISO alpha-2 country codes, with the following addition: *TW = Taiwan, Province of China.

China is now on a par with the United States in terms of the number of top 100 S&T clusters

In 2022, as in previous years, the top 100 S&T clusters are highly concentrated in three regions, Northern America, Europe and Asia and, especially, in two countries: the United States and China (see Map 1).

For the first time, China hosts as many clusters as the United States, with 21 each (see Map 2a and 2b and Table 7). Germany follows, with 10 clusters in the top 100, with Cologne and Munich as the two largest clusters. Japan has five clusters in the top 100, with Tokyo-Yokohama and Osaka-Kobe-Kyoto also represented in the top 10 clusters overall.

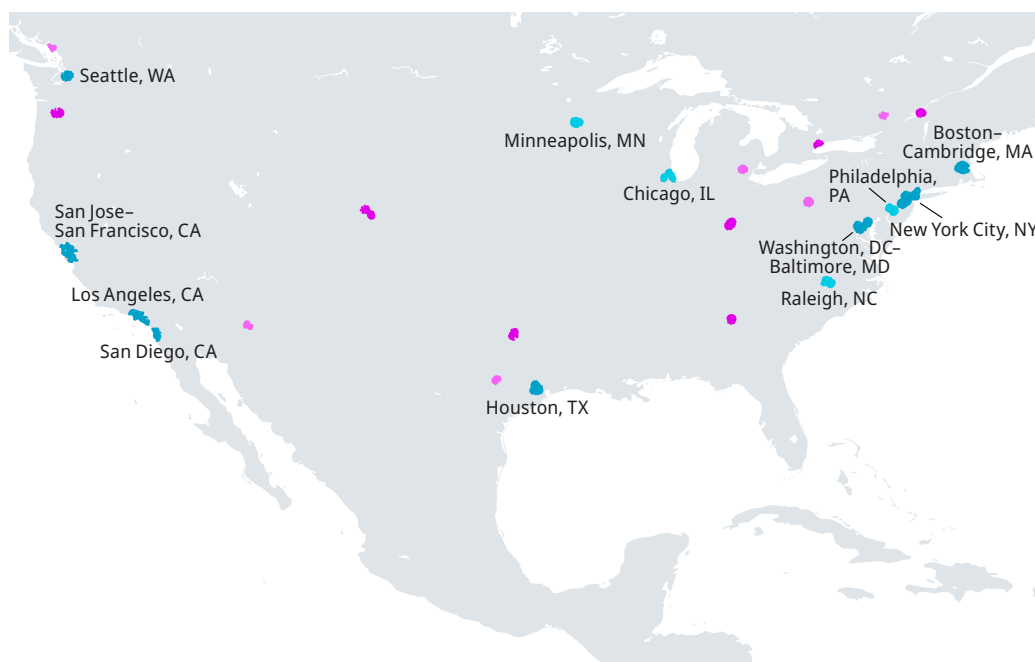
Mirroring last year's results, with the exception of China, only five middle-income economies have clusters in the top 100:

- Brazil (1 cluster), with São Paulo, the sole top 100 S&T cluster in Latin America;
- India (4), with Bengaluru, Delhi and Mumbai, as last year, and Chennai making the top 100 for the first time;
- the Islamic Republic of Iran (1), with Tehran;
- Türkiye (2), with Istanbul and Ankara; and
- the Russian Federation (1), with Moscow.

It is notable that, among the aforementioned clusters, Ankara and Istanbul, the two Turkish clusters, and Mumbai have made significant jumps forward.

Map 2 Top S&T clusters, United States and China, 2022

a - United States and Canada



Cluster rank

- 1-25
- 26-50
- 51-75
- 76-100



b - East Asia



Cluster rank

- 1-25
- 26-50
- 51-75
- 76-100



Source: WIPO Statistics Database, April 2022.

Table 7 Economies with three or more top 100 S&T clusters, 2022

| Economy | Economy name | Number of top 100 clusters |
|---------|-------------------|----------------------------|
| US | United States | 21 |
| CN | China | 21 |
| DE | Germany | 10 |
| JP | Japan | 5 |
| FR | France | 4 |
| CA | Canada | 4 |
| IN | India | 4 |
| KR | Republic of Korea | 4 |
| GB | United Kingdom | 3 |
| AU | Australia | 3 |
| CH | Switzerland | 3 |
| SE | Sweden | 3 |

Source: WIPO Statistics Database, April 2022.

Beyond the top 100: Bangkok, Buenos Aires, Cairo, Kuala Lumpur and Mexico City are top S&T clusters in middle-income economies

Using the same thresholds employed for the identification of top 100 S&T clusters, the GII 2022 also identifies clusters beyond the top 100 without determining their precise ranking.

Based on the same parameters applied to produce the top 100 ranking, 123 additional clusters are identified beyond the top 100, including 23 clusters based in the United States, 13 in both China and Germany and 10 in both France and the United Kingdom.

In India, Kolkata, Pune and Hyderabad stand out. Brazil's Rio de Janeiro and Porto Alegre were also added, along with Saint Petersburg and Novosibirsk in the Russian Federation.

Table 8 identifies top S&T clusters in economies not covered previously in the top 100, including Portugal and Saudi Arabia, with two clusters each. Among the middle-income economies, Argentina, Egypt, Malaysia, Mexico and Thailand each host a top S&T cluster in the extended list, namely Buenos Aires, Cairo, Kuala Lumpur, Mexico City and Bangkok, respectively. Other prominent Latin American urban areas – such as Mexico City, Rio de Janeiro, Porto Alegre and Santiago de Chile – feature in this extended list as well.

Table 8 Top S&T clusters in extended ranking, economies not covered in top 100, 2022

| Economy | Economy name | Cluster name |
|---------|----------------|-------------------|
| PT | Portugal | Lisbon and Porto |
| SA | Saudi Arabia | Riyadh and Dammam |
| AR | Argentina | Buenos Aires |
| CL | Chile | Santiago |
| CZ | Czech Republic | Prague |
| EG | Egypt | Cairo |
| GR | Greece | Athens |
| HU | Hungary | Budapest |
| IE | Ireland | Dublin |
| MO | Macao, China | Macau |
| MY | Malaysia | Kuala Lumpur |
| MX | Mexico | Mexico City |
| NZ | New Zealand | Auckland |
| NO | Norway | Oslo |
| RO | Romania | Bucharest |
| RS | Serbia | Belgrade |
| TH | Thailand | Bangkok |

Source: WIPO Statistics Database, April 2022.

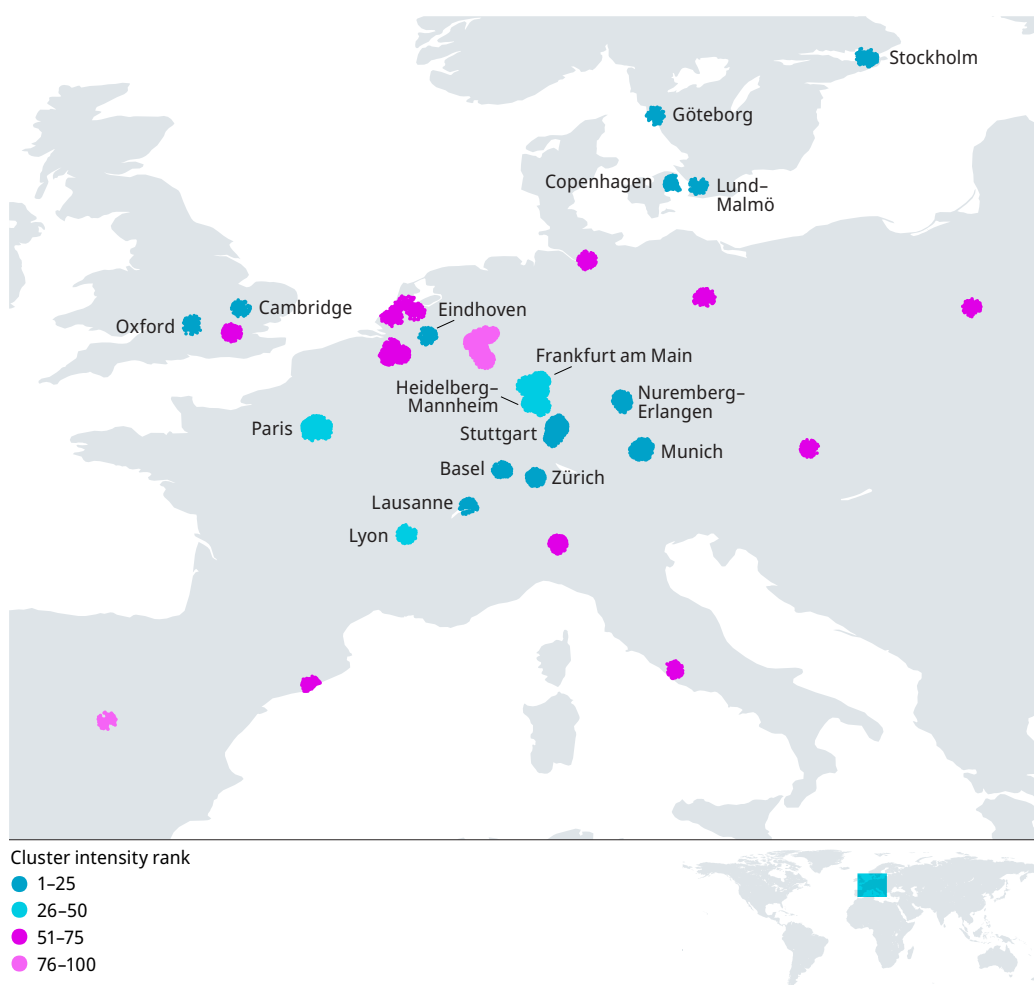
S&T intensity of the top 100 clusters

Since 2020, the GII has also presented the top 100 clusters ranked by their S&T intensity – that is, the sum of their patent and scientific publication shares divided by population. This work draws on geospatial imagery to estimate the underlying population levels (see Appendix IV).

Cambridge in the United Kingdom and Eindhoven in the Netherlands/Belgium are found to be the most S&T-intensive clusters, followed by Daejeon (Republic of Korea), San Jose–San Francisco (United States) and Oxford (United Kingdom) (see Appendix Table 4). Sweden is making a strong showing overall with Lund–Malmö, Stockholm and Göteborg. Only San Jose–San Francisco makes the top five of the GII S&T cluster and the GII S&T intensity ranking.

Through this fresh lens, many European and United States clusters show more intense S&T activity than their Asian counterparts (see Map 3 and Table 9). The United States has seven clusters in the top 25 by S&T intensity, followed by Germany with five, and Switzerland and Sweden with three each.

Map 3 European S&T clusters by intensity



Source: WIPO Statistics Database, April 2022.

Table 9 Top S&T clusters by S&T intensity, 2022

| Rank per capita | Cluster name | Economy |
|-----------------|----------------------------|----------|
| 1 | Cambridge | GB |
| 2 | Eindhoven | NL/BE |
| 3 | Daejeon | KR |
| 4 | San Jose–San Francisco, CA | US |
| 5 | Oxford | GB |
| 6 | Boston–Cambridge, MA | US |
| 7 | Ann Arbor, MI | US |
| 8 | San Diego, CA | US |
| 9 | Seattle, WA | US |
| 10 | Lund–Malmö | SE |
| 11 | Lausanne | CH/FR |
| 12 | Raleigh, NC | US |
| 13 | Munich | DE |
| 14 | Kanazawa | JP |
| 15 | Stockholm | SE |
| 16 | Göteborg | SE |
| 17 | Helsinki | FI |
| 18 | Nuremberg–Erlangen | DE |
| 19 | Zürich | CH/DE |
| 20 | Tokyo–Yokohama | JP |
| 21 | Copenhagen | DK |
| 22 | Beijing | CN |
| 23 | Stuttgart | DE |
| 24 | Basel | CH/DE/FR |
| 25 | Portland, OR | US |

Source: WIPO Statistics Database, April 2022.

As was the case in the previous year’s GII S&T cluster ranking, S&T intensity was higher in those cases where patenting activity drove a cluster’s output, with 20 out of the top 25 clusters deriving the majority of their output from patents.

As expected, China, in particular, scores less well when correcting for population. Applying this methodology, Beijing (23) makes it into the top 25 by S&T intensity but no other Chinese or middle-income economy cluster does. Relative to the top S&T cluster ranking, Brazil, India, Iran, the Russian Federation and Türkiye maintain the same number of clusters in this top 100 S&T intensity ranking: Tehran (77) in Iran; Ankara (91) and Istanbul (95) in Türkiye; Moscow (94) in the Russian Federation; Bengaluru (96), Chennai (97), Delhi (99) and Mumbai (100) in India; and São Paulo (98) in Brazil (in order of best ranked cluster, with Tehran ranking highest).

Note

- 1 S&T output growth refers to the net S&T output over time, which is the difference in total patents and publications for each cluster, for all points that were located inside the same cluster compared to the previous year.