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# The world's leading research universities

*In our current situation, where sharpening geopolitical frictions increasingly impact research collaborations, it is imperative to have a clear understanding of the global scientific landscape and how it is evolving. A decade ago, the scientific dominance of the United States and Europe seemed largely unquestioned. This Outlook examines the leading global research universities, showing that a profound transformation has occurred during the past decade: China has emerged as a dominant force in science. Chinese universities now play a central role across a broad range of disciplines, and the country's research institutions are increasingly at the forefront of high-impact scientific work. This development has not yet been fully recognised in public discourse across Europe and North America. Still, it is reshaping the world of science and has far-reaching implications for future research cooperation and policy.*

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## The world's leading research universities

Mainstream university rankings present a familiar overall picture that resembles what we have become used to in the post-WWII era, i.e. the top 100 universities in the world are mainly based in the United States and the United Kingdom, with a sprinkle of universities from Europe, the rest of the anglophone world, and (more recently) Asia. As an example, while China[1] is the largest science nation in the world,[2] Chinese universities do not feature prominently in these rankings, although the number of mainland Chinese universities in the global top 100 has somewhat increased in the past decade.[3] However, a more careful analysis of the dynamics among the universities ranked *below* the top 100 of these rankings reveals that a shift is taking place: Asian universities are moving upward, while universities in

Table 1: **Leading universities worldwide by the top 10% most cited publications across all scientific disciplines (CWTS)**

| | 2009-2012 | | | 2019-2022 | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Harvard University | USA | 1 | Harvard University | USA |
| 2 | Stanford University | USA | 2 | Zhejiang University | China |
| 3 | University of Toronto | Canada | 3 | Shanghai Jiaotong University | China |
| 4 | University of Michigan | USA | 4 | Tsinghua University | China |
| 5 | University of California Berkley | USA | 5 | Huazhong University of Science & | China |
| 6 | University of California Los Angeles | USA | | Technology | |
| 7 | University of Cambridge | United Kingdom | 6 | Stanford University | USA |
| 8 | Johns Hopkins University | USA | 7 | University of Toronto | Canada |
| 9 | Massachusetts Institute of | USA | 8 | Central South University | China |
| | Technology | | 9 | Universtiy of Oxford | United Kingdom |
| 10 | University of Pennsylvania | USA | 10 | Sichuan University | China |
| 11 | Universtiy of Oxford | United Kingdom | 11 | Sun Yat-Sen University | China |
| 12 | University of Washington Seattle | USA | 12 | University of the Chinese Academy | China |
| 13 | University of California San Diego | USA | | of Sciences | |
| 14 | University College London | United Kingdom | 13 | Peking University | China |
| 15 | University of California San | USA | 14 | University of Michigan | USA |
| | Fransisco | | 15 | Xi'an Jiaotong University | China |
| 16 | Columbia University | USA | 16 | Johns Hopkins University | USA |
| 17 | Yale University | USA | 17 | University College London | United Kingdom |
| 18 | Cornell University | USA | 18 | Wuhan University | China |
| 19 | Duke University | USA | 19 | University of Pennsylvania | USA |
| 20 | Northwestern University | USA | 20 | Harbin Insitute of Technology | China |

Table 2: **Leading universities worldwide by the top 10% most cited publications in Biomedical and Health Sciences (CWTS)**

| | 2009-2012 | | | 2019-2022 | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Harvard University | USA | 1 | Harvard University | USA |
| 2 | Johns Hopkins University | USA | 2 | University of Toronto | Canada |
| 3 | University of California San Fransisco | USA | 3 | Johns Hopkins University | USA |
| 4 | University of Toronto | Canada | 4 | University of Pennsylvania | USA |
| 5 | University of Pennsylvania | USA | 5 | Stanford University | USA |
| 6 | University of Michigan | USA | 6 | University of California San Fransisco | USA |
| 7 | University College London | United Kingdom | 7 | Shanghai Jiaotong University | China |
| 8 | Stanford University | USA | 8 | University of Michigan | USA |
| 9 | University of California Los Angeles | USA | 9 | Zhejiang University | China |
| 10 | University of Pittsburgh | USA | 10 | University College London | United Kingdom |
| 11 | University of Washington Seattle | USA | 11 | Sun Yat-Sen University | China |
| 12 | University of Texas Health Science | USA | 12 | Sichuan University | China |
| | Center at Houston | | 13 | University of Oxford | United Kingdom |
| 13 | Columbia University | USA | 14 | Fudan University | China |
| 14 | University of California San Diego | USA | 15 | Yale University | USA |
| 15 | Yale University | USA | 16 | University of Texas Health Science | USA |
| 16 | Case Western Reserve University | USA | | Center at Houston | |
| 17 | University of Oxford | United Kingdom | 17 | Huazhong University of Science & | China |
| 18 | Duke University | USA | | Technology | |
| 19 | Washington University in St Louis | USA | 18 | University of California San Diego | USA |
| 20 | University of Cambridge | United Kingdom | 19 | University of Washington Seattle | USA |
| | | | 20 | Central South University | China |

[1] In this Outlook, 'China' specifically refers to mainland China unless otherwise specified.

[2] As measured by the number the number of published peer-reviewed research publications (Tollefson, 2018).

[3] The four main global university rankings – QS, Times Higher Education, ARWU, and U.S. News – respectively ranked 5, 7, 13, and 9 mainland Chinese universities among the global top 100 in 2025.

Europe and North America are moving downward. The dynamic is clear: the global centre of gravity of the university world is shifting towards Asia in general and towards China in particular.

Mainstream rankings measure the best universities using a wide range of metrics to calculate their scores, of which research strength is only one. For example, 'research quality' accounts for 30% of the total score in the Times Higher Education ranking. 'Research reputation' counts for another 18%; however, this, by definition, reflects past achievements rather than the current situation. While this is certainly reasonable, as universities have several missions, it means that mainstream rankings are not the most relevant sources for gauging the research strength of universities.

In order to rank universities based solely on their research strength, we therefore need an alternative approach. Rankings of the strongest research institutions need to be based as much on the quality as on the quantity of research done at the respective institutions. Measuring the quality of research, however, is not a straightforward task. A common basis for research quality metrics is counting the number of times published research is cited by other scientists, based on the rationale that high-quality research will typically be cited more frequently. Using this logic, we can count the number of most frequently cited publications in the same field and the same year, i.e. the publications considered to have the greatest scientific impact. Using data from the CWTS Leiden Ranking, published by Leiden University in the Netherlands, it is possible to rank universities based on this measure, i.e., based on the number of highly-cited publications they publish.

Tables 1 to 5 list the top 20 universities worldwide based on their number of publications ranking among the top 10% most frequently cited. These tables cover all scientific disciplines combined, as well as separate data on the following fields: biomedical and health sciences, mathematics and computer science, physical sciences and engineering, and social sciences and humanities. Each table compares two periods: 2009–2012 and 2019–2022 (the most recent data available) (CWTS, n.d.). The tables reveal a substantial change during the intervening years. While there were no Chinese universities among the global top 20 for all sciences in the period 2009–2012, twelve Chinese universities were in the top 20 ten years later, comprising four of the top 5. In the fields of mathematics and computer science, as well as physical sciences and engineering, the number of Chinese universities among the global top 20 increased from five to nineteen and from two to nineteen, respectively. In biomedical and health sciences, the shift is less pronounced, with seven Chinese universities ranking in the top 20 in the period 2019–2022, partly reflecting a more recent focus on funding in these disciplines in China. Chinese universities remain absent from the top global rankings in the social sciences and hu-

Table 3: **Leading universities worldwide by the top 10% most cited publications in Mathematics and Computer Science (CWTS)**

| 2009-2012 | | | 2019-2022 | | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Massachusetts Institute of Technology | USA | 1 | University of Electronic Science & Technology of China | China |
| 2 | Stanford University | USA | | | |
| 3 | University of California Berkley | USA | 2 | Tsinghua University | China |
| 4 | Nanyang Technological University | Singapore | 3 | Xidian University | China |
| 5 | Tsinghua University | China | 4 | Harbin Institute of Technology | China |
| 6 | University of California Los Angeles | USA | 5 | Huazhong University of Science & Technology | China |
| 7 | Georgia Institute of Technology | USA | | | |
| 8 | National University of Singapore | Singapore | 6 | Shanghai Jiaotong University | China |
| 9 | Shanghai Jiaotong University | China | 7 | Southeast University | China |
| 10 | University of California San Diego | USA | 8 | Wuhan University | China |
| 11 | University of Texas at Austin | USA | 9 | Zhejiang University | China |
| 12 | Harvard University | USA | 10 | Beihang University | China |
| 13 | University of Michigan | USA | 11 | Northwestern Polytechnical University | China |
| 14 | ETH Zürich | Switzerland | 12 | Xi'an Jiaotong University | China |
| 15 | Zhejiang University | China | 13 | Beijing Institute of Technology | China |
| 16 | Harbin Institute of Technology | China | 14 | Nanyang Technological University | Singapore |
| 17 | Xidian University | China | 15 | Tianjin University | China |
| 18 | University of Toronto | Canada | 16 | Beijing University of Posts & Telecommunications | China |
| 19 | University of Illinois Urbana-Champaign | USA | 17 | South China University of Technology | China |
| 20 | City University of Hong Kong | Hong Kong SAR | 18 | Nanjing University of Aeronautics and Astronautics | China |
| | | | 19 | Northeastern University | China |
| | | | 20 | Central South University | China |

Table 4: **Leading universities worldwide by the top 10% most cited publications in Physical Sciences and Engineering (CWTS)**

| 2009-2012 | | | 2019-2022 | | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Massachusetts Institute of Technology | USA | 1 | Tsinghua University | China |
| 2 | University of California Berkley | USA | 2 | Shanghai Jiaotong University | China |
| 3 | Stanford University | USA | 3 | Zhejiang University | China |
| 4 | Harvard University | USA | 4 | Harbin Institute of Technology | China |
| 5 | University of Cambridge | United Kingdom | 5 | Tianjin University | China |
| 6 | Tsinghua University | China | 6 | Huazhong University of Science & Technology | China |
| 7 | University of Tokyo | Japan | | | |
| 8 | National University of Singapore | Singapore | 7 | Xi'an Jiaotong University | China |
| 9 | ETH Zürich | Switzerland | 8 | University of Science & Technology of China | China |
| 10 | California Institute of Technology | USA | | | |
| 11 | Nanyang Technological University | Singapore | 9 | University of the Chinese Academy of Sciences | China |
| 12 | Université Paris-Saclay (EPE) | France | | | |
| 13 | Zhejiang University | China | 10 | Central South University | China |
| 14 | University of Texas at Austin | USA | 11 | Chongqing University | China |
| 15 | University of Michigan | USA | 12 | South China University of Technology | China |
| 16 | Northwestern University | USA | 13 | Hunan Unversity | China |
| 17 | Imperial College London | United Kingdom | 14 | Sichuan University | China |
| 18 | Georgia Institute of Technology | USA | 15 | Northwestern Polytechnical University | China |
| 19 | Kyoto University | Japan | 16 | Dalian University of Technology | China |
| 20 | University of Illinois Urbana-Champaign | USA | 17 | Tongji University | China |
| | | | 18 | Southeast University | USA |
| | | | 19 | Massachusetts Institute of Technology | China |
| | | | 20 | Peking University | China |

manities, with comparatively limited funding and political and ideological constraints[4] as contributing factors.

Ranking universities by their number of publications in the top 1% most frequently cited yields a similar shift, though it is somewhat less pronounced.

These data may be compared to those of the Nature Index, published by Springer Nature. The Nature Index measures high-quality research output based on publication volumes in the most impactful scientific journals and ranks research institutions accordingly. Table 6 presents a comparison of the most recent Nature Index data with corresponding figures from a decade earlier (Nature Index, n.d.). While there are some variations, the results are consistent with those based on the CWTS University Ranking, as presented in Tables 1–5. In the 2024 Nature

Table 5: **Leading universities worldwide by the top 10% most cited publications in Social Sciences and Humanities (CWTS)**

| | 2009-2012 | | | 2019-2022 | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Harvard University | USA | 1 | Harvard University | USA |
| 2 | University of Michigan | USA | 2 | Universtiy of Oxford | United Kingdom |
| 3 | Stanford University | USA | 3 | University College London | United Kingdom |
| 4 | University College London | United Kingdom | 4 | University of Toronto | Canada |
| 5 | University of Pennsylvania | USA | 5 | Stanford University | USA |
| 6 | University of California Los Angeles | USA | 6 | University of Michigan | USA |
| 7 | Universtiy of Oxford | United Kingdom | 7 | University of Pennsylvania | USA |
| 8 | University of California Berkley | USA | 8 | Universtity of Amsterdam | The Netherlands |
| 9 | Columbia University | USA | 9 | Columbia University | USA |
| 10 | New York University | USA | 10 | New York University | USA |
| 11 | Yale University | USA | 11 | University of Cambridge | United Kingdom |
| 12 | University of Toronto | Canada | 12 | University of California Los Angeles | USA |
| 13 | University of Chicago | USA | 13 | Yale University | USA |
| 14 | Northwestern University | USA | 14 | University of Melbourne | USA |
| 15 | University of Cambridge | United Kingdom | 15 | University of California Berkley | USA |
| 16 | University of Minnesota Twin Cities | USA | 16 | Pennsylvania State University | USA |
| 17 | Duke University | USA | 17 | University of Chicago | USA |
| 18 | University of British Columbia | Canada | 18 | Northwestern University | USA |
| 19 | University of Wisconsin Madison | USA | 19 | King's College London | United Kingdom |
| 20 | University of Texas at Austin | USA | 20 | Utrech University | The Netherlands |

Table 6: **Leading research institutions worldwide ranked by publication output in high-impact journals (Nature Index)**

| | 2014 | | | 2024 | |
|---|---|---|---|---|---|
| Rank | University | Country | Rank | University | Country |
| 1 | Chinese Academy of Sciences | China | 1 | Chinese Academy of Sciences | China |
| 2 | Harvard University | USA | 2 | Harvard University | USA |
| 3 | Max Planck Society | Germany | 3 | University of Science & Technology of China | China |
| 4 | CNRS | France | 4 | Zhejiang University | China |
| 5 | Stanford University | USA | 5 | Peking University | China |
| 6 | Massachusetts Institute of Technology | USA | 6 | University of Chinese Academy of Sciences | China |
| 7 | The University of Tokyo | Japan | 7 | Tsinghua University | China |
| 8 | Helmholtz Association of German Research Centres | Germany | 8 | Nanjing University | China |
| 9 | University of Cambridge | United Kingdom | 9 | Max Planck Society | Germany |
| 10 | National Insitutes of Health | USA | 10 | Shanghai Jiaotong University | China |
| 11 | University of Oxford | United Kingdom | 11 | Fudan University | China |
| 12 | University of California Berkley | USA | 12 | Sun Yat-Sen University | China |
| 13 | University of California San Diego | USA | 13 | CNRS | France |
| 14 | University of Michigan | USA | 14 | Helmholtz Association of German Research Centres | Germany |
| 15 | Kyoto University | Japan | 15 | Sichuan University | China |
| 16 | Northwestern University | USA | 16 | Stanford University | USA |
| 17 | University of Pennsylvania | USA | 17 | Massachusetts Institute of Technology | USA |
| 18 | Yale University | USA | 18 | University of Oxford | United Kingdom |
| 19 | University of California Los Angeles | USA | 19 | Huazhong University of Science & Technology | China |
| 20 | California Institute of Technology | USA | 20 | Jilin University | China |

[4] See, e.g., discussions by Kevin Rudd in his book On Xi Jinping (Rudd, 2024).

Index ranking, four of the top 5 research institutions and thirteen of the top 20 were Chinese. Aside from the different methods used by the CWTS University Ranking and the Nature Index, they also differ in that the CWTS only lists universities. By contrast, the Nature Index includes all research-conducting institutions, which is why the Chinese Academy of Sciences and the Max Planck Society, for instance, appear in the Nature Index rankings but not in the CWTS University Ranking.

Here, it is worth addressing the issue of self-citation, as some observers have argued that China's growing research visibility may partly be driven by self-citation practices (see, for example, Tang et al., 2015). This concern is not easily substantiated. Given the size and maturity of China's research system, a high level of domestic citation is expected and is not in itself an indicator of citation manipulation. Furthermore, the performance of Chinese research institutions in the Nature Index, which is based solely on publication counts in high-impact peer-reviewed journals and not on citation metrics, indicates a high level of international scientific credibility. This suggests that the rankings based on the CWTS University Rankings are not, to any significant degree, skewed by self-citations. A recent bibliometric study shows that while national-level self-citation in China has increased, author-level self-citation has declined substantially over the past two decades, indicating that China's citation pattern increasingly follows that of a large, mature science nation (Moya-Anegón et al., 2023).

## Strategic technologies

The Australian Strategic Policy Institute (ASPI) think tank publishes the ASPI Critical Technology Tracker (ASPI, n.d.), which tracks the leading countries and research institutions in 64 technology areas deemed foundational for the future.[5] Although ASPI uses the same underlying data from Clarivate (Clarivate, n.d.) as the CWTS University Ranking, it is still of interest to include their findings here, as they provide nuance on the discussion on the world's leading research institutions from the perspective of the strategically most important technical research fields.[6]

The ASPI Critical Technology Tracker ranks China as the leader in 57 of the 64 technologies it tracked in the period 2019–2023, while the United States leads in the remaining fields. China, according to ASPI, has established "a sometimes stunning lead in high-impact research across the majority of critical and emerging technology domains" (Gaida et al., 2023). This is in sharp contrast to the period 2003–2007, when China led in only three of the 64 technologies, while the US led in 60. "China and the United States have effectively switched places as the overwhelming leader in research", as ASPI frames it (Wong Leung, Robin & Cave, 2024).

The ASPI Technology Tracker also analyses the degree to which countries have secured a technology monopoly and defines 'high monopoly risk' as a situation in which the leading country possesses eight or more of the top 10 institutions and has at least a threefold lead in high-impact research output compared to its next competitor. Of the 64 technologies tracked, 24 were at high risk of a Chinese monopoly in 2024, up from fourteen in 2023.

## Factors underpinning the shift

What, then, has propelled China to its current leading position? Without question educational and research interactions between China and the traditionally strong science nations have been consequential to the development of the Chinese academic system. However, equally important are sustained and targeted investments in research and development (R&D), talent cultivation, and infrastructure. China's university system was largely dismantled during the Cultural Revolution, only to be properly put back on track by policies formulated at the National Science Conference held in March 1978, during which the Chinese leadership formally recognised science and technology (S&T) as primary productive forces essential for modernisation (Suttmeier, 2008). Since then, China has consistently increased its R&D spending as a share of GDP amid rapid GDP growth.

Below follow data on the inputs to the Chinese research system which reinforce the conclusion that China has emerged as a strategically coordinated and well-funded leader in global research.

### R&D expenditure

China's growth in R&D spending can be traced back to the 1978 National Science Conference, and the rise in total R&D spending reflects a dual dynamic: a steady increase in R&D intensity (spending as a share of GDP), alongside sustained rapid economic growth. While China experienced strong GDP growth in the 1980s and early 1990s, growth in R&D spending remained modest during this period, largely due to the low starting base, fragmented research system, and the prioritisation of basic industrial and economic reforms. A pronounced acceleration began in the late 1990s, as more strategic national programs and systemic reforms took hold. China's R&D spending as a percentage of GDP reached 2.56% in 2022 (OECD, n.d.), to be compared with that of the EU27[7] and the United States at 2.27% (Eurostat, n.d.) and 3.46% (OECD, n.d.), respectively. In 2023, China's R&D spending grew by 8.7%, outpacing all major economies, and it now exceeds that of the EU27 in absolute terms as well (OECD, 2025).

The Chinese government has reaffirmed its commitment to continued growth in re-

[5] ASPI published its first Technology Tracker report in 2023 (Gaida et. al., 2023), which listed 44 critical technologies. This was updated to include 64 technologies in 2024 (Wong Leung, Robin & Cave, 2024).

[6] It should be noted that the ASPI Critical Technology Tracker has faced some criticism regarding its perceived geopolitical positioning. Even so, its findings align closely with those of the CWTS Leiden Ranking and the Nature Index. Criticism and methodological differences aside, the overall direction across these indicators are notably consistent, which merits including the ASPI Critical Technology Tracker results here to underscore that methodological bias is not skewing the overall picture of China as a dominant research nation.

[7] The 27 member countries of the European Union.

search investment, with particular emphasis on basic research and strategically important technologies, as outlined in the 14th Five-Year Plan (China State Council, 2021). A continued commitment is expected in the forthcoming 15th Five-Year Plan (2026–2030), with early signals pointing to a strategic emphasis on self-reliance in key technologies, green transition, and high-quality innovation-led development (Jamestown Foundation, 2024; Reuters, 2024).

China's spending on basic research rose to CNY 249.7 billion (USD 34.5 billion) in 2024, a 10.5% increase from the previous year, bringing its share of total R&D to 6.91% (China NBS, 2025). While this represents a steep upward trajectory, China's basic research funding remains considerably lower than that of the United States, which allocated USD 130 billion to basic research in 2022 (NCSES, 2024).

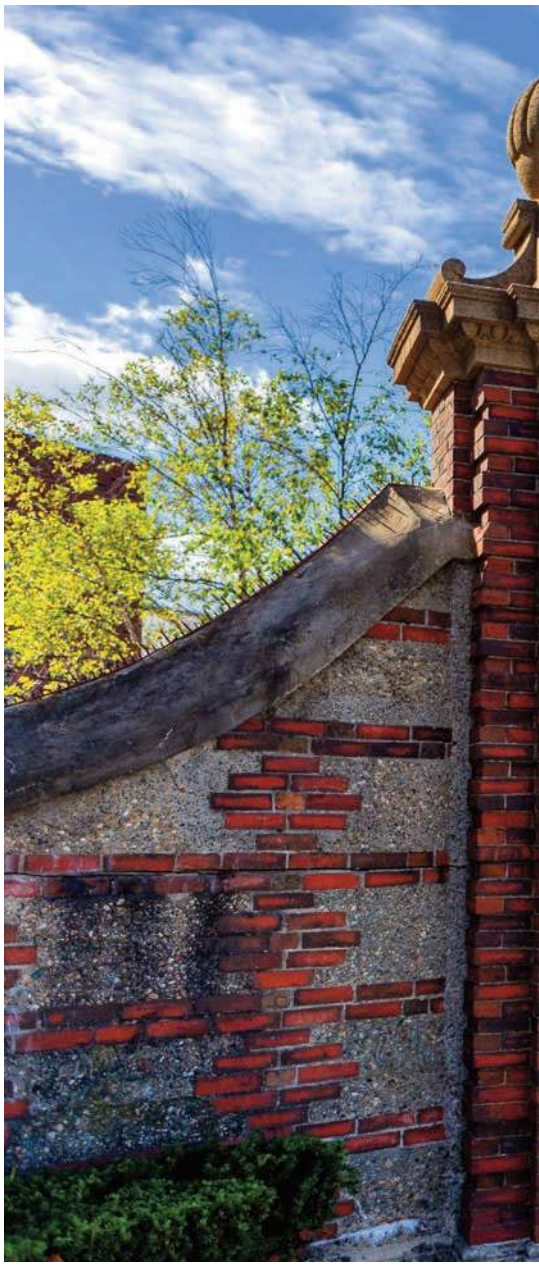
### Higher education R&D

Universities are playing an increasingly important role in China's research system. In 2024, R&D spending by higher education institutions reached USD 37.7 billion, representing a 14.1% increase from the previous year and 8.2% of total national R&D spending (Inside Higher Ed, 2025). For comparison, US universities spent about USD 86 billion, while those in the European Union invested around USD 80 billion.[8]

### Human capital

China's research workforce has expanded significantly. As of 2022, China employed approximately 2.64 million full-time equivalent (FTE) researchers, reflecting a substantial increase from previous years. In comparison, the United States had about 1.64 million FTE researchers in 2021, and the European Union employed around 2.15 million in 2023 (Eurostat, n.d.).

According to Clarivate's 2024 Highly Cited Researchers list,[9] China is home to 1,405 Highly Cited Researchers, representing 20.4% of the global total (Clarivate, n.d.), thus the country's share has more than doubled since 2018.



Harvard University, USA. Source: iStock by Getty Images

### S&T clusters

The annual Science and Technology Cluster Rankings by the World Intellectual Property Organisation (WIPO) offer another lens on China's innovation geography. In 2024, three Chinese metropolitan areas – Shenzhen-Hong Kong-Guangzhou, Beijing, and Shanghai-Suzhou – ranked among the top 5 largest global science and

[8] Approximate figures based on publicly available data from OECD and Eurostat regarding higher education R&D expenditure. Exact university-level figures may vary slightly depending on reporting methodology and currency conversion.

[9] Clarivate defines 'Highly Cited Researchers' as individuals who have demonstrated significant and broad influence in their field(s) of research. Selection is based on the publication of multiple Highly Cited Papers that rank in the top 1% by citations for their field(s) and publication year in the Web of Science over the past decade (Clarivate, 2024).


technology clusters (WIPO, 2024), at second, third and fifth place, respectively. Additionally, another five Chinese metropolitan areas rank among the world's top 20 science and technology clusters.[10] The WIPO S&T cluster rankings are based solely on the output volume of research publications and patent filings and thus provide no information about the overall quality of the output in the ranked clusters. Nonetheless, large science clusters generate significant strategic advantages by concentrating talent, infrastructure, and institutions in ways that foster collaboration, attract investment, accelerate innovation cycles, and create cumulative benefits that reinforce long-term competitiveness. In addition, there is a clear correlation when comparing the WIPO ranking with the Nature Index Science Cities ranking (Nature Index, 2024), which is based on the same methodology as the Nature Index institutional ranking, i.e., publication count in the most impactful scientific journals.[11]

## Discussion

As is evident from the discussion of the world's leading research universities in this Outlook, China is now a world-leading science nation, and its research leadership is not confined to select metrics or narrow domains. Rather, it reflects a broad-based transformation supported by public policy, institutional capacity, and human capital development. China is now ahead of the United States and Europe on virtually every metric,[12] representing a significant

[10] Nanjing (9th), Wuhan (13th), Hangzhou (14th), Xi'an (18th), and Qingdao (20th).

[11] In the 2024 Nature Index Science Cities ranking ten Chinese cities rank among the global top 20: Beijing (1st), Shanghai (2nd), Nanjing (5th), Guangzhou (8th), Wuhan (9th), Hangzhou (13th), Hefei (15th), Tianjin (18th), and Xi'an (20th) (Nature Index, 2024).

shift in global research dynamics. Although this striking development has been noted by some observers (e.g. The Economist, 2024), it remains largely absent from the public discourse in Europe and North America.

Despite its considerable advancements in research output, China still faces challenges. One such challenge is to efficiently translate academic research into commercially viable innovation. Chinese authorities have acknowledged this gap in research-based innovation, and it is a focal point in their national science and technology policies (CPC Central Committee, 2021; Zhao and Zhu, 2024). Recent developments indicate progress. According to the Information Technology and Innovation Foundation (ITIF), China is steadily closing the innovation gap to the United States, particularly in strategic sectors such as advanced manufacturing, clean energy, and artificial intelligence; the report notes that "while Chinese firms and industries are not as innovative as the global leaders in Western nations […], they are catching up, in many cases at an extremely rapid pace" (Atkinson, 2024). Furthermore, as Dan Wang articulates, China possesses significant innovation strength through its manufacturing prowess, enabling rapid iteration and practical innovation, which is often overlooked in traditional metrics (Wang, 2023). China's progress is evident in its markedly improved position in the World Intellectual Property Organisation's Global Innovation Index, from 29th in 2014 to 11th in 2024 (WIPO, 2024).

Zhejiang University, China. Source: iStock by Getty Images

Another area where China still lags behind the traditionally strong science nations is curiosity-driven research and the development of entirely new ideas. Whether this will still be the case in the future remains to be seen. China is, as mentioned, increasing its spending on basic science and has, in the past decade, increased construction of large-scale science infrastructures (Zhao and Zhu, 2024). Efforts are also made to change an entrenched incentive system at Chinese universities that is inconducive to the development of new ideas, though much remains to be done (Chen, 2025). For now, in the words of Stanford professor Philip Wong, "the US is still the principal place where […] new ideas come from, but once [it becomes known] this is a good idea […] then China will do it better" (Wirjawan, 2024).

What does this mean for Swedish universities? To remain at the scientific forefront and to meaningfully contribute to inno-

[12] The United States is still ahead of China in R&D spending and have generally been assumed to continue to be so for the foreseeable future; however, ongoing policy changes by the current US administration may upend this assumption (Nature, 2025).

vation and economic growth in Sweden, Swedish universities need to collaborate with the best research environments in the world, which, as this Outlook has made evident, are increasingly located in China. However, growing geopolitical tensions have made international research collaboration more complex, which means that the seemingly obvious conclusion – that Sweden should strengthen its research ties with China – is not as straightforward as it first appears.[13] Nevertheless, geopolitical complexities should be viewed as complicating factors rather than reasons not to engage in research partnerships with China, as was recently noted by a group of Swedish Vice-Chancellors (Svenska Dagbladet, 2025). Frameworks have been, and continue to be, implemented to manage complex research partnerships in a responsible manner (STINT, 2020; UHR, 2025). Swedish universities have also dedicated much of the 2020s to developing procedures for better handling research partnerships with research environments located in countries that are culturally and politically different from Sweden.

[13] China is today Sweden's fourth-largest research partner after the United States, United Kingdom, and Germany (SciVal, n.d.).

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