Institute for Scientific Information

Research collaboration in a changing world

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About ISI reports

ISI reports offer concise and informative analyses of topical research trends, using best-in-class publication and citation data and analytics from Clarivate.

This paper identifies key trends in international research collaboration, using bibliometric data from Web of Science Core Collection and InCites Benchmarking & Analytics.

It describes the global network of research collaboration and the nature of its growth, supporting major research initiatives and key discoveries and innovations.

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Summary

1. Executive summary

This report describes recent changes in the global network of research collaboration, a network that supports major research initiatives and key discoveries and innovations. The analysis tracks both global changes and perturbations affecting specific countries, with a focus on Mainland China, the United States and the European Union, and identifies shifts in the balance of influence.

- There has been global growth in research publication output (that is, research and review articles) this century, continuing a trend that developed through previous decades. The European Union provides a typical regional example of this. (Figure 1)
- International collaboration is rising as a proportion of total publications for all countries/regions except Mainland China, where domestic activity is expanding even more rapidly (Figure 2). Globally, international collaboration is shifting from bilateral partnerships to multilateral associations. (Figure 3)
- The United States' research collaborations dropped sharply between 2021 and 2022, in line with the trend seen for the EU, but generally began to increase again after 2023. An exception was U.S.-Mainland China, where collaboration dropped earlier (between 2019 and 2021) and more steeply. (Figure 4)
- Mainland China's international collaborations dropped between 2021 and 2022 for most partners, but it is already recovering and exceeding 2021 levels. It fell least for newer partner countries/regions in the Middle East and Asia. (Figure 5)
- The United States' total output of papers fell behind Mainland China after 2020 and is still declining. Collaboration between the two is now only slightly greater than between Mainland China and the EU-27 group. (Figure 6)
- Mainland China's research impact, as measured by average Category Normalized Citation Impact (CNCI), is rising and is now only slightly below the United States, where average CNCI is falling. The CNCI of Mainland China-EU27 papers is now higher than that of U.S.-EU27 papers. (Figure 7)
- Comparing the five-year periods 2015-2019 and 2020-2024, Mainland China's output generally grew two-fold or more, whereas U.S. volume was barely maintained in many areas. Mainland China's collaboration with the United States was generally sustained, despite policy moves in the U.S. (Table 1)
- Mainland China research collaboration is expanding in Africa, Asia-Pacific, Latin America and the Middle East faster than the underlying regional growth rate. This will be of significant technical benefit and provide new training opportunities in emerging economies. The U.S. is still a more frequent partner in all regions except Asia, but its collaboration is predominantly declining relative to overall growth. (Table 2)
- The United States appears in decline as a research partner: its growth has weakened; its citation impact is falling; it may be losing its dominant lead in global research. Recent policy statements regarding its overseas links point to negative implications for its own research future and for global networks.

2. Introduction

Research partnerships happen through discussions, projects, shared facilities, staff mobility, and collaborative meetings. The network of shared research information enables better research and faster discovery. This is hard to monitor and track directly so collaboration is usually identified and indexed through the publications that are a key output from all research activity.

This report draws relevant data from Web of Science Core Collection and InCites Benchmarking & Analytics. The data reported here are the substantive original academic publications (document types 'article' and 'review', referred to collectively as papers) in the journals that have passed editorial selection and are indexed in Web of Science Core Collection.

Research collaboration, as co-authorship between institutions, countries and regions, has been rising. In the 1980s, domestic collaboration between institutions was patchy but not uncommon. International collaboration was scarce, accounting for just 5-10% of the output of the G7 nations that dominated global research at that time.[i]

Through the 1990s, collaboration across borders and continents became increasingly frequent, enabled by better communications, greater mobility and more international conferences. Such collaboration was initially bilateral, between research groups in two countries, but increasing international awareness of other countries' research added to initiatives such as the European Commission's Framework Programmes. More than half of the United Kingdom's research publications now have at least one international author[ii] and partnerships are increasingly multilateral[iii].

International collaboration is most frequent among institutions recognized as 'research excellent' in domestic and international assessments. This global network of information exchange is at the heart of major research initiatives and underpins many key discoveries and innovations. Collaboration means an improved knowledge base and shared investment, and it accelerates research to address shared issues such as climate change and the control of pandemic disease.

Disruption to the network would be a significant risk for continuing progress, affecting both local achievements and international research. Change, constraint and disruption may come from global factors or in more targeted ways through political and security concerns and their repercussions. This report looks at evidence that this is happening and discusses how changing patterns of collaboration could influence future research outcomes.

3. Global output and collaboration

We tracked research collaboration via co-authorship between countries and regions, drawing on the papers indexed in Web of Science. To illustrate the effects of collaboration at a regional level over recent years, we counted the numbers of all

papers, domestic only, and international papers for annual data from 1999 to 2024 across the European Union group of 27 countries. (Figure 1)

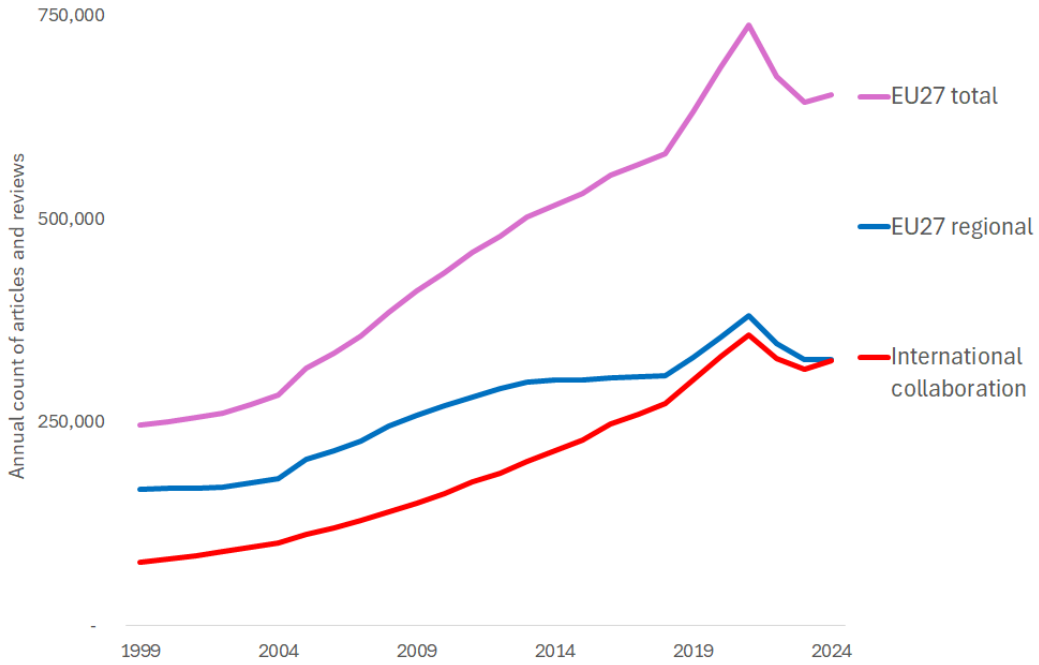

Figure 1. Annual count of publications in journals indexed in Web of Science Core Collection with at least one author in the European Union regional group of 27 countries.

The data in Figure 1 reflect two major features. First, a rising volume of output that results in a tripling of the annual total number of papers: we discuss this in the next paragraph. Second, an upward tick in the rising curve around 2019: we discuss later in this section whether this may be associated with a general increase in researcher publications during Covid which was exaggerated by the introduction of Early Access content to the Web of Science Core Collection indexing system.

The fourfold increase in output since the mid-2000s has largely been through international collaborations beyond EU borders. Consequently, whereas international collaboration accounted for only one-third of output in 1999, it now accounts for around half. As we discuss elsewhere (and will show later), multilateral collaboration also makes a major contribution to national research impact[iv].

The long-term trajectory appeared to change in 2019, with a sudden rise and a drop that continued into 2023. The decline then bottomed out, so numbers were no longer falling in the 2024 publication year. The change was pervasive: analysis for a spread of countries/regions across the globe reveals a similar spike overall; it occurs in both regional data and international collaboration; and there was no observable shift from international to local engagement.

What caused this hiccup in the data? There are two factors that could have played into the data analysis. One, scientometricians have suggested that Covid lockdown gave an extra boost to publication numbers in 2020-2022, and publishers have made similar observations. Two, publishers have decided to make articles available online prior to assignment to a final issue. In 2018, Clarivate indexing began to incorporate

these ‘Early Access’ articles, to more accurately reflect the point when this content became available. This policy change inflated Web of Science Core Collection annual totals between 2018 and 2021.

As a result, when interpreting the international trends shown in the data analyzed in this report, it will be necessary to bear in mind that the output bump may appear anomalous but is pervasive and affects all publication types. It is not, by itself, a signal of an exceptional change at national or disciplinary level. Changes that either differ from this pattern or are outside this time-window are, however, likely to be of specific significance.

4. International collaboration profiles

International collaboration is not globally uniform. It is most frequent in western Europe. In the case of the European Union, international collaboration is enhanced through a cluster of neighboring economies sharing a common research policy. International collaboration continues to be high in the U.K., despite its recent exit from the EU.

International collaboration remains below 50% in the United States, where collaborative output is substantial but diluted by extensive domestic collaboration (e.g., between East and West coasts). In Asia, just one-third of India’s papers have an international co-author. Mainland China has an even lower level of international engagement, below 20% of indexed output, perhaps because of its domestic research growth. (Figure 2)

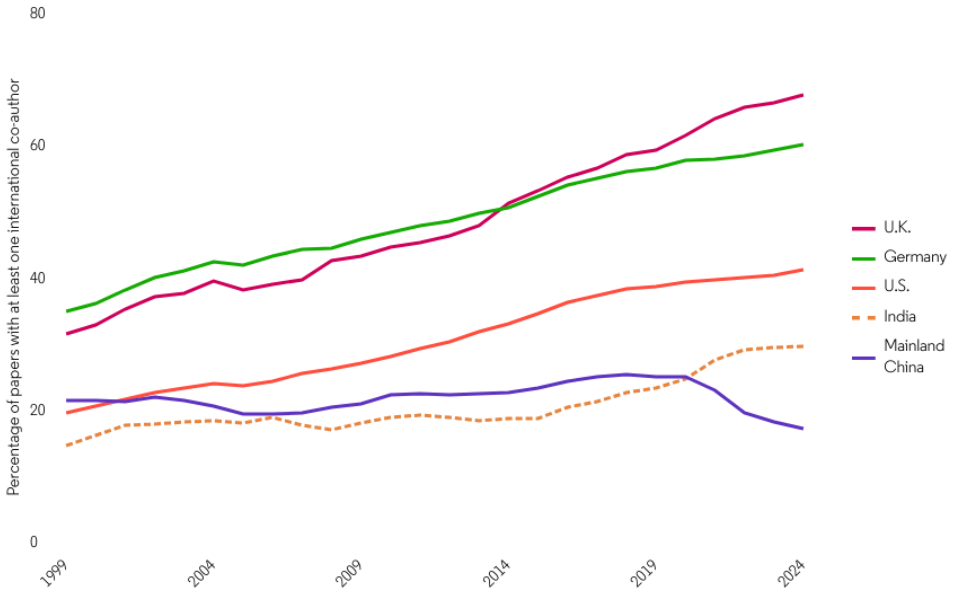

Figure 2. Internationally collaborative output as a share (%) of total publication output

International collaboration can be split into bilateral (between just two countries/regions) and multilateral (between three or more) partnerships. There has been a progressive shift towards multilateral associations, as noted above, because

modern communications can support 24-hour levels of activity across collaborative networks.

Our data show that bilateral collaboration has continued to decline in national share. Currently, Mainland China (bilateral as 72% of international papers) and the United States (61%) have the highest relative frequency of bilateral research among their international links whilst the U.K. (49%) and Germany (48%) have the lowest among major economies. (Figure 3)

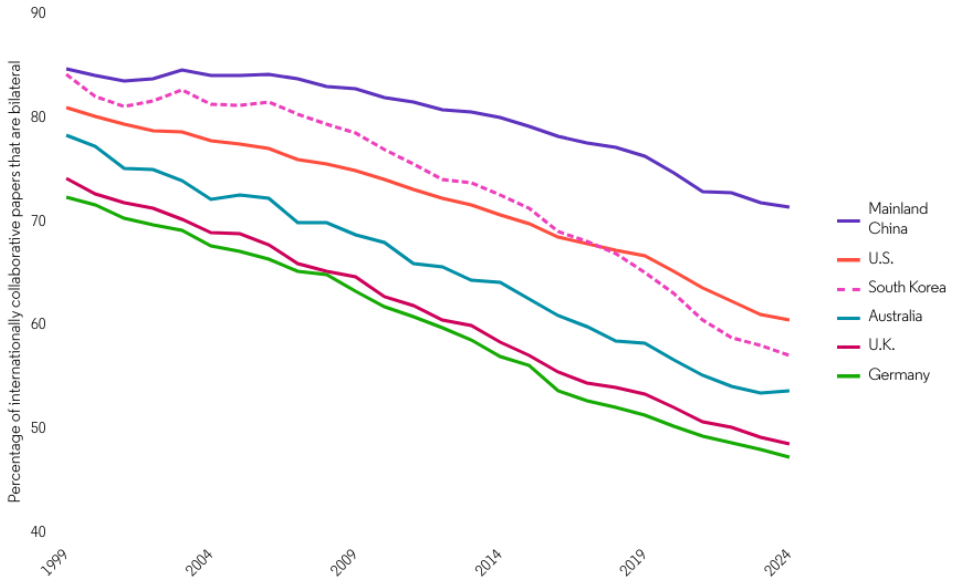

Figure 3. Bilateral co-authorship as a percentage of international collaboration for a sample of countries/regions

5. The United States and collaboration

The United States has been the world's dominant research economy since 1945. Its output has been transformative in boosting its wealth creation and quality of life as well as contributing to better research elsewhere. Such partnerships have been a powerful form of 'soft diplomacy'. The leading role of the National Institutes of Health (NIH) in biomedical research in the U.S. and in the global tropics is exceptional.

Recently, U.S. political concerns about collaborative research have changed its position as an open research environment that welcomed engagement, particularly with young researchers in training. First, since the Trump administration of 2017-2020, growing U.S. security concerns have focused on Mainland China's role as a technology research partner. This led, first, to a constraint on the numbers of Chinese researchers working in the U.S. and, more recently, to the exclusion of cooperation on 'critical and emerging technologies' such as AI and semiconductors.

Second, during 2025, the U.S. has shifted away from its global status towards more limited domestic concerns. For example, its international research role will be adversely affected by Health and Human Services (HHS) Secretary Robert F. Kennedy

Jr.'s announcement (August 5, 2025) that funding would be cut for mRNA vaccine development. The HHS also ousted all 17 members of a scientific advisory panel on vaccines at the U.S. Centers for Disease Control and Prevention. These moves reduce U.S. capacity to respond to future outbreaks of respiratory viruses like Covid and will inevitably place it further back among global leaders in biomedical research.

On August 25, 2025, the NIH issued a statement on 'Maximizing and Safeguarding NIH's Investment in Foreign Collaborations' which asserted principles that: U.S.-supported research at international sites should have a rationale to be conducted in a foreign country; and that research at international sites should have direct potential to generate knowledge applicable to understanding, improving, or protecting U.S. health. This is expected to impact a number of international organizations and will reduce if not curtail any international collaboration.

Analysis of U.S. output confirms that, as expected, it has had a large portfolio of co-authored publications with a diversity of countries. Prior to 2010, the U.K. had been the U.S.' most frequent partner, focused on biomedical sciences. Now, its most frequent partner is Mainland China, focused on technology and physical sciences. In 2019, Mainland China co-authorship on 56,136 papers accounted for 30% or more of U.S. outputs in 20 tech-based fields, an increase of up to 50% since 2010-14.

It is notable that, while U.S. co-authorship with most partners dropped by 10-15% between 2021 and 2022, in line with global patterns, its relationship with Mainland China was different. Rising joint output plateaued in 2019, started to fall by 2020, well before the global bump, and a subsequent drop of >25% from peak only recently levelled off. By contrast, U.S. collaboration elsewhere increased between 2023 and 2024. (Figure 4)

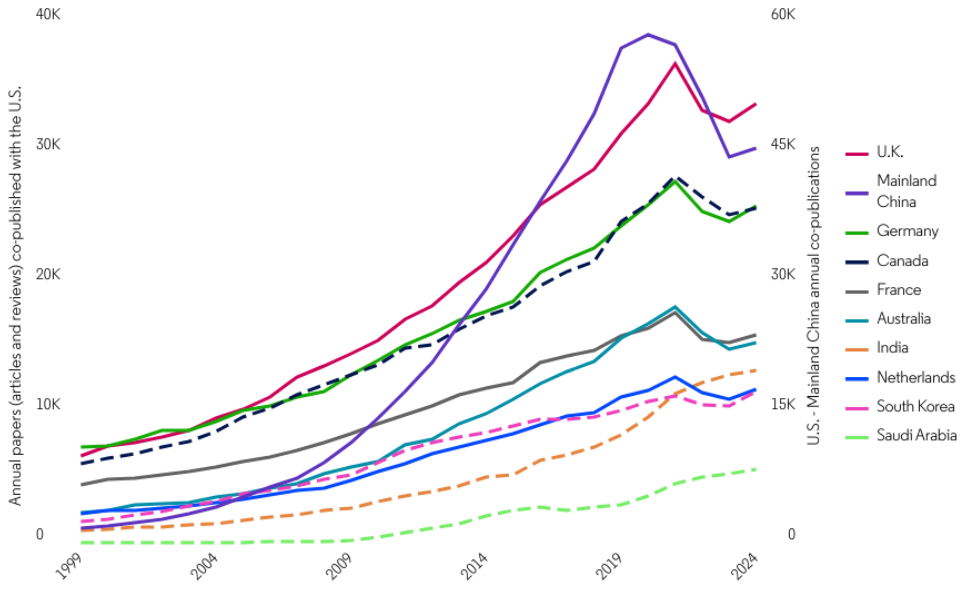

Figure 4. Annual count of research papers (articles and reviews) co-authored with the United States. Note that counts of U.S. collaborative publications with Mainland China are plotted on the right-hand vertical axis whereas all other countries are plotted on the left.

Another variation is that U.S. collaboration with India and with Saudi Arabia did not fall in 2022. U.S. co-authorship was historically low for both nations, but links rose faster over the last decade than for longer-term United States partners. Intriguingly, this absence of a 2022 output fall fits with a pattern elsewhere in Asia (see next section) and may be evidence that Covid and lockdowns (lighter in India and Saudia Arabia than, for example, Europe) were indeed a factor.

For the U.S., the outcomes of reducing engagement with Mainland China are presumably balanced against security unease. The consequences of more widespread disengagement, particularly with countries/regions that are themselves rising economies and potential research drivers, would be of more general concern.

6. Mainland China and collaboration

Mainland China's research growth is so dynamic that it needs to be viewed outside the normal framework of international research activity. Its historical research base supported major industrial-military needs, as was the case for the U.S. and others, but with far less public visibility. Mainland China's research reorganization led to a shift from single-mission institutes towards multi-faculty universities, and from Chinese-only reports to full engagement with international and Anglophone research publications. Thus, apparent growth was founded on a strong base with repurposed activity boosted by massive investment, reorganization and the expansion of research training.

Mainland China's output rose from 26,200 papers in Web of Science Core Collection in 2000 to 878,300 papers in 2024; international co-authorship rose from 6,000 to 163,230 papers. Collaboration with large Western economies (apart from the U.S., discussed above) appeared to fall between 2021-2022 but recovered by 2024. (Figure 5)

Mainland China's parallel collaborative growth in former Soviet states and in Eastern Europe has been described and analyzed elsewhere[v]. Its Asia collaborations either plateaued or grew throughout, building on steep rises from a relatively small initial pool, for Iran, South Korea, Pakistan, Singapore and Saudi Arabia (see also Table 2, below). (Figure 5)

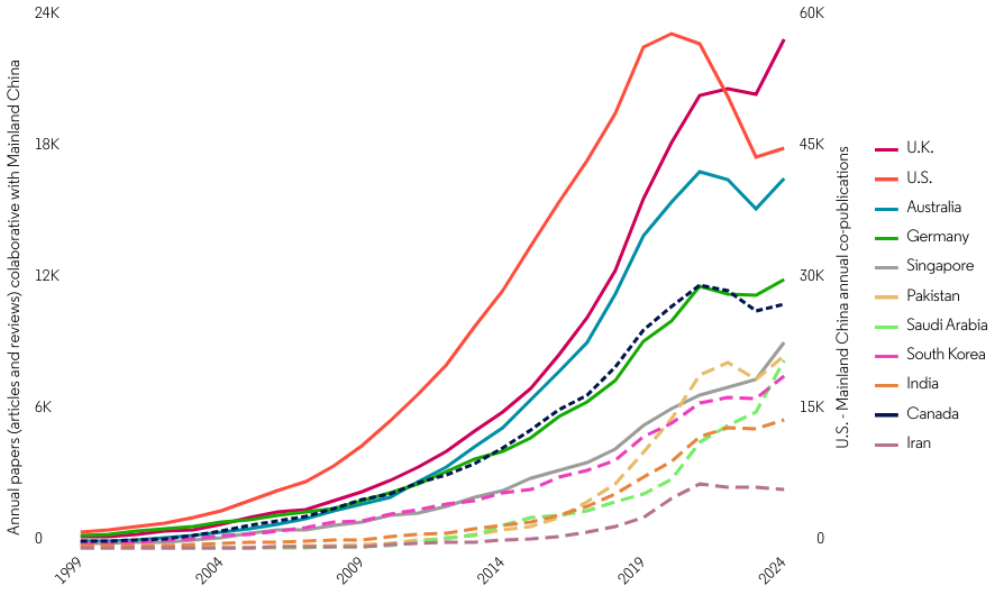

Figure 5. Annual count of research papers (articles and reviews) co-authored with Mainland China. Note that counts of U.S. collaborative publications with Mainland China are plotted on the right-hand vertical axis whereas all other countries are plotted on the left.

7. Engagement between Mainland China, the United States and the European Union

Mainland China (878,307 articles and reviews in journals in Web of Science Core Collection in 2024), the United States (509,485) and the 27 current member states of the European Union (652,335) represent the three largest blocs of global research activity. Their mutual collaboration and the impact of their collaborative research influences research outcomes everywhere.

Trans-Atlantic collaboration between Europe and North America was the bedrock of global research after 1945. Co-authorship between the U.S. and the EU-27 continues to be a major channel. It exceeded 80,000 papers in 2021 but fell back in 2023 and is now recovering. In volume, it exceeds U.S. collaboration with Mainland China, a difference that is now greater than it has been in a decade.

Mainland China's collaboration with the EU grew more slowly than its collaboration with the U.S. but U.S. policy after 2019 altered the position. The EU now co-authors only 10% fewer papers with Mainland China than does the U.S. and seems on course to close that gap. (Figure 6)

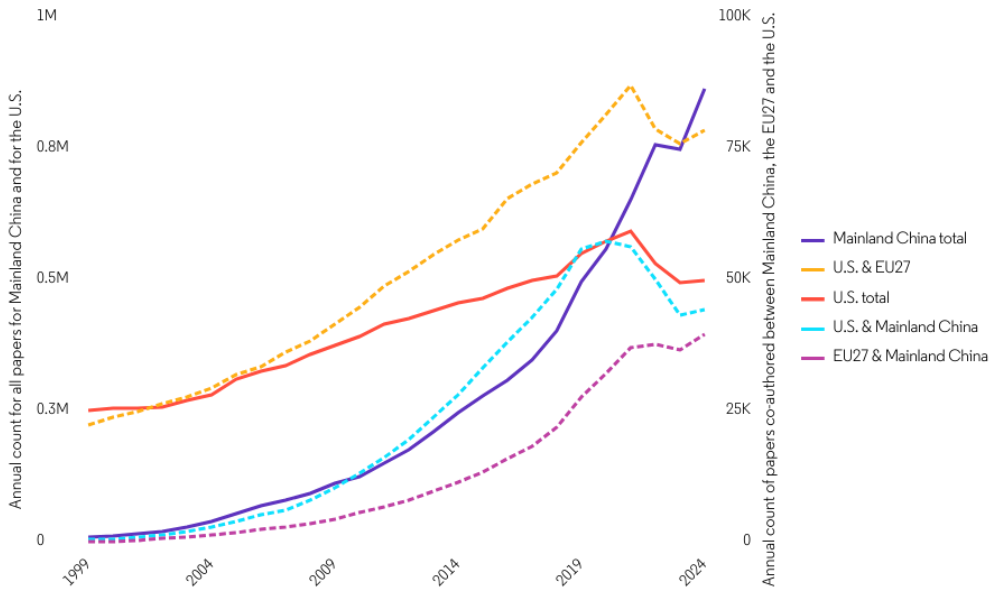

Figure 6. Comparison of total annual publication output for Mainland China and the United States [left axis] and their collaborative outputs with one another and with the European Union [right axis].

Plentiful output is, of course, of little consequence unless accompanied by research impact. The latter is conventionally quantified by analyzing how many times a publication is subsequently cited (i.e., used as a reference) in later work. In other words, does it have significance for work that follows on? There has been a strong association between highly cited papers and other indicators of achievement and esteem, though this can be compromised by citation manipulation [vi].

Citation counts grow over time at a rate that is field-dependent and they are typically greater for reviews than articles. For these reasons, the citation count for each paper indexed in Web of Science Core Collection is compared to the average for the subject category to which the journal is assigned, the year of publication and the document type. The ratio between the observed count for the paper and the average (i.e., expected) count is Category Normalized Citation Impact (CNCI). For large (e.g., national) samples of papers, CNCI is a reliable, widely used indicator of relative quality.

We evaluated the annual CNCI of papers for Mainland China, the U.S. and the EU27 and for the papers co-authored between these blocs. Mainland China's CNCI has risen from well below world average to within touching distance of the U.S. average, which has itself fallen slowly but consistently over the last 15 years.

The average CNCI of co-authored papers is higher than that of the contributing partners. This is a common pattern for collaborative work. U.S.-EU27 CNCI had greater impact than the two Mainland China co-authored sets in the past, but the gap was closed in recent years. Mainland China's capacity to sustain its research activity and output is evidently significant. (Figure 7)

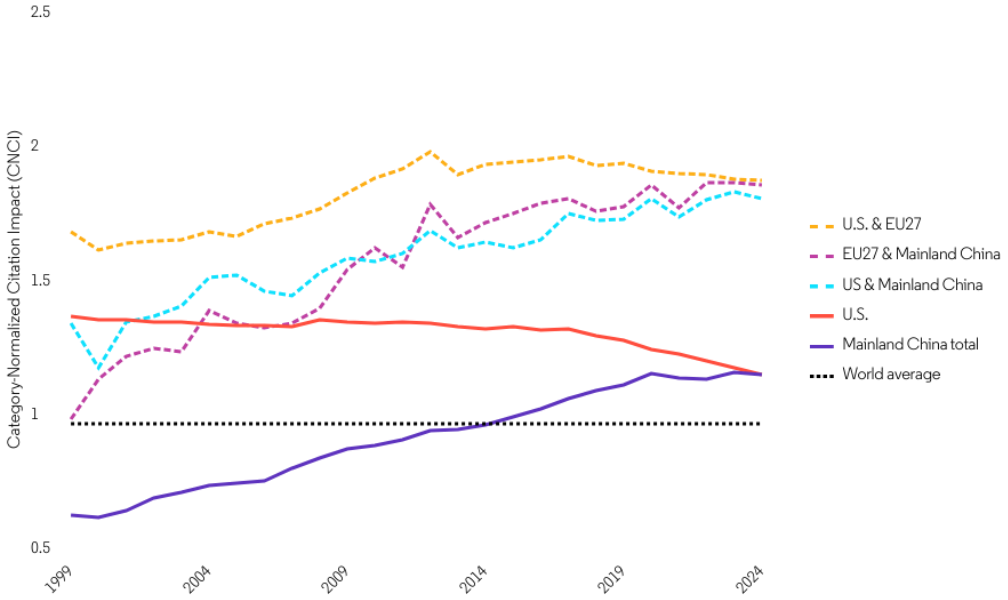

Figure 7. Annual Category Normalized Citation Impact (CNCI) of papers (articles and reviews) authored and co-authored by Mainland China, the United States and the European Union. Collaborative papers are almost always cited more frequently than domestic papers.

The U.S. research base no longer appears as competitive in global performance as it was in the past. The data show that the U.S. receives a significant academic benefit from collaborative partnerships, which have generated its highest-performing research output. So, if these partnerships decline, then that will be to the further detriment of U.S. research. Mainland China, meanwhile, is continuing to grow its output and to do so to a high academic standard.

In which research fields has Mainland China contributed most to its U.S. partnerships? To get an overview, we analyzed Mainland China's growth by major research areas, broadly corresponding to faculty level in many universities. We also sought to cover a period that would take account of the changes driven by U.S. disengagement with Mainland China and the possible impact of Covid.

The headline growth rate for Mainland China as a whole is replicated in almost all fields, with a doubling – sometimes more than doubling – of output between the five-year windows of 2015-2019 and 2020-2024. The fastest growth is in fields where Mainland China was previously much less active, such as the Social Sciences and Medical & Health Sciences, but output also more than doubled in Engineering & Technology.

The contrast with the U.S. is stark. In several areas (biosciences, physical sciences, mathematics), output for 2020-2024 did not even match the earlier period. However, the U.S. increased its co-authorship with Mainland China despite the change in political support for collaborative research, particularly so in areas where Mainland China itself has upped its investment and activity. Even in Engineering & Technology, an area of security concern, the collaborative publication rate has risen. U.S. overall output would have declined even further without this. Continuing links to Mainland

China thus appear to be lifting the U.S. in average impact (Figure 7) and volume (Table 1).

Table 1. Growth ratio between 2015-2019 and 2020-2024 for papers in journals indexed in Web of Science Core Collection and authored or co-authored by Mainland China and the United States, grouped by broad research areas.

Research areas	Mainland China, all papers	Papers co-authored by Mainland China and the United States	United States, all papers
Natural Sciences	1.80	1.10	1.01
Engineering & Technology	2.08	1.14	1.05
Medical & Health Sciences	1.89	1.11	1.15
Social Sciences	2.25	1.60	1.08
Agricultural & Veterinary Sciences	2.76	1.29	1.04
Humanities & the Arts	2.28	1.75	0.89

Each figure is the output ratio, so 2.00 equals a doubling between early and late periods. Each research area is a mapping of individual Web of Science Core Collection journal categories.

8. Global networks: Growing or slowing?

Mainland China's relationship with the U.S. is likely to change further. Political priorities in the U.S. are repatriating much of its overseas research investment, which will reduce the historical influence gained via shared research projects and trained researchers. In a world where technological capabilities, investment influences and political alliances are changing, how is Mainland China's growth influencing its research network and will Mainland China fill a vacated research leadership role?

Regionally, Mainland China has more collaborative papers with other countries than does the U.S. In Asia-Pacific, this is growing (by 1.91 times between two recent time periods) more rapidly than innate regional growth. Mainland China's co-authored share of regional publications is growing even more rapidly in Africa (2.65) and the Middle East (2.76), but slightly less in Latin America (1.57).

In these instances, Mainland China's co-authorship is expanding faster than innate regional growth. However, U.S. regional co-authorship is rising more slowly than each region's overall output. In other words, Mainland China's share of the growing regional totals is expanding while the U.S. share is predominantly falling. (Table 2)

Table 2. Growth rate between 2015-2019 and 2020-2024 of papers in journals indexed in Web of Science Core Collection and authored or co-authored by countries within a geographical region, and the count of those co-authored with Mainland China and with the United States.

Region and co-authors		Count of articles and reviews			
		2015-2019	2020-2024	Growth	Change in share
Africa		393,192	680,993	1.73	
	& Mainland China	16,379	43,327	2.65	+2.2%
	& United States	61,105	100,115	1.64	-0.8%
Asia Pacific		4,672,076	7,476,886	1.60	
	& Mainland China	209,197	399,997	1.91	+0.9%
	& United States	552,836	687,869	1.24	-2.6%
Latin America		675,561	860,482	1.27	
	& Mainland China	18,348	28,861	1.57	+0.6%
	& United States	105,157	143,882	1.37	+1.2%
Middle East		753,741	1,261,811	1.67	
	& Mainland China	30,651	84,601	2.76	+2.6%
	& United States	89,135	137,728	1.55	-0.9%

Figures are the total output in each time window. For the growth ratio between the periods, 2.00 equals a doubling between early and late.

The data suggest that Mainland China is successfully expanding its network of engagement and support for economies in regions where the domestic research base is building and evolving. As noted above, evidence from a joint report from the King's College London Policy Institute and Clarivate, "Stumbling Bear, Soaring Dragon,"[v] concluded that Mainland China has also expanded its collaboration in states formerly in the Soviet Union, in Eastern Europe and in the Baltic, filling a vacuum left by Russia's diminished international engagement.

Partnerships are of huge value in helping nations to expand the range and quality of their research and give them the opportunity to participate at the highest level. For Mainland China, they will also be of value in collecting new ideas and approaches and in developing long-term partnerships with the best researchers.

The United States appears to be drifting backwards in its global engagement and its share of outputs in these regions has fallen. Whereas the U.S. was seen in the past as the natural long-term partner, and as the preferred destination for aspiring young researchers from all these regions, this may no longer be the case. A declining network will reduce the flow of talent, information and innovative knowledge to the U.S. economy.

9. Conclusion

The pattern of international collaboration that has emerged over the last four decades is in a state of change. Some of this is due to the growth of research in economies that had much less activity back in the 1990s. They now recognize the importance of investment in the research base for knowledge, innovation and – perhaps most importantly – training for a knowledge-competent workforce. New opportunities arise for partnerships that would not have existed in the past. Mainland China's rapid growth and its soft-power outreach has built on those opportunities in Asia and will help forge new networks in the Middle East. Mainland China has also stepped into western Asia where Russia's former network has declined.

Changes in networks and partnerships arise where nations reduce their previous investment and outreach. The United States has been the globally dominant research economy for 70 years. It has been the preferred location for aspiring young researchers. It has been a key partner for most other countries/regions, whether G7 leaders or rising new economies. Our data show that it is not maintaining its role, due in part to global change and strengthening research profiles elsewhere. If it withdraws consciously from the global network, then the consequences may be complex and likely severe for the U.S. itself.

Mainland China appears on track to be a major technology economy, underpinned by existing research and supported by growing investment in life sciences and health. That influence will be enhanced through its expanding international research networks. Meanwhile, the United States' influence as 'the knowledge power' and as a source of innovation and advice will likely decline. With reduced overseas networks, its ability to monitor developments elsewhere will lessen. Its capacity for building rapidly on the ideas and discoveries of others will be compromised. And other nations will suffer from the loss of the beneficial support that the U.S. has historically given.

10. Key findings for research professionals and policymakers

This report reveals a shifting landscape of global research collaboration, shaped by geopolitical tensions, pandemic disruptions, and strategic national investments. For research professionals and policy makers, the following insights are critical:

1. Global collaboration is expanding – but not equally

- Multilateral collaboration is now the dominant mode of international research, replacing traditional bilateral partnerships. This shift enhances diversity, accelerates discovery, and supports 24-hour global research cycles.
- European nations, particularly Germany and the U.K., maintain strong international ties — around two-thirds of output involves foreign partners.
- India and other emerging economies show steady growth in international co-authorship, though levels remain below global averages.

2. Mainland China's rise is reshaping global networks

- Mainland China has become the world's most prolific research publisher, with rapid growth across all major fields, especially in Engineering & Technology, Medical & Health Sciences, and Social Sciences.
- Its collaboration with Asia-Pacific, Africa, and the Middle East is expanding faster than regional research growth itself, indicating strategic outreach and influence.
- While collaboration with the United States declined sharply post-2019, links with the EU27 are strengthening and may soon surpass U.S. levels.

3. The United States faces a strategic inflection point

- U.S. research output and citation impact are declining, and its share of global collaboration is shrinking, especially in regions where it once led.
- Policy shifts, including restrictions on foreign collaboration and reduced funding for key areas such as mRNA research, risk isolating the U.S. and weakening its global influence.
- However, continued co-authorship with Mainland China has helped sustain U.S. output and impact in several fields, underscoring the value of strategic partnerships.

4. Research impact tied to collaboration

- Collaborative papers consistently outperform domestic-only publications in citation impact (CNCI), especially those co-authored across major blocs like the U.S., EU27, and Mainland China.
- The CNCI of Mainland China–EU27 papers is now on par with that of U.S.–EU27 collaborations, reflecting a shift in research excellence.

5. Strategic implications for research offices and funders

- Universities should prioritize multilateral partnerships and monitor CNCI trends to assess the impact of collaborative outputs.
- Funders must recognize the growing importance of emerging economies and support inclusive, high-impact collaboration models.
- Policymakers should balance national security concerns with the need for open scientific exchange, especially in critical and emerging technologies.

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