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Issue Brief

China–United States Science and Technology Agreement at the Crossroads

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Summary

While the debate about the Science and Technology Agreement (STA) with China highlights US concerns over Chinese activities, the US Chamber of Commerce notes that decoupling from China in the science and technology field could lead to loss of competitive advantage, loss of power to set global standards, supply chain replacement costs and loss of international trust.

The historic China–United States Science and Technology Agreement (STA) signed by Chinese leader Deng Xiaoping and US President Jimmy Carter on 31 January 1979 was set to expire on 27 August 2023. The Chinese government wanted to renew the STA, which usually happens every five years.[1] But the Biden administration granted an extension of only six months, until February 2024.[2] The US State Department officials confirmed that the negotiations were ongoing to "amend, extend and strengthen protection within the agreement".[3]

The decision by the Biden administration to temporarily extend the STA by six months comes against the backdrop of apprehensions expressed over the existing Sino-American STA by some US lawmakers, especially conservative Republicans. In July 2023, the House Select Committee on China, headed by U.S. Rep. Mike Gallagher, strongly recommended the U.S. State Department to scrap the STA, emphasising that on the pretext of research, China "advances its military objectives". He pointed out that a balloon technology developed through a collaboration between the US National Oceanic and Atmospheric Administration and the China Meteorological Administration in 2018 to study the atmosphere was comparable to the spy balloons that China recently used to survey U.S. military sites.[4]

Michael Kratsios, former US Chief Technology Officer (2019–2021) and one of the members who voted for renewal of the STA in 2018 wrote in August 2023 however that allowing the STA to lapse "will deliver a strong diplomatic signal to Beijing that the era of accommodating CCP technology theft and bad faith dealings is over".[5] Alexander Gray, Chief of Staff for the National Security Council during the Trump administration also stated that "the Biden administration should allow the STA to lapse and replace it with reinvigorated science and technology cooperation agreements with key allies and partners".[6]

Meanwhile, Stanford University physicists Steve Kivelson and Peter Michelson in a letter endorsed by more than a thousand scientists across US universities urged Biden to

[1] **"Ambassador Xie Feng Had a Fireside Chat with a Senior U.S. Media Professional at the Aspen Security Forum"**, Embassy of the People's Republic of China in the United States of America, 20 July 2023.

[2] **"China (23-831) –Protocol Extending the Agreement on Cooperation in Science and Technology, as Amended and Extended"**, US Department of State, 31 August 2023.

[3] **"Renewal of US-China Science and Tech Pact Faces Hurdles"**, *Voice of America*, 27 February 2024.

[4] **"Letter to Secretary Blinken on Science and Technology Agreement"**, The Select Committee on the CCP, 27 June 2023.

[5] Michael Kratsios and Erik M. Jacobs, **"End the STA: Stop Helping China Steal"**, *The American Conservative,* 22 August 2023.

[6] Alexander B. Gray, **"We Must End the Experiment of Science Cooperation with China"**, *The Hill,* 11 August 2023.

preserve the landmark Sino-American STA as it has benefitted the US and the world through open and transparent scientific cooperation, though they acknowledge the "legitimate national security concerns that require the United States, at times, to limit access to certain research and information".[7]

China–US Science Diplomacy: Current Trajectory

Under the China–US STA framework, it was agreed to foster collaboration in agriculture, energy, health, environment and other fields between Chinese and US universities, laboratories and private agencies. For the US, it allowed Chinese talent into international science, gave access to Chinese data on natural and social sciences and in particular, countered the Soviet influence. For the Chinese, it provided ample opportunities to build their own science programmes and economic development by collaborating with US based facilities, as Chinese science programmes had been decimated due to the 'Cultural Revolution' under Mao.[8]

Research collaboration between China and the US has grown significantly, both in terms of joint research projects, number of visiting students in science and engineering and co-authored publications.[9] A significant collaboration under the auspices of the STA was the establishment of the US$ 150 million jointly funded, U.S.–China Clean Energy Research Center (CERC) in 2009, aimed at bolstering research and development of technologies to improve energy efficiency, carbon sequestration and low-emissions vehicles.[10] From 2009, China and US shared the highest collaborations in the area of 'high impact' and high-technology research.[11] Meanwhile, in the *Nature* Index, between 2015 and 2020, the number of papers co-authored by Chinese and US researchers leapt from 3,412 to 5,213.

However, more recently, collaboration in science and technology between China and the US has declined, mainly caused by trade friction, where Chinese technologies development figured prominently. For instance, as shown in Figure 1, in the *Nature* Index, the bilateral collaboration score between China and the US has dropped by 15

[7] **"Letter to the President Biden Urging Renewal of US-China Protocol on Scientific and Technological Cooperation"**, APA Justice, 21 August 2023.

[8] Richard P. Suttmeier, **"Scientific Cooperation and Conflict Management in US-China Relations from 1978 to the Present"**, *Annals of the New York Academy of Sciences,* Vol. 866, No. 1, 2006, pp. 137–164.

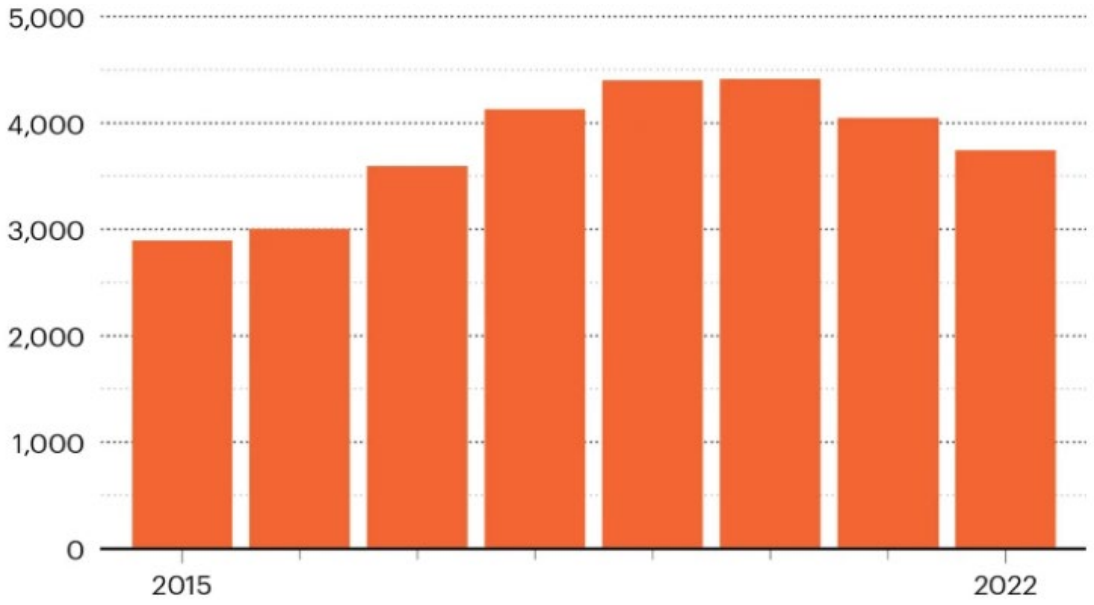
[9] James Mitchell Crow, **"US-China Partnership Bring Strength in Numbers to Big Science Projects"**, *Nature*, Vol. 603, 2022, pp. 56–58.

[10] **"U.S.-China Clean Energy Cooperation: A Progress Report by the U.S. Department of Energy"**, U.S. Department of Energy, Washington, D.C., January 2011.

[11] Yongjun Zhu et al., **"Analyzing China's Research Collaboration with the United States in High-impact and High-technology Research"**, *Quantitative Science Studies,* Vol. 2, No. 1, 2020, pp. 363–375.

per cent since 2020.[12] Dual-use technology and illicit flows of proprietary secrets and intellectual property to China have been major concerns for the US Federal Bureau of Investigation (FBI) Director, Christopher Wary declared that it has been "aggressively working to protect America's economic security from China's relentless efforts to steal our innovation and intellectual property" where around 2,000 cases are being investigated by the FBI.[13]

Figure 1: Bilateral Collaboration Score between China and the United States



Source: Nature Index, August 2023.

Scientific collaboration between China and the US came under intense scrutiny during the Trump administration. In 2018, the US Department of Justice launched the 'China Initiative' wherein, it investigated possible Chinese intellectual property theft and espionage. Simultaneously, the US National Institute of Health launched probes against mostly Chinese scientists, affiliated with more than 50 institutions across the US, for violating the terms of their grants. Several Chinese and American-Chinese descent scientists, including a prominent mechanical engineer professor from Massachusetts

[12] **"Mapping China's Shifting Research Collaboration"**, *Nature*, 9 August 2023.

[13] **"Director Wray's Opening Statement to the Senate Committee on Homeland Security and Government Affairs"**, Federal Bureau of Investigation, Washington, D.C., 31 October 2023.

Institute of Technology (MIT), Gang Chen, were charged.[14] Attorney General William P. Barr stated that the actions were "to confront China's malign behaviors and protect U.S. technology".[15] In February 2022, the Biden administration discontinued the 'China Initiative', as critics lamented that it had strayed far from its original objectives, but the effort did have chilling effects among researchers across US universities.[16]

According to the Open Doors 2003 report, as shown in Table 1, the number of Chinese students in the US is steadily declining. Experts attribute the decline not only to the COVID-19 pandemic, but largely to US administration's restrictive policies towards Chinese students, along with the China Initiative and visa restrictions.[17]

Table 1: Number of Chinese Students in US

Years	Total no. of students	% change from previous years
2013-2014	274,439	16.5
2014-2015	304,040	10.8
2015-2016	328,547	8.1
2016-2017	350,755	6.8
2017-2018	363,341	2.0
2018-2019	369,548	1.7
2019-2020	372,532	0.8
2020-2021	317,299	-14.8
2021-2022	290,086	-8.6
2022-2023	289,526	-0.2

Source: Open Doors International Students Data, Institute of International Education.

[14] **"Information About the Department of Justice's China Initiative and a Compilation of Chin-related Prosecutions since 2018"**, National Security Division, U.S. Department of Justice, Washington, D.C., 19 November 2021.

[15] **"Attorney General William P. Barr Delivers the Keynote Address at the Department of Justice's China Initiatives Conference"**, Office of Public Affairs, U.S. Department of Justice, Washington, D.C., 6 February 2020.

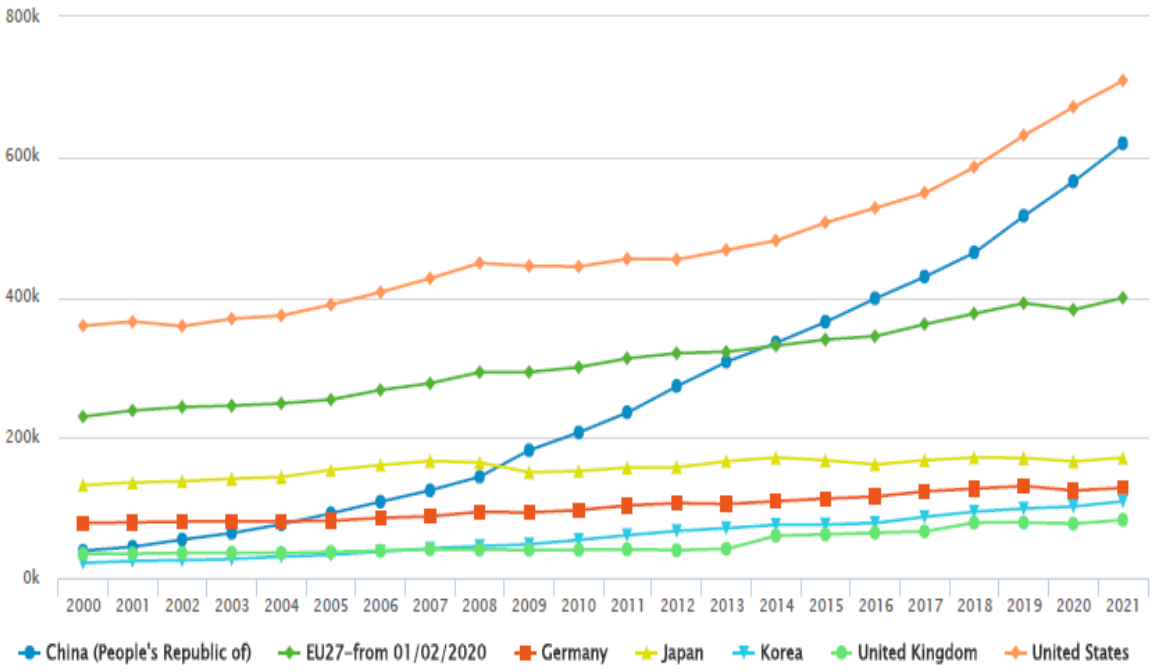
[16] **"Assistant Attorney General Matthew Olsen Delivers Remarks on Countering Nation-state Threats"**, Office of Public Affairs, U.S. Department of Justice, 23 February 2022.

[17] **"Favour Falls with Study Abroad as Chinese Students Stay Local"**, *Nature*, Vol. 620, pp. S11–S13.

Risks of Decoupling from STA

As shown in Figure 2, China's expenditure on research and development (R&D) is just behind the United States, with spending having jumped dramatically to hit US$ 464 billion or 2.14 per cent of Gross Domestic Product (GDP), surpassing the European Union spending of US$ 377.8 billion or 2.07 per cent of GDP.[18]

Figure 2: Gross Domestic Expenditure on R&D, Selected Economies 2020–2021



Source: OCED Main Science and Technology Indicator, September 2023, OCED, Paris.

For the first time, in 2022, China had the largest number of natural science research papers in *Nature Index*, surpassing the United States.[19] In 2019, China become the largest filer of international patent applications at the World Intellectual Property Organisation.[20] In the AI Index Report 2023, China is the leading nation in research on Artificial Intelligence, accounting for 40 per cent of all publications, followed by UK/EU

[18] **"OECD Main Science and Technology Indicators"**, Highlights of the September 2023 editions, OCED, Paris.

[19] Simon Baker, **"China Overtakes United States on Contribution to Research in Nature Index"**, 19 May 2023, *Nature*.

[20] **"China Becomes Top Flier of International Patents in 2019 Amid Robust Growth for WIPO's IP Services, Treaties and Finances"**, Press Release, World Intellectual Property Organization, Geneva, 7 April 2020.

(15 per cent) and the US (10 per cent).[21] In recent years, several major breakthroughs were made in quantum computing, astronomical observation and the brain-computer interface. China also successfully landed Zhurong on planet Mars in May 2021 and completed the Tiangong space station in October 2022.[22]

Given the fact that China has emerged as a dominant player in most natural sciences and engineering disciplines, what are the risks involved for not collaborating?

For the US, a number of detrimental consequences could follow from decoupling from China science and education systems and therefore experts are warning of the need to consider 'cost-benefit analysis' carefully before restrictive policies are adopted. Apart from the contribution to the US economy, international students studying across US colleges and universities have contributed US$ 40.1 billion and supported 368,333 jobs during the 2022–2023 academic year.[23] The US has been able to attract many outstanding students from China who have contributed to US science and technology innovations. Restrictive policies like denial of visas will more likely deny talent from attending American schools.[24]

The US Chamber of Commerce assessed that the US will be impacted across the four categories of trade, investment, people and ideas. Long term costs could include loss of competitive advantage, loss of power to set global standards, supply chain replacement costs and loss of international trust. It notes that the US economy will lose more than US$ 1 trillion from 'partial decoupling', whereas 'full decoupling' would be even more costly.[25] US Treasury Secretary Janet Yellen during a House hearing declared that "it would be disastrous for us to attempt to decouple from China".[26]

MIT President Rafael Reif cautioned that discouraging collaboration with Chinese scientists will not only put limits on the progress of science and technology innovation to mitigate growing global challenges, but "most significant, the United States will

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[21] **"Artificial Intelligence Index Report 2023"**, Stanford University Human-Centered Artificial Intelligence.

[22] He Zhu, **"China's Top 10 Breakthrough in Science and Technology in 2022"**, *National Science Review*, Vol. 10, No. 4, 2023, pp. 1–5; **"China's Scientific Achievements in 2023"**, Chinese Academy of Sciences, Beijing, 26 December 2023.

[23] **"The United States of America: Benefits from International Students"**, NAFSA: Association of International Educators, 13 November 2023.

[24] Steven A. Kivelson and Peter F. Michelson, **"The High Price of Overzealously Defending the US Research Enterprise Against Theft by China"**, *Proceeding of National Academy of Sciences*, Vol. 120, No. 48, 2023, pp. 1–4.

[25] **"Understanding U.S.-China Decoupling: Marco Trends and Industry Impacts"**, China Center, U.S. Chamber of Commerce, 17 February 2021.

[26] **"Hearing Entitled: The Annual Testimony of the Secretary of the Treasury on the State of the International Financial System"**, Financial Services Committee, 13 June 2023.

understand much less about where China stands – not just in terms of technology development and military modernisation but also in terms of its people goals and aspiration".[27]

Many Chinese scientists have left the US for China. In a research survey of Chinese-American academicians working in the US, it was ascertained that the majority felt unwelcome in the US. It also identified a steady increase of Chinese-descent academics leaving the US to China, and the trend has accelerated coinciding with the launch of the China Initiative. In 2021 alone, more than 1,400 Chinese scientists left the US for China.[28] Another research survey ascertains that the returnees produce higher impact work and continue to publish in top international journals.[29]

While disruptions in graduate education in training of high-level talent may significantly impact China, it still lags behind the US though in several key technologies, especially high-end semi-conductors, operating systems and software and aerospace. Experts believe that pressure from the US could stimulate renewed efforts in China to build more independent systems for research and innovation, as has been the case with Huawei.[30]

Way Forward

Former White House Science and Technology Policy Director, John P. Holdren has noted that although the Biden administration understands the significant benefits of the STA, the 2024 US elections will require the US administration to walk a political tightrope.[31] US Ambassador to China Nicholas Burns noted that though the STA is considered the 'bedrock' of US–China cooperation, it has become 'complicated' as the agreement made in 1979 has not taken into account artificial intelligence, biotech, machine learning and quantum mathematics.[32] Commenting on the outcome of the Biden–Xi meeting in November 2023 amid several US Congress members concerns over security, former US Ambassador to China, Max Baucus opined that 'national security' should not be used

[27] L. Rafael Reif, **"American Universities Shouldn't Cut All Ties with China"**, *Foreign Affairs,* 13 September 2023.

[28] Yu Xie et al., **"Caught in the Crossfire: Fears of Chinese-American Scientists"**, *Proceeding of National Academy of Sciences,* Vol. 120, No. 27, 2023, pp. 1–5.

[29] Cong Cao et al., **"Returning Scientists and the Emergence of China's Science System"**, *Science and Public Policy,* Vol. 47, No. 2, 2020, pp. 172–183.

[30] Richard P. Suttmeier, **"Chinese Science Policy at a Crossroads"**, *Issues in Science and Technology,* Vol. 36, No. 2, 2020, pp. 58–63.

[31] **"Experts' Take on the Sino-US Science and Technology Cooperation Agreement"**, *China Daily,* 11 August 2023.

[32] **"Ambassador Burns' Remarks and Q&A at the Brookings Institution"**, U.S. Embassy & Consulates in China, Beijing, 20 December 2023.

as "an excuse for commercial discrimination". He added that both countries need to "execute national security statutes" diligently which do not "prevent legitimate competition".[33]

While the fate of the China–US STA hangs in the balance, there have been some recent rapprochement activities, including:

- Recommencement of climate dialogue between climate envoys, John Kerry and Xie Zhenhua in November 2023, which had been suspended in August 2022 following US House speaker Nancy Pelosi's visit to Taiwan.[34]
- US Secretary of the Treasury, Janet Yellen's assurance during her meeting with Chinese Vice Premier He Lifeng in November 2023 that "the United States has no desire to decouple from China: A full separation of our economies would be economically disastrous for both our countries, and for the world."[35]
- President Xi Jinping's assurance of inviting 50,000 American students for exchange and study programmes in China, including simplification of the visa process, during his meeting with US President Biden on 15 November 2023.[36]
- The announcement of collaboration between US National Aeronautics and Space Administration and China National Space Administration to study the lunar sample bought back by Chang'e-5 in 2020. Collaboration was previously denied by the 'Wolf Amendment' passed by US Congress in 2011.[37]

These recent developments indicate that the two countries might arrive at a new understanding for science and technology cooperation, while addressing key US security concerns.

[33] **"Interviews with Max Baucus and Nell Calloway: China-U.S. Relations After Summit Meeting in San Francisco"**, US-China Perception Monitor, The Carter Center, Atlanta, 6 December 2023.

[34] **"Sunnylands Statements on Enhancing Cooperation to Address the Climate Crises"**, U.S. Department of State, Washington, D.C., 14 November 2023.

[35] **"Treasury Janet L. Yellen Ahead of Bilateral Meetings with Vice Premier He Lifeng of the People's Republic of China"**, U.S. Department of the Treasury, Washington, D.C., 9 November 2023.

[36] **"Full Text of Xi's Speech at Welcome Dinner by Friendly Organization in the United States"**, The State Council Information Office, The People's Republic of China, Beijing, 17 November, 2023.

[37] **"NASA Opens Door Cooperation with China on Moon Rock Research"**, *Science*, 7 December 2023.

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