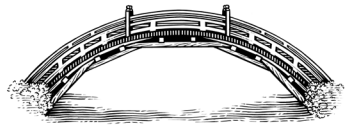
ASIA POLICY, VOLUME 19, NUMBER 2 (APRIL 2024), 139–57
HTTP://ASIAPOLICY.ORG

SPECIAL ESSAY

The Immigration Advantage in the U.S.-China Strategic Contest for STEM Talent

Jeremy Neufeld



JEREMY NEUFELD *is a Senior Immigration Fellow at the Institute for Progress (United States), where he leads the immigration policy portfolio. He is also an economics PhD student at George Mason University. Previously, he was an immigration policy analyst at the Niskanen Center. His work has been cited in numerous outlets, including the* Washington Post*, the* Wall Street Journal*, and the* Economist*. He can be reached at <jeremy@ifp.org>.*

NOTE: *This special essay was made possible by the generous support of the Hinrich Foundation ~ https://www.hinrichfoundation.com.*

KEYWORDS: U.S.-CHINA COMPETITION; HIGH-SKILLED IMMIGRATION; U.S. IMMIGRATION POLICY; STEM TALENT

One Union Square, Suite 1012, 600 University Street, Seattle, Washington 98101 USA

EXECUTIVE SUMMARY

This essay argues that recruitment of globally mobile scientists, researchers, and inventors gives the U.S. an advantage in great-power competition with China, but one the U.S. risks squandering.

MAIN ARGUMENT

The U.S. has a powerful asymmetric advantage over the People's Republic of China in advancing its global technological leadership: the ability to draw on the top talent from around the world. The recruitment of international talent in STEM fields is a major force multiplier for U.S. scientific and technological enterprises, especially in critical and emerging technologies and defense-related industries. Attracting top international talent is not a tool that China can easily replicate. For all its efforts to lure its own émigrés back and attract international students, China is still a net emigration country, while the U.S. is the top destination for immigrants, especially scientists and inventors. However, the deteriorating conditions of legal pathways to immigration for high-skilled STEM experts threaten to undermine this strategic advantage.

POLICY IMPLICATIONS

- The U.S. is becoming less attractive for globally mobile international talent over time, largely due to the onerous and worsening conditions facing legal immigrants. Most notably, there is a mismatch between the number of people allowed to apply and receive permanent residence each year, leading to untenably long—and growing—backlogs and associated wait times.
- The U.S. could increase its innovative output by expanding the quantity and improving the quality of international STEM researchers welcomed to the country. It could do so through changes in laws and regulations or merely by better recruiting and retaining talent through increased uptake of existing programs. It could also achieve greater contributions from talent it already has recruited by removing visa barriers restricting innovation-generating activities.
- Efforts by the Chinese government to transfer technologies illicitly through espionage pose a serious risk. This risk needs to be managed with care to protect sensitive information without setting back U.S. technological development.

Thanks to its open institutions, R&D infrastructure, and ability to attract the world's best and brightest, the United States is the world's most productive engine for progress at the frontier of science and technology. The United States has been able to accomplish much more than sheer population numbers would imply: although the United States has only 4% of the world's population, it produces 26% of its output, contains 30% of the top 2,000 global public companies, and wins 42% of all science Nobel Prizes.[1]

A key ingredient in that success is the ability to draw top talent from the fields of science, technology, engineering, and mathematics (STEM) into its world-class R&D enterprises. Among U.S. Nobel Prize recipients, for instance, immigrants have been awarded 40% of the prizes in science and medicine since 2001.[2]

At the same time, the country's very success has been a cause for complacency. Without a peer competitor since the end of the Cold War, the U.S. immigration system has been allowed to stagnate on the assumption that the United States will always be the world's economic, industrial, technological, and scientific leader and will remain the preferred destination of globally mobile scientists, researchers, and inventors on whom that leadership depends.

This essay argues that the United States' ability to draw on the world's talented scientists, researchers, and inventors is an asymmetric advantage in U.S.-China great-power competition, but that it is increasingly being squandered. It is organized as follows:

- pp. 142–47 examine how talent recruitment is key to developing critical strategic technologies.
- pp. 147–49 describe how the United States has allowed itself to become a less attractive destination by complacency about STEM immigration.
- pp. 149–51 discuss China's bid to compete for talent from abroad by encouraging return migration and recruiting foreign talent.
- pp. 151–55 draw lessons from the United States' own successful history of talent programs.
- pp. 155–57 describe how competition with China may shake the United States out of its complacency and discuss policies that could improve U.S. recruitment, retention, and deployment of international STEM talent.

---

1 Andrea Murphy and Hank Tucker, eds., "The Global 2000," *Forbes*, June 8, 2023 ~ https://www.forbes.com/lists/global2000/?sh=6d5edff45ac0; and "Science Nobel Prizes by Nation," Areppim, December 2, 2023 ~ https://stats.areppim.com/stats/stats_nobelhierarchy.htm.

2 "Immigrants and Nobel Prizes: 1901–2023," National Foundation for American Policy, NFAP Policy Brief, October 2023, 1 ~ https://nfap.com/wp-content/uploads/2023/10/Immigrants-and-Nobel-Prizes-1901-to-2023.NFAP-Policy-Brief.October-2023.pdf.

THE ROLE OF TALENT IN INNOVATION AND POWER COMPETITION

Even with a vastly less efficient or productive innovation ecosystem, a country with a sufficiently large demographic endowment could surpass the United States in economic or scientific output. While there is no one measure for industrial, technological, or scientific "leadership," China is rapidly advancing in numerous measures and is on track to surpass the United States in many of them, if it has not done so already. Despite lower average educational attainment, China since 2006 has produced more PhDs and master's degree graduates in STEM fields each year than the United States, and it continues to expand the gap.[3]

As a result of this expanding advanced STEM workforce, China's production of peer-reviewed scientific papers has grown rapidly. From 2008 to 2018, the number grew by over 7% a year, during which time China surpassed the United States as the world's largest source of peer-reviewed research.[4] These articles are not as high-quality as articles by U.S.-based scientists in terms of impact, but quality is also on the rise: measured by the total number of publications in top natural science journals, China surpassed the United States in 2022. In physical sciences and chemistry, it took the lead in 2021.[5] China now also has the most highly cited articles on the Web of Science platform.[6]

Moreover, in 2023, China for the first time surpassed the United States in the top 100 high-intensity science and technology clusters, with 24 to the United States' 21. In the top 25, however, China only has 1 (Beijing) to the United States' 8 (San Jose–San Francisco, Boston-Cambridge, Ann Arbor, San Diego, Seattle, Raleigh, Minneapolis, and Pittsburgh).[7] These superstar

---

3 Jeremy Neufeld, "STEM Immigration Is Critical to American National Security," Institute for Progress, March 30, 2022 ~ https://ifp.org/stem-immigration-is-critical-to-american-national-security.

4 Karen White, "Publications Output: U.S. Trends and International Comparisons," National Science Board, Science and Engineering Indicators 2020, December 17, 2019 ~ https://files.eric.ed.gov/fulltext/ED615534.pdf.

5 Simon Baker, "China Overtakes United States on Contribution to Research in Nature Index," *Nature*, May 19, 2023 ~ https://www.nature.com/articles/d41586-023-01705-7.

6 Caroline S. Wagner, Lin Zhang, and Loet Leydesdorff, "A Discussion of Measuring the Top-1% Most-Highly Cited Publications: Quality and Impact of Chinese Papers," *Scientometrics* 127, no. 4 (2022): 1825–39.

7 Soumitra Dutta et al., eds., *Global Innovation Index 2023: Innovation in the Face of Uncertainty*, 16th ed. (Geneva: World Intellectual Property Organization, 2023), 67–74 ~ https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023-en-main-report-global-innovation-index-2023-16th-edition.pdf.

clusters disproportionately drive scientific and technological progress through agglomeration effects, attracting top minds from around the world.

Fortunately, the United States does not need to rely solely on its own people to retain its technological edge. If it did, the United States would need to increase its share of STEM workers by four times for every increase in China's STEM workers share to keep up. The ability to recruit international talent is not a tool that China can easily replicate. For all its efforts to lure its own émigrés back and to attract international students—and it has made great strides in both categories—China is still a country facing net emigration, while the United States is the world's top destination for immigrants. Between 2000 and 2010, 57% of globally mobile inventors with patents came to the United States.[8] Meanwhile, international doctoral students from top U.S. research universities strongly prefer working in the United States to other countries.[9]

Thus, the United States has a powerful asymmetric advantage: the ability to recruit international talent. First, advanced STEM immigrants directly apply their disproportionately impressive skills. Despite being only 16% of inventors in the United States, immigrants account for 30% of patents.[10] They also tend to be more entrepreneurial than those born in the United States, starting companies of all sizes at higher rates.[11] These impressive characteristics can be explained easily by selection: the United States is drawing some of the best STEM talent from the global population—and the most risk-taking individuals are interested in coming to the country.

Second, advanced STEM immigrants contribute ideas that make the people they collaborate with more productive. While immigrant inventors directly produced 23% of innovative output from 1990 to 2016, they made U.S.-born collaborators more productive as well, raising their indirect

---

8 Carsten Fink and Ernest Miguelez, "Measuring the International Mobility of Inventors: A New Database," World Intellectual Property Organization, Economic Research Working Paper, no. 8, 2013 ~ https://www.wipo.int/publications/en/details.jsp?id=3952.

9 Ina Ganguli and Patrick Gaulé, "Will the U.S. Keep the Best and the Brightest (as Postdocs)? Career and Location Preferences of Foreign STEM PhDs," in *The Roles of Immigrants and Foreign Students in U.S. Science, Innovation, and Entrepreneurship*, ed. Ina Ganguli, Shulamit Kahn, and Megan MacGarvie (Chicago: University of Chicago Press, 2020), 49–69 ~ https://www.nber.org/system/files/chapters/c14108/c14108.pdf.

10 Ufuk Akcigit, John Grigsby, and Tom Nicholas, "Immigration and the Rise of American Ingenuity," *American Economic Review* 107, no. 5 (2017): 327–31 ~ https://www.aeaweb.org/articles?id=10.1257/aer.p20171021.

11 Pierre Azoulay et al., "Immigration and Entrepreneurship in the United States," *American Economic Review: Insights* 4, no. 1 (2022): 71–88 ~ https://www.aeaweb.org/articles?id=10.1257/aeri.20200588.

contribution to total U.S. innovation to 36%.[12] Furthermore, they help upskill those born in the United States. In higher education, international students subsidize the tuition of U.S.-born students, making higher education opportunities more affordable for them.[13] In addition, international experts help directly train STEM students. In semiconductor manufacturing, for example, experienced experts from Taiwan are helping instruct the next generation of talent in the United States through both formal training programs and on-the-job training.

Contributions to innovation have concrete security and defense implications that inform great-power politics surrounding the global competition for technology leadership. China has declared its intent to secure leadership in many fields, but its success (and that of the United States) varies by field. In the field of artificial intelligence (AI), China aspires to take the lead by 2030, but its ability to do so is not apparent.[14] Importantly, about half of the world's top AI talent is based in the United States. As the annual report of the U.S.-China Economic and Security Review Commission (USCC) reported in 2023, "a select few universities are driving China's AI chip and quantum research, although these centers are largely staffed by researchers returning from abroad."[15] In biotechnology, the United States' lead is strong, thanks in no small part to immigration: about half of advanced graduates in the field are international students. The United States' lead in nanotechnology is also clear, despite Chinese advances. However, in quantum computing, another critical emerging technology field, China may have already taken the lead. After spending much more on quantum information science, it has seen patents in the field exceed those of the United States.[16] As the USCC concluded in 2017,

12 Shai Bernstein et al., "The Contribution of High-Skilled Immigrants to Innovation in the United States," National Bureau of Economic Research, NBER Working Paper, no. 30797, December 2022 ~ https://www.nber.org/papers/w30797.

13 Kevin Shih, "Do International Students Crowd-Out or Cross-Subsidize Americans in Higher Education?" *Journal of Public Economics* 156 (2017): 170–84 ~ https://www.sciencedirect.com/science/article/abs/pii/S0047272717301676.

14 State Council of the People's Republic of China (PRC), "State Council Notice on the Issuance of the New Generation Artificial Intelligence Development Plan," July 20, 2017, trans. Graham Webster et al., DigiChina, August 1, 2017 ~ https://digichina.stanford.edu/work/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017.

15 U.S.-China Economic and Security Review Commission (USCC), *2023 Report to Congress of the U.S.-China Economic and Security Review Commission* (Washington, D.C., November 2023), 283 ~ https://www.uscc.gov/annual-report/2023-annual-report-congress.

16 USCC, *2017 Report to Congress of the U.S.-China Economic and Security Review Commission* (Washington, D.C., November 2017), 522–23 ~ https://www.uscc.gov/annual-report/2017-annual-report-congress.

"China has closed the technological gap with the United States in quantum information science—a sector the United States has long dominated."[17]

U.S. choices about attracting and retaining foreign STEM talent are deciding the trajectories of numerous critical technologies. For example, Erdal Arikan, a Turkish graduate from the Massachusetts Institute of Technology whose work contributed to a major innovative breakthrough in AI, sought opportunities to stay in the United States but was forced to leave the country because he could not obtain a visa. He was then recruited by Huawei, where his insights helped bring about Chinese 5G dominance.[18] According to the Defense Innovation Board, "China has taken the lead in 5G development…[and] China's handset and internet applications and services are likely to become dominant."[19] This could have been avoided had green cards been more available upon graduation.[20] As another example, mRNA vaccine technology was developed in the United States because biochemistry pioneer Katalin Karikó was allowed to come to the country in 1985, which was before the United States capped H-1B visas in 1990 and adopted visa rules in 1998 that would likely have barred her.[21]

Semiconductor manufacturing and supercomputing is another critical technology area in which China has been making important strides. In 2004, the country had less than 3% of the (known) top five hundred non-distributed supercomputers in the world. As of November 2023, it had 20%.[22] In fact, China led the world in the number of such systems from 2016 to 2021, before the Biden administration's export controls on certain chips.

Talent bottlenecks are upending plans to onshore fabs in the United States. In general, the industry should be a poster child for the role that international talent can play in driving forward cutting-edge industries. Jensen Huang, CEO of NVIDIA, and Lisa Su, CEO of AMD, are both immigrants, as is Andy Grove, Intel's former CEO. However, without changes to immigration policy to accompany the increase in funding for fabs, the United States will lose ground. Mass production at TSMC's Arizona fab, for example, has faced

---

17 USCC, *2017 Report to Congress*, 25.

18 Steven Levy, "Huawei, 5G, and the Man Who Conquered Noise," *Wired*, November 16, 2020 ~ https://www.wired.com/story/huawei-5g-polar-codes-data-breakthrough.

19 Milo Medin and Gilman Louie, "The 5G Ecosystem: Risks and Opportunities for DoD," Defense Innovation Board, April 3, 2019, 4, 12 ~ https://innovation.defense.gov/Portals/63/Templates/Updated%20Meeting%20Documents/5G%20UNCLASS%20PAPER_190404_FINAL.pdf.

20 Green cards afford foreign-born individuals lawful permanent residence in the United States, offering them the opportunity to live and work freely in the country.

21 Jeremy Neufeld, "Immigration Powers American Progress," Institute for Progress, February 8, 2022 ~ https://ifp.org/immigration-powers-american-progress.

22 TOP500, "Development Over Time" ~ https://top500.org/statistics/overtime.

delays because of skilled worker shortages.[23] Morris Chang, the founder of TSMC, expressed doubts that opening fabs in the United States would ever make sense, pointing to talent shortages.[24]

This pattern is not unique to semiconductor manufacturing or 5G development but is visible in quantum computing and AI as well.[25] Even in projects funded by the Defense Department, where the need for security clearances makes naturalization a prerequisite for employment, 37% of the advanced STEM degree holders working on these projects are foreign-born.[26] Altogether, the Department of Defense relies on 100,000 foreign-born STEM graduates at any given time for projects it funds.[27] In broader defense-related industries, the number reaches 50%.[28] Furthermore, recent research has shown that advanced STEM immigrants in defense industries are making more on average than their U.S.-born coworkers, indicating that they occupy key, high-value roles.[29]

Choking off the flow of talent—or worse, giving that talent over to our adversaries—would pose a significant national security risk. At the same time, the risks posed to U.S. intellectual property from espionage are also significant, especially from individuals with access to classified or sensitive information. In a report for the Office of Science and Technology Policy, the Institute for Defense Analyses investigated the costs and benefits of retaining foreign STEM talent inside the United States and found that the benefits far outweigh the costs.[30] First, the report analyzed cases of Chinese violations of intellectual property rights and found that the most important avenue for misappropriating U.S. trade secrets is through cybercrime. Second, it did not find evidence that foreign-born STEM talent is more likely to engage in

---

23 Nicholas Gordon, "TSMC Complains It Can't Find Enough Skilled Workers to Get Its Arizona Chip Plants Ready in Time, Delaying Mass Production to 2025," *Fortune*, July 21, 2023 ~ https://fortune.com/2023/07/21/tsmc-complains-cant-find-enough-skilled-workers-arizona-chip-plants-ready-delay-mass-production-2025.

24 Frank Chen, "TSMC Founder Doubts U.S. Competence in Chip-Making," *Asia Times*, April 24, 2021 ~ https://asiatimes.com/2021/04/tsmc-founder-doubts-us-competence-in-chip-making.

25 Neufeld, "STEM Immigration Is Critical to American National Security."

26 Jordan Chase and Jeremy Neufeld, "Strengthening the Defense Industrial Base Requires International STEM Talent," National Defense Industrial Association (forthcoming, 2024).

27 Ibid.

28 Neufeld, "STEM Immigration Is Critical to American National Security."

29 Connor O'Brien and Adam Ozimek, "Foreign-Born Skilled Workers Play a Critical Role in Strategically Significant Industries," Economic Innovation Group, April 2, 2024 ~ https://eig.org/hsi-in-strategic-industries.

30 Keith W. Crane et al., "Economic Benefits and Losses from Foreign STEM Talent in the United States," Institute for Defense Analyses, October 2021 ~ https://www.ida.org/-/media/feature/publications/e/ec/economic-benefits-and-losses-from-foreign-stem-talent-in-the-united-states/d-31855.ashx.

espionage on U.S. weapons systems than citizens born in the United States. Altogether, the findings highlight the need to develop counter-espionage methods and further develop integrity provision and vetting procedures so that the United States does not deny itself a source of talent that contributes 1.7%–1.9% of GDP.

U.S. COMPLACENCY

U.S. immigration policy was last significantly revised in 1990. Thus, the United States is substantively operating under the same immigration caps and programs as it was over 30 years ago, despite significant population growth, a changing technological and economic landscape, rising competition for talent, and a shifting geopolitical landscape. As a result, the U.S. immigration system is now no longer adequate for competing for highly skilled workers in STEM fields. The outdated rules are leading to insufficient numbers of top international STEM experts being able to come to or stay in the country and acting as a drag on the potential of those who do come.

A central driver of these effects is the growing backlog of applications for green cards. Because the number of people applying for permanent residency each year far exceeds the number of green cards that are issued, wait times have skyrocketed to untenable lengths, especially for Indian and Chinese applicants, and they show no sign of easing. In 2020, the Congressional Research Service estimated that an Indian applicant with an advanced STEM degree faces an estimated wait time of 195 years if she applied in 2020 and will face an estimated wait time of 436 years if she applies in 2030.[31] Obviously, this time frame is too long to be of any practical value to her or the country. As a result, there is declining interest by Indians and Chinese in coming to the United States. This trend helps explain why foreign enrollment in universities and the U.S. share of international students has fallen.

This trend is also affecting retention rates. One study finds that Chinese graduates' "stay rate" declines by more than two percentage points for each year that their green card applications are delayed.[32] Other studies find even larger

[31] William A. Kandel, "The Employment-Based Immigration Backlog," Congressional Research Service, CRS Report for Congress, R46291, March 26, 2020 ~ https://crsreports.congress.gov/product/pdf/R/R46291.

[32] Shulamit Kahn and Megan MacGarvie, "The Impact of Permanent Residency Delays for STEM PhDs: Who Leaves and Why," in "STEM Migration, Research, and Innovation," ed. Stefano Breschi et al., special issue, *Research Policy* 49, no. 9 (2020).

effects on retention from delays.[33] While STEM doctoral graduates have fairly high stay rates, the rates are much lower for those with master's degrees and other levels of education. According to a report from the Institute for Defense Analyses, the United States is losing 68% (or 71,000) of its international STEM graduates each year. Canada, specifically aiming to attract U.S. workers stuck in the backlog, opened 10,000 slots. Within 24 hours, it received 10,000 applications. And unlike the United States, when these slots filled up, Canada stopped accepting additional applications to prevent a backlog of its own.

U.S. complacency about the immigration system has also negatively affected the quality of the cohorts seeking international graduate degrees in the United States. In a natural experiment, hurdles to students staying in the country after graduation made U.S. education less attractive—especially for high-ability students—and caused a decline in the SAT scores of undergraduate students.[34] Because universities provide the largest recruitment pool for U.S. companies and research institutions, this trend has led to a decline in the quality of the talent available for R&D work.

Finally, visa rules are distorting the career choices and decisions of foreign-born workers already present in the United States and limiting their contributions to U.S. technological leadership. Although the bulk of R&D spending in the United States has shifted from the government to the private sector, immigration rules encourage migrants to stay in academia, since it is harder to secure a visa for the private sector (where most research and all commercialization is taking place). Starting one's own venture is even more difficult and constrained by visa rules. It is little surprise then that surveys of top international STEM students at U.S. universities find that they are more interested in academia than their U.S.-born colleagues.[35] And while 16% of U.S.-born PhDs work at startups in R&D jobs in the United States, the same is true of only 7% of foreign-born PhDs.[36] In other words, better visa rules could significantly increase the number of foreign-born PhDs already in the United States starting their own companies or otherwise commercializing their ideas.

---

33 Pooja Khosla, "Wait Time for Permanent Residency and the Retention of Immigrant Doctoral Recipients in the U.S.," *Economic Analysis and Policy* 57 (2018): 33–43.

34 Takao Kato and Chad Sparber, "Quotas and Quality: The Effect of H-1B Visa Restrictions on the Pool of Prospective Undergraduate Students from Abroad," *Review of Economics and Statistics* 95, no. 1 (2013): 109–26.

35 Ibid.

36 Michael Roach and John Skrentny, "Why Foreign STEM PhDs Are Unlikely to Work for U.S. Technology Startups," *PNAS* 116, no. 34 (2019) 16805–10 ⇝ https://www.pnas.org/doi/full/10.1073/pnas.1820079116.

Another natural experiment provides further evidence that visa restrictions drive talent misallocation. The Chinese Student Protection Act of 1992 offered green cards to thousands of Chinese nationals in the aftermath of the Tiananmen Square massacre. Receiving a green card reduced the likelihood that they would take a postdoctoral position at a university by 24%.[37] In another case, some individuals were subjected to H-1B visa caps that led to them being 51% more likely to take research and academic jobs.[38] This evidence suggests that immigrants might be increasingly "settling for academia" because it offers greater visa predictability.

CHINA'S BID FOR TALENT

China sees U.S. complacency about STEM talent as a gift. In a white paper on AI by a state-run think tank, analysts concluded that "currently, the U.S. remains the world's gathering place for research talent, but….[its] immigration policies have provided China opportunities to bolster its ranks of high-end talent."[39] From around 1992 to the early 2000s, Chinese thinking about how to handle the country's diaspora population shifted. In the 1980s, there was a movement against overseas study, and the government explored options to force people to return. The State Education Commission even reportedly compelled university lecturers who would be eligible for either an F-1 (a student visa) or a J-1 (an exchange visitor visa) to accept a J-1, which they knew had more restrictive rules that would make it difficult for the person to stay in the United States if they wanted to (the J-1 notably subjects many recipients to a requirement to return home).[40] However, when that proved unworkable and alienating, the policy was softened, originating the slogan "support overseas study, encourage people to return, and give people

---

37 Xiaohuan Lan, "Permanent Visas and Temporary Jobs: Evidence from Postdoctoral Participation of Foreign PhDs in the United States," *Journal of Policy Analysis and Management* 31, no. 3 (2012): 623–40.

38 Catalina Amuedo-Dorantes and Delia Furtado, "Settling for Academia? H-1B Visas and the Career Choices of International Students in the United States," Institute for the Study of Labor, IZA Discussion Paper, no. 10166, August 2016 ~ https://docs.iza.org/dp10166.pdf. H-1Bs are temporary work visas for specialty employment and are uncapped for universities but capped for most companies.

39 Remco Zwetsloot et al., "Keeping Top AI Talent in the United States: Findings and Policy Options for International Graduate Student Retention," Center for Security and Emerging Technology, December 2019, 37 ~ https://cset.georgetown.edu/wp-content/uploads/Keeping-Top-AI-Talent-in-the-United-States.pdf.

40 David Zweig, "Learning to Compete: China's Efforts to Encourage a 'Reverse Brain Drain,'" in *Competing for Global Talent*, ed. Christiane Kuptsch and Pang Eng Fong (Geneva: International Institute for Labour Studies, 2006), 187–214.

the freedom to come and go."[41] Starting in the early 2000s, as China's economy took off, centrally coordinated policies began to emerge to encourage returns to China.

Encouraging returners is seen as a crucial part of a strategy to prevent graduates abroad from being too decoupled from China and assimilated by other countries, as well as a source of talent and innovation for the country. In 2006, the Chinese government issued its National Medium- and Long-Term Plan for the Development of Science and Technology, intended to be a fifteen-year strategy to build the "indigenous innovation" capacity of the Chinese economy. Domestically led innovation was meant to transition China away from unsustainable reliance on acquiring and transferring foreign technologies. One of the six key issues raised in the strategy was the emigration of science and engineering talent out of China. These themes were taken up in the Talent Superpower Strategy announced at the 17th National Congress and remain key aspects of government strategy today.

In 2008, China rolled out the Thousand Talents Plan, its flagship initiative to attract top talent to China (mostly returners). While there are other talent recruitment programs, Thousand Talents appeared to have the most resources, target the highest caliber individuals, and pose the greatest risk as a path to illicitly transfer U.S. technology. After the U.S. government identified major espionage concerns, opened investigations, and arrested affiliated participants, the Chinese authorities stopped promoting the Thousand Talents Plan at the end of 2018. A new program called Qiming appears to be its successor. The program is housed in the Ministry of Industry and Information Technology for the same purposes but in a less public capacity. Operating with greater secrecy than Thousand Talents, the Qiming Plan offers incentives—including a living subsidy of 500,000–1,000,000 yuan—to overseas technical talent and entrepreneurs who come to China.

In 2021, the 14th Five Year Plan laid out China's plan to attract international experts, including permanent residency for foreigners, tax incentives, and other benefits. It also raised the possibility of a skills-based immigration system.[42] The same year, President Xi Jinping announced to the Central Committee that "by 2030, China will be significantly more attractive

41 Zweig, "Learning to Compete," 190.

42 National People's Congress (PRC), "Outline of the People's Republic of China 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2035," March 12, 2021, trans. Center for Security and Emerging Technology, May 12, 2021 ~ https://cset.georgetown.edu/publication/china-14th-five-year-plan.

to global talent" and "by 2035, the country will have competitive advantages in talent competition in many areas."[43]

While Chinese universities have increasingly attracted international students, China has yet to materialize as a permanent destination for foreign talent. However, living standards in urban centers have improved, which may make the country more appealing than it has been historically, especially if tied to generous financial and other material incentives. At the same time, repression, ethnic and cultural homogeneity, and linguistic difficulties will all continue to pose obstacles to China attracting foreigners in large numbers.

LESSONS FROM THE FORGOTTEN HISTORY OF U.S. TALENT PROGRAMS

The United States has not always had such a complacent approach to immigration recruitment and retention. Washington has a long history of advancing defense-related projects by actively recruiting top talent from abroad. In the nineteenth century, U.S. shipyards and ironworks actively recruited skilled engineers from Britain.[44] John Ericsson, the great Swedish-American inventor behind the U.S. Navy's Monitor class of warships first used during the Civil War and through the 1920s, was personally recruited by a Navy commodore. In the twentieth century, active recruitment efforts became better organized and formalized. Before World War II, for example, the director of Princeton's Institute for Advanced Study made numerous recruitment trips to Europe to take advantage of Nazi dismissals of Jews. He recruited Albert Einstein, among others. Numerous government agencies similarly recruited foreign scientists. One wartime report found that "under existing procedures, government agencies seem able to overcome any obstacles to the employment of aliens if they are in serious need of the knowledge held by these aliens…. Specific projects seem to facilitate this line of action."[45] Agencies were assisted in such recruitment by a roster of foreign specialized personnel—a list of more than 3,000 chemists, engineers, lab technicians, economists, statisticians, and medical professionals that was assembled even

43 "Xi Focus: Xi Calls for Accelerating Building of World Center for Talent, Innovation," Xinhua, September 28, 2021 ~ http://www.news.cn/english/2021-09/28/c_1310215793.htm.

44 W. Walker Hanlon, "Skilled Immigrants and American Industrialization: Lessons from Newport News Shipyard," *Business History Review* 92, no. 4 (2018): 605–32, available at http://walkerhanlon.com/papers/hanlon_newport_news.pdf.

45 Richard H. Heindel, "The Alien Scientist and the War," in "Minority Peoples in a Nation at War," *Annals of the American Academy of Political and Social Science* 223 (1942): 148.

before the bombing of Pearl Harbor compelled the United States to enter the war.[46] Many of the leading scientists of the Manhattan Project were recruited from this wave of immigrants. The military secretary of Churchill's war cabinet, Lieutenant General Sir Ian Jacob, once cracked that the Allies largely won the war "because our German scientists were better than their German scientists."[47]

Before World War II ended, the military began to see the promise of German weapons scientists. The U.S. Navy's Office of Research and Inventions launched Project 77 to bring some 60 German scientists to the United States to help understand German weapons technology and keep ahead of the Soviets. The navy also approved a smaller program for Japanese scientists. At the same time, the White House approved a bigger program—Operation Overcast—to bring 350 German rocket scientists to Texas, where they might be "exploited" for a project that could help in the Pacific war effort. This project was soon renamed Project Paperclip (sometimes called Operation Paperclip) and expanded in ambition. Project Paperclip was controversial within the government and proved even more controversial when made public. Nevertheless, it succeeded in its founding mission to bring "eminent scientists whose contributions, if added to our own, would advance the frontiers of scientific knowledge for national benefit" after careful vetting.[48] The White House approved expanding the number of scientists targeted, gave them freedom to work for civilian industry, and offered citizenship to them and the chance to resettle in the United States with their families. U.S. intelligence agents were tasked with compiling targets for U.S. recruitment efforts. These were not limited to purely military expertise. Top priority "Category I" targets would have special expertise needed by the War Department. "Category II" was designated for targets with industry-relevant expertise. The next tier included those "outstanding in their fields." Finally, some targets were identified for a fourth category for experts with good credentials but unknown value.[49]

Paperclip's exercise in assembling recruitment targets made two things clear to the officials overseeing the project: (1) talent could be critical to national security outside direct military applications and even where its precise application was completely unknown, and (2) national security demanded

---

46 Heindel, "The Alien Scientist and the War." See also Laura Fermi, *Illustrious Immigrants: The Intellectual Migration from Europe, 1930–41* (Chicago: University of Chicago Press, 1968).

47 Quoted in Andrew Roberts, *The Storm of War: A New History of the Second World War* (London: Allen Lane, 2009).

48 Quoted in Brian E. Crim, *Our Germans: Project Paperclip and the National Security State* (Baltimore: Johns Hopkins University Press, 2018), 64.

49 Ibid.

increasing the order of magnitude needed for U.S R&D and industry beyond mere hundreds.

Despite bringing many top-caliber scientists and specialists to the United States, many of Paperclip's leaders felt they had failed to achieve their goal: they were never able to recruit as many experts as they had hoped to do when they urged the program to be expanded. It was not that the targets did not want to leave. Instead, the United States lost targets to the other Allied countries. Most concerningly to Washington, the Soviet Union had the greatest success in scooping up scientists through a combination of charm, lavish promises, and coercion. As embarrassing if less dangerous, France also managed to snag more scientists than the United States. Some targets of the U.S. program were also successfully recruited by Britain through Operation Matchbox, though in smaller numbers.[50]

What the United States could not attain in numbers, it made up for in the quality of its recruits. U.S. recruiters valued targets who were young. An internal 1946 report found that the recruits to Project Paperclip "averaged just 30 years old" in 1942 when the V-2 rocket program began. Not only was the United States able to acquire some of the highest-value targets, but it successfully integrated them into the U.S. R&D enterprise in a way the Soviet Union never even attempted. Some Paperclippers eventually took on important roles at NASA and other government agencies, while others were assimilated into the private sector. They were given autonomy in their research, granted security clearances, offered citizenship, and afforded leadership opportunities.

Most of the freedoms enjoyed by Paperclippers were granted at the insistence of the Joint Intelligence Objectives Agency over the objections of the U.S. State Department. The State Department's strongest objections concerned allowing the Paperclippers to receive immigrant status and become American citizens. At the time, immigration law gave more discretion to the president, and the State Department, which oversaw the immigration system, was essentially overruled after some concessions. The open system demanded by the military fostered an environment in which the Paperclippers ended up making major contributions to the U.S. space program. Three became directors of Marshall Space Flight Center and the Kennedy Space Center, including most famously Wernher von Braun, a pioneer in rocket technology. It is only slight exaggeration to say that the moon landing was achieved over the security objections of the immigration bureaucracy.

[50] Crim, *Our Germans*.

By contrast, Soviet scientists tended to view the German scientists they recruited as merely sources of information and foreign technology. The Germans who immigrated to the Soviet Union never had the autonomy of the Paperclippers. Their freedom of movement was restricted, and their projects were dictated from above. After achieving the desired technology transfers, the Soviet Union felt it best to rely on indigenous innovation capacity. By the early 1950s, the country had rotated its foreign scientists off cutting-edge projects, secluded them for at least a year so their information would be outdated, and released them to East Germany and even to the West.

As the Soviet Union was dismissing its foreign scientists, the United States undertook another experiment in foreign recruitment. Unhappy with the number of targeted scientists who slipped through the cracks after World War II and concerned about the fate of European scientists as the Korean War was heating up (a Soviet invasion of the West was considered a possibility), the Joint Intelligence Objectives Agency launched Project 63 to initiate a new Paperclip-style project in Germany. The initiative improved on the recruitment methods of the original Project Paperclip by adopting the French and Soviet approach of using German recruiters.

Following the collapse of the Soviet Union in 1991, Congress passed the Soviet Scientists Immigration Act of 1992 to offer special visas for scientists. The objective was both to advance U.S. biodefense efforts and to prevent these scientists' weapons expertise from being used by adversaries—including terrorist groups—abroad. The bill was extended when it was about to expire in 2002, and the cap was raised from 700 to 900 recruits. This act is the most recent publicly known U.S. government-led recruitment program.

A few important lessons emerge from these past efforts to recruit foreign-born specialists that policymakers should be mindful of as they consider ways to enhance U.S. innovation and maintain U.S. leadership in technology:

- U.S. talent programs deserve credit for some of the United States' greatest technological achievements, including the Apollo program.
- The United States has surpassed the talent programs of rivals by assimilating foreign-born scientists and engineers into its R&D ecosystem.
- Proactive scouting and recruitment are often necessary to meet goals; legal frameworks alone are often not enough. Proactive recruitment can involve government, quasi-governmental, nongovernmental organizations, or a combination of these sectors. Incentives—including predictable pathways to permanent residency for the targets and their families—are invaluable in successful recruitment.

- Recruitment is most effective when targeted, with lists of eligible candidates being drawn up before they are needed. As recruiters learn through the process of recruitment, methods can be experimented with and improved.
- Specialists in industry and the private sector can play a valuable role in national security without working directly on sensitive projects or having access to sensitive information. The private sector can be a source for innovation and technological advances that can be used or applied by others to sensitive projects. Furthermore, under certain circumstances and with careful vetting and monitoring, access to sensitive information may be appropriate so that foreign-born experts can make greater contributions to the development of critical technology.

WHERE DOES THE UNITED STATES GO FROM HERE?

The United States appears to be slowly waking up from its complacency as global competition has highlighted the country's need for talent. The urgency of keeping pace with China seems to be giving momentum to policymaker interest in narrow and targeted provisions. After decades of discussing immigration in a comprehensive way, lawmakers are now more open to discussing targeted provisions. Most notably, Congress appears interested in removing obstacles to international students earning STEM degrees at U.S. universities from working in the national interest after graduation. In just the last few years, Congress has considered the following proposals:

- In the 116th Congress, Representative James Langevin and Representative Elise Stefanik introduced a bipartisan bill for "admitting essential scientists and technical experts into the United States to promote and protect the National Security Innovation Base."[51] Starting at just one hundred visas and scaling up to five hundred over five years, this legislation was within the spirit and scope of historical efforts by focusing on individuals who would directly benefit national security interests, according to the national security community.
- In a series of amendments and bills, and across the political aisle, several representatives and senators have introduced provisions to offer cap-exempt green cards to advanced STEM degree holders in an effort to better retain international talent. The details in each of these

[51] National Security Innovation Pathway Act, H.R. 7256, 116th Cong. (2020) ~ https://www.congress.gov/116/bills/hr7256/BILLS-116hr7256ih.pdf.

bills vary, but the principle is the same: green cards should be offered to vetted advanced STEM graduates. One of these efforts passed the House in the version of the bill that became the CHIPS and Science Act but did not make it into the final bill that passed Congress.[52]

- The bipartisan Select Committee on the Strategic Competition between the United States and the Chinese Communist Party recommended a new temporary visa program for partner countries in the Five Eyes intelligence-sharing program (with Australia, Canada, New Zealand, and the United Kingdom), the Quad (with Australia, Japan, and India), and select NATO countries to work on projects funded by the Department of Defense. The committee also recommended research security and vetting proposals that could mitigate espionage without endangering the benefits of scientific collaboration.[53]
- In the White House's supplemental spending proposal for 2022, the Biden administration proposed a Paperclip-style plan to recruit Russian scientists to the United States during the Ukraine war.[54]

None of these proposals has so far been passed into law, but they represent a sharp move away from the comprehensive immigration reform strategy pursued for decades. The White House has also been exploring ways in which the executive branch could better use existing authorities:

- The Biden administration has expanded the number of O-1A visas (an uncapped temporary visa for those with "extraordinary ability") by issuing clarifications and marketing the uncapped visa as an available option that can be used with predictability and certainty. It has also mentioned the possibility of making further clarifications as part of its effort to ensure U.S. leadership in AI.
- The J-1 is another uncapped visa that the White House has expressed interest in scaling up. The Biden administration launched the J-1 Early Career STEM Research Initiative to pair young STEM talent

52 See America Creating Opportunities for Manufacturing, Pre-eminence in Technology, and Economic Strength Act of 2022, H.R. 4521, 117th Cong. (2022) ~ https://www.congress.gov/117/bills/hr4521/BILLS-117hr4521eh.pdf; "Amendment to Rules Committee Print 117–54 Offered by Ms. Lofgren of California," House Committee on Rules, July 1, 2022 ~ https://amendments-rules.house.gov/amendments/LOFGRE_036_xml220705125918927.pdf; and Keep STEM Talent Act of 2023, S. 2384, 118th Cong. (2023) ~ https://www.congress.gov/118/bills/s2384/BILLS-118s2384is.pdf.

53 Select Committee on the Strategic Competition between the United States and the Chinese Communist Party, *Reset, Prevent, Build: A Strategy to Win America's Economic Competition with the Chinese Communist Party* (Washington, D.C., December 2023) ~ https://selectcommitteeontheccp.house.gov/sites/evo-subsites/selectcommitteeontheccp.house.gov/files/evo-media-document/reset-prevent-build-scc-report.pdf.

54 "White House Calls on Congress to Provide Additional Support for Ukraine," White House, Fact Sheet, April 28, 2022 ~ https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/28/fact-sheet-white-house-calls-on-congress-to-provide-additional-support-for-ukraine.

with companies. Additionally, it ordered the State Department and other agencies to consider making it easier to retain J-1 talent when their visas expire.

Fortunately, the need to develop U.S. talent programs is not a partisan issue in Washington. The bipartisan Select Committee on the Strategic Competition between the United States and the Chinese Communist Party published formal recommendations for the United States to "execute a talent strategy to promote research and development in critical and emerging technologies and strengthen the defense industrial base."[55] A key finding of the committee has been its warning that "the PRC is gaining on the United States in the race for global talent."[56] In addition, a large group of former high-ranking national security officials from both Republican and Democrat administrations has been advising Congress to address immigration bottlenecks "in the face of unprecedented competition from China."[57]

Former Singaporean prime minister Lee Kuan Yew once described why he thought the United States would win in the "final contest" between the United States and China: "Why do I believe in the long-term success of the U.S.? Firstly, the U.S. is a more attractive society than China can ever be. Every year, thousands of bright and restless immigrants are allowed into America."[58] That remains true today. But capitalizing on innate attractiveness will require modernizing the rules so that those bright and restless immigrants are allowed to stay, contribute, and succeed.

In the past, it has taken outright war or the collapse of an empire for policymakers to realize that immigration issues pertaining to STEM talent are critical national security issues. If the United States waits for a major crisis to again put immigration at the center of national security strategy, it may have already forfeited its advantage. ◈

55 Select Committee on the Strategic Competition between the United States and the Chinese Communist Party, *Reset, Prevent, Build*, 40.

56 Ibid., 3.

57 Alison Snyder and Sophia Cai, "Experts Push Congress for More High Skilled Immigrants to Compete with China," *Axios*, May 15, 2023 ~ https://www.axios.com/2023/05/15/science-tech-stem-china-immigration.

58 Lee Kuan Yew, *One Man's View of the World* (Singapore: Straits Times Press, 2013).