National Science Board

2022

International STEM Talent is Crucial for a Robust U.S. Economy

International students and workers are an essential part of the U.S. science and engineering (S&E) enterprise, but new data suggest the U.S. is becoming less attractive to this talent.[1] If the country is to remain at the forefront of innovation and discovery, the U.S. must:

1. Proactively and broadly attract talent. Potential mechanisms include: more sources of stable, long-term funding in academic labs and support for founding and growing companies. The U.S. must also continue to champion core values in S&E such as openness, fairness, and accountability.

2. Reduce deterrents to studying or working in the U.S. Potential strategies include: a streamlined and expanded visa system and research integrity policies that reduce administrative burden and maintain a welcoming atmosphere for international students and workers.

The U.S. has long been a magnet for top international STEM talent. This feature has been crucial for America's S&E enterprise, both because international students and workers bring valuable knowledge and skills and because the U.S. has failed to engage enough U.S. citizens in STEM education and careers. Even as the U.S. works to address its domestic talent shortfall, the country must continue to attract talent from around the world.

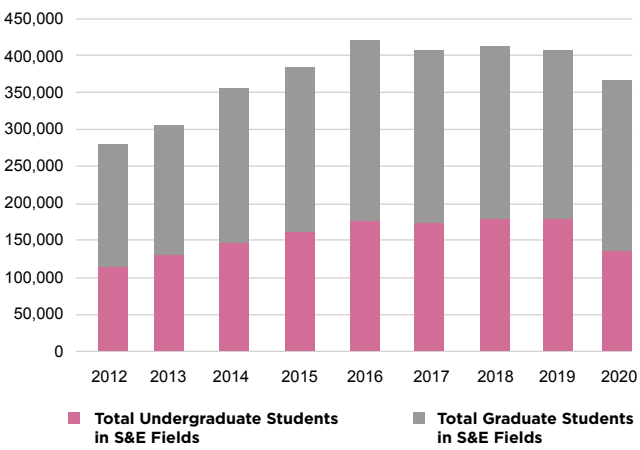
However, a major entry point for STEM talent is at risk: international enrollment at the undergraduate and graduate levels has dropped (Figure 1).

Although the U.S. remains the top destination for internationally mobile students worldwide, enrollment has declined since 2016, with a pronounced decrease in 2020 likely due to the COVID-19 pandemic. While the U.S. has tended to take foreign talent for granted, the world has changed.[2] Other countries have learned from the U.S. and are opening their doors to foreign talent, giving the world's top students an increasing number of options. Furthermore, as other countries invest in their own domestic R&D, internationally-mobile S&E students and workers have access to more education, training, and job opportunities in other nations, including in their home countries.

Approximately three-quarters of noncitizen S&E doctorate recipients stay in the U.S. following graduation, and many of them become U.S. citizens. **The proportion of the U.S. S&E workforce that is foreign-born is substantial and has continued to increase in recent decades (Figure 2).** At the doctoral level, foreign-born workers make up 45% of the S&E workforce.

The decrease in international students likely already affects university labs, which depend on international talent to conduct top-tier research. Industry leaders are struggling to hire the talent they need to stay at the cutting edge, and reduction in the flow of international students will significantly exacerbate the problem. Ultimately, the nation will lose out, as advances fail to occur and cures go undiscovered – and these losses will be particularly acute for critical and emerging technologies.

International S&E Student Enrollment Has Dropped



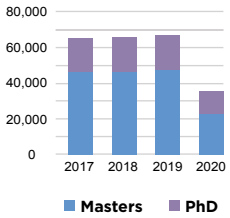


Figure 1, left: International students in S&E enrolled at U.S. higher education institutions, by academic level: 2012-2020.
Figure 1, right: First-time, full-time science, engingeering, and health graduate student enrollment of temporary visa holders, 2017-2020.[3]

Substantial and Growing Proportion of the U.S. S&E Workforce is Foreign-Born

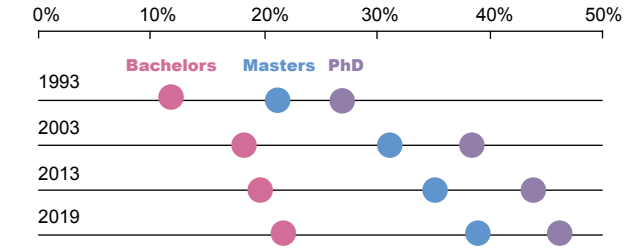


Figure 2, top: Share of foreign-born S&E workers by degree type (bachelor's, master's, and PhD).

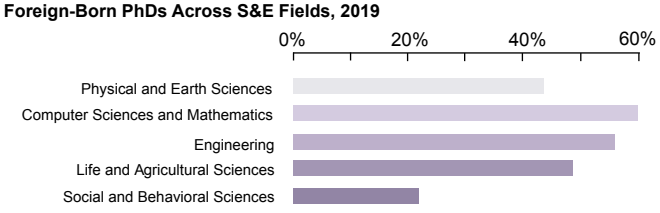


Figure 2, bottom: Percent of S&E workers holding a doctoral degree who are foreign-born, by field.

National Science Board
NationalScienceBrd@nsf.gov | 703.292.7000

NSB-2022-16
https://www.nsf.gov/nsb/publications/onepagers.jsp

Critical and emerging technologies are defined as those crucial for national security and economic prosperity. They change over time, as they reflect evolving R&D possibilities, but currently include advanced computing, advanced engineering materials, biotechnologies, and semiconductors and microelectronics.[4] **International students disproportionately earn doctoral degrees in fields underlying critical and emerging technologies relative to other fields (Figure 3).** Engineering and computer science and mathematics, fields which underlie many critical and emerging technologies, currently award more doctoral degrees to temporary visa holders than to citizens and permanent residents, due both to the excellence of U.S.-based doctoral programs and the lack of sufficient U.S. students to fill the slots available in these programs.

Naturalized citizens and non-citizens make up a large fraction of the workforces in Knowledge- and Technology-Intensive (KTI) industries using and developing critical and emerging technologies (Figure 4). They are particularly highly represented in computer, electronic, and optical products and scientific R&D. And foreign-born entrepreneurs are a vital component of launching companies: the National Foundation for American Policy found that more than half of U.S. startup companies valued at $1B or more were started by immigrants, with founders estimated to have created more than 1,200 jobs per company.[5]

In the academic sector, over half of doctorate holders employed in engineering and computer and information sciences, including over half of full-time faculty, are foreign-born (Figure 5). They contribute to U.S. S&E directly with inventions and discoveries. They also enable innovations through training and support of students and post-docs and collaborations with peers in academia and industry.

Any reduction in international S&E talent is a loss for the country. Indeed, the U.S. would benefit from an *increase*: demand for STEM jobs is projected to grow, outpacing demand for non-STEM counterparts.[6] While nurturing and strengthening domestic STEM talent must be a key component of meeting this demand in the long term, the U.S. must also double down urgently on recruiting and retaining international STEM talent from around the globe, including parts of the world that have not historically sent many students to study in the U.S.

Foreign-born S&E talent comes to the U.S. from around the world and through a wide range of entry points. These talented individuals tend to stay and contribute to the U.S. STEM enterprise, particularly in fields underlying critical and emerging technologies. The U.S. must continue to be a beacon for international talent at all education levels and career stages with reliable, consistent and welcoming policies and a strong domestic STEM ecosystem.

International Students Disproportionately Earn Doctoral Degrees in Fields Underlying Critical and Emerging Technologies

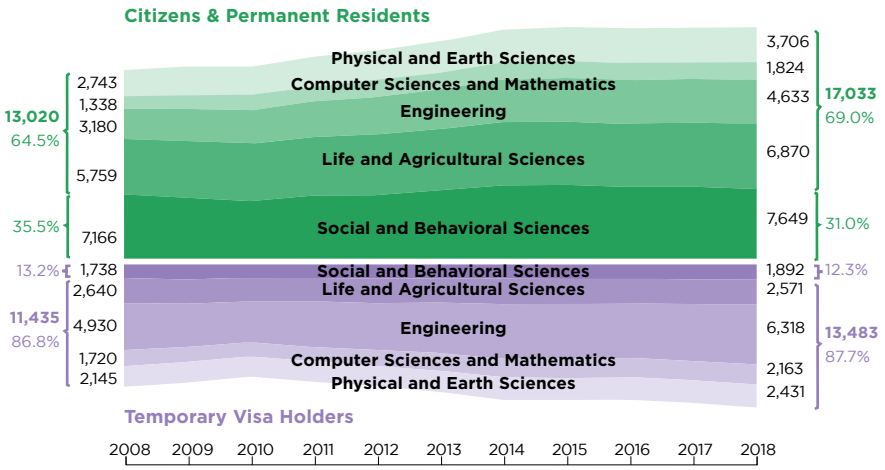


Figure 3: Science and engineering PhDs awarded, by citizenship and field: 2008-2018. Green: PhDs awarded to U.S. citizens and permanent residents. Purple: PhDs awarded to temporary visa holders. Numbers of doctorates awarded in each field are shown for 2008 (left) and 2018 (right).

Foreign-Born Individuals Make Up a Large Fraction of Knowledge- and Technology-Intensive Industry Workforce

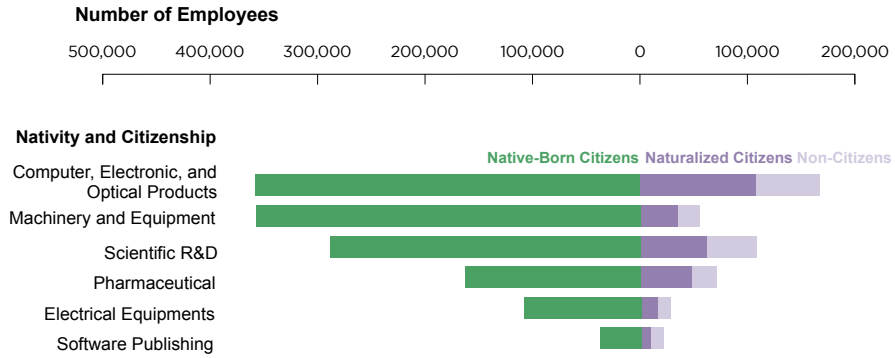


Figure 4: 2018 STEM worker employment in KTI industries, including workers with and without bachelor's degrees, by nativity and citizenship. Includes workers aged 16-17 not in military occupations or enrolled in primary or secondary school.

Over Half of Doctorate Holders Employed in Academic Engineering and Computer and Information Sciences are Foreign-Born

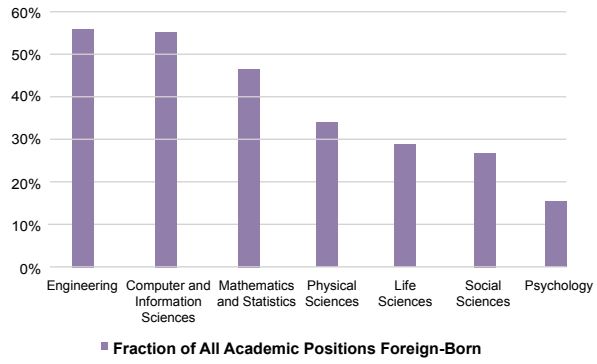


Figure 5: Fraction of all academic positions foreign-born by field of study: 2019. Academic positions include tenure-track faculty, postdoctorates, instructors, research associates, adjunct positions, lecturers, and administrative positions, among others. Percentages for full-time faculty are highly similar to those for academic employees overall.

[1] The State of U.S. Science and Engineering 2022 (2022)
[2] The U.S. is a Keystone of Global Science & Engineering (2022)
[3] Assessing the Impact of COVID-19 on Science, Engineering, and Health Graduate Enrollment: U.S. Part-Time Enrollment Increases as Full-Time Temporary Visa Holder Enrollment Declines (2022)
[4] Critical and Emerging Technologies List Update, Fast Track Action Subcommittee on Critical and Emerging Technologies of the National Science and Technology Council, February 2022; OSTP Report on the Industries of the Future Act, April 2022
[5] Immigrants and Billion-Dollar Companies, National Foundation for American Policy (2018)
[6] The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers (2021)