National Network
for Critical
Technology Assessment

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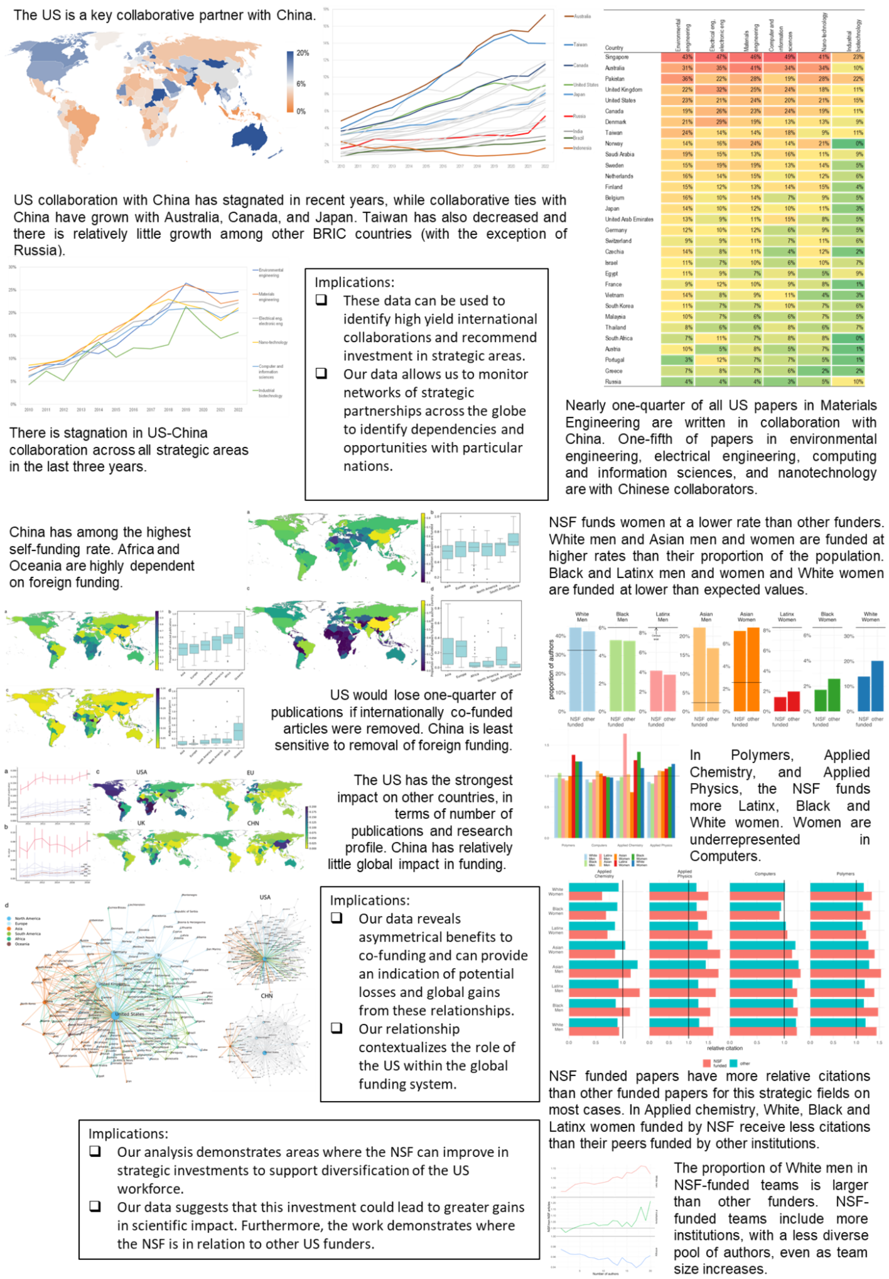
Understanding and investing in equity leads to a more robust national system of innovation and enhances US competitiveness.

Research Issue. The CHIPS and Science Act has been called "the most comprehensive effort in history to create opportunities in science and technology for women, people of color, and other underrepresented groups." In particular, the authorization to the NSF, including the funding for TIP, cites a specific mission to broaden participation in science and technology (Sec. 10303). It explicitly requires the new NSF Directorate to avoid undue geographic concentration of funding and broaden participation by populations historically underrepresented in STEM (Sec. 10384). The Act calls the NSF to conduct--not more than one year after the enactment of the Act--a "full portfolio analysis of the Foundation's skilled technical workforce investments across all Directorates in the areas of education, research, infrastructure, data collection, and analysis". The present demonstration responds to questions of competitive innovation and equity in three main dimensions: a) investigation of strategic international partnerships in scientific collaboration; b) analysis of dependencies in the global funding system; and, c) examination of potential disparities in NSF funding for marginalized intersectional identities in the US. Diversity in the scientific workforce is associated with higher productivity (Hamilton et al., 2012; Smith-Doerr et al., 2017), innovation (Hofstra et al., 2020), and focus on topics that most reflect the needs of the population (Kozlowski et al., 2022). Our analysis, therefore, provides actionable policy insight to ensure the US remains scientifically competitive and robust.

Methods and Data. To analyze international collaboration, we draw from the Dimensions database, developed by Digital Science (a Springer-Nature company), which has a non-selective indexing policy. This policy leads to higher global coverage: in 2021, we retrieved 3.7 million research papers worldwide, for which we could assign a discipline and a speciality (the comparison is 2.7 million for the Web of Science). Over the 2010-2022 period, the US authored more than 6.5 papers indexed in Dimensions; increasing from 417,456 in 2010 to 641,280 in 2021. Disciplines and specialties used are those of the OECD Field of Science and Technology. Dimensions indexes several types of documents (journal articles, preprints, books and book chapters); only journal articles are considered. Global funding is analyzed using a novel data source: the funding acknowledgement field in publications indexed in Clarivate Analytics' Web of Science. Specifically, we analyze more than 3 million funding string names in 12,759,130 articles published between 2009 and 2018 to construct a comprehensive understanding of cooperation and interdependence in global science funding. These data extend far beyond what is possible looking at R&D expenditure data from intra-governmental organizations in that they are more comprehensive, contemporary, and provide a richer analysis enhanced with the metadata from publications (including institutions, topics, etc.). We took a similar approach to analyzing the output of NSF funding: we extracted all publications from Web of Science with US affiliated authors that acknowledge some type of funding between 2008-2022. We extract all entities acknowledged that contain the string 'NSF' and hand-coded the expressions that were repeated more than 500 times, which represent 95% of data. This set is defined as the NSF-funded US articles, while the remaining articles are considered to be funded by some other institution. We algorithmically inferred probable race and gender, using techniques developed by the team and define the proportion of authors by identify for NSF-funded and articles funded by 'other' organizations, examine the diversity of teams given the proportion of White men, the number of institutions involved, and the entropy of the distribution of race and gender identities. This latter analysis of team compositions is made through the ratio between NSF-funded articles and those funded by others. We also developed an interactive dashboard with these and other metrics.

Insights and Implications. We provide the three sets of insights and implications below.



Next steps. Moving forward, we will increase granularity in the analysis, moving from disciplines to topics, and increasing the robustness of the results. We will also continue to enhance dashboards that could provide greater accessibility of these data to various user groups.