



How to Support Continued U.S. Leadership in Scientific and Engineering Research

Frank Joseph Fernandez, University of Florida

In 1900, Western Europe led the world in producing research in science, technology, engineering, mathematics, and health sciences — now called STEM+ for short. In the early part of the 20th century, the size and scope of the U.S. higher education system increased as more students enrolled at colleges or universities and faculty expanded doctoral programs for training researchers. Additionally, states, municipalities, and churches founded or expanded universities across the country. By the end of World War II, the U.S. had surpassed Europe in producing the largest share of publishable scientific research. However, beginning in the 1970s other countries — notably Japan, China, and South Korea — sought to expand their higher education systems to increase national scientific and economic competitiveness. Although the United States continues to produce a plurality of the world's STEM+ research, other countries are closing the gap.

There are many popular misconceptions about the ways that U.S. higher education contributes to the nation's STEM+ research — which in turn supports other national goals related to economic development, national security, and health. For example, beginning in the 1990s critics questioned whether U.S. universities were too bureaucratic, inefficient, and old-fashioned to compete with industry-based research and development and meet international competition. Other critics suggest that tenure guarantees of lifetime employment allow faculty to shirk their work and avoid producing new scholarship. Finally, many people assume that U.S. STEM+ research capacity rests on the strengths of the most research-intensive, private universities such as Harvard, Stanford, and the California Institute of Technology.

But are such critiques or assumptions true? I examined worldwide research production from 1900 to 2010 to help explain the strengths of the U.S. STEM+ research capacity. Based on this research, I find misconceptions that must be corrected to avoid ineffective policymaking.

How Misconceptions about Higher Education Contribute to Bad Research Policy

Analyses by my colleagues and I show that the majority of published U.S. STEM+ research through 2010 was done by university-based authors. Even when corporate and other authors outside academia publish STEM+ research, they often do so with university-based co-authors. Policymakers who assume that universities are inefficient and ineffective at research production may further cut funding to university researchers — but that would be counterproductive, because such researchers write or help write more than three-quarters of the U.S. STEM+ research publications issued each year.

American policymakers often see tenure for professors as the embodiment of university inefficiencies, but this assumption comes from an oversimplification or misunderstanding of tenure. Rather than a guaranteed job for life, tenure represents an ongoing contractual relationship that limits, but does not remove, an administrator's ability to dismiss a faculty employee. Tenured faculty may still be dismissed with cause. Furthermore, university administrators can and do shift resources among faculty at all ranks, to provide more support to those who are or remain highly productive.

More fundamentally, some researchers forego higher paying jobs outside academia for the intellectual freedom and job security that come with tenure. Tenure and university research environments allow researchers to develop long-term, sometimes costly research projects without focusing on producing short-term profits. Corporations are then willing to develop long-term partnerships with academic researchers to carry out projects, which may be difficult to pursue independently.

All of this leads to important innovations that might not occur if all research happened in short-term, for-profit settings. Thus, rather than weaken protections for tenure and academic freedom, policymakers should regard tenure as a competitive advantage for highly productive researchers to pursue teaching and research at U.S. universities — compared to universities in other countries that have severely restricted academic freedom and tenure.

Many U.S. Universities Contribute, Not Just the Wealthiest

Another misconception is that a small number of Ivy League or private research universities carry the nation's research capacity in STEM+ fields. Some research universities, including public as well as private institutions, do produce more STEM+ research than others. However, the strength of American research production lies in the fact that the small subset of the most research-intensive universities are underpinned by a broad base of colleges and universities that train new researchers in PhD programs and produce their own academic research, in addition to educating a wide range of college students who will be the parents of the next generation of innovators. In other words, for every Stanford, there are multiple schools like University of Houston and University of Mississippi that help the United States lead the globe in STEM+ research.

European countries historically focused on developing a core of small, elite universities, yet the much more varied and broader-based U.S. system outpaced those countries around the middle of the last century. More recently, policymakers in Asian countries have developed and implemented policies to support national research production by awarding extra funding to a small number of universities; but a recent study of one such policy in Taiwan showed that the policy is not very effective at achieving its stated goals. Other countries do better when they emulate the history of U.S. higher education overall.

Rather than trying to focus on supporting STEM+ research and innovation by rewarding a small number of research-intensive universities in the U.S., policymakers should further policies and funding that support the broad range of universities that contribute to U.S. STEM+ research. Both states and the national government have a stake in ensuring the continued strength and vitality of partnerships between the private sector and thousands of researchers based in hundreds of colleges and universities across the United States.

Read more in Justin J. W. Powell, David P. Baker, and Frank Fernandez, (Eds.), *The Century of Science: The Global Triumph of the Research University*, (Emerald Publishing, 2017).