U.S. Lead in Science and Technology Shrinking

National Science Foundation

Emerging economies shifting global S&T landscape

The United States' predominance in science and technology (S&T) eroded further during the last decade, as several Asian nations — particularly China and South Korea — rapidly increased their innovation capacities. According to a report released today by the National Science Board (NSB), the policy making body of the National Science Foundation (NSF) and an advisor to the President and Congress, the major Asian economies, taken together, now perform a larger share of global R&D than the U.S., and China performs nearly as much of the world's high-tech manufacturing as the U.S.

Evidence in NSB's biennial report, Science and Engineering Indicators, which provides the most comprehensive federal information and analysis on the nation's position in S&T, makes it increasingly clear that the U.S., Japan, and Europe no longer monopolize the global R&D arena. Since 2001, the share of the world's R&D performed in the U.S. and Europe has decreased, respectively, from 37 percent to 30 percent and from 26 percent to 22 percent. In this same time period, the share of worldwide R&D performed by Asian countries grew from 25 percent to 34 percent. China led the Asian expansion, with its global share growing from just 4 percent to 15 percent during this period.

"The first decade of the 21st century continues a dramatic shift in the global scientific landscape," said NSB Chairman Dan Arvizu, who is also the director and chief executive of the National Renewable Energy Laboratory. "Emerging economies understand the role science and innovation play in the global marketplace and in economic competitiveness and have increasingly placed a priority on building their capacity in science and technology."

Recognition on the part of national leaders that S&T innovation contributes to national competitiveness, improves living standards, and furthers social welfare has driven the rapid growth in R&D in many countries. China and South Korea have catalyzed their domestic R&D by making significant investments in the S&T research enterprise and enhancing S&T training at universities. China tripled its number of researchers between 1995 and 2008, whereas South Korea doubled its number between 1995 and 2006. And there are indications that students from these nations may be finding more opportunities for advanced education in science and employment in their home countries.

In addition to investing in their research and teaching enterprises, these countries have focused their attention on crucial sectors of the global economy, including high-tech manufacturing and clean energy. The size of China's high-tech manufacturing industry increased nearly six-fold between 2003 and 2012, raising China's global share of high-tech manufacturing from eight percent to 24 percent

during that decade, closing in on the U.S. share of 27 percent. In addition, emerging economies now invest more in clean energy — a critical 21st century industry — than advanced economies. In 2012, emerging economies invested nearly $100 billion in clean energy, primarily wind and solar, with China serving as the "primary driver of investment" with $61 billion. China's investment is more than double the $29 billion spent in the U.S.

Parent companies of U.S. multinational corporations (MNCs) perform over 80 percent of their worldwide R&D in the U.S. However, U.S. MNCs continue to increase their R&D investments in countries such as Brazil, China, and India, both reflecting and further contributing to a more globally-distributed R&D landscape. Majority-owned foreign affiliates of U.S. MNCs, for example, tripled their R&D investments in India and more than doubled them in Brazil between 2007 and 2010, nearly reaching the expenditure levels of the U.S. affiliates in China.

U.S. R&D Rebounds from Great Recession

The 2008-09 recession took a toll on U.S. R&D. U.S. R&D expenditures declined in 2009, primarily due to a sharp drop in business R&D, which comprises the largest portion of U.S. R&D. This decrease in business R&D was partially offset by a temporary increase in Federal R&D funding through the 2009 American Recovery and Reinvestment Act.

However, comprehensive data covering the post-economic downturn period reveal that the U.S. has rebounded from the Great Recession better than other developed countries. By 2011, with a resurgence of business R&D, overall R&D funding had returned to 2008 levels, when adjusted for inflation. Indicators data also show that S&T degree and job holders weathered the recession better than others in the U.S. workforce.

(The report released today does not cover the period during which Federal R&D was cut sharply by sequestration. The National Science Foundation reports that Federal R&D funding has declined in each fiscal year since 2010, dropping by 7.1 percent in fiscal year 2013.)

U.S. high-tech industries have generally fared better than those of other developed economies in the aftermath of the recession. In contrast to the European Union (E.U.) and Japan, the value-added output of U.S. high-tech industries grew in 2010-12, surpassing pre-recession levels. Similarly, commercial investment in clean energy technology declined sharply in the E.U. during the recession and has yet to return to pre-downturn levels.

One of the most notable S&T trends of the last decade has been the increased innovation capacity of emerging economies as they narrowed many gaps with the West. However, the U.S. S&T enterprise remains the global leader. For example, the U.S. invests twice as much as any other single nation in R&D, despite slipping to tenth in world ranking of the percentage of its GDP it devotes to R&D. In 2011, the U.S. spent $429 billion on R&D, compared to China's $208 billion and Japan's $146 billion. Among other S&T metrics, the U.S. leads in high quality research publications, patents, and income from intellectual property exports.

"The United States remains the world's leader in science and technology," said Ray Bowen, NSB member and chairman of its Committee on Science and Engineering Indicators, which oversees development of the report. "But there are numerous indicators showing how rapidly the world is changing and how other nations are challenging our predominance. As other countries focus on increasing their innovation capacities, we can ill afford to stand still. We now face a competitive environment undreamed of just a generation ago," said Bowen, visiting distinguished professor, Rice University and president emeritus of Texas A&M University.

The 2014 volume of Science and Engineering Indicators is prepared by NSF's National Center for Science and Engineering Statistics (NCSES) on behalf of NSB. Indicators provides quantitative information on science, mathematics, and engineering education at all levels, the scientific and engineering workforce, domestic and international R&D performance, U.S. competitiveness in high technology, and public attitudes and understanding of science and engineering. The publication is subject to extensive review by outside experts, other Federal agencies, NSB members, and NCSES internal reviewers. It is available at: www.nsf.gov/statistics/indicators [1]/.

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