IEEE-USA

POSITION STATEMENT

Maintaining U.S. Leadership in Innovation and Competitiveness

Adopted by the IEEE-USA
Board of Directors, June 25, 2021

IEEE-USA endorses the implementation of legislation encouraging innovation and supports related federal research and development (R&D) budget appropriations and regulations needed to restore U.S. technological leadership, promote economic competitiveness, expand the U.S. competitive high-tech workforce, and create high-value jobs in the United States. The following actions are required to accomplish these objectives:

1. Increase federal investment and maintain stable, balanced, long-term, federal R&D funding in science and engineering--including university research and education initiatives. Encourage cooperation among universities, federally funded labs, and U.S.- based companies to accelerate commercializing technological advances.

2. Revitalize U.S. high-tech manufacturing, promote public-private partnerships, and establish incentives for businesses to locate their R&D and manufacturing operations in the United States.

3. Promote private commercial investments in R&D and Academic research through further reduction of taxes on repatriation of foreign income of U.S.-based multinational corporations, provided that those funds be spent in the U.S. on R&D and related infrastructure.

4. Safeguard the fruits of domestic R&D through protection of U.S. intellectual.

5. Strengthen S&T (Science and Technology) expertise at foreign offices of U.S. agencies and S&T coordination among those agencies, to monitor foreign developments in R&D, and to facilitate interaction with the U.S. R&D community.

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To assess the effectiveness of these measures, periodically measure domestic R&D investment, patents related to STEM (Science, Technology, Engineering, and Mathematics), high-tech business formation, net high-tech job creation, workforce skills level enhancements, and the balance of high-tech imports and exports.

This statement was developed by the IEEE-USA Research and Development Policy Committee and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of the nearly 150,000 engineering, computing and allied professionals who are U.S. members of the IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE, or its other organizational units.

BACKGROUND

Return on R&D Capital Investment

Research and Development (R&D) is recognized as the key driver of economic growth, and the lifeblood of national innovation and competitiveness.[1] Economists estimate that up to half of the U.S. economic growth in the past five decades is due to advances in science & technology (S&T). The Bureau of Economic Analysis reports returns to R&D capital ranging from 5 to 14 percent of GDP growth[2].

Advances like integrated circuits, computer science, electro-optics, signal processing, machine learning, and artificial intelligence have created new markets such as information technology, the Internet, computer-aided design and manufacturing, laser technology, Global Positioning Systems, high-tech medical diagnostic equipment, mapping the human genome, cybersecurity, and virtual and remote working. But the Science, Technology, Engineering and Mathematics (STEM) enterprise is becoming increasingly global, fueled by advances in information technology and telecommunications, and efficient transportation systems.

[1] This background excludes some health sciences activities.
[2] World Economic Forum, The Global Competitiveness Report, 2016-2017 https://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf

https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

R&D Investment

IEEE-USA recognizes the potential for national innovation loss, driven by off-shoring of U.S. R&D. In the 2019, the total U.S. R&D investment was $597 B. U.S. expenditures for R&D 2010-2018 were 2.84 percent of the gross domestic product (GDP), which is below that of Sweden at 3.34 percent, Denmark at 3.06, and Japan at 3.26 percent. Although China's R&D investment 2010-2018 was only 2.19 percent of its GDP, it and India are rapidly increasing their R&D investments. European and U.S. industries off-shoring R&D are fueling India and China's increase in R&D investments. At $533 billion in 2019, China is the second largest R&D investor. China's GDP purchasing-power-parity (PPP) of $25.3 trillion is now larger than the United States' at $21.4 (PPP) trillion, and its R&D budget is projected to surpass the United States in 2026.[3]

Note that U.S. corporations generate trillions in profits overseas. Prior to the 2017 Tax Cuts and Jobs Act (TCJA), U.S. tax law in effect encouraged these corporations to retain these profits overseas, where the corporations sometimes used them to develop foreign technology and infrastructure that ended up competing directly against the U.S. TCJA exempted from taxation the dividends that domestic corporations receive from foreign corporations in which they own at least a 10 percent stake. To transition to the new system, TCJA created a new deemed repatriation tax for previously accumulated and untaxed earnings of foreign subsidiaries of US firms equal to 15.5 percent for cash and 8 percent for illiquid assets.[4] Modest changes to the TCJA could be made to encourage U.S. corporations to repatriate additional foreign profits to be spent on research and development in the U.S.

Among economies with more than 200,000 researchers, the Organization of Economic Co- operation and Development (OECD) estimates that researchers make up the highest workforce proportions in South Korea (1.3%), Japan (1.0%), the United States (0.9%), and the United Kingdom (0.9%)[5]. Although China reported a large number of researchers, these workers represent a much smaller percentage of China's workforce (0.2%), compared to OECD member countries. Nonetheless, China and South Korea have shown marked and continuous increases in their workforce percentage employed as researchers.[2]

[3] R&D World 'Global R&D Funding Forecast: Special mid-year update, Part 1', Paul Heney, August 19, 2020.
[4] Tax Policy Center, https://www.taxpolicycenter.org/briefing-book/how-did-tax-cuts-and-jobs-act-change-business-taxes
[5] R&D World Global Funding Forecast, https://www.rdworldonline.com/global-rd-funding-forecast-special-mid-year-update-part-1/

Although, as indicated in Table 1, the United States holds 25.2 percent of global R&D investment, Europe stands at 20.8%; and China, quickly narrowing the gap, ranks second, at 22.5 percent.[6]

Area/Nation	2019
North America	27.2%
United States	25.2%
Asia	43.9%
China	22.5%
Europe	20.8%

Table 1. Share of Total Global R&D Spending[4]

Although China's R&D investment, measured as a percentage of GDP, is below that of the United States, China is substantially increasing R&D investments in the coming years as shown in Figure 2. To maintain domestic expenditures on R&D, the federal government must establish policies that enable U.S. industry to promote innovation and competitiveness.[7]

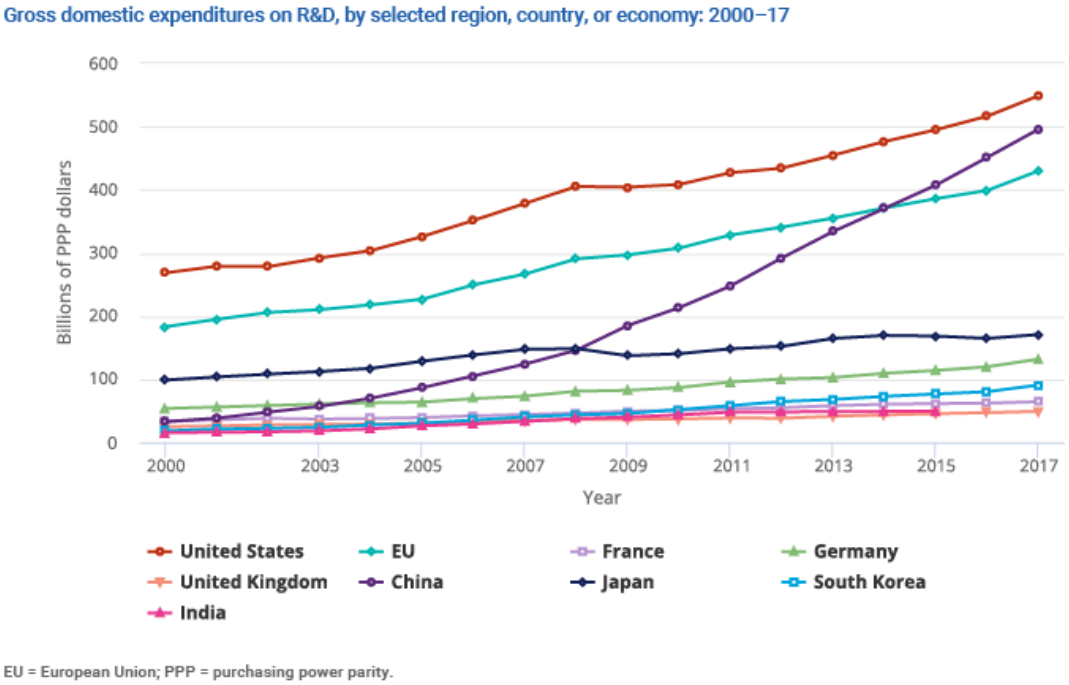

Figure 2. Gross Domestic Expenditures on R&D

[6] Global Competitiveness Index 4.0 2019 edition.
[7] World Economic Forum, https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1

Off Shoring and Decline of Federal Support for R&D as Percentage of Federal Budget and GDP

Several factors have contributed to gradually off shoring the U.S. industrial R&D portfolio. Advances in computer applications and telecommunication technologies have internationalized R&D. Economically, due to lower labor costs, increasingly favorable business climates, less restrictive environmental and occupational health and safety regulations, and tax incentives in other countries, multinational and U.S. companies are continuously enticed to establish off-shore R&D sites. Driven by this new-found asset, other countries are increasing investments in their R&D, and in producing homegrown scientists and engineers.

In 1975, China produced almost no Science and Engineering (S&E) doctorates. However, between 1995 and 2003, first year Ph.D. students in China increased by a factor of six, from 8,139 to 48,740. If this growth continues, China will soon produce more S&E doctorates than the United States.[8] Although the quality and expertise of U.S. S&E graduates presently exceed that of nations such as China, overseas STEM education in some these nations is improving steadily and eventually will rival that in the U.S. As shown in Figures 2 and 3, the total Federal R&D as a fraction of the budget has been declining over the past few years--a more serious issue.

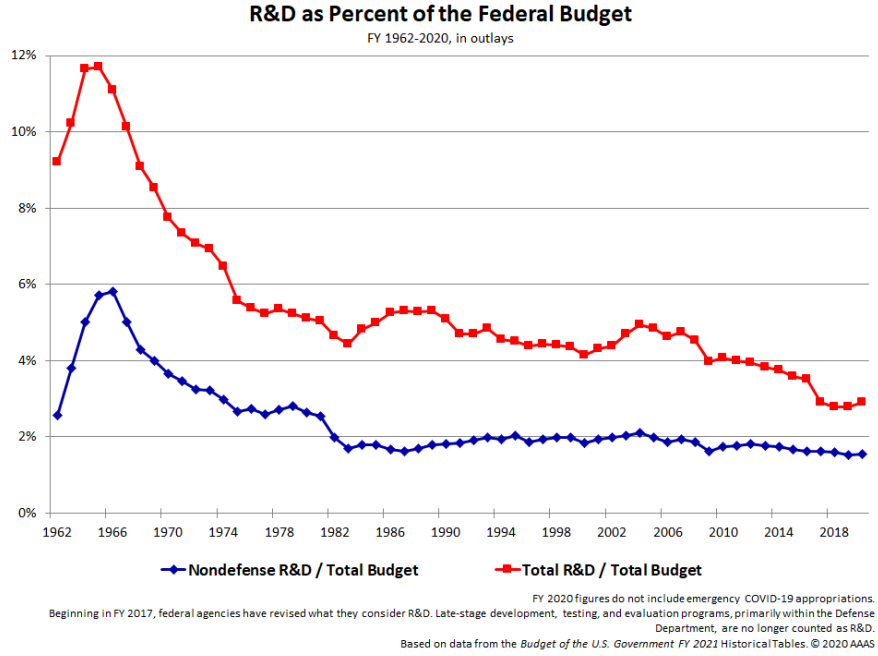

Figure 2. Decline of Federal government appropriated R&D funds over five decades, as part of the total Federal budget[9]

[8] The State of U.S. Science and Engineering 2020, National Science Foundation, https://ncses.nsf.gov/pubs/nsb20201/u-s-and-global-education.

[9] AAAS, Historical Trends in Federal R&D, December 2020

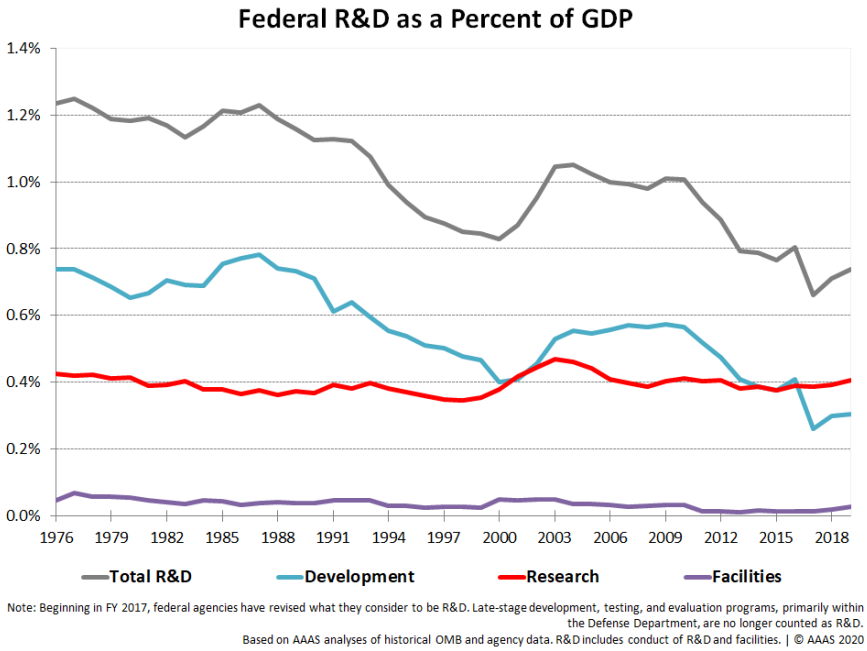

Figure 3. Decline of Federal government appropriated R&D funds over four decades, as part of GDP[9]

Role of Angel Capital and Venture Capital

Angel Capital (AC) and Venture Capital (VC) are special types of equity finance--typically for young, high-risk, and often, high-technology firms. AC investors are wealthy individuals, with experience in creating new companies, and are the most likely sources for early stage start- ups. The majority of angel groups prefer to invest in such high-tech industries as medical devices, software and biotechnology. A recent study showed that firms receiving angel funding are somewhat more likely to survive for at least four years, and that angel funding is positively related to the likelihood of subsequent external investment.[10]

VC investments peaked in 2006 and 2007, thereafter plummeting some 75 percent in 2010.[11] To offset this decline in part, IEEE-USA supports SBIR (Small Business Innovation Research) and STTR (Small Business Technology Transfer) programs that nurture this technology transition to business start-ups, and we encourage expanding such programs.[12]

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[10] Kerr, W.R.; Lerner, J. and Schoar, A. 2010. "The Consequences of Entrepreneurial Finance: A Regression Discontinuity Analysis." Working Paper No. 10-086. Harvard Business School.
[11] Because industrial sector funding of R&D decreases during times of economic distress [the dot.com and 2008 financial recessions], the federal government must maintain its commitment to R&D by protecting the SBIR and STTR capitalization programs.
[12] IEEE-USA Position Statement, "Small Business Innovative Research", 2017,

Growth of the R&D Enterprise

In the increasingly competitive global economy, other nations utilize tax incentives to encourage business R&D spending. The United States has taken proactive measures, such as a permanent R&D tax credit, to ensure a strong domestic science and technology research and development base,[13] but more should be done.[14]

The Federal, academic, and private sectors all have contributed to the STEM enterprise—a unique R&D ensemble. It is the driving force for economic and social advancement for humankind. Much of the recent policy debate in the United States regarding globalization's impact has centered on workforce preparation, and the need for American industry to sustain innovation. Increased spending on R&D addresses only part of the problem. Increasing production of STEM workers will be beneficial, if high-skilled, well-paid jobs await them. U.S. companies continuing to move R&D off-shore, will cause less demand for U.S. STEM workers. In turn, U.S. students will abandon pursuing future STEM professions, resulting in a vicious cycle of the United States losing its supply of future scientists and engineers.

Improving policies requires a deeper understanding of the economic impact of the STEM enterprise. Achieving these goals requires an in-depth analysis of reliable statistics relative to the U.S. Research and Development (R&D) workforce, a consistent and predictable budget, effective workforce incentives, and measures to encourage increased productivity. Once the operation of the STEM enterprise is prioritized and appropriately supported, the United States can establish a pathway toward maintaining its lead in the increasingly competitive, global R&D environment.

Protecting US Intellectual Property

The U.S. economy and American job growth and competitiveness depend on effective and balanced protections for intellectual property (IP). IEEE-USA supports IP reforms that promote the balance established in our constitution, and equitably serve the entire cross-section of U.S. IEEE membership--including start-up companies, individual inventors, university and national laboratory researchers and corporations.

One particular way to enforce IP rights against importers of goods that infringe on U.S. IP is to file a complaint at the U.S International Trade Commission. The IEEE-USA Position Statement Availability of Exclusion Orders at the U.S. International Trade Commission describes the ITC as follows, and contains recommendations for enhancing enforcement:

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https://ieeeusa.org/wp-content/uploads/2017/02/SBIR0617.pdf

[13] IEEE-USA Position Statement, "Expand the R&D Tax Credit", 2021 (In preparation).

[14] Atkinson, R., "On Tax Incentives", American Compass,2020 https://americancompass.org/essays/on-tax-incentives.

The U.S. International Trade Commission ("ITC" or the "Commission") is an independent Federal agency with broad investigative responsibilities on matters of trade. Those include investigating and adjudicating violations of Section 337 of the Tariff Act by issuing exclusion orders (injunctions) against the importation of goods that infringe on U.S. intellectual property ("IP"). In so doing, the ITC enforces laws that prevent unfair competition against the *entire* domestic industry *chain* involved in inventing, creating, developing, supporting and supplying the articles protected by the IP. Therefore, ITC enforcement actions against infringers-importers protect domestic jobs, including those of IEEE's U.S. members.

Building International Ties

In light of Table 1 (above), numerous valuable ideas and innovations will spring up outside the United States, and the U.S. R&D community should monitor them closely. The foreign offices of various U.S. departments and agencies are one mechanism for accomplishing this monitoring. Expert S&T personal should adequately staff these offices-- either permanently, or rotating employees from government, academic and industrial laboratories. Any information gained should be made available to the U.S. STEM enterprise.

The Air Force Office of Scientific Research's International Office[15] and the Office of Naval Research's Global Office[16] have long histories of building international ties in science and engineering. Recently, the Department of State has expanded its efforts in "Science and Technology Cooperation."[17] Some other agencies also have international science and engineering outreach activities. Building upon these commendable programs, and enhancing cooperation among them, would be of high value to U.S. R&D.

[15] http://afrl.dodlive.mil/international-programs/.
[16] https://www.onr.navy.mil/en/Science-Technology/ONR-Global.aspx
[17] https://www.state.gov/e/oes/stc/