The US "CHIPS and Science" Act Launches Industrial Policy as Counter to China

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Abstract
In an effort to counter Chinese advances in science and technology, the United States has adopted legislation that supports semiconductor manufacturing and identifies frontier technologies for R&D investments. The Act creates a new directorate to facilitate science applications at the US National Science Foundation and potentially adds tens of billions of dollars in funding to two US science agencies.

US science and technology (S&T) policy languished for more than a decade following the "America COMPETES Act" reauthorization in 2010. That changed in August 2022, when President Joseph R. Biden, Jr. signed the "CHIPS and Science Act" into law.

A Shift Toward Industrial Policy in the United States

The sprawling 1,000-page bill authorizes USD 280 billion in new spending for science and technology, a significant portion of which would be directed to university research. The bill is notable both for its explicit embrace of industrial policy and for its clear intent to counter Chinese advances in S&T.

The new law represents a repudiation of the market-oriented neoliberal consensus that held sway in Washington for four decades. Since the late 1970s, American politicians have been willing to encourage S&T partnerships between industry, government, and academe, but they have, with rare exceptions, been averse to "picking winners" through designated funding streams for frontier technologies. With the signing of the "CHIPS and Science Act," that now changes.

The precise impact on US higher education cannot yet be estimated. But US research universities are certain to benefit from R&D funding related to the nearly two dozen technologies designated for further development in the bill, including quantum communications technologies, artificial intelligence, robotics, clean energy, climate change research, bioenergy, and cybersecurity. The law authorizes USD 81 billion to the National Science Foundation (NSF) and establishes a new directorate at NSF to accelerate use-inspired research and technology development and to translate basic science findings into practical applications. The Office of Science at the Department of Energy will also see a greatly expanded budget, a large part of which will filter into university-based R&D. Billions are also allocated in the law for STEM education.

If the authorized funding is realized in the Congressional appropriations process, the NSF budget would grow by 8 percent in the next fiscal year and by USD 36 billion over five years. The Office of Science at the Department of Energy is slated for a USD 30.5 billion increase over the same period. The impact on universities would be two pronged: Most of the funding—at this point no one knows how much—would go for research projects in designated areas and the rest for STEM education, including an increase in Graduate Research Fellowships, from 2,000 to 3,000 a year.

Higher education is not the biggest winner in the new bill, however. The semiconductor industry is the recipient of USD 52 billion in subsidies and tax credits for US-based manufacturers. US policy makers have come to regard chip makers as critical for US national security because their silicon wafers help run everything from cars and computers to smartphones and home appliances. Universities will, however, also benefit from the infusion of chips funding. As US-based manufacturers ramp up production, universities located nearby will have an incentive to add training programs required for the expanded labor force.

The Question of Appropriations

The "CHIPS and Science" bill seemed destined for collapse as conferees attempted to reconcile large differences between a House bill that deferred most decision-making to the US science agencies and a Senate bill that was far more prescriptive. In the end, most features of the Senate bill prevailed. However, few of the Senate's policies to

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control intellectual property theft or limit the influence of specific Chinese companies made their way into the bill that President Biden signed.

Even so, the intent to counter China is clear. The leading Republican sponsor of the bill, Senator Todd Young of Indiana, said the bill would "put America in a position to outgrow, out-innovate, and out-compete our leading geopolitical foe."

It is not clear whether the new law will be sufficient to realize Young's prediction. Authorizations for funding often do not end up as allocated dollars in the United States. Chips funding appears to be secure, but other authorizations may not be. A Government Accountability Office review of the 2007 America COMPETES bill and its 2010 reauthorization found, for example, that only one of 28 new programs in those measures was fully funded and implemented.

Chinese Assets and Challenges

China's commitments and momentum also should not be underemphasized. Since the turn of the twenty-first century, China has caught up and surpassed the United States in the production of scientific papers, and its scientists have begun to compete with the United States in average citation impact and top one percent citations. During the same period, China has also quadrupled its investments in R&D, closing the gap between its total R&D expenditures and those of the United States.

Through these investments, the Chinese state has leveraged its assets to achieve or share global leadership in areas such as supercomputing, materials science, stem cell research, and low-carbon and sustainable energy. It is now making rapid strides in artificial intelligence. China's assets include steadily increasing public investment in research and world-class universities; competition between Chinese cities and regions to meet and exceed Central Committee S&T goals; the speed with which venture capital also moves in accordance with state S&T priorities; highly competitive national examinations that sustain the strongest universities while channeling family effort in the direction of educational success; state and family encouragement for study in science and engineering fields leading to a four-fold advantage for China in annual tertiary level graduation rates in STEM fields; and the reintegration of Chinese nationals educated abroad through state inducements and improved research opportunities.

Potential long-term weaknesses in the Chinese system include the government's restraint on freedom of expression, which has been an impediment to scientific creativity; the tendencies toward inefficiencies and corruption that may be endemic to politically directed capitalist development; and the complex local, national, party, and network ties that scientific researchers must negotiate in order to move projects forward.

Ironically, the most recent Chinese policy initiative, "Made in China 2025," adopts many practices that have been regarded as traditional US strengths, including a comprehensive approach to advanced industrial production and greater use of market mechanisms—and it does so at precisely the same time that US policy is beginning to mirror Chinese practices from previous decades by identifying frontier technologies and promoting state investment in them.

A Distinctive Approach in the European Union

Over the last decade, Europe too has moved in the direction of state-led S&T planning. The "Horizon Europe" Plan for 2021–2027 allocates nearly EUR 100 billion to meet S&T goals. As compared to US and Chinese plans, the European Union's emphasis on societal adaptation and environmental sustainability is noteworthy. The largest chunk of this funding—more than half of the total—will go to support five mission areas: adaptation to climate change; maintaining healthy oceans; developing smart cities; curing cancers; and maintaining soil health and food supply. ◢

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