

THE RESEARCH PARTNERSHIP: FRONTIER DISCOVERY TO PRODUCT DEVELOPMENT

When DARPA and universities formulated a plan to link up computers to share research in 1968, few imagined that that innovation, which would become the Internet, would shrink global distances and change the way we conduct business, communicate, gather information, listen to music, make telephone calls, and even shop.

Similarly, in 1948, Bell Labs scientists invented the transistor. They had built what at that time was the world's smallest, fastest, coolest switching device without knowing all of the potential applications. Their research was a forerunner for the integrated circuit that is the basis for all today's electronics.

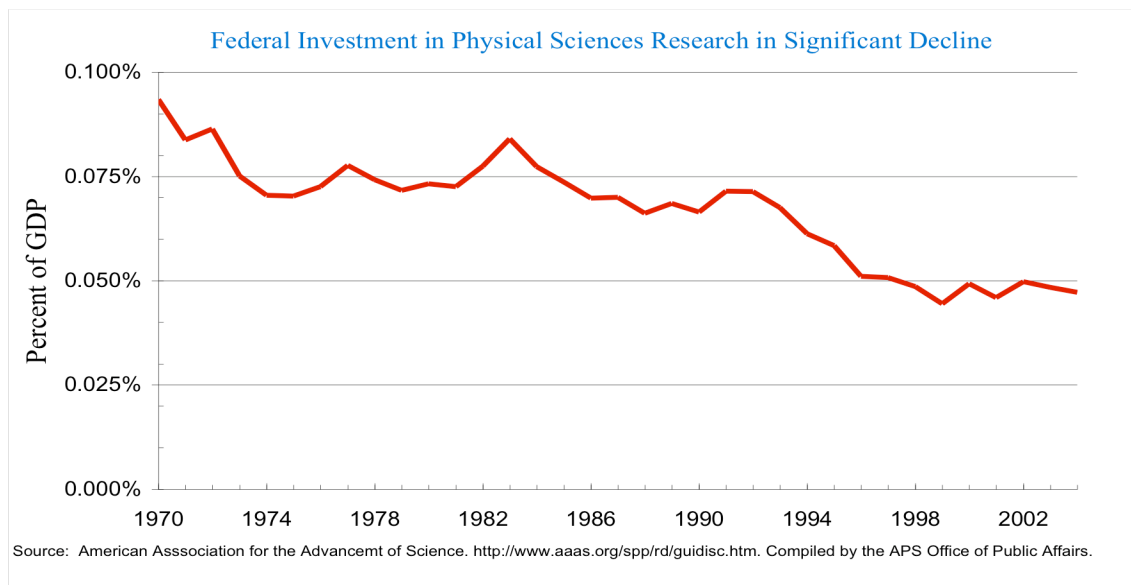
Research is the foundation for innovation. Basic scientific discovery detailed in the historic examples above is beyond the capacity of any single firm or even a united industry. Government investment in basic research funding is imperative for the continuation of America's innovation leadership, competitiveness and national security. In particular, basic research findings in physical sciences, engineering, and mathematics hold the potential to drive productivity gains and growth across all sectors of our economy. Yet, federal investment in these key areas has been flat or declining over the past 30 years.

KEY FACTS

The U.S. chip industry reinvests 15% of its revenues into R&D

U.S. federal funding for basic research in the physical sciences, as a percentage of the GDP, has dropped by one-half since 1970.

The NSF estimated in 2004 that \$2 billion in meritorious research proposals could not be funded due to resource constraints. NSF funded 24 percent of proposals in 2004, the lowest rate in fifteen years.



Solving the Basic Research Crisis

Federal basic research in the physical sciences and engineering is primarily funded through the National Science Foundation (NSF), National Institute of Standards and Technology (NIST), and U.S. Department of Defense. These basic research programs must grow at a minimum of 7 percent per year to enable research to keep up with growth and inflation. In FY 2002, Congress committed to doubling NSF's budget within five years, yet only 16 percent of that commitment has been met.

Why Does It Matter to Chip Makers?

Moore's Law projects that every eighteen to twenty-four months the capacity of a semiconductor chip will double. This means faster, more powerful and ultimately less expensive semiconductors. For the past forty years the chip industry has been delivering on this promise through aggressive research and development. U.S. chipmakers invest more than 15 percent of sales back into R&D, among the highest of any industry. The resulting growth in computing capacity has made the information revolution possible. But, to continue to deliver on Moore's Law, significant research hurdles must be overcome. Industry experts agree that a replacement technology for the current 30-year old semiconductor process, which is reaching its physical limits, needs to be discovered and manufactured by 2020 to continue the historical trends of performance enhancement, size reductions, and cost savings. Seminal research papers usually appear 12 to 15 years before commercialization, in other words, *within the next few years*.

While individual companies have and will continue to fund near term commercial research, a different approach is needed for longer-term efforts. The chip industry has mapped out the technical challenges it faces and the research needed to stay on Moore's law. Collaborative research with outcomes expected in three to eight years requires industry to pool its resources and partner with government. Longer-term research – 8 to 15 years out – involves government sponsored university research through the National Science Foundation, the Department of Defense, the National Institute for Standards and Technology and others. Government must help undertake the most fundamental research that will result in completely new technologies in decades to come.

Focus Center Research Program (FCRP)

FCRP was launched in 1997 to support university research to discover solutions to the mid- to long-term challenges to continued semiconductor advancement. The FCRP currently operates on approximately \$20 million in Defense Department annual funding coupled with an additional \$20 million industry match. All funds go directly to the 33 universities conducting the research.

National Science Foundation (NSF)

The NSF budget should be substantially increased. The Nanoelectronics Research Initiative (NRI) is an excellent example of how industry and NSF can work together to address national research needs. The NRI is a cooperative effort co-founded by NSF and industry to support university research to find the next generation of semiconductor technology by 2020. Other countries are investing heavily in the nanoelectronics research area and could surpass U.S. discoveries in this area. The U.S. must identify the replacement technology first if it is to retain its leadership position.

National Institute of Standards and Technology (NIST)

NIST must continue to lead in metrology (measurement) as the industry moves to nanometer (billionths of a meter) scales. SIA supports the Administration's research initiative "Enabling Nanotechnology from Discovery to Manufacture," which includes expansion of the Center for Nanoscale Science and Technology (+\$20m). SIA also supports the Administration's request for quantum information science (+\$9m) and manufacturing innovation/supply chain integration (+\$2M).

For more information on the important role chips play in U.S. innovation and competitiveness, visit:

www.choosetocompete.org

Or call SIA at 408.573.6612