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POLICY BRIEF

Expanding the Federal Investment in Information Technology Research

Expanding the federal investment in long-term Information Technology (IT) research is essential to sustaining the competitiveness and productivity of the U.S. economy, maintaining a technologically superior defense, advancing the frontiers of science and engineering, strengthening public infrastructure and services, and improving the lives of all Americans.

The need to make IT research a top policy and budget priority is being widely recognized:

- The President's Information Technology Advisory Committee (PITAC), an independent, Congressionally-chartered panel, has concluded that *the federal investment in information technology R&D is inadequate and too focused on near-term problems* and recommends a strategic initiative to expand support for long-term, broad-based, precompetitive IT research.

- Based on the objectives identified by the PITAC, the President's FY 2000 budget request offers a sound proposal for undertaking a $366 million information technology initiative that includes support for fundamental research in computing and communications and for development of computational infrastructure.

- Also based on the PITAC's recommendations, the bipartisan Networking and Information Technology R&D Act (HR 2086) would authorize a five-year program in long-term IT research, focused on networking, software, and high-end computing, and on developing major research equipment to establish terascale computing capabilities.

- A growing number of industrial, science, technology, and higher education organizations are expressing their support for increased IT research and infrastructure funding, including the Computing Research Association, TechNet (a consortium of high-tech companies), the Council of Scientific Society Presidents, the Computer Systems Policy Project (an association of CEOs of major American IT companies), EDUCAUSE, the National Association of State Universities and Land-Grant Colleges, the Association of American Universities, the American Association of Community Colleges, and others.

The performance of the U.S. economy indicates the crucial importance of information technology to the Nation:

- IT producers were responsible for *more than one-third of real economic growth* in 1995-98, despite accounting for only 8 percent of GDP.
- IT industries account for more than $500 billion of the annual U.S. economy.
- The "Internet economy" alone generated $300 billion in revenues in 1998, already rivaling century-old sectors like energy and automobiles.
- Falling prices in IT-producing industries reduced overall inflation by an average 0.7 percentage points in 1996-97.
- Average value-added per worker in IT-producing industries grew by more than 10 percent annually during 1990-97.
- IT companies create millions of new high-paying jobs and enable productivity increases *throughout* the economy.

Interpreting the strength of the IT sector as a sign that federal research agencies can safely retreat from their support for IT research would be a serious mistake. The vitality of today's economy *was built on a foundation* of carefully planned, long-range federal investments in computing and communications research made over several decades. The resulting innovations are the fuel that is driving the information technology revolution.

The high-risk, high-payoff research that only the federal government can support will continue to be crucial to the pace of progress in IT and the success of U.S. firms in the global IT marketplace. The dynamic pace, short product lifecycles, and intense competitive pressures on prices and profit margins in the IT marketplace require IT firms to devote the bulk of their R&D resources to shorter-term applied research and product development.

Expanding support for university-based computing and communications research is critical to increasing the supply of highly skilled information technology professionals and alleviating the shortage of IT workers – a constraint on the growth of many high-tech companies.

The Impact of Information Technology Research

Although more often noted for its contributions to industry and science and engineering, *the true power of information technology is in its role as human enabler*. An expanded investment in focused, broad-based, long-term information technology research will enable the Nation to:

- revolutionize health care, invent smart medical devices and high-performance biomedical research tools, and expand rural communities' access to top-quality health care via telemedicine.
- design twenty-first century transportation and energy systems, the reliability and safety of which depend so heavily on information technologies.
- achieve the national security imperative of information superiority and ensure military advantage over our adversaries, as precision strike and focused logistics capabilities were achieved through advances in IT.
- re-invent education, customized and delivered according to individual needs so that all Americans can share in the benefits of an information-rich society.
- develop more sophisticated climate and ecosystem models for better and longer-range forecasts of weather and other environmental conditions and to help policymakers determine appropriate responses to global change.
- build robust systems for responding rapidly to natural disasters and other national emergencies.
- make governmental information-based services less expensive and more responsiveness to citizens' needs.
- ensure the accessibility, versatility, security, and privacy of our twenty-first century communications systems and other critical infrastructure.
- intensify ongoing transformations in commerce, manufacturing, banking and finance, and entertainment for the benefit of consumers and businesses alike.
- invest in virtual laboratories and remote-access and remotely deployed instrumentation to facilitate progress in science and engineering.

Yet realizing the full potential of information technology entails addressing critical research challenges at a fundamental level in computing and communications. Many of these challenges have been identified and are embedded in federal IT research agendas awaiting sufficient funds:

- software that is more reliable and predictable, easier and more natural to use, and less expensive to develop.
- adaptable software systems that respond to changes in user requirements, technology, and environment.
- computer systems that are dependable, survivable, and trouble-free.
- computer systems that allow us to see, hear, and speak better than we can unaided.
- computers that can communicate in human languages.
- programs that extract knowledge and insight from complex information and vast datasets.
- computer simulations that more accurately represent physical properties.
- High-end computers that perform better and more efficiently.
- scalable networked systems that can grow without practical limits.
- networks that enable anytime, anywhere connectivity.
- agile networks of rapidly re-configurable mechanical, sensing, and control devices.
- autonomous systems of robotic devices that can adapt to their surroundings and accomplish physical tasks.
- better understanding of the social, ethical, and legal implications of information technology.

Proposals to expand the federal investment in IT research represent a sound strategy for science policy: they respond to clear national needs with recognizable objectives and set forth well-defined programs for meeting them.

As stated by the PITAC, we have an essential national interest in ensuring the continued flow of new ideas in information technology, a key driver of progress both economically and socially. Today's investment choices about IT research will determine how well America is able to achieve its 21st century aspirations.