Continuing
Innovation
in INFORMATION TECHNOLOGY

The results of research

The unanticipated results of research are often as important as the anticipated results. Electronic mail and instant messaging were by-products of research in the 1960s that was aimed at making it possible to share expensive computing resources among multiple simultaneous interactive users. The interaction of research ideas multiplies their impact. For example, concurrent research programs targeted at integrated circuit design, computer graphics, networking, and workstation-based computing have strongly reinforced and amplified one another.

America's international leadership in IT —leadership that is vital to the nation— springs from a deep tradition of research.
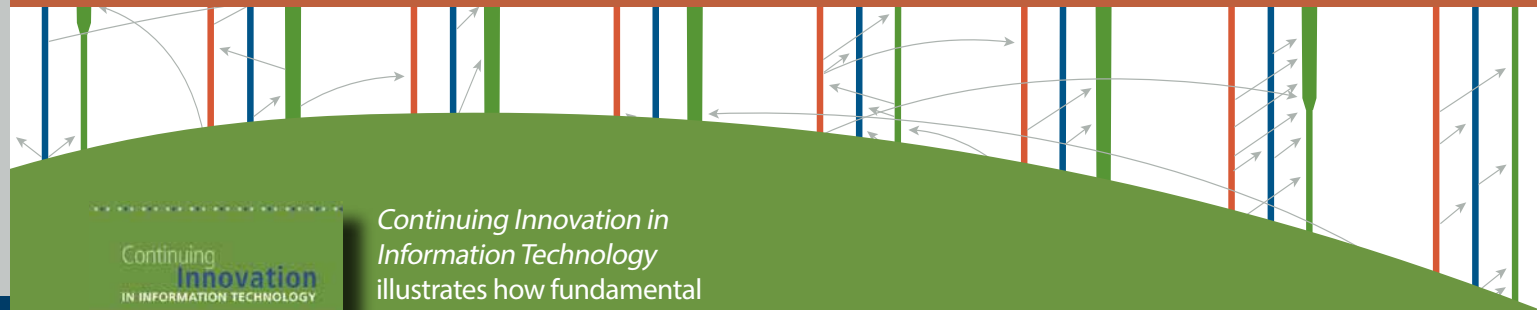
The economic payoff of research

Past returns on federal investments in IT research have been extraordinary for both U.S. society and the U.S. economy. When companies create products using the ideas and workforce that result from federally sponsored research, they repay the nation in jobs, tax revenues, productivity increases, and world leadership.

Continuing Innovation in Information Technology illustrates how fundamental research in information technology has led to the introduction of entirely new product categories that ultimately became billion-dollar industries. This report features an updated "tire tracks" figure—originally introduced in 1995—depicting the complex partnership between universities, industry, and government. Download the full report at **nap.edu/13427**.

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Research as a partnership

The federal government will continue to play an essential role in sponsoring fundamental research in IT because it does what industry does not and cannot do. Industrial and governmental investments in research reflect different motivations, resulting in differences in style, focus, and time horizon. Government sponsorship of research especially in universities also helps to develop the IT talent used by industry, universities, and other parts of the economy.

Continuing Innovation in Information Technology: Workshop Report summarizes presentations from a March 2015 workshop that illustrate how academic and industry research has underpinned innovation in IT. Workshop presenters included robotics entrepreneur Rodney Brooks, Internet pioneer Vint Cerf, Pentium microprocessor architect Bob Colwell, wireless entrepreneur Andrea Goldsmith, machine learning and translation researcher Jamie Carbonell, networked and embedded systems researcher David Culler, networked sensing pioneer Deborah Estrin, machine intelligence researcher Eric Horvitz, networking researcher Farnam Jahanian, sociologist Duncan Watts, computer architecture and mobile computing researcher Margaret Martonosi, wearable computing pioneer Thad Starner, and computer security researcher Stefan Savage.

Download the proceedings at **nap.edu/23393**.

Fundamental research performed through complex partnerships among academia, industry, and government has helped create billion-dollar market segments and a vital U.S. IT industry.

About the figure

This figure, which was most recently updated in *Continuing Innovation in Information Technology: Workshop Report*, illustrates how fundamental research in IT has led to the introduction of entirely new product categories that ultimately became billion-dollar industries. It reflects a complex research environment in which concurrent advances in multiple subfields have been mutually reinforcing one another and leading to vibrant, innovative industries exemplified by top-performing U.S. firms. Such research often starts as a search for fundamental knowledge but time and again produces practical technologies that enable significant economic impact.

The gray lines illustrate the rich interplay between academic and industry research and indicate the cross-fertilization that results from the multi-directional transfer of ideas, technologies, and people.

Major investments in basic research in subfields of computing and communications such as these have led to the creation of IT sectors, firms, and products with large economic impact.

IT Sectors with Large Economic Impact

Motorola	AMD Intel	eBay Akamai Yahoo!	IBM	Electronic Arts
Qualcomm	HP Symantec	Juniper Facebook Twitter	VMware HP	Adobe Autodesk	Nuance
Texas Instruments		Microsoft		XBox
nVidia	Apple	Cisco — Amazon	Oracle	nVidia Pixar	iRobot
iPhone	Dell	Google		iPod	Intuitive Surgical

Broadband & Mobile | Microprocessors | Personal Computing | Internet & Web | Cloud Computing | Enterprise Systems | Entertainment & Design | Robotics & Assistive Technologies

2010 — 2005 — 2000 — 1995 — 1990 — 1985 — 1980 — 1975 — 1970 — 1965

Digital Communications | Computer Architecture | Software Technologies | Networking | Parallel & Distributed Systems | Databases | Computer Graphics | AI & Robotics

Areas of Fundamental Research in IT

Legend: University | Industry R&D | Products | $1 Billion Market | $10 Billion Market