

PCAST Report

Leadership Under Challenge: Information Technology R&D in a Competitive World

Finding and Recommendations

Chapter 2: Networking and Information Technology Education and Training

Finding (page 19)

Over the coming decade, U.S. demand for networking and information technology professionals, with the exception of some readily outsourced or technologically outdated jobs, is likely to grow more rapidly than for most other employment categories. The new job openings are expected to offer higher-than-average salaries and benefits.

Finding (page 21)

Although the overall supply of networking and information technology specialists is expected to grow in response to the growth in total demand, at current rates of enrollment and graduation, shortfalls in the numbers of highly qualified computer scientists and engineers graduated at the undergraduate and doctoral levels are likely. Women and other underrepresented groups will constitute a declining proportion of the new graduates.

Finding (page 22)

Networking and information technology curricula in general, and computer science curricula specifically, do not adequately meet employer and student needs.

Recommendation 2.1 (page 23)

To provide a solid basis for subsequent action, the NITRD Subcommittee should charge the NITRD National Coordination Office to commission one or more fast-track studies on the current state of and future requirements for networking and information technology undergraduate and graduate education.

Recommendation 2.2 (page 23)

To help meet national needs for personnel with advanced degrees in networking and information technology fields, the Federal government should:

- Increase the number of multiyear fellowships for graduate study by American citizens in NIT fields each year, with the target number and fields of such fellowships informed by needs identified in sources such as the NIT education study
- Streamline the process for obtaining visas for non-U.S. students admitted to accredited graduate degree programs in NIT subjects

- Make it routine for foreign nationals who have obtained advanced degrees in NIT subjects at accredited U.S. universities to be permitted to work and gain citizenship in the United States by easing the visa and Green Card processes for them
- Simplify the visa process for international NIT R&D experts who visit the United States on a regular or a frequent basis for professional purposes

Chapter 3: Profile of Federal Networking and Information Technology Research and Development

Finding (page 26)

The Federal networking and information technology R&D portfolio is currently imbalanced in favor of low-risk, small-scale, and/or short-term efforts. The number of large-scale, multidisciplinary activities with long time horizons is limited. Few projects, whether small or large, are visionary.

Finding (page 26)

New ways are needed to stimulate, identify, and fund pioneering networking and information technology R&D that falls outside the scope of conventional funding programs.

Recommendation 3.1 (page 26)

Federal agencies should rebalance their networking and information technology R&D funding portfolios by increasing: (1) support for important networking and information technology problems that require larger-scale, longer-term, multidisciplinary R&D and using existing or new mechanisms to address those problems and (2) emphasis on innovative and therefore higher-risk but potentially higher-payoff explorations.

Finding (page 26)

Universities continue to miss opportunities for research in important networking and information technology fields and applications because their organizational structures and incentive systems encourage and reward work by small groups within traditional disciplines.

Recommendation 3.2 (page 27)

The Director of the Office of Science and Technology Policy should call on senior officials from Federal agencies with large academic networking and information technology R&D budgets to meet with senior officials from the Nation's major research universities to address how better to conduct large-scale, long-term, multidisciplinary academic research in the development and application of networking and information technology important to the Nation.

Finding (page 29)

The Federally funded networking and information technology R&D that supports agency missions also serves as a key source of innovation to maintain and advance U.S. networking and information technology industry leadership.

Recommendation 3.3 (page 29)

The NITRD agencies should use, to the fullest extent practicable, available authorities and resources to facilitate the transfer of research results into practical application and commercial products.

Chapter 4: Technical Priorities for Networking and Information Technology Research and Development

Finding (page 32)

NIT systems connected with the physical world are now a national priority for Federal R&D. Improved methods are needed for the efficient development of these systems. These methods must assure high levels of reliability, safety, security, and usability.

Recommendation 4.1 (page 33)

The NITRD Subcommittee should develop and implement a Federal Plan for coordinated multiagency R&D in high-confidence NIT systems connected with the physical world to maximize the effectiveness of Federal investments and help ensure future U.S. competitiveness in these technologies.

Finding (page 33)

Software is a critical enabler of America's security, economy, and quality of life and, therefore, is a national priority. However, software presents formidable technical challenges from the foundational to the application level. Success in addressing these challenges will strengthen U.S. competitiveness and NIT leadership.

Recommendation 4.2 (page 35)

The NITRD Subcommittee should facilitate efforts by leaders from academia, industry, and government to identify the critical issues in software design and development and help guide NITRD planning on software R&D.

Finding (page 35)

The data deluge represents an opportunity to advance U.S. leadership in science and technology, and harnessing it has become a national priority. More robust NIT capabilities are needed to fully exploit large-scale data resources.

Recommendation 4.3 (page 37)

The Interagency Working Group on Digital Data, in cooperation with the NITRD Subcommittee, should develop a national strategy and develop and implement an associated plan to assure the long-term preservation, stewardship, and widespread availability of data important to science and technology.

Finding (page 38)

U.S. leadership in advanced networking is a strategic national priority. The PCAST endorses the call by the Director of the Office of Science and Technology Policy for an interagency Federal Plan for Advanced Networking Research and Development.

Recommendation 4.4 (page 38)

A key element of the Federal Plan for Advanced Networking Research and Development should be an R&D agenda for upgrading the Internet. To meet Federal agency needs and support the Nation's critical infrastructures, the Plan should include R&D in mobile networking technologies and ways to increase network security and reliability.

Finding (page 40)

High-end computing should remain a strategic national priority of the U.S. government.

Recommendation 4.5 (page 40)

The NITRD Subcommittee should develop, implement, and maintain a strategic plan for Federal investments in HEC R&D, infrastructure, applications, and education and training. Based on the strategic plan, the NITRD Subcommittee should involve experts from academia and industry to develop and maintain a HEC R&D roadmap.

Finding (page 41)

The ability to design and develop secure NIT systems is a national priority.

Recommendation 4.6 (page 42)

The Federal NIT R&D agencies should give greater emphasis to fundamental, longer-term CSIA R&D and the infrastructure for that R&D.

Chapter 5: The Networking and Information Technology Research and Development Program

Finding (page 49)

In general, the NITRD Program has effectively balanced the statutory mandates and mission requirements of the individual member agencies with government-wide needs and national priorities.

Finding (page 49)

The current nature and scale of the NITRD Program's coordination processes are inadequate to meet anticipated national needs and to maintain U.S. leadership in an era of global NIT competitiveness.

Recommendation 5.1 (page 50)

The Director of the Office of Science and Technology Policy should take steps to ensure broad and vigorous agency involvement in the NITRD Program, given its critical importance to national security and economic competitiveness.

Recommendation 5.2 (page 50)

The NITRD Subcommittee should develop, maintain, and implement a cohesive strategic plan for the NITRD Program.

Recommendation 5.3 (page 51)

The NITRD Subcommittee should conduct periodic assessments of the NITRD PCAs, restructuring the NITRD Program when warranted.

Recommendation 5.4 (page 51)

The NITRD Interagency Working Groups and Coordinating Groups should develop, maintain, and implement public R&D plans or roadmaps for key technical areas that require long-term interagency coordination and engagement. The plans and roadmaps should be developed under the guidance of the NITRD Subcommittee and be aligned with the NITRD Program's strategic plan.

Recommendation 5.5 (page 52)

The NITRD Subcommittee, with support from the NITRD NCO, should develop a set of metrics and other indicators of progress for the NITRD Program and use them to assess NITRD Program progress.

Finding (page 53)

NITRD NCO activities have resulted in increased NITRD interagency coordination and planning.

Finding (page 53)

NITRD NCO activities have resulted in increased participation in conferences, workshops, and meetings by non-government experts that aid in identifying NITRD needs in strategic areas.

Finding (page 53)

The NITRD NCO is instrumental in facilitating communication among all stakeholders; however, the NCO could be more proactive in communicating with outside groups.

Recommendation 5.6 (page 53)

Under NITRD Subcommittee guidance, the NITRD NCO should develop and implement a plan for supporting the development, maintenance, and implementation of the NITRD strategic plan and R&D plans.