National Research Council / The National Academies

Building a Workforce for the Information Economy

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www.cstb.org/www.itworkforce.org

The Problem

- **Employers of IT** workers complain that jobs go begging and good help is very hard to find.

- **People working in IT** complain that they are frozen out of better jobs, training, and advancement.

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- Congress (PL 105-277) asked the National Academy of Sciences and the NSF to study high technology labor market needs and age discrimination in information technology employment. NASA contributed funding in addition to NSF.

For every problem, there is a solution: neat, simple, and wrong.

- H.L. Mencken

Committee Composition

- Employers of IT workers
- Information technology workers
- Academic computer scientists
- Labor economists
- Education/training and assessment specialists
- Industrial sociologist
- Biotechnologist

The Opportunity

- Review past work in the area.

- Define "problem" in a neutral way.

- Integrate theoretical perspectives (labor economists) with perspectives from the field (employers/employees, technology trends).

- Sample broader range of inputs--data and points of view--than previously considered.

Project Input

- Plenary sessions (with open testimony + briefings)

- Site Visits/Regional Hearings
  - New York City, Austin, Seattle, Fairfax (Va)

- Commissioned papers

- White papers

- Testimony to committee

- Staff consultations w/experts, interested parties

- Internet input
  - *itwinput@nas.edu;* Internet questionnaire; *www.itworkforce.org*

The Nature of IT Work

- IT work: conception, design, development, adaptation, implementation, deployment, training, support, documentation, and management of IT systems, components, or applications.

- Category 1 work: IT research; development, creation, specification, design, and testing of IT goods or services.

- Category 2 work: application, adaptation, configuration, support, or implementation of IT products or services designed or developed by others.

The Committee View of the Problem

- As written: The IT labor market is tight and likely to remain so for the immediate future, barring dramatic change. Since release: (dramatic) change?

- The driver of tightness is growth in the use of IT throughout a strong economy, exacerbated by the currently low overall unemployment rate.

- "Shortage" is limiting case--the condition in which employers find it impossible to find qualified workers no matter what they pay or how long they wait.

Tightness in the IT Labor Market

- Perception of tightness is driven by the vacancy rate, which depends both on growth and turnover.

- Tightness varies by region (e.g., Silicon Valley) and type of job (e.g., Webmaster).

- Movement from one IT job type to another may or may not be easy.

Characterizing the IT Workforce

- 2.5 M Category 1 workers; at least that many Category 2 workers.

- Rapid growth in Category 1 (60-75% in 8 years)

- Nearly 2/3 Category 1 employed in larger firms (500+ employees).

- 3/4 Category 1 in non-IT firms.

- Category 1 mostly white, male, younger, US-born, highly-educated.

Age & Employment in Categ 1 IT Workforce

- Younger than in other fields.
- Older IT workers are more likely to lose their jobs than younger IT workers.
- Older IT workers as likely to find new jobs as are younger IT workers.
- Time to find new jobs is similar for older and younger IT workers.
- Displaced older workers who find new jobs take pay cuts; displaced younger workers who find jobs get pay increases (but not statistically significant).

Conclusions on Age-Related Issues

- Causality of differences cannot be determined.

  - Could be:

    illegal age discrimination; legal conduct by employers that may be perceived as discriminatory; personal choices made by individual employees; rapidly changing industry.

- No connection between age discrimination and large-scale use of foreign workers.

Foreign IT Workers

- Foreign-born individuals about 17 % of the Category 1 IT workforce (10 % of U.S. pop).

- H-1B workers about 10 % of Category 1 IT workforce (upper-bound).

- Foreign workers are numerous enough to make important positive contributions to IT sector and IT-enabled firms, *and* to be a moderating force on wage increases in a tight labor market.

- There is no analytical basis on which to set proper level of H-1B visas--fundamentally political.

Formal Education

- Current high school mathematics education is inadequate for increasing the supply of IT workers.

- Formal post-secondary education in computer science and engineering is increasingly necessary for Category 1 jobs:
  - understanding of the fundamentals
  - skills to work successfully on large IT projects
  - ability to adapt to new technologies.

Formal Education (continued)

- Lack of resources (e.g., faculty, laboratory space) may limit further expansion.

- IT minors and concentration provide additional ways to increase the IT labor pool.

- Work-education integration is of critical importance. (Ditto for work-training integration.)

- Potential financial disincentives for post-baccalaureate education in computer science.

More Employers Should:

- Use validated structured assessment techniques in recruiting and promotion.
  - Relax job requirements--train almost-perfect v. long wait

- Develop strategies to increase the numbers of women/minorities involved in IT work.

- Take steps to improve the quality of life for current and future workers.
  - Improve productivity, provide challenge

- Promote training for current workers to enhance skills and increase loyalty.

More Educational Institutions Should:

- Improve secondary school mathematics education to prepare for study of technical fields, especially IT.
- Give greater emphasis to promoting IT fluency in K-12 and in higher education.
- Better align educational programs in IT with the demands of the IT workplace.
- Expand faculty in IT-related fields.
- Encourage IT course-taking by those not majoring in an IT-related discipline.
- Develop strategies to increase the attractiveness of IT-related majors to women and underrepresented minorities.

More Individual Workers Should:

- Negotiate release time for training and professional development.

- Seek internships with potential employers when using formal education to learn new skills.

- Take advantage of training opportunities offered by employers.

- Participate in professional societies that provide technical education.

- Take advantage of resources for updating skills.

Government Policymakers Should:

- Support development and more effective use of the domestic IT workforce.

- Level the playing field with respect to foreign vs. domestic workers.

- Change its employment and recruiting practices for Federal IT workers.

On the Domestic Workforce

- Provide support/incentives for employers to increase training (e.g., regional training consortia).

- Collect more timely, disaggregated data on different aspects of the IT workforce.

- Support research on reducing tightness
  - organizing work for improved productivity
  - developing structured assessment tools specialized for IT jobs
  - improving software engineering
  - supporting high-risk, high-payoff research would help to retain/attract top researchers in academia.

On Foreign Workers

- Reduce the time needed to obtain green cards.

- Ensure that foreign workers are as free as domestic workers to change jobs by making H-1B visas more portable.

- Consider the effect of increased numbers of H-1B visas without having streamlined the labor certification ("green-card") process or reevaluating the numerical limits on permanent residents.

On Federal IT Workers

- Be more flexible in remuneration, recruiting methods.

- Make more resources available for training IT workers.

- Remove unnecessary requirements for contract workers.

- Give more flexibility for billing for contract staff training.

- Establish a mechanism through which the government can pay for undergraduate and/or graduate IT education in return for government service.