2003 Workforce Survey

Presented at the
National IT Workforce Convocation

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Arlington, VA

Revised on May 23, 2003 – See Editor's Note

Editor's Note:

This is a revised version of the ITAA Workforce Report originally released on May 5, 2003. That document unfortunately contained errors that have been corrected in this version. Changes in the report are as follows:

- Page 4, Figure 1-- "Baseline 2002" data point is adjusted slightly.
- Page 5, Loss of employment by network administrators, the correct figure should be .6 percent (not .06 percent)
- Page 8, Figure 5 — Mislabeled demand in job categories.
- Page 10, Figure 7 – Transposed label headings for IT and non-IT companies.
- Page 10 -- 21 percent (not 22 percent) of companies report the use of recruiting services.
- Page 12—Four percent (not six percent) of non-IT companies are or are considering sending work offshore in the next 12 months.

ITAA regrets any confusion caused by these errors.

Abstract

A new report from the Information Technology Association of America finds that future demand for IT workers continues to drop even as companies layoff fewer workers and the overall size of the IT workforce stabilizes. The report finds significant differences between approaches taken by IT and non-IT companies to address workforce requirements, including the willingness to ship certain types of IT jobs offshore. Although most companies say they have not changed compensation for IT workers in the past year, for those that have, significant differences appear.

Introduction

Companies in and outside the information technology (IT) industry employ information technology workers. While one might think of the typical IT worker as employed by a major software company or systems developer, the reality is that nine out of ten IT workers are found in banks, insurance companies, manufacturing plants or other non-IT businesses. A new survey by the Information Technology Association of America (ITAA) shows that not only are IT workers found mostly outside the IT industry, but that the outlook and prospects for the two groups is likely to be far different.

In previous years, characterized by double digit growth and anxious investors betting on the next new thing, careers inside the IT industry appeared to be the way to go—at least for those on the professional fast track. Much has changed since 2001, even as the economy slowly recovers and the overall size of the IT workforce approaches its historic high point of 10.4 million. The employment footing outside the IT industry seems surer, less turbulent. Non-IT companies are more likely to hire according to plan, far less likely to move jobs overseas, more apt to increase—not cut—compensation.

Whether non-IT companies offer IT workers long-term career advantages or just a temporary "port in the storm" remains to be seen. IT companies are hard pressed by customers to field cost effective solutions. The pressure on IT companies to cut costs is clearly reflected in this survey.

This survey is a continuation of the ITAA series of reports on the IT workforce. Since 1997, ITAA has tracked employer demand for IT workers. In the run up to the year 2000, IT talent was scarce and demand exceeded supply. Because of the talent crunch, ITAA focused on the skills most demanded by employers and the education and training alternatives for gaining those skills. With job market conditions changing, ITAA's survey has evolved to explore how trends like offshore development may be changing the employment landscape.

This survey reports findings in nine areas:

- Total IT workforce size
- Future demand for IT workers
- Demand in specific job categories
- Hiring and layoff activity
- Success at hiring to plan
- Skills attainment
- Recruitment
- Offshore development
- Compensation

Findings in each area are presented below, along with a brief analysis to put survey data into broader context.

Survey Methodology

This study is based on a telephone poll of 400 hiring managers in IT and Non-IT firms, conducted between March 27 and April 15, 2003. This is a stratified, projectable sample. Margin of error for survey results is +/- 4.9 percent at the 95 percent confidence level. A detailed discussion of survey methodology is available in Appendix I.

Study Findings

Total IT workforce size

The total IT workforce peaked in size in 2000. The economy shed 500,000 IT jobs in 2001, caused largely by the stock market reverses and consequent investor flight, the elimination of many dot.com and telecom firms (and the high tech businesses supporting those firms), large-scale capital expense reductions, the Year 2000 "overhang" of new systems and software implemented to replace older, date vulnerable assets and the recession.

The IT workforce appears to have bottomed out at the start of 2002, with small but steady quarter to quarter gains since then (See Figure 1).

Figure 1

Total U.S. IT Workforce
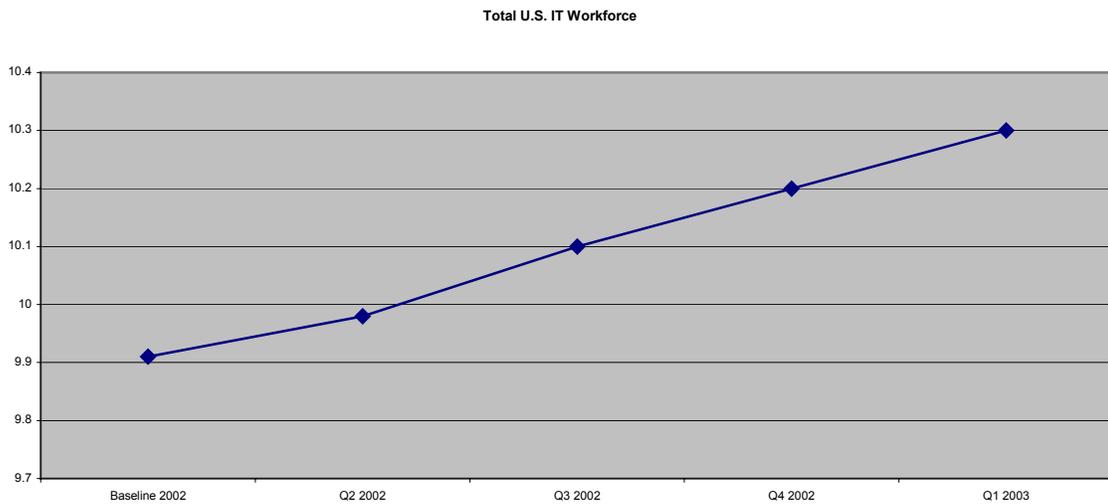
The U.S. economy begins 2003 with 10.3 million IT workers, up 4.2 percent from the start of 2002 (but less than one percent from last quarter). ITAA calculates workforce size by netting out the total number of IT workers hired and dismissed in the survey period from its baseline year measurement. Comparing quarter to quarter, the economy added 86,406 IT workers in the first three months of the year. While that is good news, the net gain in jobs is actually smaller than year-end 2002, where employers hired 97,118 more people than they released.

The picture presented by these numbers is a marketplace slowly reapportioning its human resources (Figure 2). Gains have been made not so much in response to companies adding new workers but to a slow down in the rate at which workers have been let go.

Figure 2

Total Hiring and Terminations
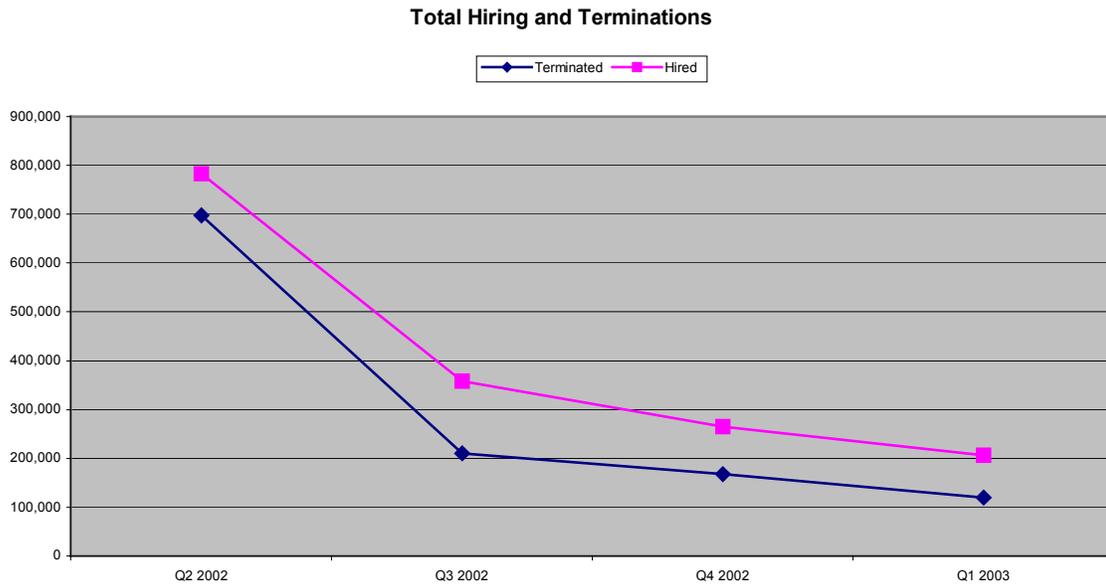
In terms of specific job categories, programmers/software engineers represent the largest single professional group within the IT workforce, followed by technical support personnel and enterprise systems specialists. Table 1 supplies a detailed view.

Table 1:   Net Total Job Count by Categories, 2003

Programming/Software Engineering	2,144,377
Technical Support	1,904,842
Other	1,290,719
Enterprise Systems	1,113,883
Database Development/Administration	1,011,331
Web Development/Administration	885,070
Network Design/Administration	729,417
Digital Media	694,251
Technical Writing	538,759
Total	10,312,650

Comparing this data to the 2002 baseline, tech support personnel scored the largest net gains with an increase of 8.8 percent. This is a hopeful sign, indicating that organizations may be adding the type of professionals needed to support new business initiatives and help firms implement and capitalize on new IT solutions. Network administrators found themselves most battered by the economy's downturn, with a loss of .6 percent of total employment from 2002.

Future demand for IT workers

Last year, ITAA titled its annual workforce survey "Bouncing Back." Demand for IT workers appeared to be recovering from 2001 lows and the tapering of force reductions seemed to provide grounds for cautious optimism. Wrong. *Data collected through 2002 and for this survey indicate that demand for IT workers is down dramatically.* Hiring managers say they will seek to fill just 493,431 IT jobs over the next 12 months—down from 1.6 million at the start of 2000. Demand projections are a clear indication that confidence in the future is lacking for many employers. Figure 3 indicates the dramatic drop in hiring intentions.

Figure 3

Total IT Workforce Demand
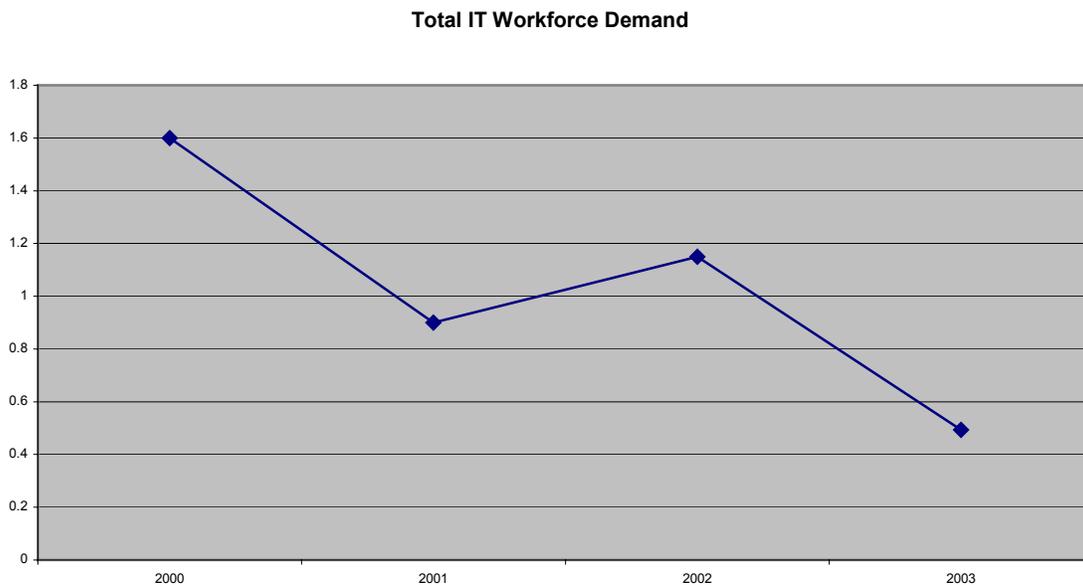
The drop in demand is approximately the same for IT and non-IT employers. When asked to look ahead 12 months for their own workforce requirements, IT companies have cut their hiring projections by 53 percent, compared to 47 percent for non-IT companies. Demand for IT workers is lower at the start of 2003 than at any point measured in 2002.[1] Figure 4 shows how current IT worker demand has erased the optimism expressed at the start of last year.

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[1] ITAA conducted quarterly updates to its survey in 2002.

Figure 4

Total Demand for IT Workers: IT vs. Non-IT Companies

□ IT ■ Non-IT
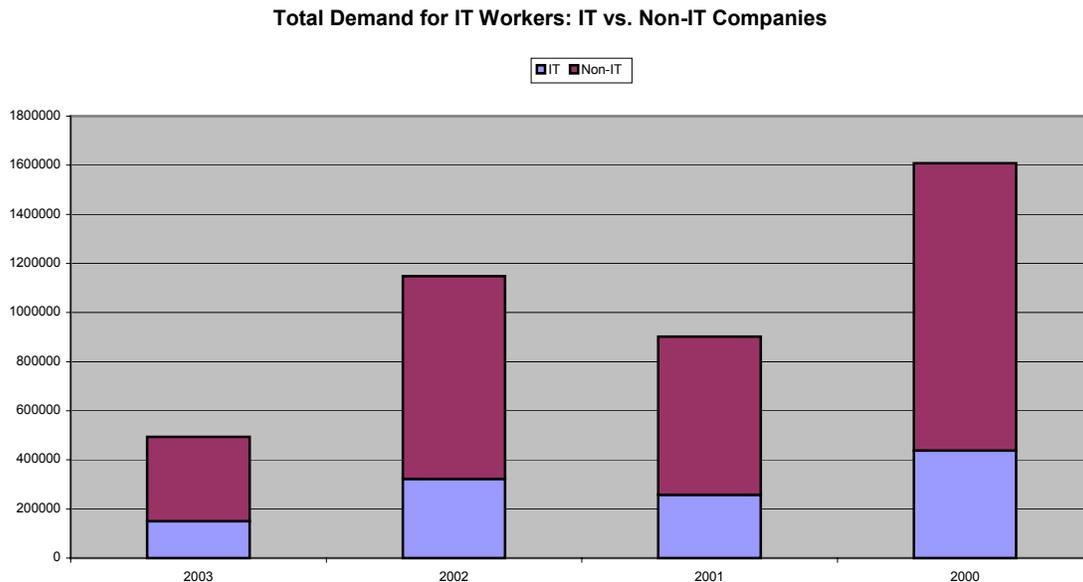
Hiring managers see a lack of demand not only for their own enterprise, but for the marketplace overall. Asked generally to look ahead 12 months at the prospects for IT workers, 67 percent of respondents predicted that demand for IT workers would stay about the same or decline. Perhaps because they have shed relatively more workers, IT companies were more sanguine about the likelihood of a jump in demand than non-IT companies (39 percent vs. 31 percent) and less apt to think that demand would stay the same (53 percent vs. 61 percent, respectively).

Employers express only a modest sense of urgency for filling open slots, with 31 percent saying they intend to hire in the next three months. IT employers are somewhat more likely to fill their slots in this timeframe (37 percent vs. 26 percent), and large IT companies are most likely of all (57 percent say they will do so).   Small non-IT firms are the least likely (only 8.4 percent) to fill jobs in the next three months.

Demand in specific job categories

The demand forecast by hiring managers for specific IT jobs fell sharply across almost all categories in the last quarter. Survey respondents say they will attempt to fill almost 400,000 fewer jobs over the next 12 months than had been predicted at year-end 2002. Job categories taking the biggest quarter-to-quarter tumble were technical support representatives and web developers. Figure 5 shows the drop in demand by job category. These numbers suggest that, at least in the short term, demand remains highly volatile as organizations shift to meet changing market conditions.
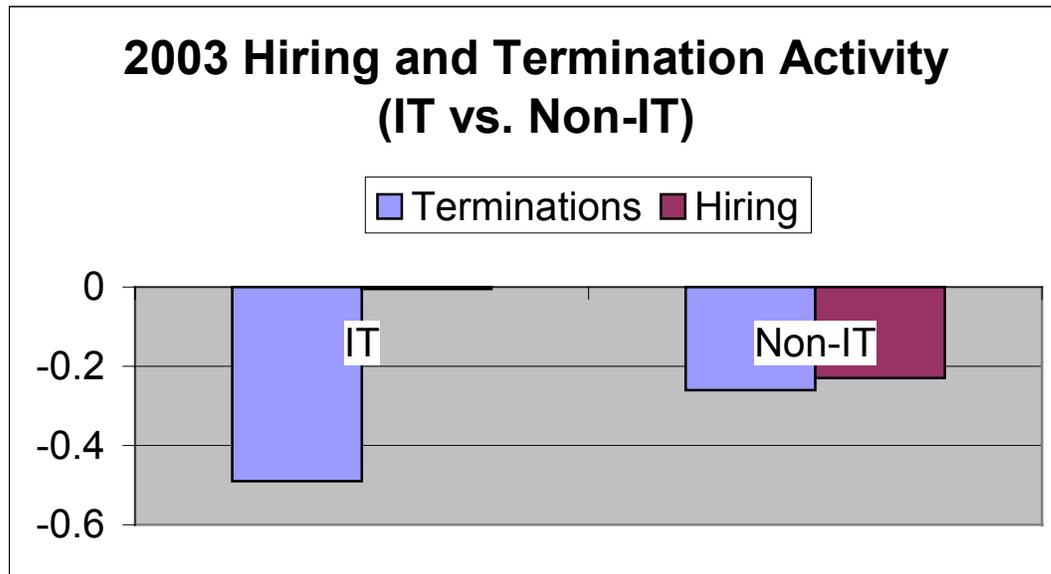
Figure 5

Change in Demand by Job Category

□ Q1 2003 ■ Q4 2002
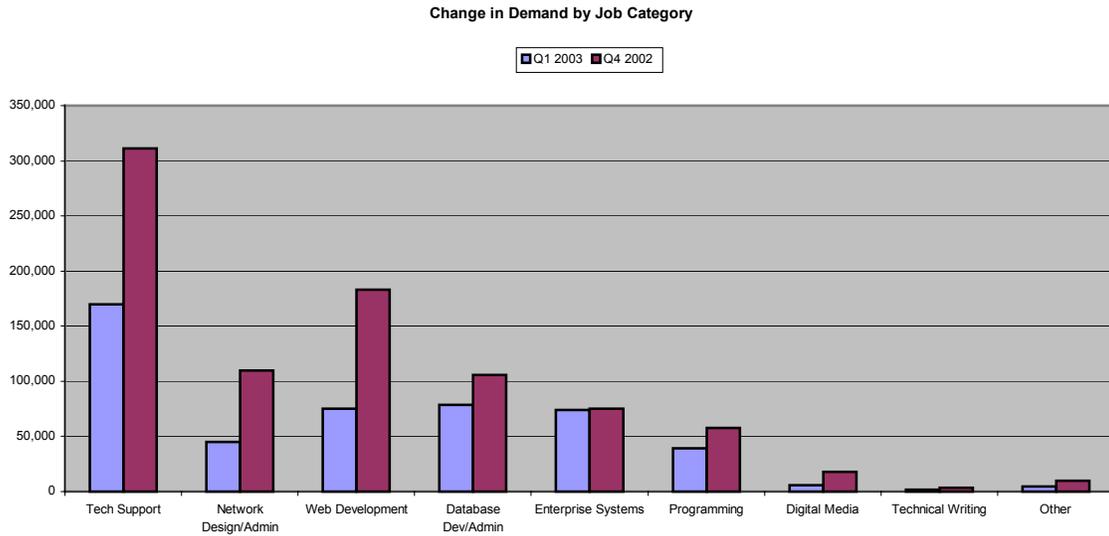
Hiring and layoff activity

On a quarter-to-quarter basis, hiring and layoff activity produced significant variations between IT and non-IT employers. As Figure 6 indicates, reductions in staff by IT companies dropped almost 50 percent, almost twice the slow down of non-IT companies. IT companies laid off 41,219 employees between first quarter 2002 and first quarter 2003, compared to 438,924 for non-IT firms. IT company hiring was flat over the 12 months. These data suggest that the IT workforce is stabilizing (if not bouncing back with dramatic resilience). For IT companies, who cut total employment last year from 960,000 to 800,000, the downtick in layoffs is an indicator that the era of downsizing may be over. Having made their cuts, it remains to be seen whether new business will support new hiring.

Figure 6

2003 Hiring and Termination Activity (IT vs. Non-IT)

□ Terminations ■ Hiring

(Bar chart showing Terminations and Hiring values for IT and Non-IT categories. IT shows a Terminations bar of approximately -0.5. Non-IT shows a Terminations bar of approximately -0.25 and a Hiring bar of approximately -0.22. Y-axis ranges from 0 to -0.6.)

For non-IT companies, both hiring and terminations are down approximately 25 percent in this 12-month period. Given the fact that roughly nine out of ten IT workers are employed by a non-IT company, this "foot on the brake" by non-IT organizations explains the marginal quarterly gain in overall IT employment.

Success at hiring to plan

If the IT workforce employment picture is indeed "bottoming out," it is not surprising that most organizations were able to meet or exceed their IT hiring plans. Ninety-one percent of companies overall were able to do so. Those that failed to meet anticipated hiring levels cited factors like economic conditions or a lack of available funding. IT companies were more likely to cite a bad economy than their non-IT counterparts (78 percent versus 67 percent). Companies least able to fulfill hiring plans were small and medium sized IT firms. Staffing within such firms may be more likely a function of active client contracts with less margin for overhead projects and non-billable hours.

On a regional basis, better than 90 percent of non-IT companies in the Northeast, South and Midwest were able to meet or exceed their hiring goals.[2] Twenty-two percent of IT companies in the South failed to meet their plan goals, the lowest such percentage measured in this area.

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[2] Regions are defined in Appendix 1.

Skills attainment

Asked for the education or training background desired in qualified applicants, 46 percent of respondents cited a four-year college degree. A college degree outpolled specific experience— a break from previous years. In ITAA's 2002 workforce report, for instance, 46 percent cited specific job experience as the primary entry-level criteria. Only 19 percent cited education of any sort. Figure 7 indicates how hiring managers ranked various sources of skills attainment.

Figure 7

Best Sources of IT Qualifications

Total   Non-IT   IT
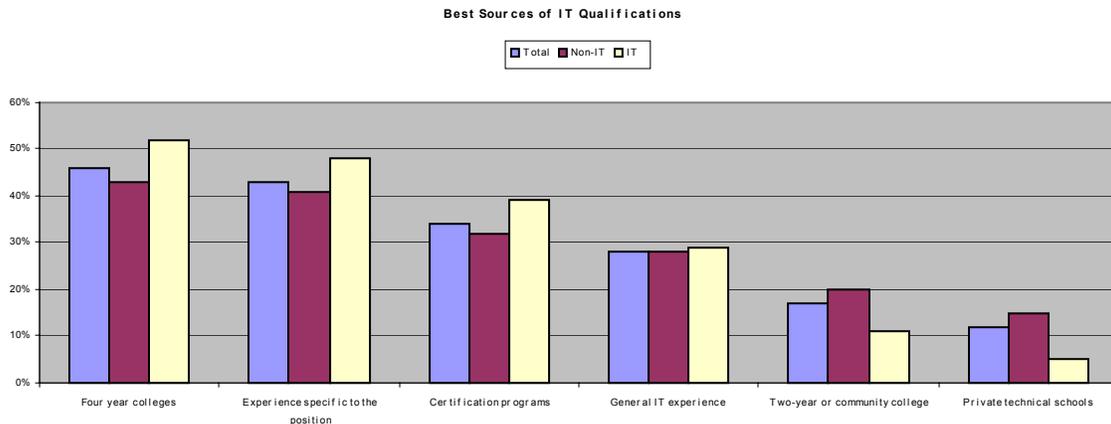
The survey indicates mild variations between IT and non-IT hiring managers in this area. Forty-eight percent of IT companies emphasized the importance of specific experience, compared to forty-one percent for non-IT firms. Similarly, IT firms appear to place greater weight on certification programs (39 percent versus 32 percent). Meanwhile, non-IT firms are three times as likely to rely on private technical schools and twice as likely to rely on community colleges for qualified applicants.

Generally speaking, these data suggest that as the economy has made an increasing number of qualified job applicants available, hiring managers can afford to be more selective in filling open positions. In the more competitive job market of the late 1990s, employers were more willing to trade formal education for specific work experience. As the job market has softened, employers are more apt to seek education *and* specific experience.

Recruitment

The ITAA survey produced few surprises about recruitment strategies. Both IT and non-IT firms appear to favor advertising as the principal means of attracting workers. Thirty-four percent say they advertise, while 21 percent indicate the use of recruiting services and 17 percent utilize online postings. Again, a software employment environment may be influencing results in this area. In a dynamic job market, many employers turned to employee referral programs or job fairs to generate an adequate pipeline of qualified candidates. Only six percent of survey respondents indicate that they use in-house recruiting and two percent say they use job placement centers and career fairs.

Offshore development

Companies may decide to move IT jobs offshore for many reasons. These include the need for extensive product or service localization, the ability to use time zone differences to add a second or third shift, as a means of opening markets, and as a strategy to cut costs. As foreign countries nurture ever more sophisticated IT workforce populations, the traditional tradeoff between cost and quality begins to disappear. As a result, offshore development becomes more of an option to more employers for more types of IT work

A small but significant percentage of firms are moving IT jobs overseas. Six percent of all firms say that they have done so, a percentage that doubles when the question applies to IT companies alone. Comparing IT to non-IT firms, 12 percent of IT companies say they have already moved jobs offshore, while only 3 percent of non-IT firms have done so (See Figure 8). IT companies appear to be four times more likely than non-IT counterparts to site IT jobs overseas.

Figure 8

Companies Moving IT Jobs Offshore

□Yes ■No
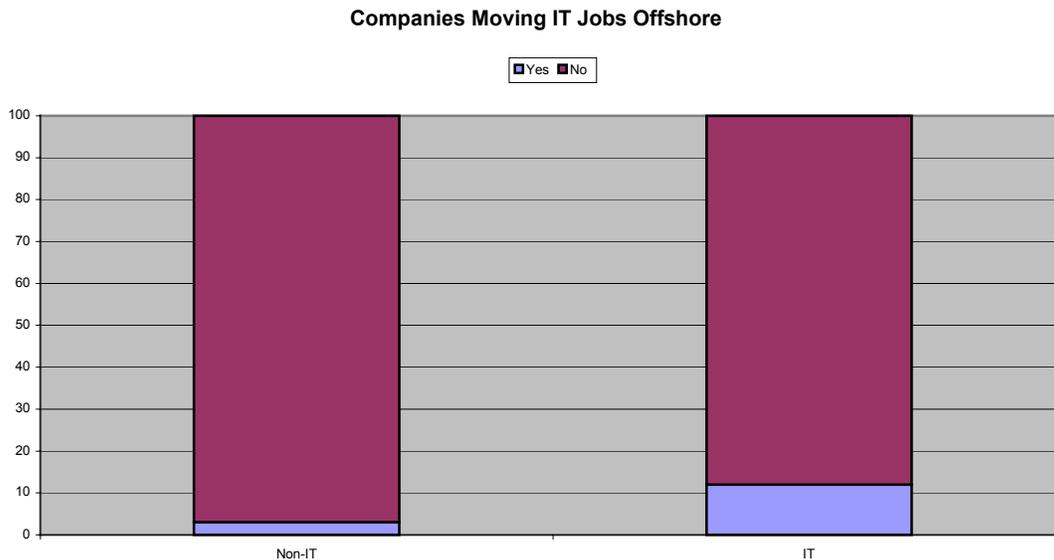
Not surprisingly, large IT companies are the respondent group most likely to have made this move. Twenty-two percent of respondents in this category say that they have moved work offshore—three times as many as large non-IT firms. In regional terms, IT companies in the Midwest and West are most apt to send jobs overseas (See Figure 9).

Figure 9

Percentage of Firms Engaged in Offshore Outsourcing (IT v. Non-IT)
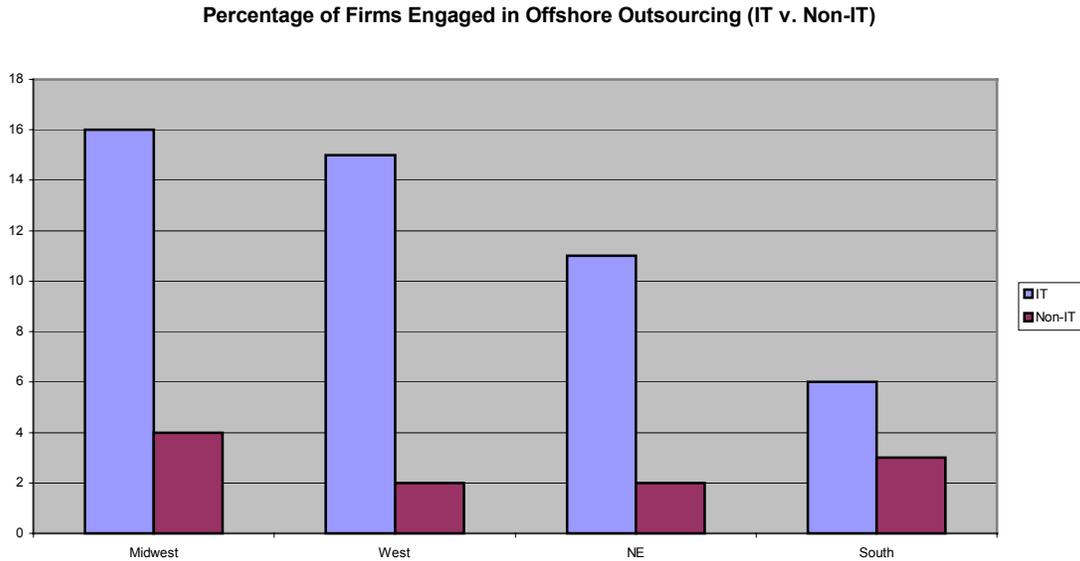
This activity appears to be both a current and future phenomenon. Fifteen percent of IT firms say they will or are undecided about the move of IT jobs off in the next 12 months. Only 4 percent of non-IT firms are in the same position.

In terms of the type of jobs being moved, the findings here are somewhat surprising. While offshore development is often considered an alternative for low end "commodity" work, the ITAA survey finds programming/software engineering the job category most likely to go overseas (67 percent), followed by network design (37 percent) and web development (30 percent). In terms of jobs going overseas in the next six months, companies cited programming/software development (35 percent) and technical support (29 percent).

These data suggest that the offshore development trend is both real and expanding to include more sophisticated, value added jobs. Large IT companies are leading in this activity no doubt in part because they tend to be multinational, large pools of IT talent exist outside the U.S., IT jobs are relatively portable, and IT work products are often intangible and therefore easily transmittable by high speed networks.

Compensation and related trends

The soft IT job market is indicated by the fact that three of four companies say they have not changed compensation for IT workers in the past 12 months. To the extent that companies have made such changes, however, the vast majority have raised not lowered wages. Seventy-six percent of non-IT and 49 percent of IT companies making changes say they increased pay in the last year. Only 8 percent of companies taking action say they lowered wages in the past 12 months. Of this number, IT companies were over 20 times more likely to have taken this step than non-IT companies. On the other hand, IT companies were four times more apt to increase bonus payouts to workers. Seventeen percent of firms said they plan changes to compensation

policies for IT workers in the next 12 months. Sixty-five percent of IT companies said they would raise wages, while 11 percent indicated that they would lower wages.

Conclusions

As this year's survey went into the field, the War in Iraq was one week old and hope for a quick victory was fading. The Dow Jones Industrial Average stood at 8200, off almost 300 points from its close the same week in 2000. Corporate spending on new structures, equipment and software had only just begun to grow following two years of consecutive cuts. And business productivity was way up--growing in 2002 at a rate not seen in more than 50 years.[3]

All of these trends (and many more) shape the views of hiring managers as they assess their future workforce needs. The uncertainty of the war, heightened terror alerts, and soft business conditions no doubt reigned in optimism. With productivity and consumer spending sustaining the economy overall, the many firms no doubt see little reason not to simply maintain the status quo. But if demand for IT workers is an indicator of business growth, this survey contains little good news. Few new business operations, offerings or initiatives can be performed without the infusion of information technology. Customers expect it. Productivity requires it. Profit margins demand it. The continued drop in demand for IT workers suggests that ripples of the 2001 recession are still being felt throughout the economy.

While the demand numbers presented here are not encouraging, other data suggest that conditions may be right for a turnaround:

- Information technology companies were hardest hit by the Internet bubble and telecom oversupply. The fact that these firms have dramatically scaled back force reductions indicates that "right sizing" is complete, that they have rationalized their operations, and companies may be staffed more cost effectively to pursue new business.

- Companies are adding tech support workers—an indication that personnel may be needed to help in new product and program sales, project implementation and customer support. This activity translates into new business and IT spending growth.

- Companies appear to be able to meet or exceed their hiring goals, often using traditional recruitment techniques like job advertisements.

- The movement of jobs offshore may account for some drop in demand for IT workers, particularly among IT companies. To the extent that this is true, a lack of demand may not necessarily equate to a lack of business requirements for access to these talents. From the point of view of business, a drop in demand may not be as dire as it otherwise seems.

- The significant difference between IT and non-IT company use of offshore developers is also interesting. IT companies may be more aggressively outsourcing IT jobs in

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[3] Federal Reserve Board of Dallas, U.S. Economy, National Update, December 2002

response to a decline in short term business conditions. Poor experiences, heightened security concerns or changing political conditions in local markets could quickly restrict this practice. On the other hand, non-IT companies may gain confidence in moving work offshore as they witness the success of IT companies.

- While compensation for IT workers is not by and large growing, most workers are not seeing cuts in pay or benefits. Amidst an uncertain business environment, companies appear determined to maintain the status quo.

As in previous years, ITAA believes that this report will serve as a significant stimulus to discussions about skills availability and the nation's high tech future. The Association will continue to work with stakeholders on solutions that fill the talent pipeline, grow opportunities for IT workers and companies, and maximize the impact of information technology in every walk of life.

Appendix I: Study Methodology

The ITAA annual workforce survey is a major empirical study that analyzes the skills needed for IT work. The research is based on interviews with hiring managers performed through a rigorous telephone research methodology. The study was commissioned by ITAA. A nationally recognized market research firm that specializes in studies of IT products and services, Market Decisions Corporation of Portland, Oregon, performed the study.

The study utilized the expertise and skills of a range of participants in the IT field. The study design and results were developed in consultation with advisory group representation from the major stakeholders in IT skill development--firms hiring IT workers, managers of the IT function, and providers of education and training programs, including representatives of technical schools, community colleges, and colleges and universities.

2003 IT Workforce Survey Methodology Synopsis

A random sample of 374,129 companies was obtained from Survey Sampling, Inc. The sample was stratified several ways;

IT vs. Non-IT companies; companies in the following SIC codes were identified as IT firms. All others were classified as non-IT firms. IT definitions were adopted in order to be consistent with earlier ITAA workforce studies
- Computer hardware, software and services, (SIC 3571, 3572, 3575,3577, 5045, 7371, 7372, 7373, 7376, 7379, 8243, 8742, 8243)
- Communications, telecom, & equip (3661, 3663, 4812, 4813,4822, 7374)
- Semi-conductors 3674

Geographic regions; regions of the United States were defined in a manner that yielded four regions. IT definitions were adopted in order to be consistent with earlier HELP WANTED studies

- Northeast-ME, VT, NH, MA, CT, NY, RI, NJ, PA, DE, MD, DC
- South, VA, WV, KY, NC, SC, TN, GA, FL, AL, MS, AR, LA, OK, TX
- Midwest- ND, SD, NE, KS, MO, IA, MN, WI, IL, IN, MI, OH
- West- WA, OR, ID, MT, WY, CO, NM, AZ, UT, NV, CA, HA, AL

Size of firm; the sample was stratified according to the total number of current employees

- Small Organization (SORG):   50 – 99 employees
- Medium Organization (MORG): 100 – 999 employees
- Large Organization (LORG):   1,000 or more employees

SPECIFICS OF THE METHODOLOGY

Research Design

The study interviewed line IT managers in for-profit US companies with 50+ employees using a stratified, projectable sample. The sample was segmented into 377 non-IT and 155 IT-companies.

Specific Goals of the Research
1. Update the projections for and changes in the IT workforce and job demand estimates developed in the previous research.
2. Determine what specific training or experience employers look for in new IT hires.
3. Investigate the incidence of and reasons for IT jobs moving offshore, the likelihood of jobs moving offshore in the future, and the types of jobs most likely to move offshore.
4. Assess recent changes in IT compensation, if any.

Sampling

- 400 telephone interviews with hiring managers of IT workers.
- Sample projectable to all US for profit companies over 50 employees with a segment for IT and non-IT companies.
- The NWCET skill standards are used to describe the skills. Questions addressed the demand for specific skill clusters and the method of acquiring the skill clusters.

     The NWCET skill standards are organized into the following categories: 1-Programmer/software developer, 2-database administrator/developer, and 3-web administrator. 4-network systems specialist, 5-enterprise information systems integrator, 6-interactive digital media specialist, 7-technical writer, 8- computer systems support representative.

Composition of the Sample

Overall maximum sampling variability for a random sample of n=400 is +/- 4.1% at the 90% confidence level.

Composition of the Sample					
Segment	**Region**				**Total**
	NorthEast	*South*	*MidWest*	*West*	
IT	5 SORG 12 MORG 12 LORG	5 SORG 12 MORG 12 LORG	5 SORG 12 MORG 12 LORG	5 SORG 12 MORG 12 LORG	**116**
Non-IT	11 SORG 30 MORG 30 LORG	11 SORG 30 MORG 30 LORG	11 SORG 30 MORG 30 LORG	11 SORG 30 MORG 30 LORG	**284**
TOTAL	**100**	**100**	**100**	**100**	**400**

Survey Administration

Market Decisions Corporation of Portland, Oregon (www.mdcresearch.com) administered the survey, including questionnaire design, data collection, tabulation, and analysis.

Appendix II: Study Sponsors

CISCO SYSTEMS

EMPOWERING THE
INTERNET GENERATION℠

Cisco Systems is the worldwide leader in networking for the Internet. Cisco is committed to working with educational institutions around the globe to ensure that today's students master the necessary skills for success in the Internet economy. The Cisco Networking Academy Program is a comprehensive e-learning program fostering student development and exposure to information technology through its Web-based content, online assessment, student performance tracking, hands-on labs, and instructor training and support. Cisco Networking Academies are active in all 50 U.S. states and in 140 countries worldwide. More information about the Cisco Networking Academy Program is available at http://www.cisco.com/edu.

Dice™
Tech Jobs. Tech Talent.

Dice Inc. (Nasdaq: DICE, http://about.dice.com) is the leading provider of online recruiting services for technology professionals. Dice Inc. provides services to hire, train and retain technology professionals through dice.com, the leading online technology-focused job board, as ranked by Media Metrix and IDC, and MeasureUp, a leading provider of assessment and preparation products for technology professional certifications.

ITT Technical Institute   ITT

The ITT Technical Institutes are leading providers of technology-oriented postsecondary degree programs, serving approximately 31,000 students. The 70 campuses located across the U.S. offer the information technology disciplines of Computer Network Systems, Multimedia, Software Applications and Programming and Web Development. A program entitled Technical Project Management for Electronic Commerce is offered online (http://www.itt-tech.edu).

Microsoft®

Microsoft is committed to narrowing the technology skills gap by providing training and certification programs for IT professionals and IT entrants through various options, including instructor-led training, online training, courseware customization, and comprehensive certification programs. Microsoft has adapted and designed skills products based on job roles that integrate customer feedback and needs, and will continue to do so in the future. For

information about training courses and certification tracks on Microsoft technologies, visit: http://www.microsoft.com/traincert/. Founded in 1975, Microsoft (Nasdaq "MSFT") is the worldwide leading software, services and Internet technologies for personal and business computing. The company offers a wide range of products and services designed to empower people through great software – any time, any place and on any device.

The Oracle Corporation (NASDAQ: ORCL) is the world's largest enterprise software company. For more than 25 years, Oracle has worked on ways to help its customers manage critical information. The company has built the only unbreakable database, with 15 international security evaluations. Oracle was the first software company to move its business application products to the Internet (www.oracle.com).

SRA is a leading provider of information technology services and solutions - including strategic consulting; systems design, development, and integration; and outsourcing and operations management - to clients in national security, health care and public health, and civil government markets. The Company delivers business solutions for text and data mining, contingency and disaster response planning, information assurance, and enterprise systems management. SRA recently acquired The Marasco Newton Group Ltd. (www.marasconewton.com), an environmental and management consulting services firm serving federal government agencies, several state and local governments, and private industry.

Fortune magazine has chosen SRA as one of the "100 Best Companies to Work For in America" for three consecutive years. The Company's 2,100 employees serve clients from its headquarters in Fairfax, Virginia, and offices across the country (www.sra.com).

Project Advisor

The National Workforce Center for Emerging Technologies is a unique organization, operating in the convergence zone between academic education, workforce development, industry advocacy, technical training, and credentialing. The Center's nationally recognized Information

Technology Skill Standards provide a common language for the Centers constituents, and facilitate their many roles www.nwcet.org.

Appendix III: NWCET Skill Standards

What Are Skill Standards?

Voluntary skill standards establish the agreed-upon, industry-identified knowledge, skills, and abilities required to succeed in the workplace. Skill standards provide benchmarks of skill and performance attainment that are behavioral and measurable. Skill standards answer two critical questions:

- What do workers need to know and be able to do to succeed in today's workplace?
- How do we know when workers are performing well?

What are the NWCET Information Technology Skill Standards?

The skill standards used in this study are based on the Information Technology Skill Standards described in the document *Building a Foundation for Tomorrow: Skill Standards for Information Technology, The Millennium Edition* revised September, 1999.

The standards enumerate technical skills, employability skills, and foundation knowledge requirements for eight IT career clusters. Career clusters are groupings of representative job titles, related by a close association with a common set of technical skills, knowledge, and abilities. The career cluster approach was used because it more closely reflects how work is organized today, especially in illustrating mobility and progression among representative job titles. They are as follows:

- Database Development and Administration
- Digital Media
- Enterprise Systems Analysis and Integration
- Network Design and Administration
- Programming/Software Engineering
- Technical Support
- Technical Writing
- Web Development and Administration

Sample Job Titles for Each Career Cluster

The career clusters on the following page represent a broad range of job titles, from entry level through senior management.

Database Administration and Development
Data Administrator
Data Analyst
Data Architect
Data Management Associate
Data Modeler
Data Modeling Specialist
Database Administration Associate
Database Administrator
Database Analyst

Database Developer
Database Manager
Database Modeler
Database Security Expert
DSS (Decision Support Services)
Knowledge Architect
Senior Database Administrator
Senior Systems Analyst
Systems Administrator
Systems Analyst
Tester

Digital Media
2D/3D Artist
Animator
Audio/Video Engineer
Designer
Media Specialist
Media/Instructional Designer
Multimedia Author
Multimedia Authoring Specialist
Multimedia Developer

Multimedia Specialist
Producer
Production Assistant
Programmer
Streaming Media Specialist
Virtual Reality Specialist
Web Designer
Web Producer
Web Specialist

Enterprise Systems Analysis and Integration
Application Integrator
Business Continuity Analyst
Cross-Enterprise Integrator
Data Systems Designer
Data Systems Manager
Data Warehouse Designer

E-Business Specialist
Electronic Transactions Implementer
Information Systems Architect
Information Systems Planner
Systems Analyst
Systems Architect
Systems Integrator

Network Design and Administration
Communications Analyst
Data Communications Analyst
Information Systems Administrator
Information Systems Operator
Information Technology Engineer
Network Administrator
Network Analyst
Network Architect
Network Engineer
Network Manager
Network Operations Analyst

Network Security Analyst
Network Specialist
Network Technician
Network Transport Administrator
PC Support Specialist
PC Systems Support Lead
PC Network Engineer
Systems Administrator
Systems Engineer
Technical Support Specialist
User Support Specialist

Programming/Software Engineering
Applications Analyst
Applications Engineer
Business Analyst
Computer Engineer
Data Modeler
Operating System Designer/Engineer
Operating System Programmer/Analyst
Program Manager
Programmer
Programmer/Analyst
Project Lead

Software Applications Specialist
Software Architect
Software Design Engineer
Software Design Engineer and Tester
Software Development Engineer
Software Engineer
Software QA Specialist
Software Tester
Systems Analyst
Systems Administrator
Test Engineer
Tester

Technical Support
Analyst
Call Center Support Representative
Content Manager
Customer Liaison
Customer Service Representative
Customer Support Professional
Help Desk Specialist
Help Desk Technician
Maintenance Technician

PC Support Specialist
PC Systems Coordinator
Product Support Engineer
Sales Support Technician
Senior Systems Analyst
Systems Analyst
Technical Account Manager
Technical Support Engineer
Technical Support Representative
Testing Engineer

Technical Writing
Desktop Publisher
Document Specialist
Documentation Specialist
Editor
Electronic Publications Specialist
Electronic Publisher
Instructional Designer
Online Publisher
Technical Communicator
Technical Editor
Technical Publications Manager
Technical Writer

Web Development and Administration
Web Administrator
Web Architect
Web Designer
Web Page Developer
Web Site Developer
Web Specialist
Webmaster

Appendix IV: ITAA Workforce Programs

The Information Technology Association of America (ITAA) is a leading provider of data and policy work on the U.S. information technology (IT) workforce. The mission of the ITAA's workforce department is to promote the creation, development, and retention of a skilled IT workforce for the high tech industry through relevant and effective partnerships among industry, education, and government stakeholders. The department draws participation from hundreds of companies from across the Association, including its Workforce and Education Committee chaired by Dr. Ernst Volgenau, President/CEO, SRA International.

ITAA's major workforce development initiatives include:

- Convening an annual **National IT Workforce Convocation** to gauge progress and track best practices in developing the IT workforce.

- Producing original national research on **IT employment and hiring trends**.

- Convening a **Blue Ribbon Diversity Panel** of national leaders from industry, education and government to develop strategies for promoting women and minorities in IT.

- Partnering with the **National Science Foundation** to provide industry-based technical assistance to tribal colleges across the U.S.

- Supporting efforts to employ and promote **people with disabilities in IT** positions through the **IT Works Project** in partnership with the University Of Iowa's Law, Health Policy & Disability Center.

- Assisting in the development of an **IT career cluster** model in partnership with the Education Development Center to integrate IT skills into educational curriculum.

- Linking high tech employers with **Workforce Investment Boards** across the U.S. to address critical training and retraining needs for today's workforce.

For more information about ITAA's workforce programs, contact:

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Or visit www.itaa.org/workforce for program descriptions.