Chapter V

Jobs in the New Economy

*by Sandra D. Cooke**

Despite reports of mounting layoffs, IT workers are still in demand, especially in industries that provide IT services and occupations related to IT security, networking, and e-commerce. As the economy has slowed, so has the demand for many types of IT equipment, but demand remains strong for many IT-related services.

For IT workers, the new economy offers both opportunity and risk. The highest skilled IT workers enjoy strong demand for their services and above average compensation packages. At the same time, less skilled IT workers and some non-IT workers face a greater chance of being displaced by rapidly evolving technologies.

Even for workers in non-IT jobs, basic IT skills are becoming a requirement. IT skill requirements are ever changing and workers are finding that life-long training is needed for long-run economic security. Educators, too, recognize the growing need for skilled workers and are designing curricula to include basic IT skills training especially at the secondary school level.

This chapter discusses implications of the IT revolution for both IT and non-IT workers. The first half of the chapter focuses on IT workers—employment demand, compensation, skill requirements and related supply issues. The second half discusses IT's role in labor markets — how IT is changing the nature of work, the way workers find work, and where they work.

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Highlights

- After growing much faster than average during the late 1990s, IT industry employment growth has slowed in recent months in response to a slowing economy. Some IT service industries, however, are still adding jobs.
- In 2000, there were 5.6 million workers employed in IT industries.
- Average wages per worker in IT industries are twice the national average. IT industry workers earn $73,800 compared with $35,000 for all workers engaged in private nonfarm industries.
- In 2000, 6.6 million workers were employed in IT occupations in all industries.
- More than half of IT jobs are "high skilled" and require at least an associate degree. High skilled IT jobs pay considerably more than low skilled IT jobs.
- Business, government, and educational institutions are working to prepare students and workers for the job demands of the information age.
- IT has contributed to rising skill requirements across a number of occupations.
- In the new economy, workers are less constrained by geographical barriers as IT allows some types of work to be done from virtually any location.
- IT plays an important role in the efficient operation of labor markets through matching employers with job seekers and allowing contingent workers to quickly respond to changing market conditions.

IT WORKERS: DEMAND AND SUPPLY

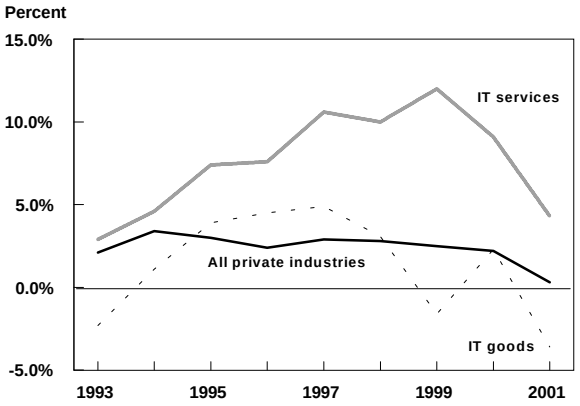
IT workers design, manufacture, operate, repair, and maintain the IT infrastructure that facilitates e-commerce and other Internet or network-related activities. For the purpose of this analysis, the IT workforce is divided into two partially overlapping groups—workers in IT-producing industries and workers in IT occupations. Workers in IT-producing industries include all occupations, e.g., sales, marketing, and financial services, in addition to workers in IT occupations. IT-producing industries consist of four major segments: hardware, software and related computer services, communications equipment, and communications services. (See Chapter 3, Table 3.1) Workers in IT occupations work across all industries, e.g., a computer programmer might work in financial services or retail trade as well as in IT-producing industries. IT occupations are listed in Box 5.1 and duties are described in Appendix Table A-5.5.

Employment in IT-Producing Industries: IT Services Adding Jobs, IT Goods Losing Jobs

From 1992 to 2000, jobs in IT-producing industries grew twice as fast as the national average, driven by growth in IT services industries. (Appendix Table A-5.1) The number of IT workers grew from 3.6 million in 1992 to 5.6 million in 2000, or from about 4 percent to 5 percent of total private nonfarm employment.[1] Since the beginning of 2001, however, as the economy has weakened, employment growth of IT industries has slowed considerably.

The overall growth in IT-producing industry employment represents a churning in IT jobs, with significant increases in some areas and declines in others. This trend is evident when we examine IT services and IT goods industries separately.[2] As shown in Figures 5.1 and 5.2, since 1992, IT services industries have enjoyed higher than average rates of employment growth, even into 2001. Industries that manufacture IT equipment, however, have seen little job growth over the period and in recent months, have even lost jobs. This trend also reflects the aggregate trend of much stronger employment growth in the services sector than in the manufacturing sector. Despite overall IT job growth during much of the 1990s,

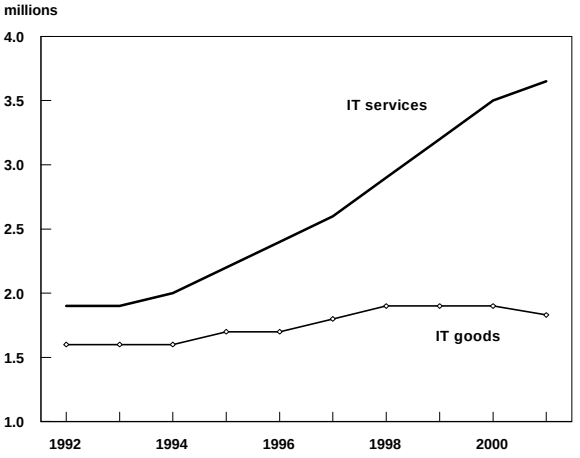
Figure 5.1
EMPLOYMENT GROWTH:*
IT GOODS, IT SERVICES, AND ALL PRIVATE INDUSTRIES
(year to year rates of change)



** 2001 - January to November 11-month average.*
IT services: computer software/related services & communications services
IT goods: computer hardware & telecommunications equipment

Source: ESA estimates based on BLS data.

Figure 5.2
EMPLOYMENT LEVELS:*
IT GOODS AND IT SERVICES



** 2001 - January to November 11-month average.*
IT services: computer software/related services & communications services
IT goods: computer hardware & telecommunications equipment

Source: ESA estimates based on BLS data.

[1] *Because of definitional changes, these estimates are not comparable to those reported in earlier Digital Economy reports. See Appendix Table A-5.1 for a complete historical revision.*

[2] *Churning is even more evident at the 4-digit SIC level as shown in Appendix Table A-5.1. Average annual rates of change in employment from 1992 to 2000 range from -5.4 percent for the optical recording media industry to 23.4 percent for the information retrieval services industry.*

some workers in IT-producing industries have been replaced by new technologies, either directly or as productivity improvements reduced the need for some workers. Also, several IT-producing industries faced import competition during the 1990s.

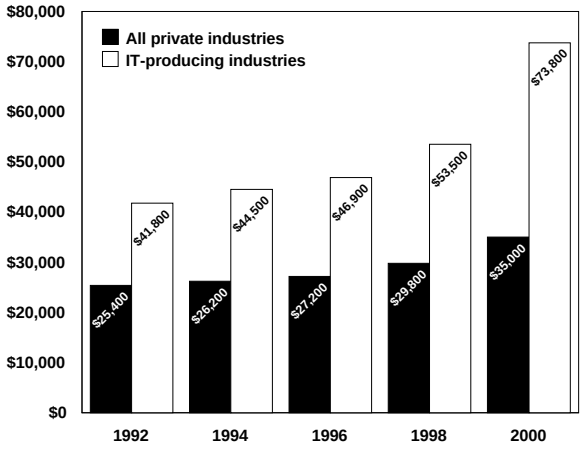
By sector, we find that software and computer services, the largest IT sector, recorded the fastest employment growth from 1992 to 2000. Jobs in this area more than doubled, from 854,000 in 1992 to more than 2.1 million in 2000 (a 12 percent annual growth rate). (Appendix Table A-5.1) Information retrieval services and computer programming services were also among the fastest growing industries in this IT sector. Employment in communications services grew slightly faster than average over the period, led by cable and other pay television service providers. By the end of 2001, however, employment in several IT services industries showed slight declines as the economy continued to weaken.

Employment in hardware industries grew more slowly than average from 1992 to 2000, at about 2.5 percent per year; and some sub-industries experienced significant employment declines, e.g., manufacturers of computers and electron tubes. Communications equipment manufacturers also lost jobs over the period. Employment demand in these IT goods-producing industries thus far in 2001 either has declined or grown very slowly, consistent with trends of the past decade.

IT Industries Consistently Pay Higher Than Average Wages

In 2000, the average annual wage for workers in IT-producing industries was $73,800—more than twice as high as the average annual wage for all private workers, $35,000.[3] (Figure 5.3) Since 1992, wages paid by IT-producing industries have grown by 7.4 percent per year, compared with private-industry average wage growth of 4.1 percent. (Appendix Table A-5.2)

Figure 5.3
ANNUAL WAGES PER WORKER:
IT-PRODUCING AND ALL PRIVATE INDUSTRIES



Source: ESA estimates based on BLS data.

Among workers in IT-producing industries in 2000, those in software and computer services industries, including computer programming services and software development, earned the highest average wage, $80,900. The wages of these workers grew at an average annual rate of 7.8 percent per year during the 1992 to 2000 period.

Although all IT-producing industries paid wages that were higher than the total private industry average in 2000, and almost all of them had higher than average annual wage growth from 1992 to 2000, some IT jobs are low-skilled and low-paying, as discussed in the next two sections.

Skill Requirements Vary Across IT Occupations

Workers in IT occupations design, manufacture, operate, maintain, and repair IT products and provide related services across all industries, not just in IT-producing industries. In general, occupations change gradually as technology creates new job categories and eliminates some old ones. For some IT jobs, however, changes have been rapid and pronounced. Technology tools and platforms used by IT workers can become obsolete

[3] *Because of definitional changes, wage estimates in this report are not comparable to those reported in previous Digital Economy reports. See Appendix Table A-5.2 for a complete historical revision.*

very quickly. This may require workers to retrain, seek recertification, or even change occupations. BLS revises the Standard Occupational Classification (SOC) system periodically to reflect such changes. Occupations noted in Box 5.1 reflect the most recent BLS revisions and additions to the list of IT-related job categories.[4]

Because of changes to the occupational classification system, historical analysis of IT occupations is not possible. However, historical analysis of IT occupations defined under the previous SOC system shows that over time, the IT workforce has become more highly skilled. Moreover, projected future demand for IT workers will favor the highest skilled workers.[5]

IT occupations included 6.65 million workers in 2000, about 4.6 percent of all U.S. workers. More than half (3.8 million) of the workers with IT occupations were in jobs that generally need at least an associate degree. By contrast, in the U.S. economy as a whole, only about one in four workers is employed in a high-skilled occupation. (Figure 5.4) Computer engineers, electrical engineers, and computer programmers are among the highest skilled IT occupations. (See Appendix Table A-5.4 for a complete list of IT occupational employment for 2000.) In 2000, about a quarter of all IT workers (1.6 million) were employed in moderately skilled occupations—jobs requiring long-term on-the-job training, related work experience, or post secondary vocational training. Such jobs include data entry keyers and telecommunications line installers and repairers. In addition, slightly less than one-fifth of IT workers were employed in low-skilled IT occupations such as switchboard

BOX 5.1

IT-RELATED JOBS

Skill Level: High

Engineering managers
Computer and information systems managers
Computer and information scientists, research
Computer programmers
Computer software engineers, applications
Computer software engineers, systems software
Computer support specialists
Computer systems analysts
Database administrators
Network and computer systems administrators
Network systems and data communications analysts
Computer hardware engineers
Electrical engineers
Electronics engineers, except computer
Electrical and electronic engineering technicians

Skill Level: Moderate

Data entry keyers
Computer, ATM, and office machine repairers
Telecommunications equipment installers and repairers, except line installers
Electrical and electronics repairers, commercial and industrial equipment
Electrical power-line installers and repairers
Telecommunications line installers and repairers
Electrical and electronic equipment assemblers
Electromechanical equipment assemblers
Semiconductor processors

Skill Level: Low

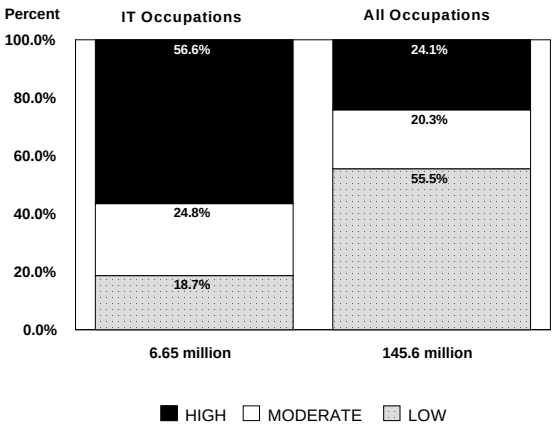
Switchboard operators, including answering service
Telephone operators
Billing and posting clerks and machine operators
Computer operators
Mail clerks and mail machine operators, except postal service
Other office machine operators

Source: ESA in consultation with BLS.

[4] *BLS recently revised its SOC classification expanding several IT-related occupations, adding new occupations, and combining others. For example, the 2000 SOC divided the computer engineer occupation into three new categories: computer software engineers - applications; computer software engineers - systems software; and computer hardware engineers. New IT occupations include network systems and data communications analysts. Because of changes in the SOC categories, the numbers reported in this chapter are not directly comparable with those reported in previous Digital Economy publications.*

[5] *Sandra Cooke, "The IT Workforce,"* iMP: The Magazine on Information Impacts, *April 2000, (http://www.cisp.org/imp) and* Digital Economy 2000, Chapter 5, *June 2000.*

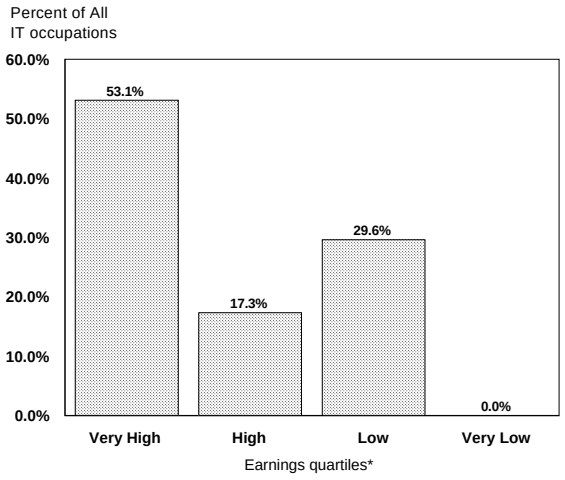
Figure 5.4
EMPLOYMENT AND TRAINING REQUIREMENTS OF IT OCCUPATIONS, 2000



Education and Training Requirements:
HIGH: *Associate degree or higher*
MODERATE: *Long-term on-the-job training, related work experience or post secondary vocational training*
LOW: *Short to moderate-term on-the-job training*

Source: ESA estimates based on BLS data.

Figure 5.5
EARNINGS DISTRIBUTION AMONG IT OCCUPATIONS, 2000



** Very High: > $39,700 High: $25,760-$39,660*
Low: $18,500-$25,760 Very Low: < $18,490

Source: ESA estimates based on BLS 2000 occupational employment and earnings.

operators and billing and posting machine operators —jobs that require little on-the-job training.

Skilled IT Jobs Pay Highest Wages

The earnings of IT workers vary greatly, based on their skills and educational levels. IT worker earnings are higher than average and IT jobs requiring high levels of education and training pay more than those requiring little formal education and training. A ranking of IT jobs according to BLS average earnings quartiles, reveals that in 2000, more than two-thirds of IT jobs paid "high" or "very high" earnings (greater than $25,760). (Figure 5.5)

In 2000, most high skilled IT jobs (86 percent) paid "very high" wages (more than $39,660), while 17 percent of moderately skilled IT jobs ranked among the highest paid. (Table 5.1) Though one quarter of all jobs rank in the "very low" earnings quartile (less than $18,500), none of them are IT jobs. Almost 60 percent of moderately-skilled IT workers earned low wages. This is because data entry keyers, an occupation that includes a large number of workers, requires a moderate amount of training but is among the lowest paid IT occupations.

For specific occupations, we find that in 2000, median earnings ranged from $84,070 for highly skilled engineering managers, who typically require a bachelors degree plus experience, to $19,840 for mail clerks and mail machine operators, a position that requires little work experience. (See Appendix Table A-5.4 for a complete list of IT occupations and median earnings.)

Private surveys provide more timely earnings estimates and include the newest IT occupations. Computerworld conducts an annual salary survey as does RHI Consulting, Inc., a major job placement firm.[6] RHI's most recent survey suggests that starting salaries will increase very little for most IT jobs during 2002. However, jobs related to corporate security and e-commerce will see large rises in base compensation. RHI forecasts that the strongest demand for IT workers will be in health care, finance, and real estate industries.

[6] *See Computerworld's 15th Annual Salary Survey: "More for the Money," September 3, 2001 for a list of earnings by occupation, industry, and region. (http://www.computerworld.com/cwi/story/0,1199,NAV63_STO63423,00.htm) RHI Consulting, 2002 Salary Guide.(http://www.rhic.com/FreeResources), December 2001.*

TABLE 5.1: IT OCCUPATIONAL EMPLOYMENT, BY EARNINGS AND SKILL LEVELS, 2000

	SKILL LEVELS 1/			
EARNINGS QUARTILES	High	Moderate	Low	Total
Very High >$39,700	3,240,440	288,670	0	3,529,110
High $25,760-$39,660	522,570	392,630	238,610	1,153,810
Low $18,500-$25,760	0	965,420	1,003,980	1,969,400
Very Low < $18,490	0	0	0	0
TOTAL	**3,763,010**	**1,646,720**	**1,242,590**	**6,652,320**
Skill shares	**56.6%**	**24.8%**	**18.7%**	
	Earnings Percent Distribution			
Very High >$39,700	86.1%	17.5%	0.0%	53.1%
High $25,760-$39,660	13.9%	23.8%	19.2%	17.3%
Low $18,500-$25,760	0.0%	58.6%	80.8%	29.6%
Very Low < $18,490	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%

1/ High: Associate degree, bachelor's degree or work experience plus a bachelor's degree or higher
Moderate: long-term on-the-job training, work experience in a related occupation or post secondary vocational training
Low: short to moderate-term on-the-job training

Source: ESA estimates based on Bureau of Labor Statistics data.

In addition to base pay, many IT workers in the past negotiated lucrative compensation packages that included stock options and profit sharing. However, the demise of many dot-coms has erased the lure of stock options as a form of compensation. Computerworld reports that in the current economic climate, job seekers are more interested in job security and less interested in extraordinary compensation packages. Employers now offer bonuses to reward workers for good work rather than as a recruiting incentive.[7]

IT Worker Supply Initiatives

In response to the IT worker supply debate that emerged during the 1990s, hundreds of programs have been implemented to increase the supply of IT workers and raise overall IT literacy. Public and private institutions are working both independently and in partnerships to promote IT literacy across all occupations, age groups, ethnic and economic categories. (See Box 5.2 for a sample of initiatives.) One response to the IT worker supply debate was the temporary increase in the number of foreign workers allowed in the United States under the H-1B visa program.[8] In addition, fees from H-1B visa applications are being used to fund IT programs to train Americans for these jobs. Another response has been the emergence of IT certification and other short-term IT training programs that have produced skilled IT workers.

In recent months, however, the slowing of the economy and the failure of some Internet firms has helped to ease supply pressures in IT labor markets. Challenger, Gray, and Christmas report that during 2001, dot-com layoff announcements totalled 100,925 and telecommunications and

[7] *Computerworld,"Hiring Gets Sane," April 2, 2001. (http://www.computerworld.com/cwi/stories/0,1199,NAV47-81_STO59071,00.html); "More for the Money," September 3, 2001 (http://www.computerworld.com/storyba/0,4125,NAV47STO63423,00.html)*

[8] *The H-1B visa program allows foreign workers to enter the country for the specific purpose of temporarily filling skilled jobs (a large share of which are IT jobs) and last year, Congress passed legislation that raised the cap on H-1B visas from 65,000 to 195,000 in FY2001, FY2002, and FY2003, after which the cap will revert to 65,000. (http://www.ins.usdoj.gov/graphics/publicaffairs/statements/018H1BCapState.htm)*

[9] *Challenger, Gray, and Christmas, Inc., press release, December 31, 2001. (http://www.challengergray.com)*

Box 5.2

SPECIFIC EXAMPLES OF CURRENT AND PLANNED IT TRAINING INITIATIVES:

POSTSECONDARY TRAINING

NCR donated $1.2 million to the University of Dayton to create two endowed professorships along with hardware and software needed to provided specialized coursework in data warehousing.

EMC², a leader in networked information storage systems, is partnering with the Massachusetts Bay Community College and New England Institute of Technology to sponsor an accelerated associate's degree program in technology skills.

PREPARING TEACHERS AND STUDENTS

Intel's "Teach to the Future" program will provide technology training for over 400,000 teachers by 2002.

Microsoft's "Classroom Teacher Network" is a free online training and professional development tool for K-12 teachers. Teachers from 80 different countries use this resource.

TECHNOLOGY GRANTS AND SCHOLARSHIPS

The Department of Labor administers the H-1B Technical Skills Training Grant Program which is authorized to use 55 percent of the $1,000 per H-1B visa application fee to fund training programs that will assist American workers in acquiring skills in occupations that are in demand, e.g., information technology.

Nortel Networks Scholars Program provides scholarships to university level students studying engineering and computer science. Over the next decade, more than 7,000 students will become Nortel Networks Scholars.

The National Science Foundation sponsors the Computer Science, Engineering, and Mathematics Scholarships (CSEMS) program which awards $2,500 per student per year for up to two years to low income and minority students.

DIVERSITY INITIATIVES

Hewlett Packard has committed $5 million over 5 years to their Diversity in Education Initiative which promotes study of engineering by minorities and women.

3com and the YWCA have established a new training program to encourage high school age females who are graduates of the YWCA's TechGYRLS program (ages 9-13) to continue their IT training in computer networking.

IT CAREER INFORMATION AND TRAINING SOURCES

The Information Technology Association of America provides information on IT careers, jobs and training. (http://www.itaa.org/workforce/resources/partner.htm)

The Department of Labor maintains America's Career Kit consisting of America's Career InfoNet (http://www.acinet.org), America's Job Bank (http://www.ajb.dni.us) and America's Learning Exchange (http://www.alx.org), which provides the public with training sources and job search information.

computer firms announced 486,172 job cuts.[9] Nonetheless, companies continue to hire for specific types of IT jobs including, networking, IT security, and e-commerce and some industries that provide IT services are still adding workers.[10]

Growth in demand for high quality digital products and electronically delivered services is expected to fuel the demand for skilled IT workers well into the future. BLS projects that seven of the ten fastest growing occupations over the next decade will be IT occupations and IT services will be among the fastest growing industries.[11]

INFORMATION TECHNOLOGY'S IMPACT ON LABOR MARKETS

The diffusion of information technology is affecting the way our labor markets operate. Widespread use of IT has reduced the importance of geographical boundaries and allowed some types of labor services to be provided from practically any location. IT has also raised education and skill requirements across the board, causing many workers and employers to commit to continuous training and skills upgrading. In addition, use of the Internet and related technologies has facilitated the matching of workers with employers, especially contingent workers who can more quickly and efficiently move among employers as needed.

IT and Job Location

The Internet and other networking technologies now allow some workers to work from virtually any location. Companies are no longer limited to local or regional job pools when competing for talent. This is especially true when the output is information and requires little person-to-person contact. In addition, businesses can leverage the Internet to subdivide work and have tasks performed at different geographical locations. They can also lower their costs by redistributing work to regions or even countries where labor costs are relatively lower. IT also gives employers access to a more diverse pool of workers including the disabled, older workers, parents with small children, and others who prefer to work from home.

E-mail, teleconferencing, video-conferencing, and the ability to reach people via cellular phones and two-way pagers help employers keep in touch with workers from all locations. This provides greater flexibility to the worker while increasing productivity, reducing costs and avoiding duplication of effort. At the same time, 24-hour access can blur the line between work and leisure, resulting in longer work hours and reduced job satisfaction. Some employers practice teleworking—an arrangement that allows employees to work from home one or more days per week. An estimated 13 to 19 million workers were involved in some form of teleworking in 2000.[12] This option is being used increasingly as a way to attract and retain high-quality workers. In addition, local governments, especially in urban areas are encouraging employers to use teleworking as a way to alleviate traffic congestion, reduce pollution, and promote energy conservation. The Federal government also favors flexibility in the workplace and has set goals for increasing teleworking by all federal agencies.[13]

IT and Rising Skill Requirements

One measure of the pervasiveness of IT is the growth in on-the-job computer use. According to

[10] *David Foote, "As 2002 Dawns, Job Market has some Bright Signs,"* Computerworld, *January 7, 2002. (http://www.computerworld.com); RHI Consulting , January 4, 2002 press release. (http://www.rhic.com/PressRoom?); Information retrieval services and cable and pay television services industries are two IT industries that continued to add jobs in 2001.*

[11] *Daniel Hecker, "Occupational Employment Projections to 2010,"* and *Jay M. Berman, "Industry Output and Employment Projections to 2010,"* Monthly Labor Review, *November 2001.*

[12] *"Telework and the Workplace of the 21st Century," Conference sponsored by the Department of Labor and Xavier University, October 2000. (http://www.dol.gov/dol/asp/public/telework/main.htm) Conference presenters cite several studies that provide evidence of the positive benefits of teleworking; U.S. Department of Labor,* Futurework: Trends and Challenges for Work in the 21st Century, *1999. (http://www.dol.gov/dol/asp/public/futurework/report.htm)*

[13] *Public Law 106-346, Section 359, 10/23/2000, as interpreted by OPM memorandum to agencies (2/9/2001), instructs federal agencies (1) to review telework barriers, act to remove them and increase actual participation, (2) to establish eligibility criteria, and (3) that subject to any applicable agency policies or bargaining obligations, employees who meet the criteria and want to participate must be allowed that opportunity if they are satisfactory performers. The law provides that its requirements must be applied, within four years, to 100 percent of the federal workforce. (http://policyworks.gov/telework)*

estimates from the Census Bureau, the number of workers using computers at work increased from 24.2 million in 1984 to almost 64 million in 1997, an average annual increase of 7.8 percent per year.[14] This growth in computer usage is widely believed to be a major contributor to the increased demand for skilled workers and the wage premium associated with using a computer.[15] Researchers have found that workers who use a computer at work can earn 17 to 22 percent more than other workers.[16]

Growth in computer use is not limited to workers in IT producing industries and IT occupations. Workers in a variety of non-IT occupations find themselves using computers and computerized devices to perform their jobs and more often than not, this requires some upgrading of skills. For example, in many financial services occupations, workers use computers for routine accounting and billing as well as more complex financial modeling. Records processing has become automated with records being maintained and transmitted electronically. Real estate agents maintain listings electronically and auto mechanics use computerized diagnostic devices. Almost any occupation that requires research involves the use of IT to search in-house or online databases.

Increased competition and rapid change in the new economy, along with rising skill requirements means workers must be able to adapt quickly to changing technologies and organizational structures. This will require technical skills as well as "soft" skills, e.g., interpersonal, management, and problem solving skills. Long-term prosperity for many workers will depend on their flexibility and willingness to upgrade their skills.

Although employer-sponsored training is offered by an estimated 80 percent of employers,[17] some skilled IT workers report spending up to 20 percent of their own time training to keep current in their field.[18] Many workers interested in upgrading their skills on their own, can take advantage of the lifetime learning tax credit.[19] Educational enrollment trends show that more workers are returning to school for job/career-related training. Between 1995 and 1999, participation in adult education programs increased across almost all age groups. For students enrolled in classes that were job related, enrollment grew fastest for the 55-59 age group.

IT and the Contingent Workforce

The contingent workforce includes workers who are part-time, temporary, self-employed, on-call, or independent contractors. Depending on how many of these groups are included in the definition, the size of the contingent workforce in 1999 ranged from 5 to almost 30 percent of all workers. BLS provides three measures of contingent workers, defined according to the worker's expected length of tenure. According to the broadest measure, the number of contingent workers has not changed much over time.[20] In 1995, the first year of the survey, there were slightly more than 6 million contingent workers; the number declined to 5.57 million in 1997 and 5.64 million in 1999. In contrast, employment in the help supply (temporary staffing) industry has grown dramatically—12 percent per year between 1992 and 2000, and BLS projects that it will be among the fastest growing industries over the next decade. Nonetheless, during the recent economic slowdown, employees in the help supply industry

[14] *Robert Kominski and Eric Newburger, "Access Denied: Changes in Computer Ownership and Use: 1984-1997," August 1999.(http://www.census.gov/population/www/socdemo/computer.html)*

[15] *David Autor, Lawrence Katz, and Alan Krueger, "Computing Inequality: Have Computers Changed the Labor Market?" NBER Working Paper 5956, March 1997; Lawrence Katz, "Technological Change, Computerization, and the Wage Structure," May 1999 (unpublished); Michael Handel, "Computers and the Wage Structure," Jerome Levy Economics Institute, Working Paper No. 285, October 1999; David Autor, Frank Levy, and Richard J. Murnane, "The Skill Content of Recent Technological Change: An Empirical Exploration," NBER Working Paper 8337, June 2001. (http://www.nber.org/papers/w8337)*

[16] *Using Current Population Survey (CPS) data, Autor, Katz, and Krueger estimated wage premiums of 18.5 percent for 1984, 20.7 percent for 1989 and 22.5 percent for 1993. McKittrick finds a wage premium of 17.6 for 1997 using CPS data and 21.9 percent for 1999 using the Survey of Income and Program Participation (SIPP) dataset. Source: George McKittrick, Department of Commerce, ESA, unpublished analysis, July 2001.*

[17] *Lisa Lynch and Sandra Black, "Beyond the Incidence of Employer-Provided Training,"* Industrial and Labor Relations Review*, Vol. 52, No. 1, October 1998.*

[18] *Based on National Research Council interviews with IT placement specialists.* Building a Workforce for the Information Economy*, National Academy Press, 2001, p. 254-255.(http://www.nap.edu/catalog/9830.html)*

[19] *Internal Revenue Service, "Tax Benefits for Higher Education," Publication 970. (http://www.irs.gov)*

[20] *Steven Hipple, "Contingent Work in the Late-1990s,"* Monthly Labor Review*, March 2001.*

have been the first to suffer layoffs. Employment (seasonally adjusted) in that industry declined by 6 percent during the first half of 2001.

More generally, information technologies have allowed the help supply industry to more efficiently and quickly match contingent workers with employers requiring these types of workers.[21] In addition, some researchers contend that increased use of temporary workers helped maintain a low rate of unemployment throughout the 1990s by helping restrain wage pressures that ordinarily accompany tight labor markets. IT also gives self-employed and independent contractors the flexibility and mobility to work outside of a traditional organization. Though temporary workers often lag behind in wages and benefits and run a greater risk of job loss, some workers prefer these types of flexible, nontraditional arrangements.[22]

IT and Job Search/Placement Outcomes

Information technologies are also changing the way we find work. From 1998 to 2000, the proportion of unemployed workers who reported regularly using the Internet to search for jobs, increased from 15 to 26 percent.[23] Companies not only post job openings on their web sites, but accept applications online. In 2000, there were over 3000 Internet job boards. Monster.com, one of the major Internet job search boards, saw the number of job seekers double in less than a year from 7 million in April 2000 to 14 million in March 2001. The number of job postings increased from 360,000 to over 500,000 during the same period. Many government agencies now allow potential employees to search and apply for jobs online.

Online job searching and advertising enable more efficient matching of workers and employers.[24] Efficiencies arise because potential employers can provide more information to job seekers more conveniently, on a more timely basis, and at a lower cost via an Internet job board or an online database. In contrast, space is limited (because of cost) in a traditional print classified advertisement. Also, employers can screen a larger number of applicants at a lower cost by scanning large volumes of information for keywords that indicate specific skills or work experience. Improved quality of matching between employers and job seekers should translate to higher productivity, output, and profitability for the employer. Moreover, access to so many job search options makes it easier for workers move between jobs.

CONCLUSION

Labor markets in the new economy provide workers with both opportunities and challenges. For higher skilled workers, the new economy offers strong demand and high wages. Lower skilled workers, on the other hand, are seeing skill requirements rise across a broad range of occupations. IT allows greater flexibility in working arrangements and lets employers quickly hire and release workers in response to changing market conditions. IT also makes the job search process easier for job seekers, and gives employers access to a wider and more diverse labor pool.

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[21] *Lawrence Katz and Alan Krueger, "The High Pressure U.S. Labor Market of the 1990s,"* Brookings Papers on Economic Activity, *1999.*

[22] *GAO report, "Contingent Workers– Incomes and Benefits Lag Behind Those of Rest of Workforce," GAO/HEHS-00-76, June 2000.*

[23] *Peter Kuhn and Mikal Skuterud, "Job search methods: Internet vs traditional*," Monthly Labor Review, *October 2000. Kukh and Skuterud unpublished estimates, December 2001.*

[24] *David H. Autor, "Wiring the Labor Market," NBER Working Paper 7959, October 2000. (http://www.nber.org/papers/w7959)*