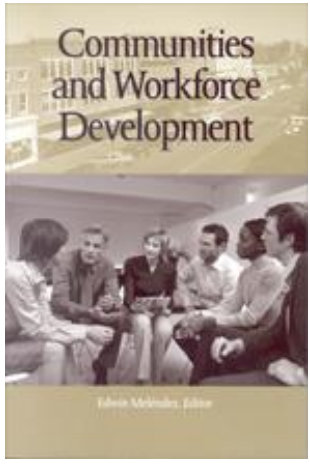
W.E. UPJOHN INSTITUTE
FOR EMPLOYMENT RESEARCH

Upjohn Institute Press

Community Technology Centers: Training Disadvantaged Workers for Information Technology Jobs



Lisa J. Servon
New School University

Chapter 7 (pp. 213-252) in:
Communities and Workforce Development
Edwin Meléndez, ed.
Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2004
DOI: 10.17848/9781417596317.ch7

7
Community Technology Centers

Training Disadvantaged Workers for Information Technology Jobs[1]

Lisa J. Servon
New School University

Information technology (IT) has wrought fundamental changes throughout society. IT has been instrumental in the shift from an industrial age to a network age. We now live in a society in which the production, acquisition, and flow of knowledge drive the economy and in which global information networks represent key infrastructure. These changes have had a profound effect on the labor market; workforce development intersects in important ways with the digital divide. Workers who do not have IT skills have access to much less opportunity in the labor market than those who do. Importantly, the area of workforce development allows for relatively straightforward intervention. This chapter focuses on the labor market for IT workers and how innovative programs and policies can be used to benefit both employers, who cannot fill available jobs, and disadvantaged workers, who cannot find good jobs. The focus here is primarily on entry-level IT jobs and workers because of this book's overarching concern for disadvantaged workers. "Disadvantaged" refers to those workers who have been largely detached from the labor force, who lack requisite skills, who may face discrimination in the labor market, and who are currently unemployed or employed in jobs that fail to pay a living wage.

This chapter makes two primary arguments. The first is that the shift to an information-driven economy involves a concomitant shift in the perception of workforce development activity. Rather than viewing these programs as social welfare—which is how they have traditionally been viewed—we must now see them as legitimate components of

larger economic development strategies. The second is that the current economy—in which there is a high demand for entry-level IT workers—presents a unique opportunity for moving disadvantaged people into good jobs. IT jobs tend to be good jobs. Many require less than two years of training and, as the economy continues to shift in ways that require more IT skills from workers, these opportunities will continue to open up.

ECONOMIC SHIFTS AND THE IT LABOR MARKET

The shift from a manufacturing to a service and information-based economy has been described in great detail elsewhere; this section touches only on the issues most relevant to this chapter (Castells 1996; Bluestone and Harrison 1982). First, information plays a different and larger role in the current economy than in previous economic incarnations—information is now both a product of the new economy and an increasingly important input to production processes (Castells 1996). These structural shifts in the economy have impacted the sectoral composition of regions and the way in which production processes are organized across space. Regions that were dominant in manufacturing have declined unless they have been able to remake themselves.[2] New cities and regions in which IT plays a large role—Silicon Valley, Seattle, and Austin, for example—have grown substantially and have become leaders in the new economy. Internationally, a few cities—New York, London, and Tokyo—have achieved an uber-status as megacities (Sassen 1991). And less developed countries have become important as places in which to locate parts of the production process that can benefit from low-skilled labor and loose environmental regulations.

How have these changes affected the labor market in terms of entry-level jobs? The effects can be described in terms of a "skills mismatch" and a "spatial mismatch" (Servon and Nelson 1999). First, there has been a significant decrease in the availability of low-skilled, stable manufacturing jobs. These jobs used to offer relatively dependable work at living wages and with benefits. The shift from a manufacturing to a more service-oriented economy has changed the kinds of jobs available. Low-end service sector jobs tend to be lower quality jobs: they are often unstable or temporary, pay low wages, and offer few if

any benefits. Although many cities have carved out new roles as service centers, the service sector tends to be highly polarized in occupation and wage structure between skilled and unskilled workers (Bluestone and Harrison 1982; Sassen 1991). As a result, the shift away from manufacturing has tended to benefit college-educated professionals and high-end service workers (Kasarda 1985). Many inner-city residents displaced by structural changes in the economy have found new jobs in the service sector, but these jobs tend to be low-wage, unstable, and without benefits. "As a result" Atkinson says, "cities face the challenge of bridging a growing gap between the skills required for employment in advanced services concentrated in urban cores and the limited skills that many entry-level big city residents bring to the job market" (Atkinson 1998, pp. 157–158). As technological literacy is added to the skill set needed to join the information economy, IT exacerbates the skills mismatch between higher end jobs in central cities and the low-skilled urban labor force living there (Atkinson 1998). Even low skilled tasks require proficiency in the use of telephones, fax machines, and computer equipment (U.S. Department of Commerce 1999). The result is that inequality persists, and many jobs in IT fields go unfilled.

The spatial mismatch has to do with economic and spatial restructuring that has resulted in a loss of stable, well-paid employment opportunities for urban residents. Advances in IT have lessened locational constraints, enabling firms offering low-skill jobs, particularly in manufacturing and routine services, to leave the inner city for the suburbs and, in some cases, overseas locations where production costs are lower. Meanwhile, segregation and discrimination have prohibited the poor and minority populations from following these jobs to the periphery, creating a spatial mismatch between low-income urban residents and employment opportunities (Teitz and Chapple 1998). IT will likely facilitate the further decentralization of economic activity, heightening the spatial mismatch, particularly as teleworking becomes more common and firms develop new ways of transmitting producer and personal services electronically (Graham and Marvin 1996). Some fear that the continued reconfiguration of spatial patterns, made possible by IT, will further cluster the affluent while leaving the poor trapped in places with few good jobs and services (Mitchell 1999).

The rise of the IT sector, however, has opened a unique window of opportunity. The Information Technology Association of America

(ITAA) estimates that the demand for IT workers in 2002 was 1,148,639, and that 578,711 of these positions would go unfilled. Many of these positions are entry level. For example, technical support people, who constitute 18 percent of the IT workforce (and who are entry level workers) are the most in demand, making up one quarter of all new positions in the field (ITAA 2001, 2002). These are relatively good jobs. According to a recent report issued by the U.S. Department of Labor (USDOL), "real average wages in the high-tech industries increased 19 percent since 1990, compared to a 5 percent average increase for the private sector as a whole. The average high-tech job pays 78 percent more than the average non-high-tech job—$53,000, compared to $30,000" (USDOL 1999, p. 3).

Many jobs experiencing high growth do not require a four-year college education. Harrison and Weiss cite research showing that for the period from 1992 to 2005, "only one of eight higher than average growth occupations will require a college degree, whereas fully two-thirds will require no more than a high school diploma" (1998, p. 10). A 1999 study put out by USDOL found that the majority of jobs currently being created require less than an associate's degree but often require other skills (USDOL 1999, p. 5). According to the USDOL researchers, "the alleged disappearance of low-skilled job opportunities in America has been exaggerated. There is, and will continue to be, considerable room in the economy for workers with modest formal schooling" (Harrison and Weiss 1998, p. 10).

Although not all of these high growth jobs are in IT or in well-paying sectors, many entry-level IT jobs also require less than a four-year college degree. At the same time, entry-level IT jobs do require specific skills, and the rapidly changing nature of the IT economy requires that IT workers continually upgrade their skills.

Furthermore, if we look at other occupational sectors we see that technology literacy is now viewed as part of the bundle of skills a worker must bring to the workforce. The Economic Policy Institute found that attainment of computer skills "tends to widen pay differences between educational groups more so than in the past" (Civille 1995, p. 202). In this new economy, "good jobs require analytical research skills, not simply the ability to read and write and follow instructions" (Civille 1995, p. 202). The Secretary of Labor's Commission on Acquiring Necessary Skills (SCANS) outlines the following set of five competencies for the

high performance worker: using resources, dealing with interpersonal relationships, working with information, working with systems, and working with technology" (Civille 1995, p. 203).

THE DEMAND FOR IT WORKERS

The ITAA estimated that approximately 9.9 million people constituted the IT workforce in 2002, a 5 percent reduction from 2001 (ITAA 2001, 2002). The demand for IT workers has been experienced first in cities such as Seattle, Austin, Boston, and San Francisco, which have economies that are heavily dependent on technology industries. IT corporations deciding where to locate a new facility weight the quality of the workforce heavily in their decision matrices. For example, in a recent survey of industry leaders in San Francisco's Multimedia Gulch, access to "a qualified labor pool" was cited as the most important reason to locate in San Francisco. The multimedia industry's demand for a mix of technical and creative talent induces firms to locate in that city, even though the cost of doing business would be significantly lower in other areas. However, although survey participants stated that access to a qualified labor pool was the reason for doing business in San Francisco, these same firms still found it challenging to find qualified staff (including entry level employees).

But the demand for workers with IT skills is not isolated to traditional IT industries. Given the transformation of business practices that information technologies have brought about, universities, banks, hotels, and insurance corporations all need technical support workers, management information systems (MIS) managers, and system administrators. According to ITAA, of the 1,148,000 IT workers needed in 2002, 826,000, or 72 percent, were needed by non-IT companies. Non-IT companies are the largest employer of the IT workforce and have the highest unmet demand for skilled IT workers (ITAA 2001, 2002). A report issued by the Council on Competitiveness cites a 1997 survey in which nearly 70 percent of CEOs identified the skills shortage as the number one barrier to growth (Congressional Commission 2000). Non-IT firms also account for the majority of new demand for IT workers (ITAA 2001, p. 12). A 2000 survey conducted by the Employment Policy Foundation found that one-third of polled businesses said they

Table 7.1 IT Demand Gap, by Job Category

	All companies w/ 50+ employees	
IT career cluster	Demand	Gap
Technical support	218,238	107,624
Database development/administration	110,104	46,166
Programming/software engineer	134,637	69,292
Web development/administration	120,982	56,957
Network design/administration	186,613	85,534
Technical writing	17,461	8,526
Enterprise systems	75,177	32,026
Other	26,437	13,362
Digital media	11,940	5,871
Total	901,589	425,358

SOURCE: ITAA (2001).

would move operations overseas if qualified workers were not available in the United States.[3] The shortage of IT workers has spread from cities with economies heavily dependent on IT to other regions. Table 7.1 illustrates the gap in demand for IT workers by job category.

Interestingly, ITAA's estimates of the demand gap in IT workers are up from a year ago but still down from 2000 figures. The changes in demand, depicted in Table 7.1, reflect the corrections in the market that have been occurring over the past few years.

Industry spokespeople, like investors, were overly optimistic about the growth potential of very thin firms.[4] The drop in demand should be thought of as a correction, not as the beginning of a long-term decline in demand for workers with IT skills. An upward trend in this demand will likely continue (Foster-Bey, Rawlings, and Turner 2000). Although this sizable change clearly demands closer analysis, the fact remains that demand for IT workers is very strong and the gap is significant. The continued need for IT workers is evidence that a fundamental shift in the type of work being performed across sectors is under way (ITAA 2000, p. 11). Programs to train disadvantaged workers for IT jobs, then, need not be thought of as social welfare, but rather as a way to fuel an economy hungry for skilled workers. According to Bruce Bernstein, president of the New York Software Industry Association (NYSIA), the

need to train low-skilled workers for available jobs is "an economic necessity, not a social prerogative." This shift in thinking is important. The perception of workforce development programs—especially those that target public assistance recipients—is often that they are in essence social work rather than economic development. Framing the issue as an economic development issue rather than strictly as a social welfare one is more likely to generate bipartisan support in the public sector as well as key backing from the private sector.

The demand for IT workers is likely to increase as the new mode of production continues to be absorbed and assimilated across institutions and industries (Meares and Sargent 1999). According to Castells, "the generalization of knowledge-based production and management to the whole realm of economic processes on a global scale requires fundamental social, cultural, and institutional transformations that, if the historical record of other technological revolutions is considered, will take some time" (Castells 1996, p. 91). As this process of transformation continues, the demand for workers with IT skills will only grow. A Department of Commerce report projects that by 2006 nearly half of all workers will be employed in industries that produce or intensively use information technology, products, and services (USDOL 1999, p. 60).

WHAT IS DIFFERENT ABOUT THE IT LABOR MARKET?

Classifying IT workers

Attempting to define and describe the IT labor market is challenging given the diversity of ways in which digital technologies are utilized. The most narrow definition of the IT labor market would include only "core" IT occupations: computer scientists, computer engineers, systems analysts, and computer programmers. These professions constitute the high end of the IT labor market. Core IT jobs require the most education and skills and pay the most. Workers with these skills are in greatest demand.

This narrow definition of the IT labor market fails to reflect the fact that as the economy becomes more digitized, virtually all occupations involve some use of information technologies. Although this paper will not discuss the way in which traditional sectors of the economy (ad-

ministrative, retail sales, etc.) have been transformed by the adoption of information technologies, it is important to note that the IT labor market is much broader than core IT occupations. There is a large gray area between computer scientists and salespeople who use computers, and this gray area is occupied by a broad range of emerging IT occupations.

Recognizing the breadth of IT-related occupations, the Northwest Center for Emerging Technologies (NWCET) has developed eight career clusters that both expand the frame to include a larger universe of IT jobs and make more precise distinctions between types of IT work. The NWCET clusters enable a finer-grained approach to research and program design for IT-based workforce development. Using these eight IT career clusters can help provide better answers to key questions such as these: What IT jobs are most in demand? What skills are required to perform these jobs? What are the best methods for providing and acquiring these skills? (ITAA 2000, p. 8)

According to the ITAA, the former, narrower scope, which is still used by other research organizations, misses "the dramatic impact that the Internet, e-commerce and other influences have had on the nature of jobs and work." The NWCET job categories are as follows:

Database Development and Administration. This is the creation and management of structures, tools, forms and reports that help companies understand their data. Work functions include needs analysis, database design, testing, and maintenance.

Digital Media. This is the process of bringing sound, video, graphics, animation, and text together to create digital media products. Delivery platforms include Web sites, videos, computer games, and CDs. Work functions include needs analysis, visual and functional design, media production and acquisition, and design implementation and testing.

Enterprise Systems Analysis and Integration. This is the integration of complex and numerous information technology systems to create comprehensive customer solutions. Work functions include defining customer requirements, determining systems solutions, providing strategic direction for systems configuration, managing technology, and implementing enterprise-wide systems.

Network Design and Administration. This entails the development of networks that connect users to computer systems via cable, fiber optics, and wireless communications. Work functions include design and analysis, configuration and implementation, and the testing, administering, monitoring, and management of networks.

Programming and Software Engineering. This involves the translation of business problems into codes a computer can understand through the use of various programming languages. Work functions include analyzing needs, developing structures, designing, developing, implementing, and testing computer programs.

Technical Support. This involves assisting customers in diagnosing and correcting computer systems problems. Work functions include troubleshooting, customer service, hardware and software installation, configuration, upgrades, and systems maintenance and monitoring.

Technical Writing. This encompasses documenting, explaining, translating, and interpreting technical information for a variety of audiences. Work functions include writing, editing, and publishing of technical documents for products, product training, internal systems, Web-based training, and more.

Web Development and Administration. The creation, maintenance, and development of Web sites. Work functions include content and technical analysis; development, implementation, and maintenance of Web applications and site design; and management of Web environments and enterprise-wide Web activities (NWCET 1999).

What Is an Entry-Level IT Worker?

An important aspect of the IT labor market has to do with changing requirements for entry-level jobs. As the technology required to do particular jobs becomes less complicated and as institutions other than four-year colleges increasingly demonstrate an ability to train people for these jobs, employers have changed or decreased what is required to obtain a job. For example, Chapple and Zook describe the process by which particular occupations, such as computer support specialist and

Web developer, have matured to the point that skill levels required for entry-level positions have been reduced (Chapple and Zook 2000).

The shortage of IT workers has clearly played some role in these shifts as well. Employers are willing to lower their requirements when they are desperate for workers. As these jobs become more institutionalized, it becomes easier to figure out how to train people for them.

At the same time, even entry-level IT workers require some training. The term "entry level" is used here to refer to those jobs that require a two-year associate's degree or less. The focus here is on jobs that disadvantaged workers could be moved into in a relatively short time, and relatively inexpensively.

The Education/Skills Distinction

The current economy clearly demands more and different skills from workers than did the manufacturing-driven economy. Qualifications for many IT jobs are measured not in terms of postsecondary degrees but rather in terms of specific skills and abilities. The distinction between skills and education has become more important (NWCET 1999). A skilled worker in 1950 was unlikely to require additional training throughout his career. Today, the skilled IT worker must constantly upgrade her skills in order to remain productive. Lifelong learning has become the norm, yet an infrastructure of policies and programs to support this norm is lacking.

Workers in many emerging occupations require specific training, but they do not necessarily need higher education. Although the three occupations projected by the Bureau of Labor Statistics to grow most quickly between 1996 and 2006 all require at least a bachelor's degree, many new IT jobs require less in the way of degrees (USDOL 1999, p. 20). Table 7.2 illustrates the salaries and training requirements for several emerging IT positions that demand two years or less of training.

According to several recent studies, hiring managers overwhelmingly focus on capability rather than on formal qualifications like degrees or certifications (Chapple and Zook 2000; ITAA 2000; Harrison and Weiss 1998). ITAA's survey of employers found that "a good knowledge base in relevant areas came out as the single most important high level qualification (62 percent), followed by hands-on experience (47 percent)" (ITAA 2000, p. 19). Responses of hiring managers to

Table 7.2 IT Salary and Training for Emerging IT Occupations

	Salary		Training		
Emerging occupation	Beginning ($)	Experienced ($)	Credential	Avg. time	Avg. cost ($)
Telecommunications installer	7–15/hr	15–22/hr	Certificate	9 months	400
Technical writer[a]	12–33/hr	20–65/hr	Certificate	1 year	200
Technical support rep.	8–15/hr	12–35/hr	AS degree	2 years	720
PC technician	8–18/hr	12–35/hr	Certificate	2 semesters	300
Network administrator	15–20/hr	18–35/hr	AS degree	2 years	720
Network technician	10–24/hr	11–35/hr	Certificate	1 year	200
Computer programmer	12–31/hr	20–60/hr	Certificate	3 semesters	250
Web designer[a]	12–40/hr	25–115/hr	Courses	4 months	400
Webmaster[a]	10–20/hr	15–40/hr	Certificate	3–9 months	300

[a] Indicates high-demand occupation.
SOURCE: 21st Century Workforce Commission (2000).

the ITAA survey indicate that "many routes lead to in-demand IT skill levels" (ITAA 2000, p. 18). Harrison and Weiss cite research showing that "what employers say they want is people with better, more reliable schooling in job-relevant skills, not necessarily people with more schooling, per se."[5] An important characteristic of the new economy is its ability to take on workers who have technical proficiency and computer skills regardless of whether they have formal degrees (Chapple and Zook 2000; Moss and Townsend 1999).

At the same time, employers responding to the ITAA survey expressed a preference for candidates with degrees from four-year colleges. Murnane and Levy (1996) suggest that employers tend to view a bachelor's degree as a warranty for "a set of advanced academic skills, a strong work ethic, and general analytical and teamwork skills required in the workplace" (21st Century Workforce Commission 2000, p. 50). Although employers responding to the ITAA survey preferred candidates with a four-year college degree, they also saw the value of shorter-term, targeted skills training. For example, some community colleges and community-based training programs can deliver applicants with solid skill packages in a relatively short amount of time. However, the extent to which employers will accept applicants coming through such community-oriented training systems remains to be seen.

IT Job Ladders

Just as there are multiple entry points into IT jobs, there are also multiple tracks within the IT sector. The traditional concept of a job ladder may not be as applicable in the information economy as it was in the manufacturing economy. The Center for an Urban Future (2000) declared that "the days of the gold watch are over: The average person can now expect to change jobs many times during the course of his or her life. Yet the current job training system doesn't serve the average person at all" (p. 4). At the same time, some training programs that focus on IT have identified routes leading from entry-level jobs to higher-paying, more advanced jobs. Patterns of advancement in IT careers differ for people working in IT versus non-IT firms. Workforce development institutions are beginning to play an important role in such patterns by identifying "entry-level occupations that pay well, offer opportunities for advancement, and require only short-term training" (Chapple and

Zook 2000, p. 5). Also, whereas traditional career ladders were set within a single firm, IT ladders can rely on a mix of firms and other organizations with, for example, a worker coming back to a training program between positions in order to acquire additional skills.

MOVING WORKERS INTO JOBS

The IT sector is characterized by rapid change. This rapid change carries with it three primary implications. First, workforce development programs must be responsive to industry needs and constantly update curricula to provide the skills demanded by employers.[6] Second, the traditional concept of job ladders is called into question. Within the IT sector, many more people move from job to job quickly, which also makes traditional measures of job training effectiveness, such as job retention, potentially less appropriate. Obtaining and keeping a job for a long time is not necessarily a good measure of whether a job training program works. And third, workers must become lifelong learners. Training must be seen less as a one shot deal: graduates of training programs will likely continue to need training after placement in order to keep their skills current.

Four types of institutions offer relatively short term training (less than two years) in IT-related areas: community-based training programs (CBTs), community colleges, employer-led training programs, and proprietary schools.[7] These institutions offer a variety of programs and serve a wide range of populations. Although all of these training institutions occupy important niches in the landscape of IT training, community-based training programs and community colleges have placed the greatest emphasis on targeting, training, and placing disadvantaged workers in IT occupations.

Community-Based Training Programs

Community-based training (CBT) programs focus explicitly on helping disadvantaged populations to find employment. These organizations fall into two basic categories. One category consists of traditional workforce development organizations that have recently added IT training to their roster of services. Take, for example, Training Inc.,

based in Newark, New Jersey. Training Inc. has been providing workforce development training and services to low income communities since 1986. In 1995 this program began offering information technology training for the following jobs: personal computer (PC) technician, software applications specialist, and office support assistant.

The other category consists of organizations focused on creating access to technology. Such organizations moved into employment-oriented training to capitalize on the opportunity to help their constituents find employment. Playing2Win, a Harlem-based community technology center, is an example of a technology-oriented CBT program. Founded in 1983, Playing2Win was created with the goal of providing access to computers and the Internet for the underserved Harlem community. Over time this program added technology training to its menu of course offerings, and it has been successful in connecting low-income residents to jobs. The unifying thread in all CBT programs is a commitment to assisting low income and low skilled workers in finding employment (Chapple and Zook 2000).

CBT programs have demonstrated promise in training disadvantaged workers for entry-level jobs in the IT sector. Some of these programs work specifically with populations thought to have significant barriers to work. OpNet is one example. Founded in 1997, OpNet's mission is to create economic opportunities in the new media industry for low-income young adults, with an emphasis on women and people of color. OpNet maintains close connections with industry and has demonstrated success in training and placing low-income San Francisco Bay Area residents. OpNet works to forge strong business-community partnerships to benefit both the new media industry and low-income communities. For example, local businesses host internships for OpNet trainees, participate in professional development workshops, and help shape the program's curriculum. Their participation helps create a program that is reflective of industry needs and ultimately leads to the development of a skilled labor pool. This industry-community partnership also helps OpNet garner the resources and knowledge it needs to effectively connect low income communities to jobs.

Although CBT programs have demonstrated success in training disadvantaged communities, their ability to tackle the larger problem of moving large numbers of disadvantaged workers into stable IT jobs is somewhat restricted. First, these programs tend to operate on a rela-

tively small scale. Second, like many community-based organizations, they tend to have exceptional, charismatic leaders. Both of these factors raise questions about whether these strategies can be replicated and brought to scale. At the same time, these programs serve an important function by creating pathways to IT employment for some of the most disadvantaged communities. At the very least, these programs must be studied more closely in order to determine what they do well, who specifically they serve best, and what happens to their graduates in the medium and long term.

Community Colleges

Community colleges offer several advantages as training institutions. They are economical, tend to be conveniently located, offer flexible schedules, and have a history of serving underrepresented minorities, adults, and immigrant populations. Research conducted thus far on community colleges that provide IT training has been largely exploratory, and the findings are mixed. In the ITAA's survey of IT employers, which asked them to rate four-year colleges, private schools, short courses, informal training, and community colleges, community colleges did not score as well as four-year colleges and private schools. The authors of the report recognize, however, that the relatively low score may reflect the fact that many community colleges do not offer specific IT degrees. Conversely, a study by the Urban Institute found that employers do not recruit at community colleges. The same study also found, though, that community college graduates "do not face any limits to their career mobility once they are hired" (Lerman, Riegg, and Salzman 2000, p. 23). Stoll posits that regulation and bureaucratization at many community colleges, coupled with the fact that many are disconnected from industry, has shaped employers' perceptions (Stoll 2000, p. 8).

It would be wrong, however, to label all community colleges in the same way; there are important exceptions. For example, in their excellent study of IT training programs, Chapple and Zook found several community colleges that appear to have effective programs. These colleges tended to have established computer science departments and committed faculty members. These community colleges have figured out ways to maneuver around the problems identified above. The Ur-

ban Institute study explored the issue of how community colleges find out what employers want and how they incorporate their findings into the curriculum (Lerman, Riegg, and Salzman 2000). The authors found that community colleges typically have an advisory board made up of industry representatives who advise the college on curriculum; suggested changes must be approved by a committee. The frequency with which this committee meets varies greatly and has much to do with how responsive course offerings are to industry needs. State regulations dictate some of this bureaucracy, so it would be useful to study more thoroughly differences in state regulations. However, some anecdotal information exists. Iowa Western Community College, for example, offers new classes on a temporary basis until they are approved. At Bellevue Community College in Washington State, administrators do not specify what software will be used for particular classes, giving instructors the opportunity to update or change what they will use without going through the approval process (Lerman, Riegg, and Salzman 2000, p. 16). Chapple and Zook (2000) cite De Anza Community College in California and the Borough of Manhattan Community College as examples of community colleges that have also overcome bureaucratization issues. Some community colleges—e.g., Seattle Central and Colorado community colleges—are members of workforce investment boards (WIBs). Their participation on these boards ensures that they maintain close connections with industry and local government.

A small number of community colleges have moved beyond industry advisory boards to create more formal connections with employers. Some of these partnerships have been initiated by particular corporations. In 1997, for example, Microsoft launched the Working Connections Program, committing $7 million to develop IT programs in community colleges. IBM created its S/390 University Program to enable colleges—both two- and four-year—to teach mainframe hardware and software. These programs tend to deliver high quality programs that produce a particular kind of graduate for a specific job. Some wonder, however, whether graduates will have mobility or whether their skill sets may lock them into one job. Some employers have taken a broader view of what is needed to increase the supply of appropriately skilled workers. For example, Sprint works with the Metropolitan Community Colleges and local agencies in Kansas City to increase the number

of underrepresented students in IT careers. Sprint's program provides scholarships, tutoring, and other support to these students.

The Urban Institute study concludes that community colleges can potentially play an important role in training people for IT jobs. The authors cite high levels of enrollment, low graduation rates, and large numbers of older students to "suggest that community colleges are functioning as retraining institutions rather than primary training institutions" (Lerman, Riegg, and Salzman 2000, p. 26). In order to make more specific recommendations about how to use community colleges to address the IT labor market problem and the digital divide, we need first to gather best practices information from the group that seems to be successful and then determine whether and how such programs could be replicated at other community colleges.

Employer-Led Training Programs

Given the current shortage of IT workers, employers are faced with a choice either to "buy" workers away from other firms or to "build" them themselves through internal training. For the most part, employers rely on their employees' obtaining basic training from external sources; in-house training tends to focus on company-specific skills (Chapple and Zook 2000). Although many IT companies are reticent to invest in training because of the frequent job switching and poaching common to the industry, other forward thinking companies recognize that they must be part of the solution to the IT worker shortage by investing in training programs. Such an investment in training also serves longer-term strategic goals such as building a market for their technologies and capturing market share.

Perhaps the best known of these programs is Cisco Systems' Networking Academy program, which is available in all 50 U.S. states, Washington, D.C., and 121 countries. Launched in 1997, the Academy program is a partnership among Cisco Systems, education, business, government, and community organizations. The curriculum focuses on teaching students to design, build, and maintain computer networks. It is an eight semester (560 hour), Web-based, hands-on curriculum that is taught mainly in high schools and colleges, but also in some community organizations. As of this writing, Cisco Academy had enrolled 260,000

students at more than 9,800 Academies located in high schools, technical schools, colleges, universities, and community-based organizations.[8]

It should be noted that not all Networking Academies target low income or disadvantaged workers—like most employer-led programs, the Networking Academy was created because it positively impacts the company's bottom line. At the same time, the Cisco program has done more than most employer-led training programs to reach underrepresented communities. Cisco does this primarily through partnerships with community groups and international organizations. As of March 2001 there were 100 Networking Academies in 26 of the program's 34 Empowerment Zone communities. To encourage the development of Networking Academies in Empowerment Zone communities, Cisco donates all of the networking equipment necessary to educational institutions that establish centers in these neighborhoods.

The corporate sector appears to be recognizing the increased need for training. In a 1994 survey, 54 percent of establishments reported providing more formal training than they had in 1990; only 2 percent reported providing less (U.S. Department of Commerce et al. 1999, p. 15). Another study documented that business investment in education and training rose more than 33 percent between 1990 and 1998 (21st Century Workforce Commission 2000, p. 57). More than one-fifth of employer-based training focuses on computers (U.S. Department of Commerce et al. 1999, p. 16). However, most training efforts are not targeted at disadvantaged workers.

In addition, many corporate actors have chosen to focus their contribution to training on the K-12 school system. For example, 3Com's NetPrep GYRLS program provides network training to high school girls to encourage them to enter IT fields. The Dell Foundation launched a program in 2000 to help children prepare for the digital age. Although these efforts are clearly important, there must be a greater investment in workforce-oriented training programs. Employer-led training efforts are fragmented; there is a lack of coordination across companies, though they could achieve greater scale were they to collaborate.

The primary benefits of employer-led training programs are that private corporations tend to have the resources to invest in these programs and they can target the training very specifically to their needs. From the perspective of potential employees, this second benefit can be a limitation. Some believe that graduates of employer-led programs are

trained too narrowly and that they face difficulty transferring the skills obtained to other work situations.

For-Profit Postsecondary Institutions, Proprietary Schools, and Private Technical Institutes

For-profit postsecondary institutions (which include private technical institutes and other proprietary schools) account for approximately 5 percent of enrollment in two-year institutions (Bailey, Badway, and Gumport 2001). Although many of these schools offer two-year associate degrees and certifications, for-profit secondary institutions cost more than community colleges. These institutions have been around for decades. For example, DeVry Institutes, one of the first and largest for-profit post secondary schools, was established in 1931. The focus of these institutions has been to provide career-oriented educational programs in business, technology, and other related services. These for-profit institutions operate close to the labor market, altering their course offerings with changing employment patterns and skills shifting. For example, when the DeVry Institutes first opened their doors the schools focused on radio, television, and sound systems. Now called DeVry University, this institution has expanded to include computer technology, electrical engineering technology, telecommunications management, and a host of other programmatic areas. The ITAA survey found that IT companies rated proprietary schools as an effective source of IT training because the perception is that these schools focus on specific skills and require few unnecessary classes. IT-related technical institutes have mushroomed in recent years. Although these institutions appear to be an effective source of short-term, specialized training, they are also very costly for participants, limiting their usefulness as a strategy to train disadvantaged populations.

Overall Advantages and Disadvantages

The four types of programs that train people for entry-level IT jobs have different advantages and disadvantages. Table 7.3 lays these out explicitly, along with some other descriptive information about each of these delivery mechanisms. Although IT training programs located in CTCs and community-based organizations have done some impressive

Table 7.3 IT Programs that Deliver Entry-Level Training

Program type	Relative cost	Target population	Length of program	Advantages	Disadvantages
Community-based training program	Free or low cost; training costs are usually covered by public or private sector grants	Low-income: disadvantaged or displaced workers	Various: programs range from a few sessions to several months of intensive training	Serves low-income people; strong connections to comunity; economical; little bureaucracy	Small-scale; replicability issues; charismatic leader syndrome
Community college	Low cost	Geographic focus, with open enrollment to the general population	2 years	Economical; many locations; flexible scheduling; history of underserved groups	Bureaucracy impedes flexibility
Employer-led program	Various: free to expensive, depending on the program	Wide ranging, depending on the goals of the program	Varies	Skills taught are relevant; eliminates the middleman; replicable	Narrow skill set; fragmentation across programs; questionable transferability of skills to other employers
For-profit post-secondary institutions/ proprietary schools	Relatively expensive	Various; general enrollment for those who can pay	1–2 years; longer for advanced degrees or certificate	Strong connections to industry; replicable	Expensive

work, it is unclear whether, in fact, they have "enormous potential for increasing the number of people who can participate in the knowledge-based economy" (Chapple and Zook 2000). Even the largest of these programs is operating on a relatively small scale. Further work needs to be done to determine whether and how these programs can achieve greater scale, who specifically they reach most effectively, and how dependent they are on "charismatic leaders" and "well-ingrained institutions" (Harrison and Weiss 1998, p. 7).

Many important questions remain unanswered because the data simply do not exist. How many people are trained each year through each of these types of programs? How many of these programs exist and where are they located? Can programs meet the demand for services? Are some programs more effective than others at placing graduates? Are some more effective at providing training that keeps a worker employable over the long term? These are questions that future studies would do well to consider.

Across the board, those programs that have thus far demonstrated success in producing graduates and placing them in jobs share the following characteristics:

- strong ties to industry
- after-placement services for graduates
- the ability to quickly modify curriculum

The primary challenge faced by all training programs is an acute shortage of faculty to do the actual teaching and training. The shortage of IT workers has created a situation in which those with the skills to teach these courses have little economic incentive to do so. Programs located in community-based organizations and CTCs also have difficulty sustaining funding and meeting demand for services (Servon and Nelson 1999; Chapple and Zook 2000).

RELEVANT POLICY EFFORTS

Policy also clearly affects the IT labor market. This section deals with those federal and state policies that relate most directly to the workforce development issue.

The H-1B Visa Program

One response to the IT labor shortage is the H-1B visa program. This program admits foreign skilled workers to the United States in order to fill jobs not being filled by U.S. workers. Although not all foreign workers who enter the country under the H-1B program are IT workers, estimates indicate that the program currently fills 70,000 IT jobs a year, roughly 28 percent of the average annual demand for IT workers (U.S. Department of Commerce 2000, p. 51). Approximately 460,000 H-1B visa recipients currently work in the United States. In 1990, Congress imposed a cap of 65,000 on the number of H-1B visas issued. In 1997, that cap was reached for the first time. The corporate sector has successfully pressured the federal government to increase the number of H-1B visas available for each of the past several years, and each year the new limit has been reached. In 2001, the cap was reached in March. Table 7.4 illustrates the annual increases in the number of H-1B visa holders allowed into the United States.

The primary accomplishment of the American Competitiveness in the Twenty-First Century Act of 2000 was that it raised to 195,000 the cap on the number of available H-1B visas, a type of temporary visa used to recruit established mid- and upper-level scientists (mainly information technology experts) from foreign countries. S 2045 was introduced on February 9, 2000, by Sen. Orrin G. Hatch (R-UT), and signed into

Table 7.4 Number of H-1B Visas, 1997–2004

Year	Number
1997	65,000
1998	65,000
1999	115,000
2000	115,000
2001	195,000
2002	195,000
2003	195,000
2004	65,000[a]

[a] This is the authorized level for 2004.

SOURCES: Tech Law Journal; U.S. Congress S 2045, American Competitiveness in the 21st Century Act; and the U.S. Citizenship and Immigration Services, Public Affairs Division.

law on October 17, 2000, by then-President Clinton. In 2004, the H-1B visa cap returned to 65,000, and as of this writing no new legislation has secured sufficient congressional and presidential support to raise this cap.

The Helping to Improve Technology Education and Achievement Act of 2000 (HR 3983, also known as the HI-TECH Act) was a related bill that sought to increase the caps on H-1B visas to 200,000 through 2003 and to increase funding for technology training and K-12 education. It also would have increased the H-1B application fee by $500 and would have earmarked the additional funds generated for education and training. HR 3983 was referred to the House Education and Workforce Committee, the House Judiciary Subcommittee on Immigration and Claims, and the House Science subcommittees on Basic Research and on Technology but failed to be moved out of committee for a vote of the House.

The H-1B visa program helps to fill demand for workers right now, but it is a stopgap measure. A longer term solution to filling these jobs with U.S. workers is needed. Even if annual increases continue in the number of H-1B visas allowed into the country, this solution is unlikely to meet the labor shortage in IT jobs by itself (Stoll 2000, p. 15). In addition, H-1B workers are likely to work in the most skilled jobs within the IT industry. These jobs create a complementary demand for lower-skilled IT workers, and that demand is currently going unmet.

Labor is often thought of as a relatively immobile input to production, especially as compared with inputs such as capital and raw materials. But labor does not necessarily need to be mobile in order to be globalized. This globalization of the labor force occurs either by moving parts of the production process offshore or by bringing foreign workers to the United States to work. First, firms can and do locate all over the world in order to take advantage of specific skills or the particular cost structure of a local labor market. One reason for the relative decrease in manufacturing jobs in the United States is the relocation offshore of a great deal of manufacturing activity to places in which labor is cheaper. Clearly, it is not that we have stopped making things. This aspect of globalization of the labor force has to do with multinational corporations expanding abroad to capture the lower cost of unskilled labor in other countries. Technology abets this disintegration of the Taylorist production process; for example, it is now easy for designers in one country to

communicate quickly with those who produce the designs in another.[9]

Second, employers' demand for increases in the H-1B visa program show that firms are soliciting and obtaining labor from other countries: thus far the United States has had no trouble filling all of the allowed H-1B slots. This aspect of globalization involves fewer but more highly educated workers—the "core" IT workers discussed at the beginning of this paper. Castells points out that only "a tiny fraction of the labor force, concerning the highest-skilled professionals" is globalized, while "the overwhelming proportion of labor…remains largely nation-bound" (Castells 1996, p. 234). Raising the H-1B visa quota means generating more jobs for the second tier of IT workers—those who have particular skills but are not as highly educated as the first tier workers—which requires figuring out how to train the current workforce for these jobs.

Workforce Development and Welfare Policy

Workforce development policy has long been identified as a form of social welfare policy. This perception arises because workforce development programs are often targeted at the unemployed and at welfare recipients, creating the commonly held belief that these people either need remedial training in "soft" skills or need to be cajoled into working.[10] Workforce development proponents argue that these programs should instead be viewed as part of economic development policy because they help to maintain an available and appropriately trained workforce.

Several factors currently combine to make the link between workforce development policy and economic development stronger (Gruber and Roberts 2000). First, the labor shortage in IT fields has engendered a useful sense of urgency among employers. A report issued by the Center for an Urban Future maintains that "job training can no longer be dismissed as a feel-good favor to the downtrodden. It is now, at every level, a business necessity" (Center for an Urban Future 2000, p. 1) Second, the Clinton administration passed the Workforce Investment Act (WIA) in 1998 with the goal of coordinating more than 163 job training programs funded through a variety of government agencies. WIA emphasizes the importance of skills training and is characterized by the following goals: coordination of services, universal access, work first, consumer choice, and employer participation (Center for an

Urban Future 2000). Third, 1996 welfare reform that replaced Aid to Families with Dependent Children (AFDC) with Temporary Assistance for Needy Families (TANF) makes getting welfare recipients into the workforce a much higher priority than it was previously.

Both TANF and WIA share another important characteristic: they give much of the control of the programs to the states. Job training and welfare policy have nearly always been federal issues, which makes these recent changes significant. In effect, then, there are currently 50 different ongoing experiments in each of these policy areas. This devolution allows states to tailor their policy responses to their particular economies and workforces. Some states have responded to the changes in legislation more creatively and entrepreneurially than have others. Some have thought about these two programs together rather than dealing with them in separate policy categories.

Washington State, for example, has a booming high tech sector and declining core industries such as lumber and aerospace. Most workers who have been laid off do not have the skills they need for available IT jobs. In response, Governor Gary Locke created two programs. The first, Worker Retraining, guarantees 18 months of training to anyone who has been laid off. The training is designed to move workers from declining industries to those experiencing fast growth. The second program, Pre-Employment Training (PET) is delivered through the state's community college system, which works with employers to identify jobs for graduates. Community colleges have focused on delivering a 12-week program which provides free job training to welfare recipients and low income families, primarily at night and on the weekends. As soon as they are able, participants enter the workforce, but they continue to attend college to strengthen their skills foundation. According to the 2003 WorkFirst Study from the University of Washington, people "who received welfare in 2001 and participated in WorkFirst activities…were more likely to be employed and had higher wages than those who did not" (Klawitter 2001). However, state officials continue to modify the program, including Governor Locke's set-aside of $10 million for job coaches to raise the wages of PET participants and other low-wage workers and to help with the issue of job retention. Locke also shut down an underused training program operating through unemployment offices, thereby demonstrating a willingness to experiment with a mix of initiatives.[11] Other states, such as Texas and Indiana, have

also launched creative initiatives based on their particular issues.

Nebraska's Applied Information Management (AIM) Institute is another example of an innovative IT workforce development program. The AIM Institute is a nonprofit membership organization created by a consortium of business, education and government entities to support and promote business growth related to information technology. Recognizing that a skilled IT workforce is critical to Nebraska's competitiveness, a critical focus of AIM's work is on information technology training. Through independent training modules and partnerships with high schools, universities, and colleges, AIM develops model technology curriculum and training opportunities for residents of Nebraska. Funding for AIM comes from a variety of sources including commitments from corporate members, subscriptions to AIM's CareerLink, and funding from state, federal and private granting agencies.

Some states, having also recognized the importance of a basic competence with technology for welfare recipients who are being moved to the workforce, are creating programs that provide these people with IT skills.

National Science Foundation: ATE and ITWC

The National Science Foundation (NSF) funds the Advanced Technology Education (ATE) program, which promotes improvement in technological education at the undergraduate and secondary school levels.[12] ATE works toward this goal by supporting curriculum development, facilitating professional development of college faculty and secondary school teachers, and creating internships and field experiences for faculty, teachers, and students. ATE also brokers relationships and partnerships between two-year and four-year colleges and funds a granting program called Centers of Excellence in Advanced Technology which supports projects that develop educational material, disseminate information, and engage in professional development for educators. The Northwest Center for Emerging Technologies (NWCET), previously mentioned, is a Center of Excellence and has received over $5 million in grants from the ATE program since 1995. ATE specifically targets women, underrepresented minorities, and persons with disabilities (Congressional Commission 2000, p. 33). In FY 2005, ATE will distribute an estimated 65 awards totaling $38 million.[13]

NSF also initiated the Information Technology Workforce Program (ITWS), a research program that focuses on projects addressing research questions related to the under-representation of women and people of color in the IT workforce. The genesis of this program was the recognition that, in order for the United States to maintain its global leadership in IT, there would need to be a continuous supply of well-trained engineering and computer science professionals. ITWS targets women and people of color as key populations that can help to increase the supply. In 2004, the program will issue approximately $5 million in funds for research in three primary areas: environment and culture, the IT educational continuum, and the IT workplace.[14]

IT Training Tax Credits

The Technology Education and Training Act (TETA) was proposed at the federal level in 2001. This legislation would provide tax credits to employers who provide training to their employees. The Technology Workforce Coalition argues that IT training tax credits will do several things: increase personal income tax revenue from new employees, increase local sales tax revenue from new employee spending, increase corporate tax revenue from increased employee productivity, and develop necessary skills in non-IT businesses.[15] In the meantime, some states have begun to move ahead with their own legislation in this area. Arizona was the first state to pass such legislation. It currently offers $5 million in Information Technology Training Tax Credits in a dollar-for-dollar match for training up to 20 employees per company in IT skills. The per employee credit cannot exceed $1,500.[16] Similar legislation is pending in other states, and at least two states, Ohio and Rhode Island, have implemented similar training tax credit programs.

RECOMMENDATIONS

What can be done to take advantage of the current window of opportunity? Moving disadvantaged workers into IT jobs requires action on the part of many stakeholders. This section lays out recommendations directed at training programs and at the public and private sectors.

For Training Programs

Work with employers. Existing research shows that workforce development initiatives work best when they include strong ties to employers (Harrison and Weiss 1998; Stoll 2000; Chapple and Zook 2000). These arrangements are most likely to create the kind of workforce development policy and institutions that are sufficiently flexible to modify training to the specific demand for skills" (Stoll 2000, p. 2). Flexibility and the ability to quickly respond to changes in the skills demanded are clearly characteristics that any IT training program must have. It is not surprising, then, that ITAA found that hiring managers value on-the-job training more highly than any other training.

For the Private Sector

Invest in training. The private sector has a great deal to gain by investing in training. The high value employers place on on-the-job training (OJT) means that the workplace is a primary site for the design and location of programs. Research on the effects of employer-based training show that firms providing formal OJT raise their productivity by roughly 10 to 15 percent, on average (U.S. Department of Commerce et al. 1999, p. 7). Another study found that employers get more bang for the buck by investing in education than by investing in capital stock. Firms whose workforce had a 10 percent higher than average educational attainment level had an 8.6 percent higher than average productivity level, while firms with a 10 percent higher than average level of capital investment had only a 3.4 percent higher than average payoff (U.S. Department of Commerce et al. 1999, p. 23). Folding training into the workplace also makes sense from the perspective of workers. Focus groups of workers interested in continuing education cited lack of time and high cost as two of the biggest barriers to taking courses outside of work. Many high tech companies have begun to invest in training, particularly at the K-12 level.

Create and participate in regional consortia. Another response involves regional consortia of firms joining forces to provide training. Some literature uses the term "coop-etition" to describe how rival companies cooperate when it is in their mutual interest (21st Century Work-

force Commission 2000, p. 29).[17] An example is the Alliance for Employee Growth and Development, a joint training trust to which AT&T, Lucent Technologies, the Communications Workers of America, and the International Brotherhood of Electrical Workers (IBEW) belong. The Alliance consists of more than 200 labor/management committees that "help identify educational needs, coordinate training, and build enrollment" (U.S. Department of Commerce et al. 1999, p. 23). The Alliance also offers a range of training and learning opportunities that are tailored to local and individual needs. For example, participants can get involved in Alliance-sponsored on-site, off-site, and distance learning training programs. The Alliance offers tuition assistance and special services for dislocated workers. In addition to technical skills training, the Alliance also offers support services such as financial planning, career planning, test preparation, and certifications.

For the Public Sector

Support entry-level IT worker training. Public investment will be critical to maximizing the potential of the new economy. The rationale for public investment in training is that we cannot remain competitive as a nation without an educated and appropriately skilled workforce. Investment in human capital is needed in order to fuel the economy and create opportunities for historically disadvantaged groups to take advantage of the current demand for workers. This kind of investment in training will also assist workers who lose their jobs in adjusting to labor market changes caused by increased trade and globalization (USDOL 1999, p. 75). The federal government has some programs in place, but these need to be expanded and updated. The employer fee for H-1B visa petitions is currently $500, much of which goes to training. Given that demand for these workers has thus far been relatively inelastic, that fee should be increased as a way to increase funding for effective programs.

Create specific incentives for small firms. It is clearly more difficult for smaller firms to take on the added cost and burden of in-house training. Government incentives could help remedy this problem. For example, Section 127 of the IRS tax code, which makes employer-provided educational assistance tax-free to both the employer and the

employee, is temporary. Section 127 should be permanently extended. State government can also create incentives for private corporations to invest in IT training.

Change regulations around education and training. The labor market has changed, but many government programs and policies have not changed along with it. For example, traditional government loans and grants can only be used toward degree programs. Lifelong Learning Tax Credits provide some assistance, and their expansion should be explored. Further, unemployment insurance (UI) recipients lose their benefits if they enroll in training that has not been approved by the state. Given that more people are receiving valuable training through alternative programs, there needs to be some shift in policy in this area. Current policy does not reflect and work with the current reality.

Target women and minorities for IT training. The ITAA points to "the under-representation of women and other minorities in the IT workforce" as a key factor contributing to the shortage of IT workers. Table 7.5 illustrates the racial/ethnic distribution of the science, engineering, and technology (SET) workforce in 1997, showing that relatively few women, African Americans, and Hispanics work in these fields.

By 2050, "the U.S. population is expected to increase by 50 percent, and minority groups will make up nearly half the population" (USDOL

Table 7.5 1997 Gender and Racial/Ethnic Distribution of U.S. and SET[a] Workforces

	U.S. workforce (%)	U.S. SET workforce (%)
White male	41.7	67.9
White female	34.7	15.4
Black	10.3	3.2
Hispanic	9.2	3.0
Asian and other	4.0	10.2
American Indian	—	0.3

[a] SET stands for science, engineering, and technology. — = not available.
SOURCE: Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development (2000).

1999, p. 2). Given that these groups represent an increasing proportion of the labor force, it makes sense to take action to prepare them for the requirements of the current economy. The need for skilled workers is so great that employers literally cannot afford to discriminate. Moving minority and women workers into these fields now will also create the positive spillover effect of creating networks and ties that will have long-lasting effects.

The percentage of women earning computer science degrees has dropped steadily since 1984, when women made up 37 percent of degree recipients. By 1994, that figure had fallen to only 28 percent. According to the Department of Commerce, only 1.1 percent of undergraduate women choose IT-related disciplines, compared to 3.3 percent of male undergraduates (Cuny and Aspray 2000). If we follow the IT workforce pipeline, we see that the underrepresentation of women continues, from those pursuing computer science degrees through all levels of the workforce. Table 7.6 illustrates the drop-off rate as women move from college through postbaccalaureate degrees in computer science. According to Catalyst Associates, a nonprofit research organization based in New York, only 8.1 percent of women occupy executive positions (senior vice president and higher) at major technology companies, compared to approximately 12 percent in other sectors of the economy (Congressional Commission 2000, p. 40). Women also make up nearly 60 percent of the working poor in this country, and minority women are more than twice as likely to be poor as white women (USDOL 1999, p. 4).

A report issued by the Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development identified several barriers that exist for women, underrepresented minorities, and persons with disabilities at various places along the SET pipeline. These include inadequacies in pre-college education; lack of access to higher education; a narrow and inflexible workplace environment; and a poor public image of the science, engineering, and technology fields (Congressional Commission 2000). According to this report, "the lack of diversity in SET education and careers is an old dilemma, but economic necessity and workforce deficiencies bring a new urgency to the nation's strategic need to achieve parity in its SET workforce" (Congressional Commission 2000, p. 5). Policies that address these barriers must be developed in order to move women and underrepresented minorities into the IT workforce. Such policies would range from im-

Table 7.6 Computer Science Degrees Awarded to Women, by Level

Academic year	PhDs awarded	% women	MSs awarded	% women	BA/BSs awarded	% women
1992–93	997	13.3	4,523	—	8,218	—
1993–94	1,005	15.6	5,179	19.1	8,216	17.9
1994–95	1,006	16.2	4,425	19.7	7,561	18.1
1995–96	915	11.7	4,260	20.0	8,411	15.9
1996–97	894	14.4	4,430	22.3	8,063	15.7

NOTE: — = not available.
SOURCE: Cuny and Aspray (2000).

proved elementary education to creating mentor relationships between IT professionals and college students majoring in related fields to providing members of these groups with early work opportunities in IT fields. The private sector can certainly share some of the burden for this work. In fact, were the number of women in the IT workforce increased to equal the number of men, the gap in supply vs. demand for IT workers would close entirely (Freeman and Aspray 1999).

Increase attention to and funding for K–12 education. This chapter is geared primarily toward understanding and solving the current shortage of IT workers. However, this issue is unlikely to go away anytime soon. In order to mitigate future problems, there must be greater investment in primary and secondary education, particularly for underrepresented minorities who often attend poorly performing schools. Three recent initiatives may provide some assistance in this area. First, the International Society for Technology in Education (ISTE) developed the National Educational Technology Standards (NETS), which outline technology skills that can be incorporated throughout the K–12 curriculum. Second, the Techforce Initiative, developed through a partnership between the Education Development Center, ITAA, and the National Alliance of Business, created an IT Pathway Pipeline Model, which integrates technology into students' learning beginning in primary school (Education Development Center 2000). Third, Intel, Hewlett-Packard, and Microsoft have joined forces on a project called Teach to the Future, which will train 100,000 U.S. classroom teachers to integrate computer technology into existing curricula. These three initiatives, although welcome, do not address the more basic problem of schools that deliver chronically poor performances in basic subjects such as math and reading. Also, pedagogy must be changed to reflect the needs of the current economy.

Partnerships

In addition to the measures outlined above, it will be critical for existing training programs, the public sector, and the private sector to partner with one another in order to devise effective ways of addressing the IT labor shortage and moving available workers into existing jobs. Promising examples of such partnerships already exist.

California's Employment Training Panel. The Employment Training Panel (ETP) is a California state agency created in 1982 as a cooperative business-labor program to retrain workers.[18] ETP's purpose has been to fund training that 1) meets the needs of employers for skilled workers, and 2) meets the needs of workers for good jobs. Since its inception, ETP has trained over 336,000 workers using over $645 million in funds. ETP is funded through the Employment Training Fund, which takes one-tenth of 1 percent of subjects' unemployment insurance wages paid by every private, for-profit employer in the state and by some nonprofits also. This fund generates between $70 and $100 million each year. Companies are eligible to apply for ETP funding if they are paying into the state's Employment Training Fund (ETF) and

- are hiring and training unemployed workers who are receiving unemployment insurance benefits (UI);
- face out-of-state competition and need to retrain current employees;
- need to upgrade workers in areas where there are demonstrable skill shortages;
- have special training programs in areas such as defense conversion, entrepreneurial training, and new industries.

ITAA partnerships. ITAA has initiated a variety of partnerships with industry, academia, and community groups in order to increase the number of IT workers. Several of these partnerships focus specifically on populations that are underrepresented in the IT industries. Recruiting for the Information Technology Age (RITA), a joint venture with Women Work!, is executing a plan to help women in transition achieve self-sufficiency through IT job training and placement. ITAA works with a group called Community Options to train and place people with disabilities. And the National School-to-Work Office has funded ITAA's work with the National Alliance of Business (NAB) and the Education Development Center (EDC) to facilitate, support, and promote IT employer participation in school-to-work efforts.

CONCLUSIONS

The current high level of demand for entry-level IT workers, from both IT and non-IT firms, presents a unique opportunity for integrating workforce development and welfare initiatives into economic development goals. Collaboration will clearly be key to solving the current shortage of IT workers. Creative partnerships among industry, government, educational institutions, and the private nonprofit sector have the potential to help industry fill jobs that will fuel the economy while at the same time creating new opportunities for groups that have historically experienced labor market discrimination. These partnerships can operate to increase and improve the flow of information about employers to job seekers, and vice versa.[19] If it is true that disadvantaged workers do not lack employment opportunities, two challenges remain. The first involves training the available pool of workers for these jobs. Doing so requires figuring out the best mechanism for delivering this training, and determining what subset of workers can be easily trained. The second challenge concerns ensuring that these jobs pay a living wage.

If history is any guide, the status (and pay and benefits) of jobs often decreases once they are occupied by disadvantaged workers, a group that consists disproportionately of women and people of color. Policy, therefore, plays a large and important role. Yet policy innovation has not kept pace with technological innovation. Policy directed at moving disadvantaged workers into stable, well-paying jobs must shift toward an investment focus. Only then can it help rectify current patterns of inequality.

Notes

1. This is a revised version of a chapter of my book, *Bridging the Digital Divide: Technology, Community, and Public Policy* (Malden, MA: Blackwell, 2002). It is reproduced in similar form here by permission.
2. Pittsburgh serves as one instance. Formerly a steel town, it has encouraged and fostered the growth of IT activities, with some success.
3. Center for an Urban Future (2000, p. 4). Chapple and Zook (2000) argue convincingly that the likelihood of massive movement of jobs overseas has been exaggerated, but that the issue of a shortage of workers with the necessary skills to fill available IT jobs remains important.

4. "Thin" firms are skeletal in organization, without many assets, resources, or personnel. Investors thought these firms would grow, flourish, and get fat.
5. Zemsky, cited in Harrison and Weiss (1998, p. 12).
6. I use Harrison and Weiss's (1998, p. 5) inclusive definition of workforce development as consisting of "a constellation of activities, from orientation to the work world, recruiting, placement, and mentoring, to follow-up counseling and crisis intervention."
7. Although four-year colleges offer a range of IT training, this chapter focuses on shorter term training programs, as these are the ones likely to be accessed by disadvantaged and transitioning workers.
8. More information on the program can be found at http://cisco.netacad.net/public/academy/About.html (accessed August 20, 2004).
9. Frederick Taylor wrote The Principles of Scientific Management in 1911; these principles became known as Taylorism. Taylorism involves vertical integration of the production process, with most aspects of production being concentrated in one place and in one firm.
10. This is not to say that soft skills are not important. In fact, Chapple and Zook (2000) show how critical it is to package soft skills training into larger IT training programs. Many programs—e.g., DeVry—market their inclusion of soft skills as a selling point.
11. This description of Washington State programs came from the Center for an Urban Future (2000).
12. The NSF is an independent U.S. government agency. Its mission is to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.
13. This information comes from the ATE Program Solicitation NSF 04-541 (replaces NSF 03-523).
14. Taken from the ATE Program Solicitation NSF 03-609 (replaces NSF 02-170).
15. The House bill (HR 1769 in the 107th Congress) was referred to the House Committee on Ways and Means on May 9, 2001, and nothing seems to have happened to it since then. The companion bill in the Senate (S 762) was read twice and then referred to the Senate Committee on Finance, where it seems to have remained.
16. Taken from the Information Technology Tax Credit Guidelines, Arizona Department of Commerce. http://www.azcommerce.com/doclib/WRKFORCE/IT%20Tax%20Credit%20Guidelines.pdf (accessed March 2001).
17. In addition, Harrison and Weiss (1998) maintain that "an important theme that has emerged from [the workforce development field] during the past 12 years is that firms must learn to strategically cooperate as well as compete with rivals (pp. 7–8).
18. This description of ETP comes from www.etp.ca.gov/program/program.cfm (accessed March 2001).
19. Holzer, cited in Harrison and Weiss (1998, p. 34), asserts that job seekers and employers lack sufficient information about each other, leading to the current state in which certain groups experience more unemployment and underemployment than others.

References

Atkinson, Robert D. 1998. "Technological Change and Cities." *Cityscape* 3(3): 129–70.

Bailey, Thomas, Norena Badway, and Patricia J. Gumport. 2001. *For-Profit Higher Education and Community Colleges.* Palo Alto, CA: Stanford University, National Center for Postsecondary Improvement.

Bluestone, Barry, and Bennett Harrison. 1982. *The Deindustrialization of America: Plant Closings, Community Abandonment, and the Dismantling of Basic Industry.* New York: Basic Books.

Castells, Manuel. 1996. *The Information Age: Economy, Society, and Culture.* Vol. 1, *The Rise of the Network Society.* Malden, MA: Blackwell Publishers.

Center for an Urban Future. 2000. "The Skills Crisis: Building a Jobs System that Works." *New York/New Jobs* (Summer).

Chapple, Karen, and Matthew A. Zook. 2000. "Promising Futures: Promising Practices in Information Technology Training for Disadvantaged Adults." Paper presented at the Association of Collegiate Schools of Planning conference, held in Atlanta, November 1–5.

Civille, Richard. 1995. "The Internet and the Poor." In *Public Access to the Internet,* Brian Kahin and James Keller, eds. Cambridge, MA: MIT Press, pp. 175–207.

Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development (Congressional Commission). 2000. *Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering, and Technology.* Washington, DC: Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology.

Cuny, Janice, and William Aspray. 2000. *Recruitment and Retention of Women Graduate Students in Computer Science and Engineering: Report of a Workshop June 20–21, 2000.* Washington, DC: Computing Research Association.

Educational Development Center. 2000. *IT Pathway Pipeline Model: Rethinking Information Technology Learning in Schools.* Washington, DC: Educational Development Center.

Foster-Bey, John, Lynette Rawlings, and Mark Turner. 2000. *Has the Rise of the Digital Economy Reduced Employment Opportunities for Less Educated Adults?* Urban Institute Working Paper on Regional Economic Opportunities. Washington, DC: Urban Institute Press.

Freeman, Peter, and William Aspray. 1999. *The Supply of Information Technol-*

ogy Workers in the United States. Washington, DC: Computing Research Association.

Graham, Stephen, and Simon Marvin. 1996. *Telecommunications and the City: Electronic Spaces, Urban Places.* New York: Routledge.

Gruber, David, and Brandon Roberts. 2000. *Workforce Development Opportunities and Challenges: A report to the James Irvine Foundation.* San Francisco: James Irvine Foundation.

Harrison, Bennett, and Marcus Weiss. 1998. *Workforce Development Networks: Community-Based Organizations and Regional Alliances.* Thousand Oaks, CA: Sage Publications.

Information Technology Association of America (ITAA). 2000. *Bridging the Gap: Information Technology Skills for a New Millennium.* Arlington, VA: ITAA.

———. 2001. *When Can You Start? Building Better Information Technology Skills and Careers.* Arlington, VA: ITAA.

———. 2002. *Bouncing Back: Jobs, Skills and the Continuing Demand for IT Workers.* Arlington, VA: ITAA.

Kasarda, John D. 1985. "Urban Change and Minority Opportunities." In *The New Urban Reality,* Paul E. Peterson, ed. Washington, DC: Brookings Institution Press, pp. 33–67.

Klawitter, Marieka M. 2001. *WorkFirst Study: Employment.* Seattle: University of Washington, Daniel J. Evans School of Public Affairs.

Lerman, Robert I., Stephanie K. Riegg, and Harold Salzman. 2000. *The Role of Community Colleges in Expanding the Supply of Information Technology Workers.* Washington, DC: Urban Institute Press.

Meares, Carol Ann, and John F. Sargent Jr. 1999. *The Digital Workforce: Building Infotech Skills at the Speed of Innovation.* Washington, DC: U.S. Department of Commerce, Technology Administration, Office of Technology Policy.

Mitchell, William J. 1999. "Equitable Access to the Online World." In *High Technology and Low-Income Communities: Prospects for the Positive Use of Advanced Information Technology,* Donald Schön, Bish Sanyal, and William J. Mitchell, eds. Cambridge, MA: MIT Press, pp. 135–161.

Moss, Mitchell L., and Anthony M. Townsend. 1999. "How Telecommunications Systems are Transforming Urban Spaces." In *Fractured Geographies: Cities in the Telecommunications Age,* James O. Wheeler and Yuko Aoyama, eds. New York: Routledge.

Murnane, Richard J., and Frank Levy. 1996. *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy.* New York: Free Press.

Northwest Center for Emerging Technologies (NWCET). 1999. *Building a*

Foundation for Tomorrow: Skill Standards for Information Technology. Bellevue, WA: Northwest Center for Emerging Technologies.

Sassen, Saskia. 1991. *The Global City: New York, London, Tokyo.* Princeton, NJ: Princeton University Press.

Servon, Lisa J., and Marla K. Nelson. 1999. *Creating an Information Democracy: The Role of Community Technology Programs and their Relationship to Public Policy.* Washington, DC: Aspen Institute Nonprofit Sector Research Fund.

Stoll, Michael A. 2000. *Workforce Development Policy and the New Economy: Challenges, Tensions and Opportunities in Connecting Low-Skill Workers to IT Jobs.* Los Angeles: University of California, Los Angeles, Center for the Study of Urban Poverty.

Teitz, Michael B., and Karen Chapple. 1998. "The Causes of Inner-City Poverty: Eight Hypotheses in Search of Reality." *Cityscape* 3(3), pp. 33–70.

21st Century Workforce Commission. 2000. *A Nation of Opportunity: Building America's 21st Century Workforce.* Washington, DC: U.S. Department of Labor, Office of Policy.

U.S. Department of Commerce. 1999. *Falling Through the Net: Defining the Digital Divide. A Report on the Telecommunications and Information Technology Gap in America.* Washington, DC: National Telecommunications and Information Administration.

———. 2000. *Falling Through the Net: Toward Digital Inclusion. A Report on Americans' Access to Technology Tools.* Washington, DC: National Telecommunications and Information Administration; Economic and Statistics Administration.

U.S. Department of Commerce, U.S. Department of Education, U.S. Department of Labor, National Institute of Literacy, and the Small Business Administration. 1999. *21st Century Skills for 21st Century Jobs.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Labor. 1999. *Futurework: Trends and Challenges for Work in the 21st Century.* Washington, DC: U.S. Department of Labor.

Communities and Workforce Development

Edwin Meléndez
Editor

2004

W.E. Upjohn Institute for Employment Research
Kalamazoo, Michigan

Library of Congress Cataloging-in-Publication Data

Communities and workforce development / Edwin Meléndez, editor
p. cm.
Includes bibliographical references and index.
ISBN 0-88099-316-2 (pbk. : alk. paper) — ISBN 0-88099-317-0
(hardcover : alk. paper)
1. Occupational training—United States. 2. Employees—Training of—United States.
3. Welfare recipients—Employment—United States. 4. Public welfare—Government
policy—United States. I. Meléndez, Edwin
HD5715.2.C613 2004
331.25'92'0973—dc22
2004025118

W.E. Upjohn Institute for Employment Research
300 S. Westnedge Avenue
Kalamazoo, Michigan 49007-4686

Cover design by Alcorn Publication Design.
Index prepared by Diane Worden.
Printed in the United States of America.
Printed on recycled paper.