

COMMUNITY TECHNOLOGY CENTERS: Narrowing the Digital Divide in Low-Income, Urban Communities

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ABSTRACT: *As access to information technology (IT) and the ability to use it increasingly become part of the toolkit necessary to participate and prosper in an information-based society, many fear that the IT revolution is bypassing low-income, urban communities. In the absence of comprehensive public or private efforts to close the technology gap, community technology centers (CTCs) have emerged at the grassroots level. The purpose of this article is to describe the work CTCs are doing to address the economic and social impacts of the shift to an information society. In addition, we develop a typology of CTCs by organizational type and programmatic goal that is helpful in conceptualizing CTCs. This exploratory work is an important first step that must occur before answering tougher questions concerning their effectiveness, outcomes, and capacity.*

As access to information technology (IT) and the ability to use it increasingly become part of the toolkit necessary to participate and prosper in an information-based society, many fear that the IT revolution is bypassing low-income, urban communities. Recent studies substantiate these fears. *Falling through the Net: Toward Digital Inclusion*, the fourth in a series of reports published by the National Telecommunications and Information Administration (NTIA, 2000), reports that the divide between those with access to telephones, computers, and the Internet still exists and in many cases, is actually widening over time. Although overall access to information and communication technologies is increasing at a rapid rate, particular kinds of households are gaining access while others are not. Low-income persons and minorities, particularly when they reside in inner cities, are among the groups that are being left behind.

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The move toward an increasingly digital society has had economic and social impacts that threaten to exacerbate existing inequalities. Although access to IT is not a panacea for the problems facing the urban poor, failure to address the technology gap will likely aggravate current levels of poverty and isolation (Goslee, 1998) and increase the already large gaps in education and access to opportunity between historically privileged and historically disenfranchised groups (Blakely, Hadi, & Johnson, 1995). IT has the potential to provide low-income, urban residents with the requisite skills to participate in the information economy, new opportunities to facilitate the communication and networking among individuals necessary for community building, the means to more effectively participate in public discourse, and data and information to understand and attack problems they face. IT can also empower historically isolated individuals and groups and serve as a tool to enhance educational opportunities (Goslee, 1998; Sanyal & Schön, 1999).

In the absence of comprehensive public or private efforts to close the technology gap, community technology centers have emerged at the grassroots level. Broadly defined, CTCs are community-based efforts to provide computer access and training to disadvantaged populations that would otherwise not have such access. CTCs endeavor to fill a critical niche in remedying imbalances in access to IT, but their work is neither well understood nor consistently supported. The purpose of this article is to describe the work CTCs are doing to address the economic and social impacts of the shift to an information society. We develop a typology of CTCs by organization type and programmatic goal that is helpful in conceptualizing them and will provide insight into how we can begin to best evaluate their efforts.

We argue that CTCs have the potential to help close the urban technology gap by providing access to IT, training residents of low-income communities to use IT tools, and distributing content targeted at and created by these communities. At the same time, community technology activists must not overstate the case of what these CTCs can accomplish. CTCs are only one way to provide low-income, urban communities with access to technology. Given their rootedness in their communities, their ability to reach a wide range of people, and their proliferation in the past several years, these new institutions merit closer examination.

This article relies on the results of a mail survey conducted in July and August 1999 of US affiliates of the Community Technology Centers' Network (CTCNet), an international membership organization that promotes and nurtures the development of CTCs. The effective response rate was 37.5%, which was based on 123 usable surveys received out of 328 surveys mailed and not returned as undeliverable. The relatively high response rate demonstrates the strong interest among CTCs in learning more about other organizations in their field. We also draw on interviews conducted between January and August 1999 with community technology activists, directors of CTC programs and local officials in three cities (Austin, Pittsburgh, and Seattle) that have high levels of community technology activity and have adopted innovative policies and programs regarding access to IT.

We begin with a discussion of the economic and social impact of information technologies on low-income urban communities. The next section provides a description of the CTC field; in this section we develop a typology of CTCs, looking specifically at the goals of these organizations and their organizational structure. We then present what we know about the outcomes CTCs have accomplished and close with thoughts about next steps.

THE IMPACT OF INFORMATION TECHNOLOGIES ON LOW-INCOME URBAN COMMUNITIES

Information technologies have wrought major socio-economic changes, fundamentally transforming the way we live and work and reshaping the nation's cities. In this article, we use IT

to refer to information and telecommunications technologies used to perform three main functions: to transmit information—voice, data, audio images, and video signals—between places; to transform information into electronic form; and to distribute information (Atkinson, 1998). In this section, we examine the economic and social impacts of IT on low-income, urban communities, and show why the gap in access should be closed.

Economic Impacts

The IT revolution has had extensive impacts on urban labor markets both in terms of opportunities available and requisite job skills. IT has aided economic and spatial restructuring, resulting in a loss of stable, well-paid employment opportunities for low-income 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 & Chapple, 1998). IT will likely facilitate the further decentralization of economic activity, exacerbating the spatial mismatch, particularly as teleworking becomes more common and firms develop new ways of transmitting producer and personal services electronically (Graham & 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 job and services (Mitchell, 1999).

The dispersal of economic activity away from the urban core has been accompanied by the centralization of certain economic functions, reinforcing the importance of cities as information-processing and exchange cores, meeting places, and command centers (Moss, 1998). Although many cities have carved out new roles as service centers, the service sector tends to be highly polarized in occupation and wage structure (Harrison & Bluestone, 1988; Sassen, 1996). 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 (1998) argues, “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” (pp. 157–158). IT has directly exacerbated the “skills mismatch” between higher end jobs in central cities and the low-skilled urban labor force living there as technological literacy is added to the skill set needed to join the information economy (Atkinson, 1998). Even low skilled tasks require proficiency with the use of telephones, fax machines, and computer equipment (U.S. Department of Commerce, 1999).

These trends have led to escalating inequality and polarization in many of the nation’s urban centers. A recent report cites the increased reliance on the use of computer and computer-assisted technology as one explanation for the accelerating income gap between the richest and poorest Americans, which is at its widest since World War II (U.S. Department of Commerce, 1999). Meanwhile, the persistence of central city poverty and the segregation of the urban poor is often attributed to the lack of entry-level jobs with career ladders resulting from the shift from a manufacturing to an information economy (Wilson, 1987, 1996; Wolpert, 1999). Although IT has not created the “dual-city,” a metaphor used to capture the economic, social and spatial inequalities and polarization in postindustrial cities (Mollenkopf & Castells, 1991), it has enhanced and deepened the power relations that underlie pre-existing inequalities (Castells, 1999).

Social Impacts

The digital divide has implications that extend beyond the labor market. The social argument for why the gap in access should be closed is that information is a public good that should be available to everyone in society (Servon & Horrigan, 1997). IT is increasingly becoming a gatekeeper to a whole range of information and resources—it facilitates democratic decision making and assists citizen participation in government, for example (Schiller, 1996, p. 35).

Governments are increasingly going on-line, creating more opportunities for citizens to participate in political and civic arenas and obtain government information and services. The ability to access government resources from the home, the workplace, or CTCs allows people who have difficulty getting to government offices to be connected. However, for those who lack the technology or the skills to use it, the government presence on-line may create a wider gap than that which already exists (Servon & Horrigan, 1997, p. 65). The widening gap between the “information rich” and the “information poor,” many maintain, increasingly puts our democratic institutions at risk (Doctor, 1994, p. 10).

In addition to making information more easily available, IT offers faster, less expensive, more diverse, and more interactive types of communication. It is the interactive potential of IT that differentiates these technologies from earlier innovations such as radio or television. As Sanyal (2000) notes “[IT] offers the opportunity for interaction between the computer and its users, creating conditions necessary for learning, confidence-building, and self-empowerment” (p. 146). More than merely consuming information, with the World Wide Web every user has the potential to produce and broadcast information (Sanyal, 2000).

Further, IT is a potentially important tool to strengthen social networks and participation in low-income, urban communities. Castells (2000) uses the example of Senior Net to show how electronic networks bring information and resources together and develop solidarity ties among people. Shaw and Shaw (1999) show how residents of a neighborhood in Newark, NJ have used the Internet to stimulate on-line discussions among community members, spur parental involvement in local schools, and organize numerous neighborhood events.

IT also provides the opportunity to bring together groups of users that share common interests but not necessarily physical proximity (Anderson & Melchior, 1995; Sanyal, 2000). On-line alliance building through the creation of “virtual communities” is particularly important given the increasing social and cultural heterogeneity among the urban poor, and thus, the difficulty for community activists to build support for their efforts by relying on spatially proximate constituencies (Sanyal, 2000).

Just because technologies are made available does not guarantee that disenfranchised populations will use them and become more engaged in the civic arena. However, lack of access to IT will preclude low-income urban communities from new spaces of participation and place potentially powerful community building and communication tools well beyond their reach.

The Potential and Limits of IT in Low-Income Urban Communities

Urban poverty is an extremely complex phenomenon resulting from a range of factors including structural changes in the economy, inadequate investment in human capital, racial and gender discrimination, the spatial segregation of poor and minority populations, and insufficient political will to fight the problems with sufficient resources (Teitz & Chapple, 1998). As such, urban poverty alleviation requires sophisticated policy responses and the political wherewithal to implement them. Ensuring access to IT, although insufficient to single-handedly eradicate inequalities, can help to level the playing field if it is appropriately packaged with other necessary interventions.

Although access to IT is not a “technical fix” for urban poverty and the range of problems facing low-income communities, it is necessary to stem further isolation and impoverishment. As Sanyal and Schön (1999) note,

One thing is clear, to profit from the potentials opened up by IT—whatever they may be—we must participate in it. This is especially true for the poor, who are already excluded from the economic, social, and cultural mainstream (p. 375).

CTCs are one mechanism by which low-income communities and the urban poor can gain access to IT and become active participants in the digital world.

THE CTC FIELD

CTCs include a wide range of public and private organizations and institutions, such as libraries, youth organizations, multi-service agencies, stand-alone computing centers, settlement houses, and various other nonprofit organizations that offer an array of technology-based services and programs to a variety of populations. Despite the diversity of organizations that fall under the CTC umbrella, CTCs share a commitment to bridging the technology gap, particularly in low-income, urban communities. Nearly two-thirds (64.2%) of CTCs are located in, and serve, urban areas. More than three-quarters of respondents target low-income populations.

CTCs differ in terms of their organizational structure and IT programming. We provide a typology of CTCs in Table 1, which shows how different IT program goals intersect with different organizational types. We have filled in the cells with organizations we studied and use as examples throughout the article. This framework is helpful in understanding the multifaceted missions and functions of CTCs and lays the foundation for more outcome-oriented research that would move beyond our exploratory effort.

With respect to organizational structure, some CTCs are stand-alone centers that were created to fill a technology-specific mission, while others are part of multiservice agencies that have incorporated technology programs into the broader activities of their organization. Most

TABLE 1
Typology of CTCs and CTC Programs

IT Goal	Organization Type	
	Stand-Alone Center	Multiservice Agencies
Access		<i>HILLCAN & Project Compute</i> (Open Lab)
Literacy/ Training	<i>Austin Learning Academy</i> (GED, ESL, & Literacy Classes) <i>Bay Area Video Coalition</i> (JobLink) <i>Austin Free-Net</i> (Computer Literacy and Training Courses)	<i>HILLCAN & Project Computer</i> (Computer Literacy & Training Courses)
Content	<i>Austin Free-Net</i> (Internet Classes for Seniors)	<i>Project Compute</i> (Life-Web Journalist Project)

CTCs (57.4%) fall into the latter category and operate their technology programs within previously existing community-based organizations. The missions and activities of stand-alone centers generally revolve around IT, whereas multiservice agencies tend to have broader, community-building missions and believe that technology will help them to accomplish their broader goals. Beyond these similarities, there is great diversity among CTCs in both categories.

CTCs also vary in terms of their IT programming. Centers provide different kinds of programming, which can focus on: 1) providing access to technology; 2) using IT for literacy and training purposes; and/or 3) creating and/or distributing content. We deal with each of these programmatic purposes separately to illustrate the range of activities in which CTCs engage. In reality, however, these IT goals are not discreet but often overlap and reinforce one another.

Access

The most common use of technology at CTCs is to provide unstructured computer access to people who might otherwise have little or no opportunity to use computers and information technologies. Eighty seven percent of CTCs offer general computer access and more than three-quarters (78.9%) use technology as a communication tool (i.e., offering access to e-mail). As access providers, CTCs allow community members to drop in and surf the Internet, work on homework, prepare resumes and cover letters, use e-mail, or engage in a variety of other activities.

The Hill House Community Access Network (HILLCAN), a computing center and network in Pittsburgh, focuses on providing access to IT and is affiliated with a multiservice agency—the Hill House Association. Although HILLCAN offers structured workshops to provide participants with the skills necessary to use computers, and has recently started offering classes designed to prepare participants for employment and certification in technical fields, its emphasis is on providing access to neighborhood residents. Carl Redwood, former associate director of the Hill House Association and HILLCAN, emphasizes the importance of providing unstructured access:

The free aspect of these centers . . . is very important. I think there is a danger in the technology center movement, particularly as it relates to low-income communities, to assume that we're doing something for people . . . I think what we have to do is just make resources available to the community and the community will figure out what, when and how to use them. And they may not use them the way the mayor's office or someone else thinks they should use them. . . . But I think it just needs to be open like that (Personal communication, 1999).

Redwood and others essentially argue that those who support IT initiatives in low-income communities must remain open to the multiple ways in which these communities may use them. Narrow, prescriptive interventions can cut off potentially rich applications of resources.

Access must be understood not merely as the provision of hardware, software, and connection to the Internet but also as the requisite skills necessary to use them. As Gordo (2000) notes:

Access includes the ability to use and manipulate technology and recognize and obtain the needed information; and the skills to be able to organize and transfer information into productive knowledge. It also includes the ability to apply and communicate this knowledge to meet personal, economic, political, and social needs and goals (p. 7).

Most CTC directors (including Redwood) have a broader definition of access than Redwood's statement implies. Access-oriented programming not only provides the necessary tools,

it also shows low-income communities how and why IT tools might be useful to them. A great deal of learning occurs during CTCs' open access hours—it simply occurs informally. CTC staff circulate among users, offering assistance and showing people new websites and software applications. In addition, much learning occurs among drop-in users. CTCs are a new form of community institution, where people meet, exchange ideas and learn.

Literacy and Training

Many CTCs create programs to develop the IT skills of program participants. CTCs' literacy and training programs directly address the economic impacts and jobs and skills mismatch problem identified above. Some CTCs use IT to deliver traditional material, such as GED, ESL or literacy curricula, or as a basic learning tool to help develop problem solving and strategic thinking skills.

The Austin Learning Academy (ALA) has offered GED and ESL classes for many years and began to integrate technology into its programs in 1988. ALA views technology as a tool that facilitates the work it was already doing. According to Belinda Rojas, director of ALA,

A component of our family literacy is technology, and in the adult education classes, the technology takes on a form that is integrated with the learning that is going on in the classroom. IT is not a separate kind of class where they go to learn keyboarding—no, it's integrated with what's going on in the classroom (Personal communication, 1999).

Other CTC programs focus specifically on developing computer literacy and IT skills. IT literacy and training programs range from basic courses in which participants learn how to use e-mail and develop keyboarding skills, to advanced courses in building computers, HTML, Web development, and media production. One CTC that trains people for IT jobs is the Bay Area Video Coalition (BAVC) in San Francisco. BAVC's JobLink program, which works primarily with low-income people, maintains close working relationships with a range of Bay Area employers who recognize the quality of the program and are eager to hire its graduates. The relationships with employers also enable BAVC to understand and respond to the quickly changing skill needs of these employers. BAVC keeps current with new programs and continually modifies its curriculum. BAVC has a 95% placement rate of its participants in jobs, such as web developers, HTML coders, and designers that have an average hourly wage of \$30 per hour. Employers hiring BAVC graduates range from high profile IT companies such as Oracle to a wider range of service companies such as Charles Schwab and TravelSmith.

Despite the wide diversity among CTCs in terms of programming, our survey results indicate that overall there is a strong emphasis on education and job preparedness among CTCs. Over half of all respondents provide adult education and literacy (56.6%), general youth development (53.3%), and tutoring (51.6%). More than 40% of all CTCs focus on job training while 35.2% work on youth employment and school-to-career services. In line with their emphasis on education and training, 82.1% of CTCs use technology to build word-processing and keyboarding skills. Over 70% use technology to conduct job searches and build resumes, more than half (54.5%) offer computer-based instruction, and 47.2% provide homework help.

Content

Finally, some CTCs employ IT as a mechanism to access, create and broadcast information that participants deem relevant. CTCs that emphasize content have three distinct purposes: 1) helping community members connect to important information that already exists on the Internet; 2) creating material that constituents can use; and 3) teaching community members to

create relevant content. Those CTCs that help community members learn how to access relevant content generally do so through unstructured access classes in which they help people who may be unfamiliar with the Internet to learn how to navigate it. The Austin Free-Net (AFN), for example, hosts special classes for seniors who may have never used a computer. AFN instructors teach them about the Internet and show them sites that offer useful information. In focus groups with residents of low-income communities, Lazarus and Mora (2000) found that “a particularly striking characteristic among underserved Americans is that they seek ‘life information,’ . . . practical information about their local community” (p. 19).

Those CTCs that actively foster the creation of content believe that it is important for people to be more than passive consumers of information. CTCs that offer programming focused on content creation begin their work from the recognition that the Internet is not currently oriented to low-income communities. According to Chapman and Rhodes (1997):

The Internet reflects the culture of its principal inhabitants—upper middle-class white males. Thus the global network is dominated by the culture, tastes, preoccupations, styles, and interests of the affluent. A network isn’t much good if you don’t know anybody who has e-mail; an online shopping mall holds little allure to someone lacking money and credit cards (p. 3).

Shapiro (1999) emphasizes that content-oriented CTCs “must provide stimulating content about local issues and an opportunity for users to talk with one another. There should be resources and discussion about issues that people really care about” (p. 5).

At Project Compute, a volunteer-run CTC in Seattle, volunteers incorporate computers and information technology into their learning programs by teaching participants how to create content. As Anthony Williams, long-time volunteer and sponsor of Project Compute, stresses, “We don’t want people to believe that a computer is a computer. We really want people to believe that a computer is a tool” (Personal communication, 1999). One example is Project Compute’s Life-Web Journalist Project, the first phase of which was completed in March 1999. As part of the initiative, Project Compute loaned 25 handheld computers equipped with Windows, an audio recorder, and a digital camera to participants for a six-month period. Participants were to go out into the community, capture stories of interest, and create an Internet Website. In addition to helping participants hone their journalism and computer skills, the Life-Web Project provides participants with the opportunity to tell their stories. During the application process one young woman noted that she wanted to participate in the Life-Web Project because she “wanted to be heard.” Project Compute also offers various classes for school-age children, adults and seniors, and provides open-lab time for all community members.

Project Compute is deeply rooted in the community it serves. This connection ensures that projects reflect the interests and concerns of the community. According to Lazarus and Mora (2000), “inclusion helps ensure that online content incorporates what the community wants and will use, that content acknowledges residents’ methods of acquiring information, and that the look and feel of the content works with the user’s literacy and linguistic levels” (p. 28). One advantage of the Internet is that it allows for two-way communication in a way that print media and television do not. Users can respond quickly and directly to the information posted and communicate with each other about topics of interest. Content-oriented CTCs exploit this attribute of the Internet, creating space for community members to shape what is available to them.

What We Know About Outcomes and Evaluation

To what extent are CTCs narrowing the urban technology gap? CTCs are too new to have been researched thoroughly. Many CTCs continue to experiment with programming, and most

of the existing research is exploratory. Preliminary research does indicate that CTCs are filling a critical need for populations that do not have access to computers and other technologies at home or work. The 1999 NTIA study reports that “households with incomes less than \$20,000 and Black households . . . are twice as likely to get Internet access through a public library or [CTC] than are households earning more than \$20,000 or White households” (p. 78). In a survey of users of CTC services, CTCNet found that CTCs have been a valuable resource for obtaining job skills and learning about employment opportunities, have had a positive effect on participants’ goals and experiences and have fostered a sense of community and personal effectiveness (Chow, Mark, & Wise, 1998).

A 1997 study indicated that most CTC users do not have access elsewhere. Those who do have other access go to CTCs to use applications and equipment they do not have access to elsewhere, for social interaction, and for the learner-centered atmosphere (Mark, Corneise, & Wahl, 1997). Evaluations of the California-based Computers in Our Future Project, which studied 11 member centers, show that these centers “are reaching groups who have normally been intimidated by technology, and people who have been difficult to attract to the computer-using world” (Lazarus & Mora, p. 28).

The high cost of evaluation coupled with the newness of these programs have kept CTCs from doing much evaluation of their own. In addition, CTCs tend to be understaffed, making evaluation efforts difficult to support. When asked what they see happening in the programs in which they work, staff members are likely to tell stories rather than to produce numbers. These stories are about connecting people who previously did not know each other; helping people stay in touch with faraway friends and relatives; and watching people learn how to use new technology and create things with it. Ana Sisnett of the Austin FreeNet observed the following:

Age groups working together that did not work together before. For a while antagonistically—looking at each other suspiciously, but then over time they get familiar with each other and they’re able to collaborate and help each other out, even if it’s something as simple as helping to reload a page, you know? And I’ve seen people find out as they talk about what their interests are, as they do searches. For example, in a class—“oh, I didn’t know that”—and then they might end up walking out of the class talking to each other about something (Personal communication, 1999).

Roxanne Epperson the director of Pittsburgh’s New Beginnings Learning Center (NBLC) points to other evidence of success:

Kids won’t leave. At 5:30 when it’s time for them to go, you have to make sure there are none hidden in the basement. They hide under the desks . . . I don’t know how their little bodies can fold up, but down in the library there’s an opening under one of the shelves, they’re all up under there. So that tells me we’re doing something right, you know (Personal communication, 1999).

Clearly, more research needs to be done to gauge the effectiveness of CTCs and to analyze in what areas, specifically, they can most effectively bridge the urban technology gap. CTCs recognize the necessity of being able to assess their programs and are beginning to engage in evaluative research. To help CTC staff evaluate their programs and accomplishments CTCNet has recently released an evaluation toolkit.

Given the range of goals and organizational types discussed earlier, it is important not to judge all CTCs by the same standards. A small access lab in a housing project will have dif-

ferent goals from a dedicated training organization such as BAVC. Evaluators need to devise performance measures that are clearly related to the intended outcomes of the program. Evaluative research will be easier in some areas (such as measuring outcomes of IT-related workforce development programs) than others (such as measuring the effects of CTCs on community building). Our work, which begins to document the diversity of what CTCs' endeavors, is a necessary first step.

Although the number of CTCs continues to grow and expand at a rapid rate, a range of challenges continues to confront program staff. These include generating sustainable funding, supporting technical assistance, meeting the demand for services, and educating the funding and policy making communities about the importance of IT (Servon & Nelson, 1999). Although CTCs offer great promise in narrowing the urban technology gap, they cannot be expected to solve the problem on their own; CTCs must be viewed as one component of a comprehensive solution to bridge the digital divide. CTCs must work in tandem with other local institutions such as schools and government agencies in confronting this problem. Likewise, local level commitments to narrowing the gap must complement public and private efforts at the regional and national levels.

CONCLUSION

Our work, and the work of others, illustrates that CTCs have used IT to address the economic and social impacts of a shift to an information-based society and benefit low-income, urban communities. CTCs help fill an important gap in providing underserved, inner-city communities with access to computers and the Internet; IT literacy and training and opportunities to create and distribute content they deem relevant.

More research needs to be done to determine the effectiveness of CTCs. Specifically, researchers must look more closely at the relationships between types of CTCs and program outcomes. What kinds of programs do the best job of mitigating against the potentially pernicious economic and social impacts of the IT revolution? Future research should also investigate how CTCs can best collaborate with other institutions that provide access to IT, such as libraries and schools. Therefore, more focus must be placed on evaluation to determine how successful CTCs are in meeting their goals.

Although we argue that CTCs offer significant promise as strategies to address the urban technology gap, policy makers and funders must proceed with caution. There are already too many examples of policy makers and funders providing computers but failing to budget sufficiently for training, technical assistance, and maintenance. Researchers, policy makers, and the media must be especially careful not to promote the wrongheaded assumption that "new technologies can be rolled out as technical quick-fix solutions to complex urban problems" (Graham & Marvin, 2000, p. 91). Access to IT is one of many small but critical elements necessary to help residents of low-income, urban communities to more fully participate in and benefit from the current socioeconomic system.

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REFERENCES

- Anderson, T. E., & Melchior, A. (1995). Assessing telecommunications technology as a tool for urban community building. *Journal of Urban Technology*, 3(1), 29–44.
- Atkinson, R. D. (1998). Technological change and cities. *Cityscape*, 3(3), 129–170.
- Beamish, A. (1999). Approaches to community computing: Bringing technology to low-income groups. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 349–369). Cambridge, MA: MIT Press.
- Blakely, E. J., Hadi, S., & Johnson, P. (1995). Information city and the ghetto: The L.A. experience. The Lusk Center Research Institute, University of Southern California.
- Castells, M. (1999). The informational city is a dual city: Can it be reversed? In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 25–41). Cambridge, MA: MIT Press.
- Castells, M. (2000). Grassrooting the space of flows. In J. O. Wheeler, Y. Aoyama, & B. Warf (Eds.), *Cities in the telecommunications age: The fracturing of geographies* (pp. 18–27). New York: Routledge.
- Chapman, G., & L. Rhodes. (1997). Nurturing neighborhood nets. Technology review. Available: www.techreview.com/articles/oct97/chapman.html [July 21, 1999].
- Chow, C., Ellis, J., Mark J., & Wise, B. (1998). *Impact of CTCNet affiliates: Findings from a national survey of users of community technology centers*. Newton, MA: Community Technology Centers' Network (CTCNet), Education Development Center, Inc.
- Doctor, R. D. (1994). Seeking equity in the national information infrastructure. *Internet Research*, 4(3), 9–22.
- Glickman, N. J., & Servon, L. J. (1998). More than bricks and sticks: Five components of community development capacity. *Housing Policy Debate*, 9(3), 497–540.
- Gordo, B. E. (2000). The 'digital divide' and the persistence of urban poverty. *Planners Network*, 141(1), 7–8.
- Goslee, S. (1998). *Losing ground bit by bit: Low-income communities in the information age*. Benton Foundation. Available: <http://www.benton.org/Library/Low-Income> [July 10, 1999].
- Graham, S., & Marvin, S. (1996). *Telecommunications and the city: Electronic spaces, urban places*. New York: Routledge.
- Graham, S., & Marvin, S. (2000). Urban planning and the technological future of cities. In J. O. Wheeler, Y. Aoyama, & B. Wharf (Eds.), *Cities in the telecommunications age: The fracturing of geographies*. New York: Routledge.
- Hall, P. (1999). Changing geographies: Technology and income. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 43–69). Cambridge, MA: MIT Press.
- Harrison, B., & Bluestone, B. (1988). *The great u-turn: Corporate restructuring and the polarizing of America*. New York: Basic Books.
- Harrison, B., & Weiss, M. (1998). *Workforce development networks: Community-based organizations and regional alliances*. Thousand Oaks, CA: Sage Publications, Inc.
- Kasarda, J. (1985). Urban change and minority opportunities. In P. Peterson (Ed.), *The new urban reality*. Washington, DC: The Brookings Institution.
- Lazarus, W., & Mora, F. (2000). *Online Content for Low-Income and Underserved Americans: The Digital Divide's New Frontier*. Santa Monica, CA: The Children's Partnership.
- Mark, J., Cornebise, J., & Wahl, E. (1997). *Community technology centers: Impact on individual participants and their communities*. Newton, MA: Education Development Center, Inc. Available: www.ctcnet.org/eval.html [February 16, 1999].
- Marx, L. (1999). Informational technology in historical perspective. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 131–148). Cambridge, MA: MIT Press.
- Mitchell, W. J. (1999). *E-topia: Urban life, Jim—but not as we know it*. Cambridge, MA: The MIT Press.

- Mollenkopf, J. H., & Castells, M. (Eds.). (1991). *Dual city: Restructuring New York*. New York: Russell Sage Foundation.
- Moss, M. (1998). Technology and cities. *Cityscape*, 3(3), 107–127.
- National Telecommunications and Information Administration (NTIA). (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. Available: <http://www.ntia.doc.gov/ntiahome/fttn99/contents.html> [July 8, 1999].
- National Telecommunications and Information Administration (NTIA). (2000). *Falling through the net: Toward digital inclusion. A report on the telecommunications and information technology gap in America*. Washington, DC: National Telecommunications and Information Administration. Available: <http://www.ntia.doc.gov/ntiahome/fttn99/contents.html> [July 1999].
- Sanyal, B. (2000). From dirt road to information superhighway: Advanced information technology (AIT) and the future of the urban poor. In J. O. Wheeler, Y. Aoyama, & B. Warf (Eds.), *Cities in the telecommunications age: The fracturing of geographies* (pp. 143–157). New York: Routledge.
- Sanyal, B., & Schön, D. A. (1999). Information technology and urban poverty: The role of public policy. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 371–393). Cambridge, MA: MIT Press.
- Sassen, S. (1996). Service employment regimes and the new inequality. In E. Mingione (Ed.), *Urban poverty and the underclass: A reader* (pp. 64–82). Cambridge, MA: Blackwell Publishers, Inc.
- Schiller, H. I. (1996). *Information inequality: The deepening social crisis in America*. New York: Routledge.
- Schroerlucke, K. L. (1997). *Technical support and training for community technology centers in the Greater Pittsburgh area*. Pittsburgh, PA: Office of the Mayor, Office of Grants and Development.
- Schuler, D. (1996). *New community networks: Wired for change*. New York: Addison-Wesley Publishing Company.
- Servon, L. J., & Horrigan, J. B. (1997). Urban poverty and access to information technology: A role for local government. *Journal of Urban Technology*, 4(3), 61–81.
- Servon, L. J., & Nelson, M. K. (1999). *Creating an information democracy*. Report to the Aspen Institute Nonprofit Sector Research Fund. Washington, DC: The Aspen Institute.
- Shapiro, A. L. (1999, June 21). The net that binds: Using cyberspace to create real communities. *The Nation*.
- Shaw, A., & Shaw, M. (1999). Social empowerment through community networks. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 315–335). Cambridge, MA: MIT Press.
- Teitz, M., & Chapple, K. (1998). The causes of inner-city poverty: Eight hypotheses in search of reality. *Cityscape*, 3(3), 33–70.
- U.S. Department of Commerce, US Department of Education, US Department of Labor, National Institute for Literacy and Small Business Administration. (1999). *21st Century skills for 21st century jobs*. Washington, DC: U.S. Government Printing Office.
- Wilson, W. J. (1987). *The truly disadvantaged: The inner city, the underclass, and public policy*. Chicago: University of Chicago Press.
- Wilson, W. J. (1996). *When work disappears: The world of the new urban poor*. New York: Alfred A. Knopf.
- Wolpert, J. (1999). Center cities as havens and traps for low-income communities: The potential impact of advanced information technology. In D. A. Schön, B. Sanyal, & W. J. Mitchell (Eds.), *High technology and low-income communities: Prospects for the positive use of advanced information technology* (pp. 69–105). Cambridge, MA: MIT Press.